STEM MEP Modifications Project

TCNJ Advertised Bid # AB190029

PROJECT REQUIREMENTS

SCOPE OF WORK

DRAWINGS

April 12, 2019

Please place the following advertisement in the Legal Section of Classified Advertising. Please ensure that the invoice for this advertisement is prepared and an affidavit forwarded to The College of New Jersey, Office of Finance and Business Services, Administrative Services Building, Room 201, P.O. Box 7718, Ewing, NJ 08628-0718.

To be published on **April 12, 2019.** Contact person regarding placement of ad is Roselle Horodeski (609) 771-2894.

THE COLLEGE OF NEW JERSEY
ADVERTISEMENT FOR BIDS
BID #AB190029

Under the provisions of the State College Contracts Law, Chapter 64 of Title 18-A, The College of New Jersey will receive sealed bids for the **STEM MEP Modifications Project** until **2:00 P.M. on the 9th day of May, 2019** at The College's Office of Finance and Business Services, Administrative Services Building, Second Floor, Room 201, Route 31 (Pennington Road), Ewing Township, New Jersey. At 2:00 P.M. all bids will be publicly opened and read in Room 203 of the Administrative Services Building.

The project will be bid as a Single Lump Sum.

No bidder may submit more than one bid.

Bid Documents may be obtained on/after **April 12, 2019 via our website (www.tcnj.edu/~budfin/).**

A **strongly encouraged pre-bid conference/on-site inspection** is scheduled on **April 18, 2019 at 10:00 A.M**. in Room 103 of the Administrative Services Building, located on The College's Ewing Township, New Jersey campus on Route 31 (Pennington Road).

Bidders are required to comply with the requirements of P.L. 1975 c. 127 (N.J.S.A. 10:5-31 et seq. and N.J.A.C. 17:27 - Affirmative Action); the New Jersey Prevailing Wage Act, N.J.S.A. 34:11-56.25 et seq.; N.J.S.A. 52:25-24.2, "Statement of Stockholders Exceeding 10%"; the Public Works Contractor Registration Act (N.J.S.A. 34:11-56.48 et seq.); the New Jersey Business Registration of Public Contractors provisions (N.J.S.A. 52:32-44); Executive Order 117 and P.L. 2005 Chapter 51 (N.J.S.A. 19:44a-1 et seq.) and all amendments thereto

A bid bond is required in the amount of 10% of the total bid. Bid bond shall consist of a certified check or cashiers check to the order of The College of New Jersey, or an individual or annual bid bond issued by an insurance company or surety company authorized to do business in the State of New Jersey. The successful Bidder(s) is required to provide a Performance and Payment Bond equal to 100% of the contract. A Surety Disclosure Statement and Certification form must accompany the performance bond.

The College will award the contract to the lowest responsible bidder who satisfies the qualification criteria as set forth in the contract documents.

The College of New Jersey reserves the right to reject any or all bids or to waive any informalities in the bidding in accordance with law. No bid shall be withdrawn for a period of sixty (60) days subsequent to the opening of bids without the consent of The College of New Jersey.

STEM MEP MODIFICATIONS

Milestone Schedule
April 12, 2019

Advertised for bidding	April 12, 2019
Pre-Bid Meeting (10:00 am, ASB bldg.-Rm 103)	April 18, 2019
Cut-off for questions	April 25, 2019
Addendum Issued	May 2, 2019
Bids Received (2:00 pm)	May 9, 2019
Notice of Intent to Award issued by	May 16, 2019
End of Protest Period	May 22, 2019
Notice to proceed issued	May 29, 2019
Substantial Completion in field no later than	August 30, 2019
Project Closeout by	September 30, 2019

THE COLLEGE OF NEW JERSEY
Construction Bid Proposal Form

Office of Finance & Business Services
Administrative Services Building, Rm. 201
2000 Pennington Road
Ewing, New Jersey 08628-0718

Bid Number: AB190029
Bid Due Date: May 9, 2019

Project Name: STEM MEP Modifications

BIDDER INFORMATION

Firm Name:

Contact Person:
Address:

Telephone Number:

Fax Number:

Email Address:
Federal I.D. Number:

SOLICITATION OF CONSTRUCTION BIDS

1. **Bid proposals are solicited as follows:**
   - **A. Single Bid (Lump Sum) which combines all trades.**
     - **(1) The total number and types of trades are set forth in the Specifications.**
     - **(2) Bidder enters the Bid Price on the line provided.**
     - **(3) Pursuant to the requirements of N.J.S.A. 18A:64-76, bidder lists the names of the subcontractors on the Subcontractor Information page.**

2. **The scope of work includes additional scope for Mechanical work in the STEM Building for increased efficiency of the MEP systems. These modifications to include new steam motive pump traps and paddle type flow switches to serve the existing heat exchangers and selective modifications to the Sequence of Operations for the HVAC Controls. (Revisions on Drawings are noted as Bulletin #28, dated 03/04/2019.)**

   - **A. See Specifications and Drawings for Details (included in RFP package).**
   - **B. The College may issue Addenda or Clarifications which may include additions to or deletions from the scope of work; changes to the Specifications, Drawings, and proposal form; and clarifications of requirements. Bidder is advised to review all Addenda and/or clarifications carefully, and shall note the receipt of same with their bid package.**

GENERAL INSTRUCTIONS AND REQUIREMENTS

1. PRICES

A. Bidder submits prices for the Base Bid and any Alternate Proposals and Unit Prices which are listed for the contract of the bid. If there is no cost associated with the Alternate or Unit Price, bidder is required to enter "0.00" or "no change".

B. Prevailing wage rates apply (Mercer County).

C. Bid is to remain good for sixty (60) days after the Bid Due Date.

2. BOND REQUIREMENTS AND SURETY STANDARDS

A. Bidder must submit with its bid a Certified Check in the amount of ten percent (10%) of the base bid, or a Bid Bond in the amount of ten percent (10%) of the total bid.

B. The successful bidder must submit a Performance and Payment Bond equal to 100% of the contract. A completed Surety Disclosure Statement and Certification must accompany the Performance and Payment Bond.

(1) The Performance and Payment Bond form and a sample Surety Disclosure Statement and Certification form are included at the end of this Construction Bid Proposal Form.

C. All bid deposits shall be returned within three (3) days of Notice of Intent to Award, except for the successful bidder(s) whose bid security shall be returned after execution of a formal contract, and delivery of the Performance Bond/Labor and Material Bond and Certificates of Insurance.

D. Should the successful bidder fail to enter into said contract after acceptance of bid by the College, then the check or security deposited by that bidder shall, at the option of the College, be retained as liquidated damages, or if Bid Bond has been supplied, principal and surety shall be liable to the amount of the Bid Bond.

E. Attorneys-in-fact who sign bid bonds or contract bonds must file with each bond a certified copy of their Power of Attorney to sign said bonds.

3. LICENSES, CERTIFICATIONS, REGISTRATIONS, QUALIFICATIONS

A. The bidder or, as applicable, its subcontractors shall at the time of bid have those required licenses, certifications, registrations, qualifications and the like ("LCRQ") listed below and shall present satisfactory evidence thereof upon request of the College prior to the notice of intent to award.

(1) The electrical contractor or subcontractor, as applicable, shall have a valid electrical license. (An electrical license is not required when the work is below 110Volt)

(2) The plumbing contractor or subcontractor, as applicable, shall have a valid plumbing license.

(3) The HVAC contractor or subcontractor, as applicable, shall have a valid HVACR license.

B. The selected bidder/contractor or, as applicable, its subcontractors shall have and shall present satisfactory evidence of all other required LCRQ noted in the Specifications after execution of contract during the submittal process and prior to the start of the applicable work, unless otherwise requested by the College or a date or event specified for that LCRQ in the Specifications.

4. SUBCONTRACTORS

A. Pursuant to New Jersey State Law (N.J.S.A. 18A-76.1), a Single Bid (Lump Sum) bidder discloses its subcontractors to whom the bidder intends to subcontract the work. The Subcontractor Information sheet is provided for this purpose.

5. Under Executive Order 34, the College is responsible for soliciting demographic information from its vendors. The College is required to seek the following information from each firm under contract with the College:

1. Is more than fifty percent (50%) of your company minority owned? (circle one) YES NO (African-American, Hispanic, Asian, and/or Native American)

2. Is more than fifty percent (50%) of your company woman owned? (circle one) YES NO

3. What is the ethnicity of the owner of your company: (check applicable according to 51% ownership)

☐ Asian American
☐ Multiple Ethnicities
☐ Non-Minority
☐ Hispanic American
☐ African American
☐ Caucasian American Female
☐ Native American
☐ Unspecified

The College is required to solicit the foregoing information. Your response, however, is **strictly voluntary**. Please be advised that any contracting decisions made by the College will **not** be influenced in any way by your decision to provide the above information.

EXECUTIVE ORDER #34: MINORITY AND WOMEN BUSINESS ENTERPRISES

On September 15, 2006, Governor Corzine signed Executive Order 34 establishing a Division of Minority and Women Business Development. The Division is charged with administering and monitoring policies, practices, and programs to ensure that minority and women business enterprises (MWBE) are afforded an equal opportunity to participate in New Jersey's purchasing and procurement processes.

State entities are required to report to the Division the ethnic and gender composition of the vendors with which those state entities do business.

6. Bidder completes Statement of Ownership Disclosure form and the Non-Collusion Affidavit form.

~~7. Bidders are required to be registered with the New Jersey Department of Property Management and Construction (DPMC) and possess a DPMC C008 classification at the time of bid submission.~~

8. **PREVAILING WAGE AND PUBLIC WORKS CONTRACTOR REGISTRATION ACTS**
   - The work described in this project is subject to the New Jersey Prevailing Wage Act, N.J.S.A. 34:11-56.25 et seq. and the Public Works Contractor Registration Act, N.J.S.A. 34:11-56.48 et seq.
   - The Public Works Contractor Registration Act requires the bidder and any subcontractors listed in the bid to be registered with the New Jersey Department of Labor and Workforce Development at the time the bid is submitted. The contractor must submit registration certificates for all listed subcontractors prior to award of the contract.
   - The Contractor must comply with the New Jersey Prevailing Wage Act, N.J.S.A. 34:11-56.25 through 56.57. Workers employed by the Contractor or any subcontractor or sub-subcontractor in the performance of services directly on the project must be paid prevailing wages. As required by N.J.S.A. 34:11-56.27 and 56.28, this contract cannot become effective until the College obtains from the New Jersey Department of Labor and Workforce Development a determination of the prevailing wage rates applicable to the project as of the contract award date and attaches a copy to the contract. As required by N.J.S.A. 34:11-56.27, the Contractor or any subcontractor may be terminated if any covered worker is not paid prevailing wages on the project, and the Contractor and its surety shall be liable for any additional costs which result. The Contractor and its subcontractors must be registered with the New Jersey Department of Labor and Workforce Development (N.J.S.A. 34:11-56.51 et seq.), and the prevailing wage rates must be posted at the job site (N.J.S.A. 34:11-56.32). The Contractor and its subcontractors must prepare accurate certified records of wages paid for each worker on the project (N.J.S.A. 34:11-56.29), and copies for the period covered by each invoice must be attached to the invoice submitted under the contract. In accordance with N.J.S.A. 34:11-56.33, the Contractor's final invoice must include a statement of all amounts still then due to workers on the project. The Contractor is also cautioned that it must use job titles and worker classifications consistent with those approved by the Department of Labor and Workforce development, and that, if it intends to pay apprentice rates, it must comply with the Department of Labor and Workforce Development regulations at N.J.A.C. 12:60-7.1 through 7.4.
   - Please refer to http://lwd.dol.state.nj.us/labor/wagehour/wagerate/wage_rates.html for official wage rate determinations for Mercer County, NJ.

9. NEW JERSEY EQUAL PAY ACT

On April 24, 2018, Governor Phil Murphy signed into law New Jersey's Diane B. Allen Equal Pay Act (P.L. 2018, c. 9) The law provides in pertinent part that as of July 1, 2018, any employer entering into a contract with the State of New Jersey or an instrumentality of the State for "qualifying services" or "public works" must provide to the Department of Labor and Workforce Development – upon commencement of the contract – wage and demographic data for all employees who are employed in connection with the contract (for public works) and for all employees (for qualifying services). This requirement DOES NOT apply to employers who are contracting with local governments (for example: municipalities and counties). The report must contain the gender, race, ethnicity, job category, compensation, and number of hours worked by each employee.

The extent of the Department of Labor and Workforce Development's responsibilities under the Equal Pay Act is the collection of data regarding compensation, hours worked, job/occupational category, job title, gender, race, and ethnicity for State contactors and making that data available to the Division on Civil Rights (DCR), within the Department of Law and Public Safety, and upon request to certain individuals. Complaints of unlawful discrimination under the Equal Pay Act should be directed to the DCR, as should any questions regarding the filing of such a complaint.

The Department of Labor and Workforce Development has issued two forms, as required by the law, to be completed by employers. The forms should be used to report the employee's wage and demographic data and can be found on the LWD website (http://www.nj.gov/labor/equalpayact). **A completed copy of the forms is not required at time of bid; however, it will be required of the bidder who receives the notice to proceed from the College. Completed forms should be emailed to: equalpayact@dol.nj.gov**

10. In order for your proposal to be accepted and deemed valid, your company/firm will be required to comply with the requirements of N.J.S.A. 19:44A-1 et seq/P.L. 2005 Ch. 51 ("Chapter 51") and Executive Order 117. Enclosed are the requirements of Chapter 51 and Executive Order 117, the forms for Certification and Disclosure. The contract that will be generated based on this bid proposal cannot be awarded without approval of the Certification and Disclosure forms by the State of New Jersey, Department of Treasury. **A completed copy of your Certification form is not required at time of bid; however, it will be required from the bidder who receives the notice of intent to award from the College prior to the execution of the contract**.

11. Pursuant to N.J.S.A. 52:32-44, The College of New Jersey ("Contracting Agency") is prohibited from entering into a contract with an entity unless the bidder/proposer/contractor, and each subcontractor that is required by law to be named in a bid/proposal/contract has a valid Business Registration Certificate on file with the Division of Revenue and Enterprise Services within the Department of the Treasury.

Prior to contract award or authorization, the contractor shall provide the Contracting Agency with its proof of business registration and that of any named subcontractor(s).

Subcontractors named in a bid or other proposal shall provide proof of business registration to the bidder, who in turn, shall provide it to the Contracting Agency prior to the time a contract, purchase order, or other contracting document is awarded or authorized.

During the course of contract performance:

(1) the contractor shall not enter into a contract with a subcontractor unless the subcontractor first provides the contractor with a valid proof of business registration.

(2) the contractor shall maintain and submit to the Contracting Agency a list of subcontractors and their addresses that may be updated from time to time.

(3) the contractor and any subcontractor providing goods or performing services under the contract, and each of their affiliates, shall collect and remit to the Director of the Division of Taxation in the Department of the Treasury, the use tax due pursuant to the Sales and Use Tax Act, (N.J.S.A. 54:32B-1 et seq.) on all sales of tangible personal property delivered into the State. Any questions in this regard can be directed to the Division of Taxation at (609)292-6400. Form NJ-REG can be filed online at http://www.state.nj.us/treasury/revenue/busregcert.shtml.

Before final payment is made under the contract, the contractor shall submit to the Contracting Agency a complete and accurate list of all subcontractors used and their addresses.

Pursuant to N.J.S.A. 54:49-4.1, a business organization that fails to provide a copy of a business registration as required, or that provides false business registration information, shall be liable for a penalty of $25 for each day of violation, not to exceed $50,000, for each proof of business registration not properly provided under a contract with a contracting agency.

12. Record Retention: Pursuant to N.J.A.C. 17:44-2.2, the vendor shall maintain all documentation related to products, transactions or services under this contract for a period of five years from the date of final payment. Such records shall be made available to the New Jersey Office of the State Comptroller upon request.

13. Energy Star energy efficient products: Under Executive Order #11 (Corzine), the College is required to select ENERGY STAR energy-efficient products when acquiring new energy-using products or replacing existing equipment. For products that do not have ENERGY STAR labels, vendors shall follow guidelines established by the New Jersey Clean Energy Program.

14. QUESTIONS

A. Direct inquiries and correspondence relating to this proposal form and questions regarding the technical specifications and requests for clarification must be submitted in writing via fax to **609-637-5140 or email to horodesk@tcnj.edu** and must be received **prior to 4:00 p.m., on April 25, 2019.**

B. Should any questions be received, an addendum or clarification will be available on or after **May 2, 2019. If an addendum and/or clarification is posted, it SHOULD be noted in the General Agreement section of the bidder's proposal. Failure to do so may subject Bidder to disqualification.**

15. HOW TO SUBMIT THE COMPLETED CONSTRUCTION BID PROPOSAL FORM

A. Bidder places all pages of the completed form and the requisite additional documents in an envelope, seals the envelope, and labels it with his/her firm name, address, and "Sealed Bid Enclosed for (**Bid Number and Project Name**)".

B. Bidder mails or deliver by hand the sealed bid, no later than **2:00 p.m., May 9, 2019**, to The College of New Jersey, Attention: Roselle Horodeski for (specify the Bid Number), Office of Finance & Business Services, Room 201, 2000 Pennington Road, Ewing, New Jersey 08628-0718. **At 2:00 p.m., all bids will be publicly opened and read in Room 203 of the Administrative Services Building.**

C. Contractors are advised that the U.S. Postal Service and all express mail companies deliver to The College's Mail Room or Receiving Department, not directly to the Office of Budget & Finance. The College is not responsible for lost or misdirected bids.

16. Any bid not prepared and submitted in accordance with the provisions described herein may be rejected by the College. Any bid received after the time and date specified will not be considered. No bidder shall withdraw a bid within sixty (60) days after the date of the bid opening to allow the College to determine the lowest bid that will most economically serve the intentions of this Contract.

17. Any bidder who has defaulted on any contract with the College or any other State Agency may be considered as not responsible and their bid may be rejected. THE COLLEGE OF NEW JERSEY reserves the right to exercise this option, as the College deems proper and/or necessary in its best interest.

18. Bids shall include all costs of any nature necessary to complete the project in the manner and within the time required by the contract.

19. The College reserves the right to require bidders to provide a schedule of values of their lump sum bid price upon request.

20. The College is exempt from all taxes including Federal Excise Tax, Transportation Taxes, State Excise, Sales Tax and local taxes. Rentals of equipment for 28 days or less is not exempt from any tax under the State sales tax act.

21. Before submitting his bid, the bidder shall be familiar with the Drawings, Specifications, and other Documents that will form part of the contract and shall have visited the site of the project to confirm for themselves the character and amount of work involved.

22. No bidder shall be allowed to offer more than one price on each item even though he/she may feel that he/she has two or more types or styles that will meet specifications. Bidders must determine for themselves which to offer. This may be cause for automatic rejection of bid.

23. It is understood and agreed that all prices quoted are firm and not subject to any increase during the life of the contract.

24. Should any difference arise between the contracting parties as to the meaning or intent of these instructions or specifications, the College's decision shall be final and conclusive.

25. Should the bidder discover discrepancies in this Request for Bids, the matter shall be at once brought to the attention of the College, and the discrepancies corrected by written agreement before submission of bid. The correction will be issued by addendum.

26. ACCEPTANCE/REJECTION OF BIDS

- **A.** THE COLLEGE OF NEW JERSEY, pursuant to State College Contract Law reserves the right to accept or reject any or all items covered in the bid request, or any portion(s) thereof, re-advertise and/or take such other steps decreed necessary and in the best interest of the College in accordance with law. Where two or more bidders are tied and all other relevant factors being equal, the College reserves the right to make the award to one of the bidders.
- **B.** The bid is irrevocable by the bidder or the bidder's representatives. The bid, and any award made to the bidder by the College, shall bind the bidder and the bidder's heirs, executors, administrators, successors or assigns.
- **C.** Award of contract shall be made to the lowest responsible bidder, whose bid, conforming to the invitation for bids, is the most advantageous to the College.
- **D.** The award of the contract or the rejection of the bids shall be made within sixty (60) days of the date of receiving bids, unless written extensions are requested by the College and accepted by the bidder(s). All bid securities shall be returned immediately if all bids are rejected. The successful bidder(s) to whom the award is to be made will be notified by receipt of a written "Intent to Award" from the College.
- **E.** When award of contract is made in one fiscal year with effective date in the next fiscal year, award shall be contingent upon the availability and appropriation of sufficient funds for that purpose for the year in which said contract takes effect.

When a contract shall be awarded for a period in excess of one year, said contract shall be contingent upon the annual availability and appropriation of sufficient funds for that purpose for each year of the contract term.

27. WITHDRAWAL OF BIDS

A. A written request for the withdrawal of a bid, or any part thereof, will be granted if the request is received by the College prior to the specified time of the bid opening.

B. Should the bidder refuse to perform the work for the price provided, they will forfeit their bid security and will be held liable for the difference between their low bid and the next highest/responsive bidder.

28. OSHA COMPLIANCE:

A. The Contractor shall guarantee that all materials, supplies and equipment to be provided under his contract shall meet all applicable requirements, Specifications and standards of the Federal Occupational Safety and Health Act (OSHA) of 1970 as amended to date of acceptance by the College, and shall also apply to Contractors Construction procedures.

29. APPLICABLE LAWS:

A. The following list of statutes and regulations, which may be applicable in whole or in part, is provided for the benefit of the Contractor and is not meant to be all-inclusive. In the event that other laws are applicable, it shall be the responsibility and obligation of the Contractor to ascertain and comply with them.

(1) <u>New Jersey Statutes and Regulations</u>

N.J.S.A. 10:5-31 *et seq.* and N.J.A.C. 17:27-1 *et seq.*, Affirmative Action
Prevailing Wage Act, N.J.S.A. 34:11-56.25 *et seq.*
N.J.S.A. 52:32-44, Business Registration Certificate
N.J.S.A. 34:11-56.48 *et seq.*, Public Works Contractor Registration Act

(2) <u>Federal Statutes</u>

Immigration Control and Reform Act (1986) – 8 U.S.C.A. Section 1324(a) *et seq.*
Civil Rights Act of 1964 – 42 U.S.C.A. Section 1971 *et seq.*
The Americans with Disabilities Act of 1990

30. EXAMINATION OF SITE, DRAWINGS AND SPECIFICATIONS

A. Each Bidder shall visit the site of the proposed work and fully acquaint themselves with the conditions as they exist so that they may fully understand the facilities, difficulties, and restrictions attending the execution of the work under this Contract.

B. Bidders shall also thoroughly examine and be familiar with the Drawings and Specifications. The failure to receive or examine any form, instrument or

document, or to visit the site and acquaint himself with conditions there existing shall in no way relieve any bidder from obligation with respect to his bid. By submitting a bid, the bidder agrees and warrants that he has examined the site, the Drawings and Specifications and, that the Specifications and Drawings are adequate and the required result can be produced under the Drawings and Specifications. No claim for any extra will be allowed because of alleged impossibilities in the productions of the results specified or because of unintentional errors or conflicts in the Drawings and Specifications. No change orders will be issued for items, materials or issues that existed on or with respect to the site prior to bidding.

31. DRAWINGS AND SPECIFICATIONS

A. The project shall be performed in accordance with the requirements of the Drawings and Specifications, subject to modification as provided in General Conditions. The Drawings and Specifications are intended to complement and supplement each other.

B. Any work required by either of them and not by the other shall be performed as if denoted in both. Should any work be required which is not also denoted in the Specifications or on the Drawings because of an obvious omission, but which is, nevertheless, necessary for the proper performance of the project, such work shall be performed as fully as if it were described and delineated.

32. FORM OF AGREEMENT

A. Every successful bidder shall be required to sign the standard form contract, a copy of which is attached. Any proposed language or form changes which in any way modifies the contractor's responsibilities as set forth in the Contract Documents will not be acceptable and will be deemed to constitute a bid exception.

33. MULTIPLE BIDS NOT ALLOWED:

A. No bidder is allowed to submit more than one bid from an individual, firm, partnership, corporation or association under the same or different name. This will be cause for automatic rejection of each bid.

34. SUBSTITUTIONS:

A. The bidder may include in their bid substitute materials or equipment or methods in lieu of those specified in the contract documents, but they do so at their own risk. Any substitution must be equivalent in type, function and quality to the item required in the contract. The successful bidder must submit all information required within 20 days of contract award to determine if the proposed substitute is equal to the contract requirements, and any substitution must be approved by the architect and the College.

B. The College shall have complete discretion to decide whether it will accept any substitution. No substitution shall result in any increase in the

contract price or times. The successful bidder in its application for the substitution must certify in writing that the substitution is equal to what is specified in the contract documents in all material respects and will not increase the time or price of the contract work.

C. Should the substitution be rejected, the contractor will then be required to provide the specified product, material or method at no additional cost to the College and no change in the project schedule.

35. DOCUMENTS/SUBMISSIONS THAT MUST BE PROVIDED BEFORE CONTRACT AWARD:

- AFFIRMATIVE ACTION: The bidder is required to complete and submit a copy of Initial Project Workforce Report (AA-201) to the College and the Division of Public Contracts Equal Employment Opportunity Compliance verifying that the bidder is operating under a federally approved or sanctioned Affirmative Action program. The bidder also agrees to submit a copy of the Monthly Project Workforce Report once a month thereafter for the duration of this contract to The College and the Division.

- CERTIFICATE OF INSURANCE: The bidder is required to submit proof of liability insurance in accordance with The College's contract.

- P.L. 2005, Chapter 51 / Executive Order 117 - Contractor Certification and Disclosure of Political Contributions:

  In order for your proposal to be accepted and deemed valid, your company/firm will be required to comply with the requirements of Chapter 51 and Executive Order 117. Enclosed are the requirements of Ch. 51 and EO 117, the forms for Certification and Disclosure. The contract that will be generated based on this bid cannot be awarded without approval of the Certification and Disclosure forms by the State of New Jersey, Department of Treasury.

- New Jersey Business Registration Certificate

- All applicable licenses, certificates, and requirements specified in the scope of work, contract documents and specifications.

The following Bidder's Checklist **is provided as an aid to the bidder. It does not in any way relieve the bidder of its responsibility to insure that its bid proposal is complete.**

a. _____ Bidder has completed the Bidder Information section and General Agreement section and filled out the receipt of addendum and clarifications.

b. _____ Bidder has completed the form of proposal and indicated base bid for either Separate Bid or Single Bid (Lump Sum all trades), prices for Alternate Proposals, and Unit Prices.

c. _____ Bidder for Single Bid (Lump Sum) has listed and has disclosed the subcontractors on the Subcontractor Information form.

d. _____ Bidder has enclosed a certified check or bid bond for ten percent (10%) of the amount of the bid.

e. _____ Bidder has completed and enclosed the Non-Collusion Affidavit.

f. _____ Bidder and each disclosed subcontractor has enclosed a copy of its **registration certificate** in accordance with the requirement of the Public Works Contractor Registration Act. (NJ Dept. of Labor and Workforce Development)

g. _____ Bidder has acknowledged the **Affirmative Action Language** in accordance with the requirements P.L. 1975 C.127. (NJAC 17:27).

h. _____Bidder has enclosed its MWBE information.

i. _____Bidder has enclosed its Electrical and Plumbing License and any other licenses, certifications, certifications, and qualifications.

j. _____Bidder has enclosed its Vendor Qualification Statement

~~**k.** _____ Bidder has included a copy of its latest Experience Modification Rating (EMR Safety Rating). The College requires an average rating over the last 5 years of 1.25 or less.~~

~~**l.** _____ Bidder has included a copy of its DPMC Notice of Classification and Total Amount of Uncompleted Contracts.~~

m. _____ Bidder has enclosed a copy of its Chapter 51 & EO117 Certification form. **A completed copy of your Certification form is not required at time of bid; however, will be required from the bidder who receives the intent to award from the College.**

n. _____ Bidder has enclosed a copy of its New Jersey Business Registration Certificate in accordance with the requirements of the New Jersey Division of Revenue. **A completed copy of your Certificate is not required at time of bid; however, will be required from the bidder who receives the intent to award from the College.**

GENERAL AGREEMENT

1. Having examined the plans and specifications with related documents and the site of the proposed work and being familiar with all of the conditions surrounding the construction of the proposed project including the availability of materials and labor, the undersigned hereby proposes to furnish all labor, materials, and supplies, and to construct the project in accordance with the Contract Documents, within the time set forth therein, and at the price stated. This price covers all expenses incurred in performing the work required under the Contract Documents, of which this proposal is a part.

2. Bidder acknowledges receipt of the following Addendums/Clarifications:

Addendum Number _____ Date _____Addendum Number ____ Date_____
Addendum Number _____ Date _____Addendum Number ____ Date_____
Addendum Number _____ Date _____Addendum Number ____ Date_____

3. Bidder acknowledges and affirms that he/she has personal knowledge of or has obtained and reviewed a copy of the valid prevailing wage rates at the time of the bid and for the duration of the contract for all trades involved in the project for the geographical location of the project as issued by the Commissioner of the Department of Labor & Workforce Development, Trenton, NJ 08625 (609) 292-2259 or visiting the Department of Labor website at (http//lwd.dol.state.nj.us/labor/wagehour/wagerate/wage_rates.html).

4. Bidder agrees that its price is good and the bid shall not be withdrawn for a period of 60 calendar days after the scheduled Bid Due Date and Time.

5. Upon conclusion of the 5 business day protest period, Bidder will execute the formal contract within 5 business days and deliver as required in the General Conditions: a Performance and Payment Bond; Surety Disclosure and Certification Statement; and certificates of insurance for general liability, automobile and worker's compensation.

6. Bidder acknowledges work to commence on site not later than ten (10) calendar days after receipt of a Notice to Proceed.

Respectfully submitted,

(Seal if bid is by Corporation)

_____
(Signature of Principal)

_____
(Printed Name of Principal)

_____
(Title of Principal)

PRICES FOR SINGLE BID (LUMP SUM): Base Bid, Alternate Proposals, and Unit Prices
FORM OF PROPOSAL

To: **The College of New Jersey**

for: STEM MEP Modifications

Date _____

A. BID:

1.**Base:** We, _____, the Undersigned, in accordance with the published advertisement inviting proposals, will furnish all labor, material, equipment and services necessary for the complete construction, as defined in the advertisement, specimen contract, specifications, addendums/clarifications/bulletins, drawings, and proposal, for the Contract amount indicated below for the **above noted project** in strict accordance with the Contract Documents and Addenda thereto for the total sum of:

_____Dollars $_____
(words)

General Construction (Single overall Prime Contract)

~~2. **Add /Deduct Alternate**~~
~~**Check One: _____Add _____Deduct**~~

No Alternates are requested for this bid.

3. CHECK LIST FOR BIDDERS:
A check list has been provided in these specifications for the use in completing this proposal. Bidders are encouraged to reference said list to minimize the opportunity for errors by the bidder.

B. UNIT PRICES: We, the Undersigned, agree, if awarded the Contract to perform additional work or delete work at the Unit Prices set forth below or at a negotiated unit price (Unit Prices are for work that is in addition to or is deleted from the base bid work):

No Unit Prices are requested for this bid.

C. AGREEMENT: We, the Undersigned, agree, if awarded the Contract, to execute an agreement for the above stated work and compensation on the Standard Form of Agreement Between Owner and Contractor.

D. SURETY: We, the Undersigned, agree, if awarded the Contract, to execute and deliver to the Owner, prior to the signing of the Contract, the Performance and Payment Bonds as required.
- Contractor shall provide a Maintenance Bond at job completion for a period of one year for 100% of the final contract price.

E. BID SECURITY: The attached bid security is to become the Property of the Owner in the event that the Contract and bond are not executed within the time set forth, as liquidated damages for the delay and

additional expense (including the difference between the price provided with said bond and the next lowest responsive bidder) to the Owner caused thereby.

Certified Check $_____
Bid Bond $_____

F. STATEMENT:

1. We, the Undersigned, acting through its authorized officers and intending to be legally bound, agree that this bid proposal shall constitute an offer by the Undersigned to enter into a Contract with the acts and things therein provided, which offer shall be irrevocable for sixty (60) calendar days from the date of opening hereof and that the Owner may accept this offer at any time during said period by notifying the Undersigned of the acceptance of said offer.

2. We, the Undersigned, acknowledge receipt of the following Addenda/Clarifications:

Addenda Number	Dated
_____	_____
_____	_____
_____	_____

The undersigned further agrees to comply with the requirements as to conditions of employment, wage rates, and hours of labor set forth in the Contract Documents.

Dated _____

Firm Name _____ Phone Number:_____

Address _____

_____

**If a corporation, give the State of Incorporation, using the phrase:
"A corporation organized under the laws of _____."
If a partnership, give names of the partners, using also the phrase:
"Co-partners trading and doing business under the firm name and style of
_____.
If an individual using a trade name, give individual name, also using the phrase:
"An individual doing business under the firm name and style of _____.

Dated: _____

STATE OF _____
SS.
COUNTY OF _____

_____ being duly sworn say that the several matters stated in this proposal are in all respects true, and that no member of the State or employee of the College are interested in any way in this proposal.

Sworn and subscribed before me _____
Bidder signs above line

this _____ day of_____ 20____

_____ _____
Print Name and Title

SUBCONTRACTOR INFORMATION FOR SINGLE BID (LUMP SUM)

Pursuant to the State Colleges Contract Law, N.J.S.A. 18A:64-76.1, all bids submitted shall set forth the names and license numbers of all subcontractors to whom the bidder intends to subcontract the plumbing and gas fitting work; the refrigeration, the heating and ventilating systems and equipment; the electrical work, including any electrical power plants; tele-data, fire alarm, or security systems; the structural steel and ornamental iron work (individually, the "Trade" or collectively, the "Trades").

For each Trade listed below for which the work will be completed by a subcontractor you must list for each such subcontractor at a minimum the name and, where applicable, license number (or in lieu thereof enclose a copy of the license with this form) and preferably you will also list the subcontractor's address, telephone number, and fax number. If the work will be self-performed by the bidder, you may indicate that by inserting the name of the bidder (next to "Name"). If work by that Trade is not required per the scope of work of the project, you may indicate that by inserting "Not required" (next to "Name"). If the name of a subcontractor is not provided on this form for any one or more of the Trades, the bidder, in submitting its bid, certifies that, for such Trades, either the work will be self-performed by the bidder, or the work is not required per the scope of work.

Failure to complete this form as required may result in your bid being disqualified.

Plumbing and Gas Fitting Work

List information for Subcontractor, if any:

Name: _____

License Number: _____

Address: _____

_____

Telephone: _____

Fax: _____

Refrigeration, Heating and Ventilating Systems and Equipment

List information for Subcontractor, if any:

Name: _____

License Number: _____

Address: _____

_____

Telephone: _____

Fax: _____

Electrical Work, including any Electrical Power Plants, Tele-data, Fire Alarm, or Security Systems

List information for Subcontractor, if any:

Name: _____

License Number: _____

Address: _____

_____

Telephone: _____

Fax: _____

Structural Steel Work and Ornamental Iron Work

List information for Subcontractor, if any:

Name: _____

License Number: _____

Address: _____

_____

Telephone: _____

Fax: _____

_____
Bidder Name

By: _____
Signature

_____
Printed Name of Signing Individual

_____
Date

SMALL BUSINESS, MINORITY AND/OR FEMALE-OWNED BUSINESS REPORTING

1. Contractor and sub-contractors are requested to check all of the following that apply to their company and, if applicable, submit a copy of their certificate(s):

A. My company is certified by the NJ Department of Treasury, Division of Revenue as a:

_____ small business_____ minority-owned business _____female-owned business

B. My company is certified by the NJ Department of Transportation as a:

_____ small business_____ minority-owned business _____female-owned business

C. My company is a _____small business_____ minority-owned or _____ female-owned but is not certified by either NJ Department.

C. _____ My company is not a small business, minority-owned or female-owned.

_____

Signed

_____

Date

PERFORMANCE BOND & PAYMENT BOND

BOND NO._____

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned _____ _____as Principal, and_____, a corporation of the State of _____, duly authorized to do business in the State of New Jersey, having an office at _____, are hereby held and firmly bound unto The College of New Jersey in the Penal Sum of _____ DOLLARS, for payment of which well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

SIGNED this _____ day of _____, 20_____

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH THAT, WHEREAS, the above named Principal did on the _____ day of _____, 20_____, enter into a written contract with The College of New Jersey for _____ which said contract is made a part of this bond as set forth herein;

NOW, if the said _____ shall well and faithfully do and perform the things agreed by _____ to be done and performed according to the terms of the said contract; shall pay all lawful claims of sub-contractors, materialmen, laborers, persons, forms of other suppliers or teams. fuel, oils, implements or machinery furnished, used or consumed in the carrying forward, performing, or completing of said contract, we agreeing and assenting that this undertaking shall be for the benefit of any subcontractor, materialman, laborer, person, firm or corporation having a just claim, as well as for the obligee herein; then this obligation shall be void, otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the surety for any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated.

The said surety hereby stipulated and agrees that no modifications, omissions, or additions in or to the terms of the said contract, or in or to the plans and specifications therefore shall in any wise effect the obligation of said surety on its bond.

This bond is given in compliance with the requirements of the statutes of the State of New Jersey including N.J.S.A. 18A:64-68 and any amendments thereof.

SIGNED, SEALED AND DELIVERED
IN THE PRESENCE OF

_____ BY:_____
Witness

_____ BY:_____
Witness as to Surety ATTORNEY-IN-FACT

Countersigned

NOTE: General Power of Attorney and the current

this _____ day of _____, 20_____

BY:_____

financial statement of the bonding company must be attached to each copy (a total of three) of the Performance Bond.

SURETY DISCLOSURE STATEMENT AND CERTIFICATION

_____, surety(ies) on the attached bond, hereby certifies(y) the following:

(1) The surety meets the applicable capital and surplus requirements of R.S. 17:17-6 or R.S. 17:17-7 as of the surety's most current annual filing with the New Jersey Department of Insurance.

(2) The capital (where applicable) and surplus, as determined in accordance with the applicable laws of the State of New Jersey, of the surety(ies) participating in the issuance of the attached bond is (are) in the following amount(s) as of the calendar year ending December 31, ____, (insert most recent calendar year for which capital and surplus amounts are available), which amounts have been certified as indicated by certified public accountants (indicating separately for each surety that surety's capital and surplus amounts, together with the name and address of the firm of certified public accountants that shall have certified those amounts):

_____

_____

_____

(3) (a) With respect to each surety participating in the issuance of the attached bond that has received from the United States Secretary of the Treasury a certificate of authority pursuant to 31 U.S.C. 9305, the underwriting limitation established therein and the date as of which that limitation was effective is as follows (indicating for each surety that surety's underwriting limitation and the effective date thereof):

_____

_____

_____

(b) With respect to each surety participating in the issuance of the attached bond that has not received such a certificate of authority from the United States Secretary of the Treasury, the underwriting limitation of that surety as established pursuant to R.S. 17:18-9 as of date on which such limitation was so established, is as follows (indicating for each such surety that surety's underwriting limitation and the date on which that limitation was established:

_____

_____

_____

(4) The amount of the bond to which this statement and certification is attached is $_____.

(5) If, by virtue of one or more contracts of reinsurance, the amount of the bond indicated under item (4) above exceeds the total underwriting limitation of all sureties on the bond as set forth in items (3) (a) or (3) (b) above, or both, then for each such contract of reinsurance:

(a) The name and address of each such re-insurer under that contract and the amount of that re-insurer's participation in the contract is as follows:

_____

_____

_____

_____

(b) Each surety that is party to any such contract of reinsurance certifies that each reinsurer listed under item (5) (a) satisfies the credit for reinsurance requirement established under P.L. 1993, c. 243 (C. 17:51B-1 *et seq.*) and any applicable regulations in effect as of the date on which the bond to which this statement certification is attached shall have been filed with the appropriate public agency.

CERTIFICATION

(to be completed by an authorized certifying agent for each surety on the bond)

I, _____ (name of agent), as _____ (title of agent)

for _____ (name of surety),

a corporation/mutual insurance company/other (indicate type of business organization by circling one) domiciled in _____ _____ (state of domicile), DO HEREBY CERTIFY that, to the best of my knowledge, the foregoing statements made by me are true, and ACKNOWLEDGE that, if any of those statements are false, this bond is VOID and I am subject to punishment.

_____
(Signature of certifying agent)

_____
(Printed name of certifying agent)

_____
(Title of certifying agent)

_____
(Date of Certification)

MANDATORY EQUAL EMPLOYMENT OPPORTUNITY LANGUAGE
N.J.S.A. 10:5-31 et seq. (P.L. 1975, C. 127)
N.J.A.C. 17:27

CONSTRUCTION CONTRACTS

During the performance of this contract, the contractor agrees as follows:

The contractor or subcontractor, where applicable, will not discriminate against any employee or applicant for employment because of age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Except with respect to affectional or sexual orientation and gender identity or expression, the contractor will ensure that equal employment opportunity is afforded to such applicants in recruitment and employment, and that employees are treated during employment, without regard to their age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Such equal employment opportunity shall include, but not be limited to the following: employment, up-grading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Public Agency Compliance Officer setting forth provisions of this nondiscrimination clause.

The contractor or subcontractor, where applicable will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex.

The contractor or subcontractor will send to each labor union, with which it has a collective bargaining agreement, a notice, to be provided by the agency contracting officer, advising the labor union or workers' representative of the contractor's commitments under this act and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

The contractor or subcontractor, where applicable, agrees to comply with any regulations promulgated by the Treasurer, pursuant to N.J.S.A. 10:5-31 et seq., as amended and supplemented from time to time and the Americans with Disabilities Act.

When hiring or scheduling workers in each construction trade, the contractor or subcontractor agrees to make good faith efforts to employ minority and women workers in each construction trade consistent with the targeted employment goal prescribed by N.J.A.C. 17:27-7.2; provided, however, that the Dept. of LWD, Construction EEO Monitoring Program may, in its discretion, exempt a contractor or subcontractor from compliance with the good faith procedures prescribed by the following provisions, A, B and C, as long as the Dept. of LWD, Construction EEO Monitoring Program is satisfied that the contractor or subcontractor is employing workers provided by a union which provides evidence, in accordance with standards prescribed by the Dept. of LWD, Construction EEO Monitoring Program, that its percentage of active "card carrying" members who are minority and women workers is equal to or greater than the targeted employment goal established in accordance with N.J.A.C. 17:27-7.2. The contractor or subcontractor agrees that a good faith effort shall include compliance with the following procedures:

(A) If the contractor or subcontractor has a referral agreement or arrangement with a union for a construction trade, the contractor or subcontractor shall, within three business days of the contract award, seek assurances from the union that it will cooperate with the contractor or subcontractor as it fulfills its affirmative action obligations under this contract and in accordance with the rules promulgated by the Treasurer pursuant to N.J.S.A. 10:5-31 et. seq., as supplemented and amended from time to time and the Americans with Disabilities Act. If the contractor or subcontractor is unable to obtain said assurances from the construction trade union at least five business days prior to the commencement of construction work, the contractor or subcontractor agrees to afford equal employment opportunities minority and women workers directly, consistent with this chapter. If the contractor's or subcontractor's prior experience with a construction trade union, regardless of whether the union has provided said assurances, indicates a significant possibility that the trade union will not refer sufficient minority and women workers consistent with affording equal employment opportunities as specified in this chapter, the contractor or subcontractor agrees to be prepared to provide such opportunities to minority and women workers directly, consistent with this chapter, by complying with the hiring or scheduling procedures prescribed under (B) below; and the contractor or subcontractor further agrees to take said action immediately if it determines that the union is not referring minority and women workers consistent with the equal employment opportunity goals set forth in this chapter.

(B) If good faith efforts to meet targeted employment goals have not or cannot be met for each construction trade by adhering to the procedures of (A) above, or if the contractor does not have a referral agreement or arrangement with a union for a construction trade, the contractor or subcontractor agrees to take the following actions:

(l) To notify the public agency compliance officer, the Dept. of LWD, Construction EEO Monitoring Program, and minority and women referral organizations listed by the Division pursuant to N.J.A.C. 17:27-5.3, of its workforce needs, and request referral of minority and women workers;

(2) To notify any minority and women workers who have been listed with it as awaiting available vacancies;

(3) Prior to commencement of work, to request that the local construction trade union refer minority and women workers to fill job openings, provided the contractor or subcontractor has a referral agreement or arrangement with a union for the construction trade;

(4) To leave standing requests for additional referral to minority and women workers with the local construction trade union, provided the contractor or subcontractor has a referral agreement or arrangement with a union for the construction trade, the State Training and Employment Service and other approved referral sources in the area;

(5) If it is necessary to lay off some of the workers in a given trade on the construction site, layoffs shall be conducted in compliance with the equal employment opportunity and non-discrimination standards set forth in this regulation, as well as with applicable Federal and State court decisions;

(6) To adhere to the following procedure when minority and women workers apply or are referred to the contractor or subcontractor:

(i) The contactor or subcontractor shall interview the referred minority or women worker.

(ii) If said individuals have never previously received any document or certification signifying a level of qualification lower than that required in order to perform the work of the construction trade, the contractor or subcontractor shall in good faith determine the qualifications of such individuals. The contractor or subcontractor shall hire or schedule those individuals who satisfy appropriate qualification standards in conformity with the equal employment opportunity and non-discrimination principles set forth in this chapter. However, a contractor or subcontractor shall determine that the individual at least possesses the requisite skills, and experience recognized by a union, apprentice program or a referral agency, provided the referral agency is acceptable to the Dept. of LWD, Construction EEO Monitoring Program. If necessary, the contractor or subcontractor shall hire or schedule minority and women workers who qualify as trainees pursuant to these rules. All of the requirements, however, are limited by the provisions of (C) below.

(iii) The name of any interested women or minority individual shall be maintained on a waiting list, and shall be considered for employment as described in (i) above, whenever vacancies occur. At the request of the Dept. of LWD, Construction EEO Monitoring Program, the contractor or subcontractor shall provide evidence of its good faith efforts to employ women and minorities from the list to fill vacancies.

(iv) If, for any reason, said contractor or subcontractor determines that a minority individual or a woman is not qualified or if the individual qualifies as an advanced trainee or apprentice, the contractor or subcontractor shall inform the individual in writing of the reasons for the determination, maintain a copy of the determination in its files, and send a copy to the public agency compliance officer and to the Dept. of LWD, Construction EEO Monitoring Program.

(7) To keep a complete and accurate record of all requests made for the referral of workers in any trade covered by the contract, on forms made available by the Dept. of LWD, Construction EEO Monitoring Program and submitted promptly to the Dept. of LWD, Construction EEO Monitoring Program upon request.

(C) The contractor or subcontractor agrees that nothing contained in (B) above shall preclude the contractor or subcontractor from complying with the union hiring hall or apprenticeship policies in any applicable collective bargaining agreement or union hiring hall arrangement, and, where required by custom or agreement, it shall send journeymen and trainees to the union for referral, or to the apprenticeship program for admission, pursuant to such agreement or arrangement. However, where the practices of a union or apprenticeship program will result in the exclusion of minorities and women or the failure to refer minorities and women consistent with the targeted county employment goal, the contractor or subcontractor shall consider for employment persons referred pursuant to (B) above without regard to such agreement or arrangement; provided further, however, that the contractor or subcontractor shall not be required to employ women and minority advanced trainees and trainees in numbers which result in the employment of advanced trainees and trainees as a percentage of the total workforce for the construction trade, which percentage significantly exceeds the apprentice to journey worker ratio specified in the applicable collective bargaining agreement, or in the absence of a collective bargaining agreement, exceeds the ratio established by practice in the area for said construction trade. Also, the contractor or subcontractor agrees that, in implementing the procedures of (B) above, it shall, where applicable, employ minority and women workers residing within the geographical jurisdiction of the union.

After notification of award, but prior to signing a construction contract, the contractor shall submit to the public agency compliance officer and the Dept. of LWD, Construction EEO Monitoring Program an initial project workforce report (Form AA 201) electronically provided to the public agency by the Dept. of LWD, Construction EEO Monitoring Program, through its website, for distribution to and completion by the contractor, in accordance with N.J.A.C. 17:27-7. The contractor also agrees to submit a copy of the Monthly Project Workforce Report once a month thereafter for the duration of this contract to the Division and to the public agency compliance officer.

The contractor agrees to cooperate with the public agency in the payment of budgeted funds, as is necessary, for on-the-job and/or off-the-job programs for outreach and training of minorities and women.

(D) The contractor and its subcontractors shall furnish such reports or other documents to the Dept. of LWD, Construction EEO Monitoring Program as may be requested by the Dept. of LWD, Construction EEO Monitoring Program from time to time in order to carry out the purposes of these regulations, and public agencies shall furnish such information as may be requested by the Dept. of LWD, Construction EEO Monitoring Program for conducting a compliance investigation pursuant to **Subchapter l0 of the Administrative Code (NJAC 17:27)**.

IF AWARDED A CONTRACT YOUR COMPANY/FIRM WILL BE REQUIRED TO COMLY WITH THE AFFIRMATIVE ACTION REQUIREMENTS LISTED ABOVE.

Firm Name:_____

Signature:_____

Title:_____

Date:_____

Additional Mandatory Construction Contract Language For State Agencies, Independent Authorities, Colleges and Universities Only

The Executive Order No. 151 (Corzine, August 28, 2009) and P.L. 2009, Chapter 335 include a provision which require all state agencies, independent authorities and colleges and universities to include additional mandatory equal employment and affirmative action language in its construction contracts. It is important to note that this language is in addition to and does not replace the mandatory contract language and good faith efforts requirements for construction contracts required by N.J.A.C. 17:27-3.6, 3.7 and 3.8. The additional mandatory equal employment and affirmative action language is as follows:

> It is the policy of the **[Reporting Agency]** that its contracts should create a workforce that reflects the diversity of the State of New Jersey. Therefore, contractors engaged by the **[Reporting Agency]** to perform under a construction contract shall put forth a good faith effort to engage in recruitment and employment practices that further the goal of fostering equal opportunities to minorities and women.
>
> The contractor must demonstrate to the **[Reporting Agency]**'s satisfaction that a good faith effort was made to ensure that minorities and women have been afforded equal opportunity to gain employment under the **[Reporting Agency]**'s contract with the contractor. Payment may be withheld from a contractor's contract for failure to comply with these provisions.
>
> Evidence of a "good faith effort" includes, but is not limited to:
>
> 1. The Contractor shall recruit prospective employees through the State Job bank website, managed by the Department of Labor and Workforce Development, available online at http://NJ.gov/JobCentralNJ;
> 2. The Contractor shall keep specific records of its efforts, including records of all individuals interviewed and hired, including the specific numbers of minorities and women;
> 3. The Contractor shall actively solicit and shall provide the **[Reporting Agency]** with proof of solicitations for employment, including but not limited to advertisements in general circulation media, professional service publications and electronic media; and
> 4. The Contractor shall provide evidence of efforts described at 2 above to the **[Reporting Agency]** no less frequently than once every 12 months.
> 5. The Contractor shall comply with the requirements set forth at N.J.A.C. 17:27.

To ensure successful implementation of the Executive Order and Law, state agencies, independent authorities and colleges and universities must forward an Initial Project Workforce Report (AA 201) for any projects funded with ARRA money to the Dept. of LWD, Construction EEO Monitoring Program immediately upon notification of award but prior to execution of the contract.

STATEMENT OF OWNERSHIP DISCLOSURE

N.J.S.A. 52:25-24.2 (P.L. 1977, c.33, as amended by P.L. 2016, c.43)

This statement shall be completed, certified to, and included with all bid and proposal submissions. Failure to submit the required information is cause for automatic rejection of the bid or proposal.

Name of Organization: _____

Organization Address: _____

Part I Check the box that represents the type of business organization:

☐ Sole Proprietorship (skip Parts II and III, execute certification in Part IV)

☐ Non-Profit Corporation (skip Parts II and III, execute certification in Part IV)

☐ For-Profit Corporation (any type) ☐ Limited Liability Company (LLC)

☐ Partnership ☐ Limited Partnership ☐ Limited Liability Partnership (LLP)

☐ Other (be specific): _____

Part II

☐ The list below contains the names and addresses of all stockholders in the corporation who own 10 percent or more of its stock, of any class, or of all individual partners in the partnership who own a 10 percent or greater interest therein, or of all members in the limited liability company who own a 10 percent or greater interest therein, as the case may be. (**COMPLETE THE LIST BELOW IN THIS SECTION**)

OR

☐ No one stockholder in the corporation owns 10 percent or more of its stock, of any class, or no individual partner in the partnership owns a 10 percent or greater interest therein, or no member in the limited liability company owns a 10 percent or greater interest therein, as the case may be. (**SKIP TO PART IV**)

(Please attach additional sheets if more space is needed):

Name of Individual or Business Entity	Home Address (for Individuals) or Business Address

Part III DISCLOSURE OF 10% OR GREATER OWNERSHIP IN THE STOCKHOLDERS, PARTNERS OR LLC MEMBERS LISTED IN PART II

If a bidder has a direct or indirect parent entity which is publicly traded, and any person holds a 10 percent or greater beneficial interest in the publicly traded parent entity as of the last annual federal Security and Exchange Commission (SEC) or foreign equivalent filing, ownership disclosure can be met by providing links to the website(s) containing the last annual filing(s) with the federal Securities and Exchange Commission (or foreign equivalent) that contain the name and address of each person holding a 10% or greater beneficial interest in the publicly traded parent entity, along with the relevant page numbers of the filing(s) that contain the information on each such person. **Attach additional sheets if more space is needed**.

Website (URL) containing the last annual SEC (or foreign equivalent) filing	Page #'s

Please list the names and addresses of each stockholder, partner or member owning a 10 percent or greater interest in any corresponding corporation, partnership and/or limited liability company (LLC) listed in Part II **other than for any publicly traded parent entities referenced above**. The disclosure shall be continued until names and addresses of every noncorporate stockholder, and individual partner, and member exceeding the 10 percent ownership criteria established pursuant to N.J.S.A. 52:25-24.2 has been listed. **Attach additional sheets if more space is needed.**

Stockholder/Partner/Member and Corresponding Entity Listed in Part II	Home Address (for Individuals) or Business Address

Part IV Certification

I, being duly sworn upon my oath, hereby represent that the foregoing information and any attachments thereto to the best of my knowledge are true and complete. I acknowledge: that I am authorized to execute this certification on behalf of the bidder/proposer; that the **The College of New Jersey** is relying on the information contained herein and that I am under a continuing obligation from the date of this certification through the completion of any contracts with **The College of New Jersey** to notify the **The College of New Jersey** in writing of any changes to the information contained herein; that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification, and if I do so, I am subject to criminal prosecution under the law and that it will constitute a material breach of my agreement(s) with the, permitting the **The College of New Jersey** to declare any contract(s) resulting from this certification void and unenforceable.

Full Name (Print):		Title:	
Signature:		Date:	

TCNJ THE COLLEGE OF NEW JERSEY

NON-COLLUSION STATEMENT

Date:_____

The College of New Jersey
The Office of Budget and Finance, Department of Purchasing
Administrative Services Building, Room 201
P.O. Box 7718
Ewing, New Jersey 08628-0718

To Whom It May Concern:

This is to certify that the undersigned bidder _____ as not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with the proposal submitted to The College of New Jersey on the_____ day of_____ , 20_____.

Signature:_____

Corporate Seal:

Attest by: _____

Sworn to and subscribed before me this_____day of _____ , 20____.

My commission Expires:_____

Notary Public

THIS STATEMENT MUST BE COMPLETED AND SIGNED

INFORMATION AND INSTRUCTIONS
For Completing the "Two-Year Vendor Certification and Disclosure of Political Contributions" Form

Background Information

On September 22, 2004, then-Governor James E. McGreevey issued E.O. 134, the purpose of which was to insulate the negotiation and award of State contracts from political contributions that posed a risk of improper influence, purchase of access or the appearance thereof. To this end, E.O. 134 prohibited State departments, agencies and authorities from entering into contracts exceeding $17,500 with individuals or entities that made certain political contributions. E.O. 134 was superseded by Public Law 2005, c. 51, signed into law on March 22, 2005 ("Chapter 51").

On September 24, 2008, Governor Jon S. Corzine issued E.O. 117 which is designed to enhance New Jersey's efforts to protect the integrity of procurement decisions and increase the public's confidence in government. The Executive Order builds upon the provisions of Chapter 51.

Two-Year Certification Process

Upon approval by the State Chapter 51 Review Unit, the Certification and Disclosure of Political Contributions form is valid for a two (2) year period. Thus, if a vendor receives approval on January 1, 2014, the certification expiration date would be December 31, 2015. Any change in the vendor's ownership status and/or political contributions during the two-year period will require the submission of new Chapter 51/Executive Order 117 forms to the State Review Unit. **Please note that it is the vendor's responsibility to file new forms with the State should these changes occur.**

State Agency Instructions: Prior to the awarding of a contract, the State Agency should first send an e-mail to CD134@treas.nj.gov to verify the certification status of the vendor. If the response is that the vendor is NOT within an approved two-year period, then forms must be obtained from the vendor and forwarded for review. If the response is that the vendor is within an approved two-year period, then the response so stating should be placed with the bid/contract documentation for the subject project.

Instructions for Completing the Form

NOTE: *Please refer to pages 3 and 4 "USEFUL DEFINITIONS for the purposes of Chapter 51 and Executive Order 117" for guidance when completing the form.*

Part 1: BUSINESS ENTITY INFORMATION

Business Name – Enter the full legal name of the vendor, including trade name if applicable.

Address, City, State, Zip and Phone Number -- Enter the vendor's street address, city, state, zip code and telephone number.

Vendor Email – Enter the vendor's primary email address.

Vendor FEIN – Please enter the vendor's Federal Employment Identification Number.

Business Type - Check the appropriate box that represents the vendor's type of business formation.

Listing of officers, shareholders, partners or members - Based on the box checked for the business type, provide the corresponding information. (A complete list must be provided.)

Part 2: DISCLOSURE OF CONTRIBUTIONS

Read the three types of political contributions that require disclosure and, if applicable, provide the recipient's information. The definition of "Business Entity/Vendor" and "Contribution" can be found on pages 3 and 4 of this form.

Name of Recipient - Enter the full legal name of the recipient.

Address of Recipient - Enter the recipient's street address.

Date of Contribution - Indicate the date the contribution was given.

Amount of Contribution - Enter the dollar amount of the contribution.

Type of Contribution - Select the type of contribution from the examples given.

Contributor's Name - Enter the full name of the contributor.

Relationship of the Contributor to the Vendor - Indicate the relationship of the contributor to the vendor. (e.g. officer or shareholder of the company, partner, member, parent company of the vendor, subsidiary of the vendor, etc.)

NOTE: If form is being completed electronically, click "Add a Contribution" to enter additional contributions. Otherwise, please attach additional pages as necessary.

Check the box under the recipient information if no reportable contributions have been solicited or made by the business entity. **This box must be checked if there are no contributions to report.**

Part 3: CERTIFICATION

Check Box A if the representative completing the Certification and Disclosure form is doing so on behalf of the business entity and all individuals and/or entities whose contributions are attributable to the business entity. **(No additional Certification and Disclosure forms are required if BOX A is checked.)**

Check Box B if the representative completing the Certification and Disclosure form is doing so on behalf of the business entity and all individuals and/or entities whose contributions are attributable to the business entity with the exception of those individuals and/or entities that submit their own separate form. For example, the representative is not signing on behalf of the vice president of a corporation, but all others. The vice president completes a separate Certification and Disclosure form. **(Additional Certification and Disclosure forms are required from those individuals and/or entities that the representative is not signing on behalf of and are included with the business entity's submittal.)**

Check Box C if the representative completing the Certification and Disclosure form is doing so on behalf of the business entity only. **(Additional Certification and Disclosure forms are required from all individuals and/or entities whose contributions are attributable to the business entity and must be included with the business entity submittal.)**

Check Box D when a sole proprietor is completing the Certification and Disclosure form or when an individual or entity whose contributions are attributable to the business entity is completing a separate Certification and Disclosure form.

Read the five statements of certification prior to signing.

The representative authorized to complete the Certification and Disclosure form must sign and print her/his name, title or position and enter the date.

State Agency Procedure for Submitting Form(s)

The State Agency should submit the completed and signed Two-Year Vendor Certification and Disclosure forms either electronically to: cd134@treas.nj.gov or regular mail at: Chapter 51 Review Unit, P.O. Box 230, 33 West State Street, Trenton, NJ 08625-0230. Original forms should remain with the State Agency and copies should be sent to the Chapter 51 Review Unit.

Business Entity Procedure for Submitting Form(s)

The business entity should return this form to the contracting State Agency.
The business entity can submit the Certification and Disclosure form directly to the Chapter 51 Review Unit only when:

- The business entity is approaching its two-year certification expiration date and is seeking certification renewal;
- The business entity had a change in its ownership structure; OR
- The business entity made any contributions during the period in which its last two-year certification was in effect, or during the term of a contract with a State Agency.

Questions & Information

Questions regarding the interpretation or application of Public Law 2005, Chapter 51 (N.J.S.A. 19:44A-20.13) or E.O. 117 (2008) may be submitted electronically through the Division of Purchase and Property website at: https://www.state.nj.us/treas/purchase/eo134questions.shtml
Reference materials and forms are posted on the Political Contributions Compliance website at: http://www.state.nj.us/treasury/purchase/execorder134.shtml

USEFUL DEFINITIONS for the purposes of Chapter 51 and Executive Order 117

- **"Business Entity/Vendor"** means any natural or legal person, business corporation, professional services corporation, limited liability company, partnership, limited partnership, business trust, association or any other legal commercial entity organized under the laws of New Jersey or any other state or foreign jurisdiction. The definition also includes (i) if a business entity is a for-profit corporation, any officer of the corporation and any other person or business entity that owns or controls 10% or more of the stock of the corporation; (ii) if a business entity is a professional corporation, any shareholder or officer; (iii) if a business entity is a general partnership, limited partnership or limited liability partnership, any partner; (iv) if a business entity is a sole proprietorship, the proprietor; (v) if the business entity is any other form of entity organized under the laws of New Jersey or any other state or foreign jurisdiction, any principal, officer or partner thereof; (vi) any subsidiaries directly or indirectly controlled by the business entity; (vii) any political organization organized under 26 U.S.C.A. § 527 that is directly or indirectly controlled by the business entity, other than a candidate committee, election fund, or political party committee; and (viii) with respect to an individual who is included within the definition of "business entity," that individual's civil union partner and any child residing with that person. [1]

- **"Officer"** means a president, vice president with senior management responsibility, secretary, treasurer, chief executive officer or chief financial officer of a corporation or any person routinely performing such functions for a corporation. Please note that officers of non-profit entities are excluded from this definition.

- **"Partner"** means one of two or more natural persons or other entities, including a corporation, who or which are joint owners of and carry on a business for profit, and which business is organized under the laws of this State or any other state or foreign jurisdiction, as a general partnership, limited partnership, limited liability partnership, limited liability company, limited partnership association, or other such form of business organization.

[1]Contributions made by a spouse, civil union partner or resident child to a candidate for whom the contributor is eligible to vote or to a political party committee within whose jurisdiction the contributor resides are permitted.

USEFUL DEFINITIONS for the purposes of Chapter 51 and Executive Order 117

- **"Contribution"** is a contribution, including an in-kind contribution, in excess of $300.00 in the aggregate per election made to or received by a candidate committee, joint candidates committee, or political committee; or per calendar year made to or received by a political party committee, legislative leadership committee, or continuing political committee or a currency contribution in any amount.

- **"In-kind Contribution"** means a contribution of goods or services received by a candidate committee, joint candidates committee, political committee, continuing political committee, political party committee, or legislative leadership committee, which contribution is paid for by a person or entity other than the recipient committee, but does not include services provided without compensation by an individual volunteering a part of or all of his or her time on behalf of a candidate or committee.

- **"Continuing Political Committee"** includes any group of two or more persons acting jointly, or any corporation, partnership, or any other incorporated or unincorporated association, including a political club, political action committee, civic association or other organization, which in any calendar year contributes or expects to contribute at least $4,300 to aid or promote the candidacy of an individual, or the candidacies of individuals, for elective public office, or the passage or defeat of a public questions, and which may be expected to make contributions toward such aid or promotion or passage or defeat during a subsequent election, provided that the group, corporation, partnership, association or other organization has been determined by the Commission to be a continuing political committee in accordance with N.J.S.A. 19:44A-8(b).

- **"Candidate Committee"** means a committee established by a candidate pursuant to N.J.S.A. 19:44A-9(a), for the purpose of receiving contributions and making expenditures.

- **"State Political Party Committee"** means a committee organized pursuant to N.J.S.A. 19:5-4.

- **"County Political Party Committee"** means a committee organized pursuant to N.J.S.A. 19:5-3.

- **"Municipal Political Party Committee"** means a committee organized pursuant to N.J.S.A. 19:5-2.

- **"Legislative Leadership Committee"** means a committee established, authorized to be established, or designated by the President of the Senate, the Minority Leader of the Senate, the Speaker of the General Assembly, or the Minority Leader of the General Assembly pursuant to N.J.S.A. 19:44A-10.1 for the purpose of receiving contributions and making expenditures.

- **"Political Party Committee"** means:

    1. The State committee of a political party, as organized pursuant to N.J.S.A. 19:5-4;
    2. Any county committee of a political party, as organized pursuant to N.J.S.A. 19:5-3; or
    3. Any municipal committee of a political party, as organized pursuant to N.J.S.A. 19:5-2

State of New Jersey
Department of the Treasury

Division of Purchase and Property
Two-Year Chapter 51/Executive Order 117 Vendor Certification and
Disclosure of Political Contributions

FOR STATE AGENCY USE ONLY

Solicitation, RFP, or Contract No._____ Award Amount_____

Description of Services _____

State Agency Name _____ Contact Person _____

Phone Number _____ Contact Email _____

☐ Check if the Contract / Agreement is Being Funded Using FHWA Funds

Please check if requesting recertification ☐

Part 1: Business Entity Information

Full Legal Business Name _____
(Including trade name if applicable)

Address _____

City _____ State _____ Zip _____ Phone _____

Vendor Email_____ Vendor FEIN (SS# if sole proprietor/natural person)_____

Check off the business type and list below the required information for the type of business selected.
MUST BE COMPLETED IN FULL

- ☐ Corporation: LIST ALL OFFICERS and any 10% and greater shareholder
- ☐ Professional Corporation: LIST ALL OFFICERS and ALL SHAREHOLDERS
- ☐ Partnership: LIST ALL PARTNERS with any equity interest
- ☐ Limited Liability Company: LIST ALL MEMBERS with any equity interest
- ☐ Sole Proprietor

Note: "Officers" means President, Vice President with senior management responsibility, Secretary, Treasurer, Chief Executive Officer or Chief Financial Officer of a corporation, or any person routinely performing such functions for a corporation.

All Officers of a Corporation or PC	**10% and greater shareholders of a corporation or all shareholder of a PC**

All Equity partners of a Partnership	**All Equity members of a LLC**

If you need additional space for listing of Officers, Shareholders, Partners or Members, please attach separate page.

IMPORTANT NOTE: You must review the definition of "contribution" and "business entity" on the Information and Instructions form prior to completing Part 2 and Part 3. The Information and Instructions form is available at: http://www.state.nj.us/treasury/purchase/forms.shtml#eo134

Part 2: Disclosure of Contributions by the business entity or any person or entity whose contributions are attributable to the business entity.

1. **Report below all contributions solicited or made during the 4 years immediately preceding the commencement of negotiations or submission of a proposal to any:**

   Political organization organized under Section 527 of the Internal Revenue Code and which also meets the definition of a continuing political committee as defined in N.J.S.A. **(See Information and Instructions form.)**

2. **Report below all contributions solicited or made during the 5 ½ years immediately preceding the commencement of negotiations or submission of a proposal to any:**

   Candidate Committee for or Election Fund of any Gubernatorial or Lieutenant Gubernatorial candidate
   State Political Party Committee
   County Political Party Committee

3. **Report below all contributions solicited or made during the 18 months immediately preceding the commencement of negotiations or submission of a proposal to any:**

   Municipal Political Party Committee
   Legislative Leadership Committee

Full Legal Name of Recipient _____

Address of Recipient _____

Date of Contribution _____ Amount of Contribution _____

Type of Contribution (i.e. currency, check, loan, in-kind) _____

Contributor Name _____

Relationship of Contributor to the Vendor _____

If this form is not being completed electronically, please attach additional contributions on separate page.

Click the "Add a Contribution" tab to enter additional contributions.

Remove Contribution

Add a Contribution

☐ Check this box only if no political contributions have been solicited or made by the business entity or any person or entity whose contributions are attributable to the business entity.

Part 3: Certification

(A) ☐ I am certifying on behalf of the business entity and all individuals and/or entities whose contributions are attributable to the business entity as listed on Page 1 under **Part 1: Vendor Information**.

(B) ☐ I am certifying on behalf of the business entity and all individuals and/or entities whose contributions are attributable to the business entity as listed on Page 1 under **Part 1: Vendor Information**, except for the individuals and/or entities who are submitting separate Certification and Disclosure forms which are included with this submittal.

(C) ☐ I am certifying on behalf of the business entity only; any remaining persons or entities whose contributions are attributable to the business entity (as listed on Page 1) have completed separate Certification and Disclosure forms which are included with this submittal.

(D) ☐ I am certifying as an individual or entity whose contributions are attributable to the business entity.

I hereby certify as follows:

1. **I have read the Information and Instructions accompanying this form prior to completing the certification on behalf of the business entity.**

2. **All reportable contributions made by or attributable to the business entity have been listed above.**

3. **The business entity has not knowingly solicited or made any contribution of money, pledge of contribution, including in-kind contributions, that would bar the award of a contract to the business entity unless otherwise disclosed above:**

a) Within the 18 months immediately preceding the commencement of negotiations or submission of a proposal for the contract or agreement to:

(i) A candidate committee or election fund of any candidate for the public office of Governor or Lieutenant Governor or to a campaign committee or election fund of holder of public office of Governor or Lieutenant Governor; OR
(ii) Any State, County or Municipal political party committee; OR
(iii)Any Legisative Leadership committee.

b) During the term of office of the current Governor or Lieutenant Governor to:

(i) A candidate committee or election fund of a holder of the public office of Governor or Lieutenant Governor; OR

(ii) Any State or County political party committee of the political party that nominated the sitting Governor or Lieutenant Governor in the last gubernatorial election.

c) Within the 18 months immediately preceding the last day of the sitting Governor or Lieutenant Governor's first term of office to:

(i) A candidate committee or election fund of the incumbent Governor or Lieutenant Governor; OR
(ii) Any State or County political party committee of the political party that nominated the sitting Governor or Lieutenant Governor in the last gubernatorial election.

4. **During the term of the contract/agreement the business entity has a continuing responsibility to report, by submitting a new Certification and Disclosure form, any contribution it solicits or makes to:**

(a) Any candidate committee or election fund of any candidate or holder of the public office of Governor or Lieutenant Governor; OR

(b) Any State, County or Municipal political party committee; OR
(c) Any Legislative Leadership committee.

The business entity further acknowledges that contributions solicited or made during the term of the contract/agreement may be determined to be a material breach of the contract/agreement.

5. **During the two-year certification period the business entity will report any changes in its ownership structure (including the appointment of an officer within a corporation) by submitting a new Certification and Disclosure form indicating the new owner(s) and reporting said owner(s) contributions.**

I certify that the foregoing statements in Parts 1, 2 and 3 are true. I am aware that if any of the statements are willfully false, I may be subject to punishment.

Signed Name _____ Print Name _____

Title/Position _____ Date _____

Procedure for Submitting Form(s)

The contracting State Agency should submit this form to the Chapter 51 Review Unit when it has been required as part of a contracting process. The contracting State Agency should submit a copy of the completed and signed form(s), to the Chapter 51 Unit and retain the original for their records.

The business entity should return this form to the contracting State Agency. The business entity can submit this form directly to the Chapter 51 Review Unit only when it -

- Is approaching its two-year certification expiration date and wishes to renew certification;
- Had a change in its ownership structure; OR
- Made any contributions during the period in which its last two-year certification was in effect, or during the term of a contract with a State Agency.

Forms should be submitted either electronically to:cd134@treas.nj.gov **, or regular mail at: Chapter 51 Review Unit, P.O. Box 230, 33 West State Street, Trenton, NJ 08625.**

State of New Jersey

DISCLOSURE OF INVESTMENT ACTIVITIES IN IRAN

Solicitation Number: _____ **Bidder/Offeror:** _____

Pursuant to Public Law 2012, c. 25, any person or entity that submits a bid or proposal or otherwise proposes to enter into or renew a contract must complete the certification below to attest, under penalty of perjury, that the person or entity, or one of the person or entity's parents, subsidiaries, or affiliates, is not identified on a list created and maintained by the Department of the Treasury as a person or entity engaging in investment activities in Iran. If the Director finds a person or entity to be in violation of the principles which are the subject of this law, s/he shall take action as may be appropriate and provided by law, rule or contract, including but not limited to, imposing sanctions, seeking compliance, recovering damages, declaring the party in default and seeking debarment or suspension of the person or entity.

I certify, pursuant to Public Law 2012, c. 25, that the person or entity listed above for which I am authorized to bid/renew:

☐ is not providing goods or services of $20,000,000 or more in the energy sector of Iran, including a person or entity that provides oil or liquefied natural gas tankers, or products used to construct or maintain pipelines used to transport oil or liquefied natural gas, for the energy sector of Iran, **AND**

☐ is not a financial institution that extends $20,000,000 or more in credit to another person or entity, for 45 days or more, if that person or entity will use the credit to provide goods or services in the energy sector in Iran.

In the event that a person or entity is unable to make the above certification because it or one of its parents, subsidiaries, or affiliates has engaged in the above-referenced activities, a detailed, accurate and precise description of the activities must be provided in part 2 below to the Division of Purchase and Property under penalty of perjury. Failure to provide such will result in the proposal being rendered as non-responsive and appropriate penalties, fines and/or sanctions will be assessed as provided by law.

PART 2: PLEASE PROVIDE FURTHER INFORMATION RELATED TO INVESTMENT ACTIVITIES IN IRAN You must provide a detailed, accurate and precise description of the activities of the bidding person/entity, or one of its parents, subsidiaries or affiliates, engaging in the investment activities in Iran outlined above by completing the boxes below.

EACH BOX WILL PROMPT YOU TO PROVIDE INFORMATION RELATIVE TO THE ABOVE QUESTIONS. PLEASE PROVIDE THOROUGH ANSWERS TO EACH QUESTION. IF YOU NEED TO MAKE ADDITIONAL ENTRIES, PLEASE ADD AN ADDITIONAL SHEET.

Name _____ Relationship to Bidder/Offeror _____

Description of Activities _____

_____

Duration of Engagement _____ Anticipated Cessation Date _____

Bidder/Offeror Contact Name _____ Contact Phone Number _____

Certification: I, being duly sworn upon my oath, hereby represent and state that the foregoing information and any attachments thereto to the best of my knowledge are true and complete. I attest that I am authorized to execute this certification on behalf of the above-referenced person or entity. I acknowledge that the State of New Jersey is relying on the information contained herein and thereby acknowledge that I am under a continuing obligation from the date of this certification through the completion of any contracts with the State to notify the State in writing of any changes to the answers of information contained herein. I acknowledge that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification, and if I do so, I recognize that I am subject to criminal prosecution under the law and that it will also constitute a material breach of my agreement(s) with the State of New Jersey and that the State at its option may declare any contract(s) resulting from this certification void and unenforceable.

Full Name (Print): _____ Signature: _____

Title: _____ Date: _____

PB-MP.1 R10/2011

MACBRIDE PRINCIPLES FORM

BIDDER'S REQUIREMENT: TO PROVIDE A CERTIFICATION IN COMPLIANCE WITH MACBRIDE PRINCIPLES AND NORTHERN IRELAND ACT OF 1989

Pursuant to Public Law 1995, c. 134, a responsible bidder selected, after public bidding, by the Director of the Division of Purchase and Property, pursuant to N.J.S.A. 52:34-12, or the Director of the Division of Building and Construction, pursuant to N.J.S.A. 52:32-2, must complete the certification below by checking one of the two representations listed and signing where indicated. If a bidder who would otherwise be awarded a purchase, contract or agreement does not complete the certification, then the Directors may determine, in accordance with applicable law and rules, that it is in the best interest of the State to award the purchase, contract or agreement to another bidder who has completed the certification and has submitted a bid within five (5) percent of the most advantageous bid. If the Directors find contractors to be in violation of the principles which are the subject of this law, they shall take such action as may be appropriate and provided by law, rule or contract, including but not limited to, imposing sanctions, seeking compliance, recovering damages, declaring the party in default and seeking debarment or suspension of the party.

I certify, pursuant to N.J.S.A. 52:34-12.2 that the entity for which I am authorized to bid:

☐ has no ongoing business activities in Northern Ireland and does not maintain a physical presence therein through the operation of offices, plants, factories, or similar facilities, either directly or indirectly, through intermediaries, subsidiaries or affiliated companies over which it maintains effective control; or

☐ will take lawful steps in good faith to conduct any business operations it has in Northern Ireland in accordance with the MacBride principles of nondiscrimination in employment as set forth in N.J.S.A. 52:18A-89.5 and in conformance with the United Kingdom's Fair Employment (Northern Ireland) Act of 1989, and permit independent monitoring of their compliance with those principles.

I certify that the foregoing statements made by me are true. I am aware that if any of the foregoing statements made by me are willfully false, I am subject to punishment.

Signature: _____

Print Name: _____

Title: _____

Firm Name: _____

Date: _____

VENDOR QUALIFICATION SHEETS

Vendors are requested to submit evidence of qualifications to meet all requirements as required by the Office of Finance & Business Services at The College of New Jersey by providing the information listed below.

If this information is being requested as part of an RFP or RFQ, vendors may be requested to furnish additional information for clarification purposes. This will in no way change the vendor's original proposal.

TO BE COMPLETED BY VENDOR

1. Please list the types of commodities that your company can provide.

   A.

   B.

   C.

2. The number of years your firm has been providing these services. _____ Year(s)

3. Location of vendor's office that will be responsible for managing contract/service:

   Name: _____

   Telephone: _____ Fax: _____

   Email Address: _____

   Street Address: _____

   City/State/Zip: _____

   Federal Identification Number: _____

4. Address where all purchase orders and payment are to be mailed by users of any contract(s) resulting from this proposal (if different from above).

   Purchase Orders:

   Firm Name: _____

   Street Address: _____

   City/State/Zip: _____

   Remittances:

   Firm Name: _____

   Street Address: _____

   City/State/Zip: _____

VENDOR QUALIFICATIONS- continued

5. Name of insurance company:

   Street Address: _____

   City/State/Zip: _____

   Types of Insurance: _____

6. Name of individual to contact for sales/services information:

   Name: _____

   Telephone: _____

   Email Address: _____

   Street Address: _____

   City/State/Zip: _____

7. List the names and titles of personnel who will service this contract:

   _____

   _____

   _____

8. Is your firm registered with the Secretary of State of New Jersey? **Yes_____ No_____**

9. Is your firm incorporated? **Yes_____ No_____**

   A) In What State? _____

10. Is your firm considered a small business in the State of New Jersey? **If yes, please attach a certificate or certification statement from the New Jersey Commerce and Economic Growth Commission.** If no and you would like to register, please contact the New Jersey Commerce and Economic Growth Commission at 609-777-0885.

    Small Business: **Yes_____ No_____**

    A) What category does your firm fall under?

    Gross Revenues do not exceed $500,000 _____

    Gross Revenues do not exceed $5 million _____

    Gross Revenues do not exceed $12 million _____

Under Executive Order 34, TCNJ is responsible for soliciting demographic information from its vendors. TCNJ is required to seek the following information from each firm under contract with us:

1. Is more than fifty percent (50%) of your company minority owned? (circle one) YES NO
   (African-American, Hispanic, Asian, and/or Native American)

2. Is more than fifty percent (50%) of your company woman owned? (circle one) YES NO

3. What is the ethnicity of the owner of your company: (check applicable according to 51% ownership)

   … Asian American
   … Multiple Ethnicities
   … Non-Minority
   … Hispanic American
   … African American
   … Caucasian American Female
   … Native American
   … Unspecified

TCNJ is required to solicit the foregoing information. Your response, however, is **strictly voluntary**. Please be advised that any contracting decisions made by TCNJ will **not** be influenced in any way by your decision to provide the above information.

EXECUTIVE ORDER #34: MINORITY AND WOMEN BUSINESS ENTERPRISES

On September 15, 2006, Governor Corzine signed Executive Order 34 establishing a Division of Minority and Women Business Development. The Division is charged with administering and monitoring policies, practices, and programs to ensure that New Jersey owned minority and women business enterprises (MWBE) are afforded an equal opportunity to participate in New Jersey's purchasing and procurement processes.

State entities are required to report to the Division the ethnic and gender composition of the vendors with which we do business.

VENDOR QUALIFICATIONS-

11. Please provide a list of former or present clients. Also, indicate the name of a contact person and telephone number for reference purposes. **Any personnel from The College of New Jersey listed as a reference will not be considered a valid reference.**

A. Client Name:

Contact Name:

Telephone Number:

Fax Number:

Email Address:

B. Client Name:

Contact Name:

Telephone Number:

Fax Number:

Email Address:

C. **Client Name:**

Contact Name:

Telephone Number:

Fax Number:

Email Address:

D. **Client Name:**

Contact Name:

Telephone Number:

Fax Number:

Email Address:

VENDOR QUALIFICATIONS- continued

12. Please answer the following questions related to your prior experience:

a. Has the bidder been found, though either court adjudication, arbitration, mediation, or other contractually stipulated alternate dispute resolution mechanism, to have: failed to provide or perform goods or services; or failed to complete the contract in a timely manner; or otherwise performed unsatisfactorily under a prior contract with the contracting unit? If yes, attach summary of details on a separate sheet.

Yes_____ No_____

b. Has the bidder defaulted on a contract, thereby requiring the local unit to utilize the services of another contractor to provide the goods or perform the services or to correct or complete the contract? If yes, attach summary of details on a separate sheet.

Yes_____ No_____

c. Has the bidder defaulted on a contract, thereby requiring the local unit to look to the bidder's surety for completion of the contract or tender of the costs of completion? If yes, attach summary of details on a separate sheet.

Yes_____ No_____

d. Has the bidder been debarred or suspended from contracting with any of the agencies or departments of the executive branch of the State of New Jersey at the time of contract award, whether or not the action was based on experience with the contracting unit. If yes, attach summary of details on a separate sheet.

Yes_____ No_____

Firm Name:_____

Signature:_____

Title:_____

Date:_____

CONTRACT FOR CONSTRUCTION

Agreement made on , 2019 between The College of New Jersey as the project owner, and, as the Construction Contractor

Contractor:
Address:

Project: STEM MEP Modifications

1. **EMPLOYMENT OF CONTRACTOR/PROJECT DESCRIPTION**. The College employs the Contractor and the Contractor agrees to perform the construction for the project identified above. The project is described in the College's plans and specifications prepared by the project architect.

2. **CONTRACT DOCUMENTS**. This contract includes the plans and specifications, and also the following documents:

    1. Request for Bids
    2. Contractor's Bid
    3. General Conditions of the Contract for Construction
    4. Addenda and clarifications issued before the bid due date
    5. Project Bidding Schedule

3. **PROJECT ARCHITECT**. The project architect is responsible for the design of the project, acting as the College's representative on the project, and performing the duties of the project architect during the construction and completion of the project. The project architect is:

    AE Firm:
    Address:

4. **SCOPE OF WORK**. The Contractor shall perform the construction work specified in this contract including the contract documents. The Contractor shall assume full responsibility for constructing and completing the project and all the work in this contract and the contract documents, including providing all labor, subcontractors, materials and equipment required, and providing all supervision, management, and scheduling required in the general conditions and as noted throughout the contract documents.

5. **CONTRACT TIMES**. All dates and durations specified for the start of construction, the milestones dates specified in this contract and the substantial completion and final completion of the project are agreed to be of the essence.

    a. **CONSTRUCTION START.** The construction work shall start no later than10 calendar days after the College issues a Notice to Proceed to the Contractor.

    b. **MILESTONES.** The construction tasks or activities shall be completed within the following number of calendar days after the construction start date (the actual dates will be set forth in the Notice to Proceed):

c. SUBSTANTIAL COMPLETION. The construction work and the project shall be substantially completed, meaning capable of being reasonably utilized for the purpose intended, within _____ calendar days after the construction start date (the actual date will be set forth in the Notice to Proceed). Substantial Completion pertains to all milestone dates of the project schedule.

d. FINAL COMPLETION. The construction work, the project and the contract shall be finally completed within _____ calendar days after the construction start date (the actual date will be set forth in the Notice to Proceed). The requirements for final completion are defined in the general conditions of the contract for construction as well as the technical specifications of the project.

e. DELAYS AND EXTENSIONS OF CONTRACT DATES.

1. **Delays Warranting Extensions.** If the Contractor is unavoidably prevented from completing any part of the work within the milestone, substantial completion or final completion dates in this contract by causes beyond the control and without the fault of the Contractor or its subcontractors, those contract dates will be extended by amounts equal to the time lost due to such delays, provided the Contractor requests extensions in accordance with the general conditions. The Contractor's right to extensions, the terms and conditions of extensions, and the right to extra compensation for certain extensions shall be governed by the general conditions.

2. **Requests for Extensions.** The Contractor must provide the College with a written notice of delay and request for an extension within 24 hours of the beginning of a delay, or it will not be entitled to an extension. Written notices and requests must comply with the general conditions, and the failure to submit them will preclude the Contractor from making any claim for an extension under the contract.

f. EXTENSION TERMS. The contract dates will be extended for the delays specified in the general conditions to the extent the delays prevent completion of the work required by the contract dates and shall be calculated in accordance with the general conditions. When there is a delay warranting an extension of the contract dates, the College is not required to authorize extra compensation to fund efforts to reduce or eliminate the effect of the delay, but if the College elects to do so, and requires such efforts as a change to the contract, the Contractor shall perform the extra work and be entitled to extra compensation for it under the change order provisions in the contract and the general conditions. The possibility of additional compensation to accelerate because of delays shall not apply to delays for which the Contractor is responsible under the contract and general conditions.

6. LIQUIDATED DAMAGES FOR DELAY. If the Contractor fails to substantially complete the project by the substantial completion date specified, the Contractor shall pay the following amounts as liquidated damages for delay for each calendar day that the project is not substantially complete beyond the substantial completion date. Liquidated damages shall be established at 1/20th of 1% of the base contract amount per calendar day.

The College and the Contractor agree that the actual loss to the College from construction delays and the inability to use the project in a substantially completed state are for the most part difficult to quantify, and that the foregoing liquidated damages formula results in damages amounts that are reasonable and are not penalties and are not intended to be penalties. The College and the Contractor agree that the amount of liquidated damages per calendar day for delays in the substantial completion of the project is a reasonable estimate of the damage to the College for not being able to use the project in a substantially completed state. The College may deduct liquidated damages from payments due under this contract, but its failure to

withhold liquidated damages to assert claims for liquidated damages shall not be deemed a waiver of the College's right to withhold or to assert claims for damages for any delays which occur at any time on the project.

7. **CONTRACT PRICE**. The Contractor shall be paid $_____ for the complete performance of this contract which was proposed by the Contractor in its bid and accepted by the College. The Contractor shall be entitled to additional compensation for authorized changes which include the cost of the changes and mark-ups included in change orders approved by the College in accordance with the change order provision in the general conditions.

8. **PAYMENTS TO CONTRACTOR**. The Contractor will be paid by the College in accordance with this paragraph and the general conditions in the contract.

a. **MONTHLY PROGRESS PAYMENTS.** The College will make progress payments as the work proceeds based on written invoices submitted monthly by the Contractor and approved by the architect and the College. No payments will be made until the Contractor submits a unit schedule break down showing the portions of the total contract price for each principal category of work and value loaded CPM schedule allocating the contract price among the schedule activities. Monthly progress payment amounts shall be based on the percentages of the work completed as of the end of the pay period (less earlier payments). All payment requests or invoices and all payments shall be governed by the general conditions as well as the special requirements of this contract, including the requirement that progress payments shall be based on a unit schedule breakdown and a value loaded CPM schedule.

b. **RETAINAGE**. The College will retain 2% of the amount due on each partial payment pending completion of the contract.

Upon acceptance of the work performed pursuant to the contract, all amounts being withheld by the College shall be released and paid in full to the contractor within 45 days of the final acceptance date agreed upon by the contractor and the State college, without further withholding of any amounts for any purpose whatsoever, provided that the contract has been completed as indicated. The holding and release of retainage shall be governed by the general conditions.

c. **CHANGE ORDERS.** The Contractor shall invoice for change order work in the monthly contract progress payment invoices as the change order work is performed, but only after a written change order and TCNJ issued Purchase Order has been signed by the College.

d. **FINAL PAYMENT.** Upon final completion of all work included in the contract including all change orders, upon acceptance of the work by the architect and the College, upon the satisfactory completion of all of the requirements in the general conditions for completion, and upon the issuance of the certificate of final completion, the Contractor will be paid the fully adjusted contract balance including any retainage withheld. The invoice for final payment and final payment shall also be subject to the general conditions and the special requirements of this contract.

e. **PAYMENT TERMS.** All invoices and payments shall also be subject to the general conditions, including the provisions regarding payments, and to the right of the College to withhold payments or to make deductions from payments. See also the Prevailing Wage Act requirements in paragraph 22. The College will pay proper final invoices within 30 days of their submission to the College with the approval of the architect.

f. **SUBMISSION OF INVOICES:** Prior to the submission of the invoice, the contractor will submit to the owner and architect, in draft form, a "pencil copy" of the monthly invoice for review and approval setting forth each line item the contractor intends to request payment in that invoice based on the claimed percent completed for that line item. Upon receipt of said "pencil copy", the owner and architect shall observe the work and in place and, on the basis of such observations, will either approve the amounts requested or modify the contractor's request, based on the owners independent assessment of the work in place. The owner will then return the pencil copy invoice to the contractor for the contractor to then adjust and submit the final invoice with the agreed to percentages completed per line item to the owner for payment. No invoice shall be submitted for payment until all amounts and completion percentages have been determined in this manner.

g. For the purposes of the State's Prompt Payment of Contractors and Subcontractors Act (N.J.S.A. 2A:30A-1, et seq.)

(1) An invoice will be deemed to have been received when it is received by the owner at the address designated in the pre-construction conference for receipt of the invoices.
(2) The "billing date" as that term is used in N.J.S.A. 2A:30A-2 shall be the earlier of the date upon which an invoice for payment is approved for payment or 20 days after the invoice is received, unless within such 20 day period the invoice is found to be incomplete or otherwise unacceptable and returned to the contractor, with a written explanation of deficiencies.
(3) In the event that an invoice is found to be deficient and returned to the contractor, the "billing date" shall be calculated from the date that a corrected invoice is received.
(4) Payment shall be considered to have been made on the date on which a check for such payment is dated.
(5) Payment terms (e.g. "net 20") offered by the contractor shall not govern the owners obligation to make payment.
(6) The following periods of time will not be included in the calculation of the due date of any contractor invoice:

- Anytime elapsed between receipt of an improper invoice and its return to the contractor, not to exceed 20 calendar days; or
- Any time elapsed between the owner's return of an improper invoice to the contractor and the owner's receipt of a corrected invoice.

h. **LIMITATIONS ON APPLICABILITY:** The provisions of this Article shall not govern the owner's payment obligations nor shall they supersede or modify any other contractual provision allowing the withholding of monies from the contractor to the extent that the contractor has not performed in accordance with the provisions of the contract. Nor shall this Article govern the owner's payment obligations nor supersede or modify any other contractual provision governing contractor claims for additional compensation beyond the base contract price and approved change orders.

i. **INTEREST:** Interest shall be payable on amounts due the contractor if not paid within thirty (30) calendar days after the billing date specified in the above subparagraph, as provided under the State's Prompt Payment of Contractors and Subcontractors Act. Interest on amounts due shall be payable to the contractor for the period beginning on the day after the required payment date and ending on the date on which the check for payment is drawn. Interest may be paid by separate payment to the contractor, but shall be paid within 30 days of payment of the principal amount of the approved invoice. Nothing in this article shall be construed as entitling the contractor to payment of interest on any sum withheld by the owner for any reason permitted under the contract or applicable law, or on any claim for additional compensation, over

and above sums due under the base contract or approved change orders.

j. SUSPENSION OF PERFORMANCE: A contractor not paid sums due under an approved invoice within thirty (30) days of the billing date may suspend performance without penalty for breach of contract, but only after providing the owner with seven (7) days written notice of non-payment, and only in the event that the owner fails to furnish the contractor, within that seven day period, with a written statement of the amount withheld and the reasons for the withholding. Nothing herein shall be construed to excuse the contractor's nonperformance, or to limit the owner's rights and remedies relating to such nonperformance, with regard to any monies withheld from the contractor upon the proper notice provided under this Article, or with regard to any contractor claim disputed by the owner.

k. Alternative Dispute Resolution: Disputes regarding nonpayment of a contractor's invoice under this Article may be submitted to a mediator upon agreement of the College. In such event, the College and the contractor shall share equally the fees and expenses of the selected mediator. Provided, however, that nothing herein shall be construed, in whole or in part, as a waiver, release or modification of the provisions of the New Jersey Contractual Liability Act, N.J.S.A. 59:13-1 et seq., as it governs claims against the College.

9. CHANGES, CHANGE ORDERS AND CHANGE ORDER DELAYS. The College may at any time authorize and direct written changes in the work which change the scope of the work and which increase or decrease the contract price. All changes including adjustments of the contract price shall be governed by this paragraph and the change order provision in the general conditions. If a change issued by the College delays the completion of any activity in the project CPM schedule, the time allowed for that activity shall be extended, and if a delay in that activity delays other activities, the critical path or the completion dates in the contract, then they too will be extended. The Contractor shall make reasonable efforts in scheduling changed work so that it does not delay or extend activities in the CPM schedule critical path, including the substantial and final project completion dates. The Contractor shall also make alternate proposals for change order work which include acceleration for the changed work where feasible to achieve this goal, and shall include the cost of such efforts in its change order requests and proposals. Change orders must specify whether they result in any delay (or extension) to any activities in the schedule, including an identification of the activities and the amount of delay in each. If no delay or extension is specified in a change order, it will be deemed an agreement by the College and the Contractor that no delay or extension results from the change order.

10. CONTRACTOR'S REPRESENTATIONS. The Contractor represents to the College that it has:

a. EXAMINATION OF CONTRACT DOCUMENTS. Examined and carefully studied the contract documents and the other documents in the bid documents, and that they are sufficient for performing the contract work at the contract price.

b. EXAMINATION OF SITE. Visited the site and become familiar with and is satisfied as to the general, local and site conditions that may affect the cost, progress, and performance of the contract work.

c. FAMILIARITY WITH LAW. Familiarized itself with all federal, state, and local laws and regulations that may affect the cost, progress, and performance of the contract work.

d. FAMILIARITY WITH OTHER INFORMATION AND OTHER DOCUMENTS. Carefully studied all reports of investigations and tests of site and subsurface conditions at or contiguous to the site and all drawings of physical conditions at the site including surface or subsurface composition, water, structures and utilities at or near to the site.

e. ADDITIONAL INFORMATION NOT REQUIRED FOR BIDDING OR CONTRACT PERFORMANCE. Does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the work at the contract price.

11. ASSIGNMENT OF CONTRACT. The Contractor may not assign this contract or any rights under or interests in the contract including its right to payments under the contract.

12. CONTRACTOR PERSONNEL ASSIGNED. The College reserves the right to request and have any member of the contractor's or subcontractor's staff replaced on the project for any reason.

13. DOMESTIC MATERIALS - N.J.S.A. 52:33-2. Notwithstanding any inconsistent provision of any law, and unless the head of the department, or other public officer charged with the duty by law, shall determine it to be inconsistent with the public interest, or the cost to be unreasonable, only domestic materials shall be acquired or used for any public work.

This section shall not apply with respect to domestic materials to be used for any public work, if domestic materials of the class or kind to be used are not mined, produced or manufactured, as the case may be, in the United States in commercial quantities and of a satisfactory quality.

14. NOTIFICATIONS/AUTHORIZED REPRESENTATIVE:

a. Notice to the Contractor. Written notices to the Contractor should be addressed to:

_____
_____
_____
_____

b. Notice to the College/Authorized Representative: Written notices from the Contractor to the College should be addressed to:

The College of New Jersey
PO Box 7718,
Ewing, New Jersey 08628

The College's contracting officer hereby authorizes the Owner's project representative to receive all contract related correspondence.

15. CLAIMS BY THE CONTRACTOR.

a. GENERAL PROVISIONS APPLICABLE TO ALL CLAIMS. Claims by the Contractor against the College shall be subject to the New Jersey Contractual Liability Act, N.J.S.A. 59:13-1 et seq. including the notice and time for suit provisions. For the purpose of determining the time within which The Contractor must file suit under the New Jersey Contractual Liability Act, 'completion of the contract' shall be deemed to have occurred upon achievement of substantial completion as defined in section 12A of these General Conditions.

The Contractor also agrees that it shall not be entitled to assert claims against the College for any compensation beyond that provided for in this contract by reason of the acts or omissions of any third parties, including but not limited to the project architect and any other contractor on this project. The Contractor also agrees that it may not assert claims for extra costs for home office expenses, home office overhead, lost profits or revenue or consequential damages as that term is defined in law. All claims shall also be subject to the terms of this contract including the general conditions, and the Contractor may not assert any claims for extra costs unless it maintains all the records of its estimated and actual costs as required by paragraph 16 and the general conditions. The Contractor also agrees that suits against the College must be pursued in the county where the project is located.

1. Notice of litigation shall be filed in writing with the other party to the Owner-Contractor Agreement and with the court having competent jurisdiction and a copy shall be filed with the Architect and the Construction Manager. The litigation shall be made within the time limits specified herewith where applicable, and in all other cases within a reasonable time after the claim, dispute and other matter in question has arisen, and in no event shall it be made after the date when institution of legal or equitable proceedings based on such claim, dispute or other matter in question would be barred by the applicable statute of limitations.

2. Unless otherwise agreed in writing, the Contractor shall carry on the Work and maintain its progress during any proceedings, and the Owner shall continue to make payments to the Contractor in accordance with the Contract Documents.

b. DELAY CLAIMS. The Contractor agrees that it may not assert claims for extra compensation by reason of any delays in its work resulting from acts or omissions of any third parties irrespective of extensions granted under paragraph 5, including but not limited to delays caused by third parties such as the project architect, other contractors, utilities and governmental authorities. The College shall only be required to pay additional compensation for delays caused by the College itself, and only to the extent required by N.J.S.A. 2A:58B-3 (delayed performance caused by the College's own negligence, bad faith, active interference or other tortuous conduct, but not for reasons contemplated by the parties and not for the negligence of others including others under contract with the College on the theory that such negligence should be imputed to the College). The College shall not be liable for any period of delay when there is a concurrent delay for which it is not responsible. Finally, the Contractor also agrees that it can only assert claims for extra costs due to delays for extra costs at the job site, and may not assert claims for extra costs for home office expenses, home office overhead, lost profit or revenue, or consequential damages as that term is defined in law.

c. CLAIMS BASED ON CONTRACT DOCUMENTS AND INFORMATION PRIOR TO BIDDING. The Contractor agrees that it can assert no claims for extra compensation beyond the bid and contract price for constructing the completed project by reason of any errors, omissions or deficiencies in the contract documents to the extent that a reasonably competent contractor should discovery the error, omission or deficiency in connection with the preparation of a bid because of its obligation to review and study the bid documents before submitting its bid, and because of its representation in paragraph 10 that it did so. In addition, the Contractor agrees that it can assert no claims for extra compensation beyond the bid and contract price for constructing the completed project by reason any lack of information affecting the construction of the project at the time of bidding, or errors in the information included or referenced in the

bid documents except to the extent permitted by Article 1 of the general conditions. The Contractor shall notify the College in writing before submitting its bid of any errors or omissions in the information provided or be precluded from seeking extra compensation or asserting a claim.

d. MEDIATION. If a dispute or claim arises out of or relates to this contract, or the breach thereof, and if the dispute cannot be settled through negotiation, the parties agree first to try in good faith to settle the dispute by mediation administered by the American Arbitration Association under its Construction Industry Mediation Rules before resorting to arbitration or litigation. The Owner reserves the right to request a mediation if it deems it necessary.

16. COST RECORDS FOR EXTRAS, AUDITS, CLAIMS: Pursuant to N.J.A.C. 17:44-2.2, the Contractor shall maintain all documentation related to products, transactions or services under this contract for a period of five years from the date of final payment. Such records shall be made available to the New Jersey Office of the State Comptroller upon request.

The Contractor shall maintain and retain weekly payroll, material, subcontractor, supplier, overhead and other cost and accounting records for the project, and for additional services or extras required by the College, including all costs which the Contractor is entitled to be paid under the contract. The Contractor shall require its subcontractors on the project to do likewise. The Contractor shall also maintain all estimates and takeoffs used in preparing and calculating its bid price. The records shall be maintained and shall be made available to the College or its representatives when requested. These records shall be maintained in accordance with generally accepted accounting principles and practices for a period of 5 years after final payment is received by the Contractor, or the duration of any dispute or lawsuit arising out of the project, whichever is later. Any failure to maintain or produce such records shall preclude the Contractor from being paid or retaining any payments which are based on costs or which should be, and expenses of it or its subcontractors including extra costs which are reflected in the records. This includes the basic contract compensation as well as extra compensation for change orders and claims of any kind.

17. INDEMNITY/LIABILITY TO THIRD PARTIES: The Contractor agrees to defend, indemnify and save harmless the College and its officers, agents, servants and employees from and against any and all suits, demands, claims, losses and damages of any kind arising out of, or claimed to have arisen out of any negligent act, error, omission or breach by the Contractor, its officers, agents, servants, employees, consultants, subcontractors or suppliers, in the performance of this contract. The Contractor shall, at its own expense, defend, and pay all charges for attorneys and all costs and other expenses arising from such suits or claims. If any judgment is rendered against the College or any of its officers, agents, servants or employees for which indemnification is required under this paragraph, the Contractor shall satisfy and discharge it. The College shall give prompt written notice to the Contractor of claims and suits for which indemnity is required in this paragraph.

18. INSURANCE BY THE CONTRACTOR: The Contractor shall procure and maintain at its own expense, insurance for damages imposed by law and assumed under this contract until at least 1 year after the completion and acceptance of the project. The insurance shall be of the kinds and in the amounts required in this paragraph, and shall be issued by insurance companies approved to do business in New Jersey. The College of New Jersey, the State of New Jersey, and the NJ Educational Facilities Authority shall be named as an additional insured on the Commercial General Liability Insurance policy. The Contractor expressly agrees that any insurance protection required by this

contract shall in no way *limit* the Contractor's obligations under this contract, and shall not be construed to relieve the Contractor from liability in excess of such coverage. Nor shall it preclude the College from taking such actions as are available to it under any other provisions of this contract or law.

a. TYPES AND MINIMUM AMOUNTS OF INSURANCE REQUIRED:

(1) Commercial General Liability Insurance (CGL). Commercial General Liability insurance ISO 1088 or later occurrence form of insurance including contractual liability with limits of at least $2,000,000 combined single limit for bodily injury and property damage liability for each occurrence. The CGL policy shall also include products/completed operations with limits of at least $2,000,000 per occurrence. This insurance shall be maintained for at least 1 year after the completion of the project.

(2) Automobile Liability Insurance. The Automobile Liability Insurance policy shall cover owned, non-owned and hired vehicles and have limits of at least $1,000,000 combined single limit for bodily injury and property damage for each occurrence.

(3) Workers Compensation/ Employer Liability. Workers Compensation Insurance shall be maintained by the Contractor and all subcontractors in accordance with the requirements of the law of New Jersey. They shall also maintain Employer's Liability insurance with limits of at least $500,000 for each occurrence.

b. EVIDENCE OF INSURANCE. The Contractor shall when this contract is signed and before beginning the work required under this contract, provide the College with valid certificates of insurance signed by an insurance provider or authorized agent or underwriter to evidence the Contractor's insurance coverage as required in this paragraph, and also copies of the policies themselves. The certificates of insurance shall specify that the insurance provided is of the types and in the amounts required in this paragraph, and that the policies cannot be canceled except after 30 days written notice to the College.

c. CANCELLATION. The certificates of insurance shall provide for 30 days written notice to the College before any cancellation, expiration or non-renewal during the term the insurance is required by this contract. The Contractor shall also be required to provide the College with valid certificates of renewal when policies expire. The Contractor shall also, when requested, provide the College with additional copies of each policy required under this contract, which are certified by an agent or underwriter to be true copies of the policies issued to the Contractor.

d. REMEDIES FOR LACK OF INSURANCE. If the Contractor fails to renew any of its required insurance policies, or any policy is canceled, terminated or modified, the College may refuse to pay monies due under this contract. The College, in its sole discretion and for its sole benefit, may use monies retained under this paragraph to attempt to renew the Contractor's insurance or obtain substitute coverage if possible for the College's sole benefit, and may invoke other applicable remedies under the contract including claims against the Contractor and its surety. During any period when the

required insurance is not in effect, the College may also, in its sole discretion, either suspend the work under the contract or terminate the contract.

19. **PAYMENT AND PERFORMANCE BOND.** The Contractor is required to furnish the College with a payment bond and a performance bond from an approved surety as described in the general conditions and bid documents. They shall conform to N.J.S.A. 2A:44-147. This contract will not become effective until these bonds are provided to and approved by the College. The bonds must also be accompanied by the surety disclosure statement and certification required by N.J.S.A. 18A:64-68.

20. **ABANDONMENT, POSTPONEMENT, TERMINATION OF PROJECT**: The College reserves the right to terminate this contract for convenience at any time by written notice to the Contractor. Unless otherwise directed, the Contractor shall immediately stop all work upon receipt of such a notice. The College also reserves the right to suspend performance and to terminate for default or improper performance by the Contractor. The rights and duties of the Contractor and the College in the event of a termination or a suspension shall be governed by the general conditions.

21. **CONTRACT TERMS, CHANGES, AND LAW:** This contract (including the completed checklist which is attached) constitutes the entire agreement between the College and the Contractor, and it shall be governed by the law of New Jersey. The terms and conditions of this contract may not be changed except by a writing signed by the Contractor and the College.

22. **PREVAILING WAGE STATUTE.** The Contractor must comply with the New Jersey Prevailing Wage Act, N.J.S.A. 34:11-56.25 through 56.57. Workers employed by the Contractor or any subcontractor or sub-subcontractor in the performance of services directly on the project must be paid prevailing wages. As required by N.J.S.A. 34:11-56.27 and 56.28, this contract cannot become effective until the College obtains from the New Jersey Department of Labor a determination of the prevailing wage rates applicable to the project as of the contract award date and attaches a copy to the contract. As required by N.J.S.A. 34:11-56.27, the Contractor or any subcontractor may be terminated if any covered worker is not paid prevailing wages on the project, and the Contractor and its surety shall be liable for any additional costs which result. The Contractor and its subcontractors must be registered with the New Jersey Department of Labor (N.J.S.A. 34:11-56.51 et seq.), and the prevailing wage rates must be posted at the job site (N.J.S.A. 34:11-56.32). The Contractor and its subcontractors must prepare accurate certified records of wages paid for each worker on the project (N.J.S.A. 34:11-56.29), and copies for the period covered by each invoice must be attached to the invoice submitted under the contract. In accordance with N.J.S.A. 34:11-56.33, the Contractor's final invoice must include a statement of all amounts still then due to workers on the project. The Contractor is also cautioned that it must use job titles and worker classifications consistent with those approved by the Department of Labor, and that, if it intends to pay apprentice rates, it must comply with the Department of Labor's regulations at N.J.A.C. 12:60-7.1 through 7.4.

23. **DISCRIMINATION IN EMPLOYMENT.** The Contractor and any subcontractors employed by it shall comply with N.J.S.A. 10:2-1 through 10:2-4 and N.J. S.A. 10:5-1 et seq., including N.J.S.A. 10:5-31 through 35 and the American with Disability Act, 42 U.S.C. 12101, which prohibit discrimination in employment in public contracts. The statute and the rules and regulations promulgated thereunder shall be considered to be part of this contract and binding upon the Contractor and its subcontractors. If the College is notified of any violation of the public contract awarding regulations in accordance with N.J.A.C. 17:27-7.4 concerning the financing of minority and women outreach and training programs, the College reserves the rights to deduct the outreach and training allocation from the contract. During the performance of this contract, the Contractor agrees that:

a. In the hiring of persons for the performance of work under this contract or any subcontract hereunder, or for the procurement, manufacture, assembling or furnishing of any such materials, equipment, supplies or services to be acquired under this contract, no contractor, nor any person acting on behalf of such contractor or subcontractor, shall, by reason of race, creed, color, national origin, ancestry, marital status, gender identity or expression, affectional or sexual orientation or sex, discriminate against any person who is qualified and available to perform the work to which the employment relates;

b. No contractor, subcontractor, nor any person on his behalf shall, in any manner, discriminate against or intimidate any employee engaged in the performance of work under this contract or any subcontract hereunder, or engaged in the procurement, manufacture, assembling or furnishing of any such materials, equipment, supplies or services to be acquired under such contract, on account of race, creed, color, national origin, ancestry, marital status, gender identity or expression, affectional or sexual orientation or sex;

c. There may be deducted from the amount payable to the contractor by the contracting public agency, under this contract, a penalty of $50.00 for each person for each calendar day during which such person is discriminated against or intimidated in violation of the provisions of the contract; and

d. This contract may be canceled or terminated by the contracting public agency, and all money due or to become due hereunder may be forfeited, for any violation of this section of the contract occurring after notice to the contractor from the contracting public agency of any prior violation of this section of the contract.

24. **COMPLIANCE WITH PROCUREMENT STATUTES:** The Contractor warrants and represents that this contract has not been solicited or secured, directly or indirectly, in a manner contrary to the law of New Jersey, and in particular the provisions of N.J.S.A. 18A:64-6.1, 6.2 and 6.3, and that the Contractor has not and shall not violate the law of New Jersey relating to the procurement of or the performance of this contract by any conduct, including the paying of any gratuity of any kind, directly or indirectly, to any College employee or officer. Any violation of this provision shall be cause for the College to terminate this contract, to retain all unpaid and/or unearned monies, and to recover all monies paid. The Contractor shall notify the College in writing of any interest which any officer, employee or consultant of the College has in, or association with, any contractor, subcontractor, material supplier, consultant, or manufacturer, or other party which has any interest in this project.

25. **CONFLICT OF INTEREST:** a. No vendor shall pay, offer to pay, or agree to pay, either directly or indirectly, any fee, commission, compensation, gift, gratuity, or other thing of value of any kind to any State officer or employee or special State officer or employee, as defined by N.J.S.A. 52:13D-13b. and e., in the Department of the Treasury or any other agency with which such vendor transacts or offers or proposes to transact business, or to any member of the immediate family, as defined by N.J.S.A. 52:13D-13i., of any such officer or employee, or any partnership, firm, or corporation with which they are employed or associated, or in which such officer or employee has an interest within the meaning of N.J.S.A. 52:13D-13g.

b. The solicitation of any fee, commission, compensation, gift, gratuity or other thing of value by any State officer or employee or special State officer or employee from any State vendor shall be reported

in writing forthwith by the vendor to the Attorney General and the Executive Commission on Ethical Standards.

c. No vendor may, directly or indirectly, undertake any private business, commercial or entrepreneurial relationship with, whether or not pursuant to employment, contract or other agreement, express or implied, or sell any interest in such vendor to, any State officer or employee or special State officer or employee having any duties or responsibilities in connection with the purchase, acquisition or sale of any property or services by or to any State agency or any instrumentality thereof, or with any person, firm or entity with which he is employed or associated or in which he has an interest within the meaning of N.J.S.A. 52:13D-13g. Any relationships subject to this provision shall be reported in writing forthwith to the Executive Commission on Ethical Standards, which may grant a waiver of this restriction upon application of the State officer or employee or special State officer or employee upon a finding that the present or proposed relationship does not present the potential, actuality or appearance of a conflict of interest.

d. No vendor shall influence, or attempt to influence or cause to be influenced, any State officer or employee or special State officer or employee in his official capacity in any manner which might tend to impair the objectivity or independence of judgment of said officer or employee.

e. No vendor shall cause or influence, or attempt to cause or influence, any State officer or employee or special State officer or employee to use, or attempt to use, his official position to secure unwarranted privileges or advantages for the vendor or any other person.

f. The provisions cited above in paragraph 3a. through 3e. shall not be construed to prohibit a State officer or employee or special State officer or employee from receiving gifts from or contracting with vendors under the same terms and conditions as are offered or made available to members of the general public subject to any guidelines the Executive Commission on Ethical Standards may promulgate under paragraph 3c.

26. **SET-OFF FOR STATE TAX NOTICE:** Pursuant to N.J.S.A. 54:49-19, and notwithstanding any other provision of law to the contrary, Whenever any taxpayer under contract to provide goods or services to the State of New Jersey or its agencies or instrumentalities, and including the legislative and judicial branches of State government, or under contract for construction projects of the State of New Jersey or its agencies or instrumentalities, and including the legislative and judicial branches of State government, is entitled to payment for the goods or services or on that construction project and at the same time the taxpayer is indebted for any State tax, the Director of the Division of Taxation shall seek to set off so much of that payment as shall be necessary to satisfy the indebtedness. The director, in consultation with the Director of the Division of Budget and Accounting in the Department of the Treasury, shall establish procedures and methods to effect a set-off. The director shall give notice of the set-off to the taxpayer, the provider of goods or services or the contractor or subcontractor of construction projects and provide an opportunity for a hearing within 30 days of such notice under the procedures for protests established under R.S.54:49-18, but no request for conference, protest, or subsequent appeal to the Tax Court from any protest under this section shall stay the collection of the indebtedness. No payment shall be made to the taxpayer, the provider of goods or services or the contractor or subcontractor of construction projects pending resolution of the indebtedness. Interest that may be payable by the State pursuant to P.L.1987, c.184 (C.52:32-32 et seq.), to the taxpayer, the provider of goods and services or the contractor or subcontractor of construction projects shall be stayed.

THE COLLEGE OF NEW JERSEY

By_____
William Rudeau, Director of Construction

Date_____

By_____
Facilities Management

Date_____

By_____
Lloyd Ricketts, Treasurer

Date_____

By_____
Anup Kapur, Executive Director of Procurement

Date_____

CONTRACTOR:

By_____

Title_____

Date_____

THE COLLEGE OF NEW JERSEY

December 2007

GENERAL CONDITIONS
OF THE
CONTRACT FOR CONSTRUCTION

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ARTICLE 1.CONTRACT DOCUMENTS, INTERPRETATION, INFORMATION FOR BIDDERS, CLAIMS BASED ON BID AND CONTRACT DOCUMENTS.

A. Definitions.

Definitions for the purpose of the contract include the following:

Addendum: A document issued to bidders by the College prior to the bid due date which supplements, revises or modifies the bid solicitation documents furnished for bidding purposes, and which must be identified and included in bids for the contract.

Architect: The architect (A/E) engaged by the College to design the project, to prepare the design documents and assist with bid documents, and may administer the construction contract and act as the agent of the College as described in the contract.

Bulletin: A document prepared by the architect describing proposed changes or additions to the work in the contract document which is issued after contract award. If the College decides to implement the change, it will provide the bulletin to the Contractor and ask it to submit a change order proposal or request (in accordance with the change order provision in the contract, general conditions and other sections of the bidding documents).

Change Order Proposal or Request: A written proposal or request submitted by the contractor in accordance with the change order provision of the contract, general conditions and other sections of the bidding documents, including proposals submitted in response to contract change directives which proposes cost, time and other terms under which the contractor will perform changed work under the contract. If accepted by the College, a written change order signed by the Vice President Facilities Management, Construction and Campus Safety and purchase order signed by the Contracting Officer of the College, and if accepted by the Contractor in writing, it will become part of the contract as a change order.

Contract Amendment: The contract can only be amended by (1) a written amendment identified as such which is signed by the College and the Contractor, (2) a change order signed in accordance with the contract documents, (3) a written contract change directive (CCD) issued by the College which should result in a change order unless issued to address some fault of the Contractor, (4) a written approval or acceptance by the College or the architect of a change requested by the Contractor in writing, provided the request for a change is specifically identified in a submittal.

Contract Change Directive (CCD): A contract change directive (CCD) is a written directive issued by the College which orders an addition, deletion or revision in the work, or a response to an emergency. A contract change directive does not by itself change the contract, but it should result in a change order which does change the contract price or times if warranted. A CCD should specify the terms of the change order which will result, and/or specify a deadline for the submission by the Contractor of a proper change order request, and/or contain other similar terms.

Contract Documents: The contract documents include the signed contract, the bid solicitation documents, the Contractor's bid proposal, and the contract documents listed in the contract. They include but are not limited to the general conditions, any supplemental general conditions, any addenda, plans and specifications, and change orders which are issued and approved by the College after the contract is awarded.

Contract Limit Lines: The lines shown on the contract plans which limit the boundaries of the project site, and beyond which no construction work or activities shall be performed by the Contractor unless otherwise specified in the contract documents including the plans and specifications and supplemental general conditions.

Contracting Officer: The Associate Treasurer of the College shall be the Contracting Officer in connection with the contract and the project. The Contracting Officer and other designee shall have authority to act on behalf of the College under the contract.

Field Order (FO): A written order issued by the architect or the College which requires minor changes in the work which do not result in a change in the contract price or the contract time. If the Contractor believes that a field order warrants the issuance of a change order which changes the contract times or price, it must notify the College and the architect in writing within 48 hours, and its notice must specify the terms of the change order which it believes are warranted, including specific time and price change requests.

Owner's Representative: The Owner's representative is a person or persons designated by the Owner to act on its behalf in administering the construction contract for the College. The Owner's representative may include the Director of Campus Construction, the Project Manager or an independent construction manager working for the Office of Campus Construction.

Site Superintendent: The site superintendent is a person or persons designated by the Owner to witness, observe, record and report on activities in and around the construction site. The site superintendent does not have the authority to stop or change the scope of work of the contract for construction.

Supplemental General Conditions: The part of the contract documents which amends or supplements the general conditions for the project.

B. Intent of Contract Documents.

The intent of the contract documents is to describe a functionally complete and aesthetically acceptable project to be constructed and completed by the Contractor in every detail in accordance with the contract documents. Any work, services, materials, equipment or documentation that may be reasonably inferred from the contract documents or from prevailing custom or trade usage as being required to produce a complete project shall be supplied whether or not specifically identified at no additional cost to the College. Where the contract documents describe portions of the work in general terms but not in complete detail, only the best construction practices and only materials and workmanship of the first quality are to be used. Only where the contract documents specifically describe a portion of the project as being performed by others is the contract work to be considered to include less than the entire project.

C. Interpretation of Contract Documents.

When two or more interpretations of a specification for the work are possible, the most stringent or the highest cost interpretation shall apply as determined by the Architect. The Architect (or in the absence of the Architect, the Owner) shall be the sole interpreter of the plans and specifications and the contractor's performance therewith. It is the intent of these plans and specifications to provide materials of a quality consistent with the highest standards provided under similar circumstances in the same general geographical area.

D. Law and Referenced Standards.

The Contractor is required to comply with all federal, state and local laws and regulations which apply to the project, the work and the contract. Where the contract documents refer to any publication, including but not limited to any standard, which affects any portion of the work or the project, it shall be considered to mean the edition or revision in effect on the bid due date unless otherwise specified in the contract documents. No provision in any publication including any standard shall change or affect the duties and responsibilities of the College, the Architect or the Contractor. Nor shall they create an obligation on the part of the College or the Architect to supervise or direct the Contractor's work.

E. Plans and Specifications.

The plans will include general plans and such details as deemed necessary to give a comprehensive representation of the construction required. The Contractor shall keep one set of plans available at the project site which shall be available for inspection by the College and the Architect at all times. All alterations affecting the requirements in the plans must be authorized in writing, and shall be promptly noted on the Contractor's record set of plans which are maintained at the site for inspection by the Contractor, the College and the Architect

F. Order of Precedence of Contract Documents.

Each of the contract documents is an essential part of the contract, and a requirement specified in one part of the documents is binding as if specified in all. The contract documents are intended to be complementary and to describe and provide for a complete project. If there is any conflict among the contract documents, the signed contract and all approved change orders shall control. As to the other contract documents, the order of the precedence shall be as follows:

(a) Contract
(b) Addenda
(c) Supplemental General Conditions
(d) General Conditions
(e) Specifications
(f) Plans
  i. Notes
  ii. Large Scale Details
  iii. Sections
  iv. Elevations
  v. Plans
(g) Scope of Work Description

G. Organization of Plans and Specifications.

The arrangement of the plans and the organization of the specifications into divisions, sections or articles shall not be construed by the Contractor as being intended to divide or allocate the work among subcontractors or trades or to establish the scope of the work to be performed by particular subcontractors or trades. The Owner is not liable for the Contractor dividing and separating the contract documents into individual packages to sub-contractors and therefore contract items not being figured for by the contractor accordingly. The contract documents work together as a whole, and therefore the contractor is required to coordinate the entire package with all its sub contractors.

H. Required Approvals.

In all cases where approvals or decisions under the contract documents are required from the College, the work shall not proceed without the required approvals and decisions in writing.

I. Conformity of Work to Contract Documents.

All work performed shall conform to the lines, grades, cross-sections, dimensions, material requirements, tolerances, details and other information in the contract documents. The purpose of tolerances is to accommodate occasional minor variations from the middle portion of the tolerance range which are unavoidable despite reasonable construction practices. When a maximum or minimum tolerance value is specified, the material and the work shall be controlled so that they shall not be preponderantly of borderline quality or dimension.

J. Work Involving Existing Structures.

On projects involving alterations, remodeling, repairs, installations or other work in pre-existing structures or systems, the Contractor shall by personal inspection of the existing structures and systems satisfy itself as to the accuracy of any information provided which may affect the quantity, size and/or quality of materials required for a satisfactorily completed contract and project, including information which is not identified or included in the plans and specifications. The Contractor shall provide all material and labor required to complete the work and contract based on conditions which can be reasonably observed by a competent and diligent contractor before bidding.

K. Verification of Dimensions.

The Contractor shall verify all dimensions at the job site and shall take any and all measurements necessary to verify the information in the plans. The Contractor shall properly and accurately layout and survey the work. Any errors or discrepancies affecting the layout of the work shall be reported to the Architect and the College immediately in writing. No work affected by any error or discrepancy shall proceed until such discrepancy is resolved by a written decision of the Architect with the consent of the College.

L. Manufacturer Literature.

Manufactured articles, materials and equipment shall be installed, applied, connected, erected, used, cleaned and conditioned in accordance with the manufacturer's written instructions unless otherwise specified in the contract documents. If there is any conflict between manufacturer literature and the contract documents, it shall be reported by the Contractor to the Architect and the College in writing, and the Contractor shall not proceed without a written decision by the Architect with the consent of the College.

M. Quality -- General Requirement.

Where no explicit quality or standard are specified for work, materials or equipment, they shall be new, of good quality, free of defects, suitable for their intended use, in conformity with the contract documents, and consistent with the highest quality of the surrounding work and of the construction of the project generally.

N. Examination of Contract Documents Before Bidding/Errors, etc.

The Contractor represents and warrants that before bidding it examined and carefully studied the contract documents and other documents included or referred to in the bid documents. The Contractor also represents and warrants that the documents are sufficient for bidding and performing the contract work at the contract price. Should it appear that any of the work or materials are not sufficiently or properly detailed or explained in the contract documents, the Contractor shall notify the College in writing before the bid deadline for submitting questions.

Errors, omissions, conflicts, discrepancies, inconsistencies or other defects in the contract documents or between the contract documents and any codes, standards or other applicable documents which are capable of being discovered by a diligent and competent contractor before bidding shall be reported to the College in writing before the bid deadline for submitting questions. If errors, omissions, inconsistencies or other defects in the contract documents are not discovered until after the bid due date, the Contractor shall promptly notify the College and the Architect of them, provide written recommendations regarding changes or corrections to resolve any such errors, omissions, inconsistencies or defects, and obtain the Architect’s written interpretation and approval before proceeding with the work affected.

O. Site Information.

Soil borings, test pits or other subsurface or site information regarding the physical site and subsurface conditions on or near the site may have been obtained from independent contractors for the purpose of preparing the design documents for the project rather than for the purpose of contractor estimating or bidding. Such information may be identified or included in the contract documents so that it can be reviewed by bidders during the bidding phase, but

because of the limited nature and purpose of the information, it shall not be considered to be part of the contract documents, and the Contractor must assume responsibility for interpreting and relying upon the information.

P. Sufficiency of Documents Provided for Bidding.

The Contractor represents and warrants that before bidding it carefully studied all reports, surveys and documents included or identified in the bid documents regarding observations, inspections, investigations and tests of the site and subsurface conditions at or near to the site, and all information provided to bidders regarding physical conditions at or near the site, including surface and subsurface composition, water, structures and utilities, and that it determined that no further examinations, investigations, tests, studies or data were necessary for bidding or the performance of the contract work at the contract price. If the Contractor concluded that additional information is required, it must notify the College in writing before the bid deadline for submitting questions.

Q. Examination of Site Before Bidding.

The Contractor represents and warrants that before bidding it visited the site and familiarized itself with and was satisfied as to the general, local and site conditions which may affect the cost, progress and performance of the work and the contract, and that its bid and bid price take into account all such conditions. No additional costs will be borne by the Owner for conditions that existed and were reasonably observable or described at the time of bidding.

R. Hazardous Materials On Site.

The Contractor will not be responsible for hazardous environmental conditions uncovered or discovered on the site which were not disclosed in the contract documents. If such conditions are discovered, the Contractor shall stop work and notify the College in writing immediately. The College may issue a written directive to the Contractor requiring it to stop work until the hazardous environmental condition is remedied, and the Contractor will be entitled to an extension of the contract times if an extension is warranted under the provisions of the contract and the general conditions regarding extensions. The College may also make changes in the contract in response to the conditions, and the contract will be changed in accordance with the change order provisions in the contract and the general conditions.

S. Limitation on Claims Based on Contract Documents and Information Provided for Bidding.

The Contractor may not assert claims for extra compensation beyond the bid and contract price for constructing the completed project by reason of any errors, omissions, inconsistencies, or defects in the contract documents which are discoverable by a diligent and competent contractor, because of its obligation to review and study the bid documents before submitting its bid, and because of its obligation to notify the College in writing before submitting its bid of errors, omissions, inconsistencies, and defects in the documents. This limitation on claims may be modified and further restricted in the signed contract when the contract requires the Contractor to participate in any aspect of the design phase.

The Contractor may assert claims for extensions and additional compensation in accordance with the contract and general conditions if information regarding the site which is identified in the bid or contract documents is factually inaccurate, and the inaccuracy is one which a reasonably competent and diligent contractor would not discover in preparing a bid. The Contractor may not assert a claim for an extension or extra compensation when it claims, not that the information is factually inaccurate, but rather that conclusions, inferences or judgments made in reliance on accurate information prove to be incorrect.

ARTICLE 2. THE COLLEGE.

A. General Rights and Responsibilities of the College.

The College as the owner of the project is entitled to have the Contractor perform and complete the contract work in accordance with the contract documents, including the time of completion, quality and documentation requirements of the contract. The College for its part undertakes to furnish the site, to notify the Contractor of any restrictions on the site which could affect the Contractor's performance of the contract, to obtain approvals relating to the

site which are needed for the construction to proceed, to pay the Contractor in accordance with the contract, and to act reasonably in reviewing all documentation, claims and questions properly submitted to it under the contract. The College also undertakes to provide the information and items which it expressly agrees in the contract documents to provide.

The College shall also have such other rights and responsibilities as are specified in the contract documents. The College will not supervise the Contractor's work or be responsible for the Contractor's construction means and methods, or the contractor's safety practices, or any failure of the Contractor to comply with the contract or any laws or regulations.

B. College Representative, Authority to Decide Contract Questions.

The Contracting Officer delegates its authority to the Owner's representative who is authorized to act and make decisions on behalf of the College regarding matters specified in the contract documents. However, the Owner's representative is not authorized to make or agree to changes to the contract involving time, contract price or material changes.

All changes to the contract including change orders that modify contract price, contract time or other material change to the contract must be reviewed and approved by the Contracting Officer or his/her designee. The contracting officer designates that the Vice President for Facilities Management, Construction and Campus Safety is authorized to approve change orders.

The Owner's representative, in consultation with the Architect, is authorized to decide on behalf of the College all questions regarding the quality, acceptability and rate of progress of the work, all questions regarding the interpretation of the contract documents, all questions regarding the acceptability of the performance of the contract by the Contractor, and all questions regarding the compensation due to the Contractor. Where the Owner's representative is authorized to render decisions under the contract regarding disputes or claims, he/she shall consult with the Architect and shall not act arbitrarily so as to unfairly benefit either the College or the Contractor.

C. Required Approvals.

In all cases where approvals or decisions are required from the College under the contract documents, such approvals or decisions shall be made reasonably, except in cases where a specific standard applies such as, for example, situations where the College is entitled to exercise unqualified discretion in selecting the types of materials, products or construction which it decides to procure.

D. Information Required from College.

Information which the contract documents specify the College will provide shall be provided with reasonable promptness.

E. Permits, Responsibility for.

The College will arrange and pay for permits and permit inspections, including building code permits except to the extent that the specifications specify otherwise. The Contractor will arrange for and coordinate all inspections and the dates and times for all inspections with local, state and independent agencies and include the Owner's representative or the site superintendent.

F. College Inspection of the Project.

The College shall have the right to be represented at the site by the Owner's representative(s), the site superintendent and other College employees designated by the College, the project architect, and other consultants designated by the College or the architect. They shall have the right to visit the site, inspect work and materials, inspect project documentation, conduct tests, attend meetings, meet with Contractor and subcontractor representatives, investigate problems, conduct studies, and make reports. They shall be allowed access to all parts of the work, and the Contractor shall furnish them with information and assistance when they request it.

The Contractor shall give the College and the architect timely notice of readiness of work for observation, inspection and testing, and shall cooperate with these efforts. The Contractor shall also comply with any inspection and testing procedures specified in the contract documents.

The Contracting Officer, the Architect and the Owner's representative shall have the right to direct the Contractor to remove or uncover unfinished work if deemed necessary to inspect work or materials in place.

If work is covered before it is inspected because the College, the architect or any consultant were not afforded a reasonable notice and opportunity to inspect, or where the contract documents or any law require an inspection, the Contractor shall uncover and replace work at its own expense if required to do so by the College.

If any other portion of the work not specifically required to be inspected is covered, and the College or the architect did not ask to observe or inspect the work before it was covered, the College may nonetheless ask to inspect the work. If the College does so, the Contractor shall uncover the work for inspection. If the work uncovered is found to be in accordance with the contract documents, the cost of uncovering and replacement shall be paid by the College by a change order. If the work uncovered is found not be to in compliance with the contract documents, the Contractor shall pay all costs of uncovering and replacement, and also remedy the defect or deficiency at its own cost.

The College at all times retains the right to stop all or part of the work by a written direction because of defective work until the defect is eliminated. This right shall not give rise to any duty on the part of the College to exercise the right for the benefit of the Contractor or those performing its contract.

G. College Inspectors, Duties and Limitations.

If the College designates inspectors to inspect work and materials and project documentation, they will not be authorized to alter or waive any requirements or provisions in the contract documents. The College's inspectors will not be authorized to issue instructions contrary to the contract documents or to act as foremen or employees of the Contractor. College inspectors will have the authority to reject unsuitable work or materials, subject to written confirmation by the Owner's representative. If the Contractor believes that any action of a College inspector is contrary to the contract documents, it shall notify the Owner's representative and the Architect in writing within 48 hours. The College does not undertake to have inspectors sufficient in number to inspect every item of work or material as it is provided, or to have inspectors with the expertise needed to judge every aspect of the work.

The Contractor shall remain responsible for defective work or materials irrespective of any inspections or lack of inspections during the work. If the Contractor seeks a binding determination of the acceptability of work or materials during the performance of the contract, it shall do so by making a written request for such a determination to the Owner's Representative with a copy to the Architect.

H. College Rejection of Defective Work.

The College shall have the right to reject defective work, materials, or equipment at any time, and to require the Contractor to remove and replace it at the Contractor's expense. The Contractor shall also be responsible for repairing damage to other work caused by defects or deficiencies in its work. The Owner's representative, upon consultation with the Architect may elect to accept work or materials which do not conform to the contract and to credit or reduce the

contract price, but the College shall have no contractual obligation to elect this remedy. Changes to the contract in these circumstances must be recorded via regular change order process.

ARTICLE 3. ARCHITECT

A. Architect's General Role.

The project architect is by contract with the College responsible for the design of the project. During construction, the architect is responsible for reviewing Contractor submittals to determine if they conform to the contract documents and good industry practice, to provide some level of inspection to determine if work and materials provided conform to the contract documents and good industry practice, and to review Contractor payment applications. During the performance of the work the architect may investigate any defects and deficiencies in the work or materials provided, and make recommendations to the College regarding the defects or deficiencies. The architect will conduct inspections to determine if the Contractor has achieved proper substantial and final completion and submitted all documents required at completion. The Contractor shall cooperate with and render assistance to the architect in the performance of these duties.

B. Architect's Access and Facilities.

The Contractor shall allow the architect and its consultants access to the project at all times, and shall facilitate their access to inspect work and materials and project documentation. The architect and its consultants shall be permitted to attend job meetings, scheduling meetings and other meetings at the site, and the Contractor shall facilitate their ability to do so. The Contractor shall provide an office at the site for the project architect if the specifications require it to do so.

C. Limitation of Architect's Responsibilities.

The architect will not be responsible for or have control of construction means and methods, or safety precautions and programs in connection with the work. The architect will not be responsible for or have control of acts or omissions of the Contractor, its subcontractors, or any of their agents or employees, or any other person performing any of the contract work.

D. Architect Rejection of Work.

The architect may recommend rejection of work or materials which it believes do not conform to the contract documents. Whenever the architect considers it necessary or advisable, it may recommend to the College special inspections or testing of work or materials, including completed work and materials.

E. Architect Review of Contractor Submittals.

The architect will review, approve or take other appropriate action regarding Contractor submittals, such as shop drawings, product data and samples, to assure that they conform with the design requirements and contract documents. The approval of a specific item shall not normally be deemed to constitute approval of an assembly of which the item is a component.

F. Architect Review of Contractor As-Built Plans.

The architect will periodically review the Contractors' as-built plans maintained at the site to ensure that they are up-to-date, and shall review the completed as-built plans at project completion to ensure that they are complete and are provided to the College.

G. Architect Determination of Satisfactory Completion.

The architect will conduct inspections to determine the dates of substantial and final completion and to determine if the Contractor has properly substantially and finally completed the project. The architect will obtain from the contractor all written warranties and all other documents which the Contractor is required to provide at the time of the project completion. The architect will make a recommendation to the College regarding final project and final contract acceptance.

ARTICLE 4. CONTRACTOR.

A. Contractor Responsibility for Performance of the Contract and Work.

The Contractor shall perform all of the duties in the contract documents, shall furnish the labor, materials and equipment to complete the construction of the project in accordance with the contract, and furnish all services, labor, materials and equipment necessary or appropriate to construct the project. The Contractor shall manage, supervise, schedule, direct, and inspect the work as competently, skillfully, and efficiently as possible, and shall be solely responsible for all construction means, methods, techniques, safety, security, sequences, procedures, and coordination.

The Contractor shall comply with all applicable laws, and shall establish and maintain reasonable quality assurance and safety programs in connection with its work. The Contractor shall complete the contract in compliance with the contract documents and by milestone, substantial completion and final completion dates in the contract or any authorized extensions thereof. The Contractor shall maintain good order and discipline at the site at all times.

B. Contractor Key Personnel.

The Contractor shall assign to the project a project executive, project manager, superintendent, and scheduler, and such other key personnel as are specified in the contract or as required to carry out the requirements of the project. The College has the authority to reject and have replaced any staff member of the contractor or subcontractors for any reason.

C. Contractor Supervision of Contract Work/Superintendent.

The Contractor shall supervise and be responsible for the acts and omissions of the Contractor's employees, agents, subcontractors, sub-subcontractors, suppliers and other persons performing portions of the work and the contract. The Contractor's designated project superintendent shall be at the project site at all times when work is in progress. The Contractor may designate in writing an alternate superintendent which must be approved by the College. The superintendent (or alternate) shall have full authority to represent and act for the Contractor at the site, and shall have full authority to execute orders and directives of the College without delay.

Communications to the superintendent shall be deemed to have been given to the Contractor. The superintendent shall be capable of and authorized to respond to all hazardous and unsafe conditions at the project site and to implement prompt corrective measures to eliminate all unsanitary, hazardous or dangerous conditions at the site. The College may suspend all or part of the work at the project site if the superintendent or alternate is not present at the project site, and such suspensions shall not be the basis of a claim against the College.

The superintendent shall attend all meetings at the project site including job meetings, scheduling meetings, and meetings with the College and/or the architects. The superintendent shall have a written plan which must be approved by the College for responding to emergencies when the work is not in progress. The Contractor shall also utilize qualified competent craftsmen on the project.

D. Cooperation with College and Other Contractors.

The College reserves the right to contract for and perform other or additional work on or adjacent to the project site. When separate contracts are let within the limits of the project site, or in areas adjacent to the site, the Contractor shall perform its work so as not to interfere with or hinder the progress or completion of the work being performed by other contractors. The Contractor shall also affirmatively cooperate with such other contractors and coordinate its activities with theirs, and include coordination measures in the project CPM construction schedule. The Contractor shall arrange its work and shall place and dispose of materials being used so as not to interfere with the operation of other contractors within the limits of the project site. The Contractor shall join its work with that of the other contractors in an acceptable manner and shall perform the work in proper sequence with that of other contractors.

If there is a disagreement as to the respective rights of the Contractor and others doing work within the limits of or adjacent to the project site, the College shall determine the respective rights of the contractors involved to secure the satisfactory completion of all affected work. The Contractor shall not be entitled to additional compensation beyond its contract price which may arise because of inconvenience, delay, or loss experienced by it as a result of the presence and operations of other contractors working within the limits of or adjacent to the project site.

The Owner reserves the right to occupy any portion of the Project which is ready for occupancy prior to completion and acceptance of the Project, after Local and State Construction Enforcing Agency approval.

The occupancy of any portion of the Project does not constitute an acceptance of any work nor does it waive the Owner's right to liquidated damages or constitute an acceptance of any work as the Project will be accepted as a whole and not in units. Prior to such occupancy, however, the Architect, a representative of the Owner, and the Contractor shall fully inspect the portions of the Project to be occupied, preparing a complete list of omissions of materials, faulty workmanship, or any items to be repaired, torn out or replaced. The Owner will assume responsibility for damage to premises so occupied of any items not on this list when such damage is due to greater than normal wear and tear, but does not assume responsibility for improper or defective workmanship or materials.

E. Performance of College Directives.

When the College issues a written directive to the Contractor under the authority of any provision in the contract or general conditions, the Contractor shall perform as directed in a diligent manner and without delay. Compliance with written directives shall not adversely affect the rights of the Contractor under the contract or law, but if the Contractor objects to a directive of the College, or claims that a directive infringes upon its rights or entitles it to a change order, it shall notify the College in writing within 2 business days of any directive and describe any objection it has to the directive and the reasons for its objection. Objection to a written directive does not relieve the contractor of the obligation to comply with the directive and proceed in a diligent manner to implement the directive without delay.

ARTICLE 5. PERFORMANCE OF WORK

A. Protection of Work/Materials, etc.

The Contractor, shall at its own expense, protect all finished work and materials from damage and keep them protected until the project is accepted as substantially completed, and shall repair or replace any work or material damaged before acceptance. After the project is accepted as substantially complete, the Contractor will remain responsible up through final completion for damage to work and materials caused by it or its subcontractors or others participating in the performance of its contract obligations. The Contractor shall also secure and protect its own tools, equipment, materials and supplies, and the College shall have no liability for damage, theft or injury to the Contractor's property.

B. Safety and Safety Programs.

The Contractor shall have full responsibility for safety at the project site at all times up to final completion and acceptance of the project and the contract. The Contractor shall provide for the safety of all individuals on the project site, and take measures to ensure that individuals on or near the project site are not injured by the performance of the contract. The Contractor shall establish and maintain a project safety program in accordance with all applicable laws including OSHA, good industry practice, and any additional requirements in the contract documents. If the College or the Architect become aware of an unsafe situation, the Contractor will immediately respond to remedy the safety concern.

C. Working Hours.

Except as required for the safety or protection of persons or property, or as specified in the contract documents, all work at the site shall be performed during regular working hours, and not on Saturdays, Sundays, or legal holidays without the prior written consent of the College which will not be unreasonably withheld.

D. Site Security.

The Contractor shall provide, maintain and oversee security at the site if required in the specifications. The project site shall be fenced as specified in the specifications, and the Contractor shall control access when gates are unlocked or open.

E. Site Use.

The Contractor shall confine construction equipment, storage and work to the project site absent written approval from the College. Any request by the Contractor to use areas outside the project site must be described in written form and included with the Contractor's bid.

F. Submittals (Shop Drawings, Product Data, Samples).

The Contractor shall submit to the architect with reasonable promptness a schedule for all submittals, including shop drawings, product data and samples required by the contract documents. Submittals shall be complete as to quantities, details, dimensions and design criteria. The architect will approve and the College will review submittals if they conform to the contract documents, the design concept and good industry practice. The Contractor shall note its approval of all submittals and the date for any submittals prepared by any subcontractor or supplier, and it shall be responsible for determining and verifying all materials, field dimensions, field construction criteria, and coordination requirements pertaining to the submittal.

The Contractor will not be relieved of responsibility of deviations in submittals from the requirements in the contract documents by reason of approvals of the submittals unless the Contractor specifically identifies the deviation in the submittal and the architect expressly approves and the College will review the deviation. The Contractor shall be responsible for errors or omission in its submittals. No work or materials included in a submittal shall begin until the submittal is approved by the architect and the College.

G. Layout and Dimensional Control.

The Contractor shall be responsible for locating and laying out the project components and all of the project parts on the project site in strict accordance with the plans, and shall accurately establish and maintain dimensional control. The Contractor shall employ a competent and licensed New Jersey engineer or land surveyor as appropriate to perform all layout work and to fix the level and location of excavations, footing base plates, columns, walls, floors and roof lines. The Contractor shall furnish to the College and the architect certifications that each such level is as required by the plans as the work progresses.

The plumb lines of vertical surfaces shall be tested and certified by the Contractor's engineer or surveyor as the work proceeds. The engineer or surveyor shall establish all points, lines, elevations, grades and bench marks for the proper control and execution of the work. The engineer or surveyor shall establish a single permanent benchmark to be approved by the architect, to which all three coordinates of dimensional control can and shall be based. The engineer or surveyor shall verify all College-furnished topographical and utility survey data, and all points, lines, elevations, grades and benchmarks provided.

Should any discrepancies be found between information in the plans and the actual site or field conditions, the Contractor shall notify the architect and the College in writing, and shall not proceed with any work affected until it receives written instructions from the College.

The contractor is required to provide a final "as built" survey from a New Jersey Licensed/Certified Surveyor of the project site showing all structures, elevations, grades and required information on the project site and submit to the College in CADD format.

H. Construction Access, Roads, Walks, and Parking.

The Contractor shall construct and keep all roadways, drives, walkways and parking areas within or near the site free and clear of debris, gravel, mud or any other site materials, including, for example, by the cleaning of muddy wheels and undercarriages on vehicles before they exit the site. The Contractor shall be responsible for any citations, fines, or penalties imposed on it or the College for failing to comply with applicable local rules or laws regarding its use of roads and the like.

The Contractor shall obtain permission in writing from the College before using for construction purposes any existing driveways, parking areas, walkways or areas not specifically designated for such use in the contract documents. The Contractor shall maintain such driveways and areas in good and clean condition during construction and not damage them. At final acceptance and completion, it shall leave them in the same condition as they were at the start of the work. Conditions of such facilities before use shall be photographed and otherwise documented by the Contractor. The Contractor shall not commence construction of permanent driveways, parking areas or walks on the project without the written approval of the College.

Any existing walkways, driveways, aprons, or curbs damaged by the work of this contract shall be replaced in kind immediately upon project completion, or as required to maintain campus safety and campus aesthetics.

I. Construction Site Condition, Storage, Dust Control.

The Contractor shall provide reasonable, safe and orderly storage for its equipment, tools and materials, and not unreasonably encumber the site. The Contractor shall keep the site and the project free from the accumulation of refuse, debris and scrap materials caused by its operations so that the site has a neat, orderly and workman-like appearance. Loading, cartage, hauling and dumping will be at the Contractor's expense. The Contractor shall provide at its expense temporary dust-proof partitions around areas of work in existing buildings, and where reasonably required in new building areas.

J. Photographs.

The Contractor shall provide at its expense monthly progress photographs of the project. The photographs shall be 8 inches by 10 inches and shall be submitted to the College in duplicate monthly. Unless otherwise specified in the supplemental general requirements, four photographs shall be submitted each month which provide views of the project taken from the same four points each month which should be selected by the architect.

K. Project Sign.

The Contractor shall at its expense provide, erect and maintain two project signs at the site which shall be described in the contract documents. The College will specify the locations. The sign shall be painted by a professional sign painter. No other sign will be permitted at the site. The Contractor shall remove the signs when the project is finally accepted unless the College requests that it be removed earlier.

L. Soil Conservation.

The Contractor shall employ reasonable measures to conserve the soil at the site, and determine and comply with all soil conservation measures required by the Mercer County Soil Conservation District.

Contractor shall coordinate and schedule all Soil Conservation inspections and provide the College with all site inspection notes, approvals or notices.

M. Temporary Facilities, Services, Electric, Heat and Enclosures.

The Contractor shall provide storage areas, temporary drives and sidewalks, employee parking areas, staging areas, excavation borrow/spoil areas, commercial canteen areas, field offices including a meeting room, telephones, toilet facilities, and other temporary facilities which are necessary to perform the work or which may be required by the project specifications. The Contractor shall locate these facilities on the project site, and the location shall be subject to the approval of the College.

The Contractor shall provide adequate and clean temporary toilet facilities on the project site in locations to be approved by the College, and they shall be serviced at least twice a week by a firm qualified and experienced in such functions. The Contractor shall provide such temporary electricity, water, and other utilities which are necessary to perform the work, or which may be required by the project specifications. The Contractor shall also supply such temporary enclosures and heat which are necessary to perform the work or which may be required by the project specifications. The contractor and the subcontractors will not enter or use any College facilities not required by the work of the contract.

Temporary electric and heat shall be furnished by the Contractor for the benefit of other contractors working on the project if specified in the project specifications.

The Contractor shall not anticipate using the permanent heating or air conditioning system in a building for temporary heat or air conditioning prior to the acceptance of the project as substantially complete unless specified otherwise.

Any natural gas, or combustible material, or hazardous material containers utilized by the Contractor must be stored in a safe, ventilated location approved by the College. The Contractor must also submit for approval a reasonable safety plan for the operation of temporary heat equipment.

N. Substitutions

The Contractor may include in their bid substitute materials or equipment or construction methods in lieu of those specified in the contract documents, but they do so at their own risk. Any substitution must be equal in type, function and quality to the item required in the contract. The Contractor must submit all information required within 20 days of contract award to determine if the proposed substitute is equal to the contract requirements, and any substitution must be approved by the architect and the College

The College shall have complete discretion to decide whether it will accept any substitution. No substitution shall result in any increase in the contract price or times. The Contractor in its application for the substitution must certify

in writing that the substitution is equal to what is specified in the contract documents in all material respects and will not increase the time or price of the contract work.

Should the substitution be rejected, the contractor will then be required to provide the specified product, material or method at no additional cost to the College and no change in the project schedule.

O. License Fees.

The Contractor shall be responsible for obtaining the right to use any equipment, design, device or material required to perform the contract, and to include in its contract price any license fee or royalty required.

ARTICLE 6. SUBCONTRACTORS.

A. Contractor Responsibility for Subcontracted Work.

The Contractor shall be fully responsible to the College for the proper performance of the contract irrespective of whether the work is performed by the Contractor's own forces or by subcontractors employed by the Contractor. The Contractor shall be responsible for the acts and omissions of its subcontractors and suppliers on the project and shall take appropriate measures if they are not properly supervising or performing their work.

B. Subcontractor Identification and Approval.

The Contractor shall include with its bid for the contract the names, addresses and license numbers of all subcontractors which it proposes to utilize on the project for plumbing and gas fitting work, HVAC work, electrical work, structural steel and ornamental iron work. No subcontractor may perform work on the project until it has been approved by the College.

Within 20 days after Notice to Proceed, the Contractor shall furnish to the College in writing for review by the Architect a list of the names of all Subcontractors, Sub-subcontractors, fabricators, manufacturers, sources of supply, articles, devices, fixtures, pieces of equipment, materials and processes proposed for each item of Work on List of Subcontractors, AIA Document G805. The Architect or Owner will promptly notify the Contractor in writing if either the Owner or Architect, after due investigation, has reasonable objection to any names on such list. Failure of the Owner and Architect to make objection within 10 days to any name on the list shall constitute acceptance of such name.

In submitting the names of subcontractors, the Contractor shall list 1) the name and address of the Subcontractor, 2) the name and address of all Sub-subcontractors for each significant subdivision of the trade or work 3) reference in the form of a list of at least 3 jobs similar in size and quality to this Project performed in the last 5 years, with name and location of work, dollar value and names of the Owner and Architect.

In submitting sources of supply of materials, articles and pieces of equipment including those under subcontracts and sub-subcontracts, the Contractor shall list 1) the name and address of the source of supply 2) the name of the manufacturer of the items.

If the College disapproves a proposed subcontractor, it will provide the reason for its decision in writing. The College will not be liable for any extra cost or delays caused by the reasonable disapproval of proposed subcontractors. The approval of subcontractors by the College shall not relieve the Contractor of the responsibility for complying with all of the provisions of the contract including those performed by the subcontractors. Subcontractors approved by the College may not be changed without prior notice to and approval by the College.

C. Subcontractor Qualifications.

The College may disapprove a proposed subcontractor if it has a reasonable objection to the subcontractor, or if there is evidence of poor performance on other projects or financial problems, or if the subcontractor has been suspended or debarred by any public agency within the State of New Jersey, or if the subcontractor is not properly licensed and registered to do business in New Jersey or with the New Jersey Department of Labor regarding prevailing wages, or if the subcontractor has been charged with or convicted of violating any laws including but not limited to the New Jersey Prevailing Wage Act, criminal laws, public procurement laws, anti-trust laws, election laws, laws against employment discrimination, environmental laws, tax laws, professional licensing laws, or laws regarding attempts to improperly influence College or other public officials. Subcontractors shall also utilize qualified, competent craftsmen on the project.

D. Subcontractor Compliance with Contract/Subcontractor Supervisors.

The Contractor shall require its subcontractors on the project to comply with all pertinent terms of the contract and contract documents, and shall include all appropriate terms and provisions in subcontracts on the project to achieve proper contract performance. Each subcontractor shall have competent superintendents and foremen supervising their work, and the Contractor shall take appropriate measures if they do not do so.

E. No Contract Relationship Between College and Subcontractors.

Nothing in the contract or contract documents shall create any contractual relationship or duties between the Contractor's subcontractors and the College.

ARTICLE 7. TIME, LIQUIDATED DAMAGES, DELAY CLAIMS AGAINST COLLEGE.

A. Contract Times.

The Contractor shall begin the contract work within 10 days after the issuance of a notice to proceed by the College, and shall perform the work in the contract by the dates specified in the contract, including milestone, substantial completion and final completion dates.

B. Liquidated Damages For Delay.

If the Contractor fails to substantially complete the project by the substantial completion date specified, the Contractor shall pay the amounts specified in the contract as liquidated damages for delay for each calendar day that the task remains incomplete beyond the substantial completion date.

The College and the Contractor agree that the actual loss to the College from construction delays and the inability to use the project in a substantially completed state are for the most part difficult to quantify, and that the foregoing liquidated damages formula results in damages amounts that are reasonable and are not penalties. The College and the Contractor agree that the amount of liquidated damages per calendar day for delays in the substantial completion of the project is a reasonable estimate of the damage to the College for not being able to use the project in a substantially completed state. The College may deduct liquidated damages from payments due under this contract, but its failure to withhold liquidated damages or to assert claims for liquidated damages shall not be deemed a waiver of the College’s right to withhold or to assert claims for damages for any delays which occur at any time on the project.

C. Delay Claims Against The College -- Limitations

The Contractor may not assert claims against the College for extra compensation by reason of any delays in its work resulting from acts or omissions of any third parties irrespective of extensions granted under the contract, including but not limited to delays caused by third parties such as the project architect, other contractors, utilities and governmental authorities.

The College shall only be required to pay additional compensation for delays caused by the College itself, and only to the extend required by N.J.S.A. 2A:58B-3 (delayed performance caused by the College's own negligence, bad faith, active interference or other tortuous conduct, but not for reasons contemplated by the parties and not for the negligence of others including others under contract with the College on the theory that such negligence should be imputed to the College). The College shall not be liable for any period of delay when there is a concurrent delay for which it is not responsible.

When the Contractor is entitled to extra compensation for delay under the contract and general conditions, it can only assert claims for extra costs at the job site, and may not assert claims for extra costs for home office expenses, home office overhead, lost profit or consequential losses. Any additional compensation under this paragraph shall also be subject to the provisions in the contract and general conditions regarding claims, and the provisions in the contract and general conditions regarding the maintenance and availability of cost records.

D. MEDIATION

If a dispute or claim arises out of or relates to this contract, or the breach thereof, and if the dispute cannot be settled through negotiation, the parties agree first to try in good faith to settle the dispute by mediation administered by the American Arbitration Association under its Construction Industry Mediation Rules before resorting to arbitration or litigation. The Owner reserves the right to request a mediation if it deems it necessary.

ARTICLE 8. PROJECT SCHEDULE.

A. General Schedule Requirements.

The Contractor shall schedule the construction work and determine the most feasible means and order for the work to complete the project within the times required by the contract. The Contractor shall prepare a project schedule and monthly schedule updates which must be approved by the College and the architect, and it shall perform the contract and the work in accordance with the schedule. The project schedule should include a schedule of submittals for approval. The project schedule must be submitted before any work (other than mobilization to site and general layout and site preparatory work) on the project can begin under the notice to proceed. When the Contractor's schedule is approved by the College, it shall become an additional contract document and the Contractor shall be required by the contract to comply with it. The project schedule and updates shall be used in determining the amount of the monthly progress payments to the Contractor. The College may also use the schedule and updates to determine if the Contractor is adequately planning and performing the work in accordance with the contract.

B. Form and Content of Schedule.

The Contractor shall prepare the project schedule using Critical Path Method (CPM) scheduling techniques. The Contractor shall utilize the latest revision of Primavera P3 or Microsoft Scheduling software. The Contractor shall prepare a detailed schedule which shows how it will plan, organize, execute and complete the work. The schedule shall be in the form of an activity oriented network diagram (CPM). The principles and definitions used in this section shall be as set forth in the Associated General Contractors of America (AGC) publication "Construction Planning and Scheduling", copyright 1994.

The detailed network diagram shall provide sufficient detail and clarity of form and technique so that the Contractor can plan, schedule and control its work properly, and the College and the architect can readily monitor and

follow the progress of all portions of the work. The network diagram shall comply with the limitations imposed by the scope of the work and contractually specified milestone dates and completion dates. The CPM schedule shall include the arrow or network diagram and the computer produced schedule with dates. The schedule shall include and reflect the following factors:

1. Project phasing, and contract milestones and completion dates.
2. The structural breakdown of the project.
3. The types of work to be performed and the labor trades involved.
4. Reasonable logic and activity durations.
5. Reasonable coordination of all activities.
6. Purchase, manufacture and delivery activities for all major materials and equipment.
7. Deliveries of College furnished equipment.
8. Allowances for work by separate contractors identified in writing by the College at the time of contract award.
9. Submittals and approvals of shop drawings, material samples, and other required submittals.
10. Subcontract work.
11. Crew flows and sizes (manpower).
12. Assignment of responsibility for performing all activities.
13. Access and availability to work areas.
14. Identification of interfaces and dependencies with preceding, concurrent and follow-on contractors, and sequences and interdependence of activities.
15. Testing and inspections.
16. Phased or total inspection, acceptance, and takeover by the College.
17. Utilization of schedule to determine amounts of monthly progress payments.
18. Activities required of the College and the project architect such as approvals, including reasonable durations for the activities.

Activities should be set forth in working days and have a maximum duration of 60 days, except for non-construction activities such as the procurement and delivery of materials and equipment. All durations shall be the result of definitive manpower and resource planning by the Contractor. The level of detail in the schedule shall be subject to the approval of the College. The schedule shall include a reasonable approach to achieve milestones and completion dates in the contract. Any failure of the Contractor to include any element of the work in the schedule shall not excuse the Contractor from completing that work and all of the work needed to complete the project by the completion dates in the contract.

The network diagram is to be prepared by a computer plotter. The logic diagram will be pure logic and shall not be drawn to time scale. The logic diagram shall be drawn on 30" x 42" size sheets and prepared on a tracing/mylar or similar material suitable for reproducing high quality prints.

C. Computerization of Schedule.

The mathematical analysis of the detailed network diagram shall be made by computer, and the tabulation for each activity shall include the following:

1. Activity numbers.
2. Activity descriptions.
3. Durations in work days for each activity.
4. Earliest start date (by calendar date).
5. Earliest finish date (by calendar date).
6. Latest start date (by calendar date).
7. Latest finish date (by calendar date).
8. Slack or total float in work days.

The following computer documents shall be prepared as part of the initial schedule submission and each update:

1. Activity file sort, including sorts listing activities required of the College and the project architect, such as approvals.
2. Eight week "Lookahead" detailed bar chart.
3. Eight week summary bar chart.
4. Additional computer sorts requested by the College.
5. High density floppy disks or CDs of all computer files.

D. Weather Inclusion in Schedule.

Seasonal weather conditions shall be included in the schedule, including average precipitation, temperature and other weather conditions typical in the geographic area over a 5 year period by quarterly period (spring, summer, fall, winter).

E. Schedule Updates.

The Contractor shall prepare schedule updates monthly until its contract and the project are completed. The first update shall be issued 30 calendar days after the construction start date specified in the notice to proceed. Updates shall include the following information:

1. Actual start and completion dates for activities.
2. Activity percent completion.
3. Remaining durations for activities in progress.

Each schedule update shall also include a narrative report which includes the following information:

1. Summary of work completed during update period.
2. Comparison of actual progress and status to activities and dates in original schedule.
3. Analysis of critical path including affect of activity progress on critical path.
4. Analysis of secondary critical paths, meaning float within 10 days of the project critical path.
5. Analysis of time lost or gained during the update period.
6. Identification of problem areas.
7. Identification of change orders and delays impacting or delaying the project under the project schedule.
8. Solutions or proposed solutions to current problems and delays.
9. Extensions requested by the Contractor, including activities affected and the amounts, and the reasons for the requests.
10. Extensions granted by the College for delays and changes, including the activities affected and the amounts, and any effect on the critical path and contract completion dates.
11. Delays in activities required of the College and the project architect, and activities which they are required to complete in the update period following the issuance of the update.

All schedule updates must be submitted to the College and the architect for approval. Schedule updates including the reports which are approved by the College shall be deemed to be official records of the progress and status of the project under the schedule and the contract, and may be utilized by the College in determining if the Contractor is adequately planning and performing the work under contract.

F. Meetings/Eight Week Bar Charts.

The Contractor’s project manager and scheduler shall arrange for and attend monthly progress and scheduling meetings with the College and the project architect. Monthly progress meetings shall be scheduled 3 to 7 days after monthly schedule updates and reports are issued and provided to the College and the project architect. The purpose of

these meetings will be to review past progress, current status, problem areas, delays, measures to reduce delays, future progress, and the Contractor's most recent schedule update and report. At the monthly progress meetings, the Contractor shall provide look ahead summary and detailed bar charts showing the work and activities to be performed and/or completed during the 8 week period following the schedule update.

G. Schedule Documentation for Contract Payments.

The Contractor will not be entitled to payments under the contract until a project schedule has been submitted to and approved by the College. No payment will be made under the contract if, when the payment is due, a schedule update and narrative report is due under this paragraph but has not been submitted to and approved by the College. The original CPM project schedule shall include a breakdown allocating the total contract price among the network activities in the schedule which must be approved by the College.

H. Progress, and Recovery Schedules.

The Contractor shall perform its work in accordance with the schedule. If the Contractor's work falls behind the requirements of the schedule, it shall at its own cost institute measures to improve its progress and bring its work in compliance with the schedule, including but not limited to increasing manpower, increasing work hours per shift, increasing shifts, increasing working days per week, and re-scheduling work activities to perform them concurrently where feasible.

If monthly schedule updates show that the Contractor's progress has fallen behind the project schedule so as to jeopardize the achievement of milestone or completion dates in the contract by more that 10 work days, the Contractor shall, if requested by the College in writing, prepare a recovery schedule with acceleration measures to regain the lost time, and shall proceed in accordance with the recovery schedule in additional to the project schedule at its own cost.

I. Contractor Failure to Provide Schedule Updates.

If the Contractor fails to provide monthly schedule updates and reports when required, the College can elect in it sole discretion to employ any of the following remedies: 1) not make progress payments; 2) on 10 days written notice to the Contractor, retain its own consultant to provide schedule updates and reports and deduct the cost from the contract price; 3) terminate the contract for default in accordance with the termination provision in these general conditions.

J. Scheduler Qualifications.

The Contractor must utilize a scheduler which satisfies the qualification requirements for the project. If at any time during the project it appears that the Contractor's scheduler is not competent to provide the scheduling services required in this article, the Contractor shall within 10 days after a written notice and demand from the College, retain a replacement scheduler which is competent to provide the services required. The College may also utilize any of the remedies in this article and the contract and general conditions for the Contractor's failure to provide proper schedule updates and reports.

ARTICLE 9. EXTENSIONS, COMPENSATION FOR CERTAIN EXTENSIONS.

A. Delays Warranting Extensions of Contract Dates.

If the Contractor is unavoidably prevented from completing any part of the work within the milestone, substantial completion or final completion dates in the contract by causes beyond the control and without the fault of the Contractor or its subcontractors, those contract dates will be extended by amounts equal to the time lost due to such delays, provided the Contractor requests extensions in accordance with this article. Delays warranting extensions of the contract dates include unforeseeable and unavoidable delays caused by the College, the project architect, other contractors employed by the College, utility owners or other third parties, acts of God, acts of governmental authorities, wars, abnormal weather conditions, fires, floods, earthquakes, epidemics, plagues, and other unavoidable casualties. The

contractor has 24 hours to notify the owner in writing from the start of a delay with a clear and concise reason for the delay, otherwise the delay will not be reviewed. This limited time frame is to provide the College the opportunity to immediately address the issue and limit the amount of time in the potential delay and its potential impact on the project schedule.

B. Weather Delays.

No time extensions will be granted for time lost due to normal seasonal weather conditions. To qualify for a time extension due to unusually severe or abnormal weather conditions, the Contractor must demonstrate that the weather conditions during a given quarterly period (summer, fall, winter, spring) were more severe at the project site than the previous five year average for the geographic area by quarter, and that the weather conditions critically impacted contract milestone, substantial completion or final completion dates by delaying the performance of work on the project's critical path. No time extensions will be considered for any weather conditions that do not affect work on the critical path or contract dates.

Where the cause of delay is due to weather conditions, extension of time shall be granted only for unusually severe weather, as determined by reference to historical data. The term "historical data" as used in the preceding sentence shall be construed according to this formula: Average rainfall (or snow or low temperature) for the past five years for the month in question, plus 10 percent. In other words, weather is not deemed to be unusually severe unless it is 10 percent worse than the average for that month over the last five years.

Apart from extension of time, no payment or allowance of any kind shall be made to the Contractor as compensation for damages on account of hindrance or delay from any cause in the progress of the work, whether such delay be avoidable or unavoidable. The Contractor agrees that he will make no claim for compensation, damages for any such delays, and will accept in full satisfaction for such delays said extension of time.

C. Float Time Use.

Float time in the schedule is not for the exclusive use of either the Contractor or the College. Float time is available for use by both parties to facilitate the effective use of available resources and to minimize the impact of problems and delays which may arise during construction. No time extension will be granted as a result of any problem, change order or delay which only results in the loss of available positive float on the project schedule. Float time shown on the project schedule shall not be used by the Contractor in a manner which is detrimental to the interests of the College or the project.

D. Calculation of Extensions.

Extensions will be calculated based on the effect of delays on the project schedule and the activities in the schedule. If the Contractor is entitled to an extension for a delay based on the nature of the delay under this article, the activities in the schedule affected by the delay will be extended by the amount they are affected. If extensions of activities in the project schedule affect the critical path and delay the contract milestone and completion dates, they too will be extended to the extent affected. The critical path and contract dates will only be extended to the extent that they are actually affected under the schedule by a delay for which the Contractor is entitled to an extension.

If for any scheduled activity or period there are concurrent delays which include delays for which the Contractor is entitled to an extension and delays for which the Contractor is not entitled to an extension, the Contractor will be given an extension for the delays for which it is entitled to extension so that it will not be liable to pay liquidated damages for delay, unless the College eliminates or reduces that delay. A concurrent delay will not justify an extension to the Contractor if it has minimal effect on the completion of the project, and/or if it would likely have been avoided if it had become apparent that it was having an effect on the progress of the project and the project completion date.

E. Elimination of Delays and Extensions (Acceleration).

If the effect of a delay for which the Contractor is entitled to an extension can be reduced or eliminated by changes in the schedule or other measures which have no material adverse impact on the Contractor in terms of cost or otherwise, the Contractor shall employ those measures so that no extension is required or so that a shorter extension is required. If the Contractor is entitled to extensions for delays, and if the College (in its sole discretion) notifies the Contractor in writing that it prefers to eliminate the lost time to avoid or reduce the extension required, by changes or additional efforts such as acceleration efforts, the Contractor shall perform those measures as a change to the contract to be compensated under the change order provisions of the contract and the general conditions.

F. Requests for Extensions Required.

The Contractor must provide the College with a written notice of delay and request for an extension within 24 hours of the beginning of a delay, or it will not be entitled to a review. The written notices of delay and requests for extensions must include the nature and cause of the delay, the known extent of the delay, the work activities on the project schedule affected by the delay and the extent of the affect to each, and suggestions or proposals to reduce or eliminate the delay.

G. Compensation for Certain Extensions and Limitations.

Under the contract and general conditions, the College does not assume responsibility for many types of delays, including additional costs resulting from extensions granted because of those delays. Where the College is responsible for a delay under the express terms of the contract and general conditions, it will pay extra compensation for any extension granted because of the delay.

Compensation by the College for delays (and extensions) for which it is responsible under the contract and general conditions shall only include additional costs actually incurred at the site, and shall not include home office expense, home office overhead, lost profit or consequential losses. Any additional compensation under this paragraph shall be subject to the provisions in the contract and general conditions regarding claims, and the provisions in the contract and general conditions regarding the maintenance and availability of cost records.

No compensation will be paid if an extension for a delay for which College is responsible is concurrent with another delay for which the Contractor is not entitled to an extension, or is concurrent with another delay which the Contractor is entitled to an extension but the College is not responsible for the other delay.

If the College requests a change in the contract work, potential delays and extensions which result from the change and any resulting extra compensation for the change shall be addressed under the change order provisions in the contract and the general conditions in addition to this article.

ARTICLE 10. PAYMENTS TO CONTRACTOR.

The College will pay the Contractor as full compensation for performing the contract the contract price as adjusted by approved change orders which increase or decrease the contract price. The College will do so in accordance with this article, any supplemental general conditions regarding payment, and the payment terms in the signed contract. Payment provisions in the supplemental general conditions which add to or modify this provision shall take precedence over this provision. Payment provisions in the signed contract which add to or modify payment terms shall take precedence over the supplemental general conditions and this article.

A. Monthly Progress Payments.

The College will pay the Contractor monthly progress payments as the contract work proceeds and will pay for work completed, less retainage. The Contractor shall submit monthly invoices using the College's invoice form for the work completed in each calendar month, and the monthly invoice shall be submitted in accordance with the contract. The Contractor shall be entitled to monthly progress payments based on the percentage of the contract work completed (less earlier payments), and that amount shall be based on the unit schedule breakdown and the update of the CPM for the

billing period showing schedule activities completed and progress on incomplete activities, in conjunction with the values assigned to those activities. If there is a discrepancy between the amount due based on the unit schedule breakdown and the amount due based on the CPM update, the Contractor shall only be entitled to the lesser amount unless the Owner's Representative, in his/her sole discretion, decides otherwise.

B. Unit Schedule Breakdown/CPM Activity Price Breakdown.

Before the contract is signed, the Contractor shall submit to the College and the architect a unit schedule breakdown (schedule of values) utilizing the College's form which reasonably allocates the contract price among the principal categories of work and materials in the contract. The unit schedule breakdown must be signed by the Contractor and is subject to approval by the architect and the College for use in calculating monthly progress payments under the contract. The Contractor shall not "front end load" the unit schedule breakdown. The unit schedule breakdown may include line items for mobilization, bonds and insurance.

The Contractor's proposed CPM schedule shall reasonably allocate the contract price among the activities in the schedule so that monthly CPM schedule updates can be utilized in connection with the unit schedule breakdown in determining the amount of monthly progress payments. The Contractor's unit schedule breakdown and CPM activity price breakdown must be approved by the architect and the College before any payments are made under the contract.

C. Invoices for Monthly Progress Payments: Form and Content.

The Contractor must utilize the College's invoice form and the invoice forms must be completed before they are submitted for payment. Each invoice must be signed by the Contractor, and shall certify that the work and materials represented as having been provided have been provided, and that all subcontractors and all suppliers on the project have been paid all amounts legitimately due for work and materials billed to the College in earlier invoices which were paid by the College.

Invoices for monthly project payments must include the status of the work in the unit schedule breakdown and the CPM update for the billing period which shows the activities completed or started and the value of them based on the CPM schedule. Invoices must also include certified payrolls for the Contractor and all subcontractors for the billing period, affirmative action monthly manning reports, a certification of subcontractor/supplier payments, a partial waiver of liens, a list of all materials stored to date including descriptions, values, quantities and location, and any documents required in the contract documents.

The Contractor will be entitled to have an invoice paid if the architect and the College approve the invoice including the percentage of work completed, and if the quality of the work and materials conform to the contract documents. The approval of invoices shall not waive claims for defects or deficiencies in the work or materials provided, or the right to subsequently inspect the project as a complete and functioning whole.

D. Payment for Materials and Equipment Procured But Not Installed.

The Contractor may seek payment in monthly invoices for materials and equipment delivered to the project site but not yet incorporated into the work. The Contractor shall include with its monthly invoices a list of the stored equipment, the amount and type of stored materials, and the place where they are stored. Each invoice which seeks payment for materials and equipment delivered to the project site but not installed or incorporated into the work shall include a signed bill of sale to the College and an invoice from the supplier. All risk of loss or damage for materials and equipment delivered in the project site shall remain with the Contractor.

The College will only rarely pay for material or equipment stored offsite, and only when it determines in its sole discretion that there is good cause. The College will consider no request to pay for materials or equipment stored off site unless the Contractor includes a written request for such payment with its bid for the project. If the College does agree to pay for material or equipment stored off site during the performance of the contract, it will do so when the contract is signed.

If the College does agree to pay for materials and equipment stored off site, such payments shall be subject to any conditions in the signed contract, and in all cases, a bill of sale to the College, a paid invoice, insurance and proof the storage facility is bonded will have to be provided to the College when each payment is sought. The location will have to be specified in writing and the material or equipment will have to be inspected by the College. The Contractor and it performance bond surety must agree in writing that they retain all risk of loss or damage, and each payment application must contain a consent to payments for materials stored off site signed by the Contractor's bonding company.

Payments on account of materials or equipment not incorporated in the Work but delivered and suitably stored at the site, or at some other location agreed upon in writing, may be made by the Owner subject to the following conditions:

Such materials or equipment shall have been fabricated or assembled specifically for the Project and delivered to storage no earlier than needed for the orderly progress of the Work as demonstrated by the Progress Schedule.

Title to such materials or equipment shall pass to the Owner pursuant to the Contractor's bill of sale which shall contain guarantee of replacement thereof in the event of damage thereto or disappearance thereof due to any cause. The Contractor shall also affirm that it will pay for such materials or equipment immediately upon receipt of payment therefore from the Owner.

In the case of off site storage, the Contractor shall also provide Consent of Surety to such payment and insurance of such materials or equipment against the perils set forth in the General Conditions both while storage and during transportation to the site. Raw materials or other materials or equipment readily duplicated or usable on other projects will be paid for only after the materials are incorporated in the construction.

E. Retainage.

The College will retain 2% of the amount due on each partial payment pending completion of the contract.

Upon acceptance of the work performed pursuant to the contract, all amounts being withheld by the College shall be released and paid in full to the contractor within 45 days of the final acceptance date agreed upon by the contractor and the State college, without further withholding of any amounts for any purpose whatsoever, provided that the contract has been completed as indicated.

F. Payment for Change Order Work.

The Contractor shall invoice for change order work in the monthly contract progress payment invoices as the change order work is performed, but may only do so after a written change order has been signed by the appropriate College personnel and a purchase order issued by the College.

G. Final Payment.

Upon final completion of all work included in the contract including all change orders, upon acceptance of the work by the architect and the College, and upon the issuance of the final acceptance certificate, the Contractor will be paid the fully adjusted contract balance including any retainage. The Contractor shall submit an invoice for the final payment, and that invoice must include a release of all claims except claims expressly identified and described in the invoice including the amounts. The final invoice must be accompanied by all warranties, guarantees, manufacturer literature, approved as-built drawings, shop drawings required, and other documents which the Contractor is required by the contract to provide to the College at the time of final completion. The final invoice must also include a written signed consent to the final payment signed by the Contractor's bonding company.

H. Payment Terms.

All invoices and payments shall be subject to the terms of the contract and the general conditions, including the provisions regarding payments, and to the right of the College to withhold payments or to make deductions from payments for damages, defective work, liquidated damages, third party claims, failure to complete work, contract requirements, failure to comply with schedule obligations or other causes authorized by the contract documents. See also the Prevailing Wage Act requirements in the signed contract.

I. Payment Based on Partial Acceptance (Limitation).

The College will not accept portions of the project as substantially or finally complete unless specified elsewhere. If the specifications authorize partial acceptances, they will also specify the terms and conditions of such acceptances.

J. Failure to Pay Amounts in Dispute Not to Affect Performance.

The failure of the College to pay any amount requested by the Contractor in an invoice based on a determination that the invoice is improper or some other dispute shall not entitle the Contractor to stop or slow down the performance of the contract work.

K. Waiver of Certain Claims by College Against Contractor in Connection with Final Payment.

In its final acceptance certificate the College shall certify that it has no claims against the Contractor in connection with the performance and completion of the contract except for claims listed in the final acceptance certificate, such as claims for cost overruns, delays, or known defects. The College's certification shall not apply to or release post-completion claims, such as claims for defects or other problems in the completed project which are discovered or which become serious after project completion, warranty or maintenance claims, indemnity or contribution claims, claims for damage occurring after completion, or other claims for the performance of post-completion obligations in the contract or problems which manifest themselves after completion.

ARTICLE 11. CHANGES.

A. Changes Authorized.

The College may at any time authorize and direct changes in the work or accelerations of the work which increase or decrease the contract price. All changes including changes in the contract price shall be governed by this Article and the change provision in the contract. All changes must be in a written change order signed by the Vice President for Facilities, Construction and Campus Safety, the Owner’s Representative, the architect and the contractor. A

Purchase Order will then be issued by the College and signed by the Contracting Officer. At which time the contractor can then bill for the completed change order work. Any extensions in the contract times and increases in compensation because of extensions resulting from changes shall be governed by Article 9 regarding extensions, but the authorization for the extra compensation itself resulting from an extension must be contained in a change order which complies with this Article as well. The College may elect to have changed work on the project which is within the scope of this contract performed by another contractor. Changes in the contract shall not affect the surety bond protection or insurance coverage required by the contract.

B. Change Request or Directive.

The College may request a change in the work or materials to be provided under the contract by a written contract change directive ("CCD") signed by the Owner's Representative. If the College is of the opinion that no change in the contract price or times is required because of the change request, it shall so state in the CCD. A CCD may include provisions regarding the scope of the changed work or materials, and may also include conditions including time parameters or an upset price. A CCD may provide that specified contract work shall stop until further notice, but the Contractor shall not stop or delay any contract work because of a CCD unless the CCD provides that work should stop because of the change. A CCD may provide that the performance of changes shall not commence until a change order is issued and a subsequent purchase order is issued and signed by the Contracting Officer, or that changed work should proceed before a change order and purchase order are issued by the College to maintain the progress of the project.

C. Change Orders Which Are Protested.

If the Contractor protests the terms of a change order, it shall notify the College in writing within 2 business days of its protest. It shall describe the terms which it objects to and the reasons for its protest. It shall include supporting documentation if appropriate. The College may elect to direct the Contractor in writing to perform the change order requirements despite the protest. If it does so, the Contractor's right to pursue further relief based on the protest shall be preserved and the contractor shall immediately proceed with the change work

D. Changes Affecting Contract Times.

Changes and change orders shall not affect or extend any of the contract times unless the change order itself specifies that it changes contract times. If a change order issued by the College delays the completion of any activity in the project CPM schedule, the time allowed for that activity shall be extended, and if a delay in that activity delays other activities, the critical path or the completion dates in the contract, they too will be extended. The Contractor shall make reasonable efforts in scheduling changed work so that it does not delay or extend activities in the CPM schedule including the substantial and final project completion dates. The Contractor shall also make alternate proposals for change order work which include acceleration for the changed work where feasible to achieve this goal, and shall include the cost of such efforts in its change order requests.

Change orders must specify whether they result in any delay (or extension) to any critical path activities in the schedule, including an identification of the activities and the amount of delay in each. If no delay or extension is set forth in a change order, it will be deemed an agreement by the College and the Contractor that no delay or extension results from the change order.

E. Contractor Initiated Change Order Requests.

If the Contractor contends that any directive or communication from the College or architect, or any condition, event or circumstance entitles it to a change order changing the contract scope, terms, price or times, it shall submit a written change order request to the Owner's Representative within 5 days of the event upon which the request is based. The written request shall specify the terms of the change order requested, and include all documentation and information which the Contractor seeks to have considered in support of the request, or which is necessary to a proper consideration of the request.

F. Change Order Amounts.

All price changes or amounts in change orders shall be based on (1) lump sum, (2) actual work time and materials plus mark-ups for overhead and profit, or (3) unit prices times actual quantities which may or may not include separate mark-ups for overhead and profit. If a change order price is to be based on a lump sum price or a unit price, the College may request the submission of such documentation regarding market price or cost which it reasonably deems necessary to determine a lump sum or unit price. If a change order is based on actual work time and material costs, it will include a not-to-exceed price.

Applications for payment for change order work shall be included in monthly progress payment invoices as the change order work is performed, but only after a purchase order has been issued to the contractor by the College. For change orders based on time and material costs or unit prices times actual quantities, the time spent, material provided, and quantities performed shall be recorded in daily time slips, material invoices, and quantity of work performed tickets which are signed by a representative of the College to certify that the work and materials were provided, and the quantities. Labor costs and material costs for change orders shall be based on actual costs to the Contractor without any mark-ups except as provided in this Article.

Mark-ups may be added to time and material costs where a change order is authorized to be paid on a time and material basis, and also unit price change orders if the change order price term expressly authorizes mark-ups as a separate additional charge to be added to the unit price. When mark-ups for overhead and profit are authorized, the standard mark-up for overhead and profit shall be 15% of net costs properly invoiced in the change order. The schedule for mark ups is as follows:

- 15% of direct costs for overhead, profit, bond, and insurance for work performed directly by the contractor;
- 15% of direct costs for overhead, profit, bond, and insurance for work performed directly by the subcontractor and 5% of the direct and indirect costs of the work performed by the subcontractor for the contractor;
- 15% of direct costs for overhead, profit, bond, and insurance for work performed directly by the subcontractor's subcontractor and 5% of the direct and indirect costs of the work performed by the subcontractor's subcontractor for the subcontractor and 5% of the direct and indirect costs of the work performed by the subcontractor for the contractor;

There shall be no additional mark-ups for materials or suppliers and bond and insurance costs are included in the noted mark ups above. Refer to Division 1 specifications also for further delineation of items included in mark ups.

CONTRACTOR MUST USE THE COLLEGE OF NEW JERSEY FORM INCLUDED IN THE PAYMENT PROCEDURE DOCUMENTS.

G. Right to Audit Extra Costs (Before and After Payment).

The College reserves the right to audit all change orders and additional costs claimed and/or paid under the contract at any time.. The obligation of the Contractor, subcontractors and suppliers to establish, maintain and produce cost records and remedies for failing to do as specified elsewhere in these general conditions and the contract shall govern. If an audit reveals that actual costs invoiced to the College and/or paid by the College in change orders exceed the actual costs incurred, the Contractor shall refund the excess, or the College may deduct the excess from future payments under the contract, or the College may assert claims against the Contractor and/or its surety for such overpayments.

H. Change Orders with Both Price Increases and Decreases.

If a change order reduces the scope of the work or materials to be provided by the Contractor under the contract, the change order shall provide for a reduction in the contract price in the amount of the actual reduction in cost. If a change order results in both added costs and reduced costs, they shall be combined for a net plus or minus contract price

adjustment, and when mark-ups are applicable, they shall only be added to a net increase in the contract price which results from a combination of additions and deductions in the change order.

I. Waiver of Rights In Connection with Change Orders Issued Without Protest.

The Contractor shall not be entitled to seek any additional compensation or any extension of the contract times beyond the amounts and any extensions included in a change order signed by the College or a written change order request submitted by the Contractor to the College for approval, the intent being that the Contractor must disclose all additional costs and delays claimed to result from a change so that the College can take measures in considering the change to effect cost savings and avoid delays. The failure to include extra costs or delays in a change order request will preclude the Contractor from later claiming such costs or delays in connection with the change in any form or fashion.

ARTICLE 12. COMPLETION.

A. Substantial Completion.

When the Contractor believes that the project is substantially complete, meaning all essential requirements of the contract have been sufficiently completed so that the project can be occupied and used for its intended purpose, it can make a written request to the architect and the College to conduct an inspection and to issue a certificate of substantial completion. The Contractor's request shall list all work and contract requirements which remain to be completed or corrected and an estimate of the value of the incomplete items.

The architect and the College will conduct an inspection, and if they determine the Contractor has substantially completed the project, the College will issue a certificate of substantial completion. If they determine that the Contractor has not achieved substantial completion, the College will notify the Contractor in writing and will list the work and contract requirements which must be completed for substantial completion and provide a punchlist. They will also assign a value to the incomplete items to be added to the 2% retainage held after the certificate of substantial completion is issued. The College and the architect will re-inspect when the Contractor notifies them in writing that those items have been completed.

Any failure of the College or architect to include incomplete or deficient items in a certification of substantial completion or a notice regarding a substantial completion inspection shall not affect the Contractor's obligation to properly complete all requirements of the contract.

The College will not issue a certificate of substantial completion unless it can occupy and use the project for its intended purpose, and the Contractor agrees that the College's use and occupancy of the project shall not affect the Contractor's obligation to complete the project and contract requirements. The Contractor also agrees that its completion of the project will not unreasonably interfere with the College's occupancy and use of the project.

Unless otherwise specified in the supplemental general conditions, a certificate of substantial completion will not be issued unless an unqualified temporary or permanent certificate of occupancy is issued, and the College is able to use and occupy the project without interruption.

After substantial completion, the Contractor is relieved of the duty of maintaining and protecting the project, and of its responsibility for damage to the project occurring after substantial completion, except insofar as such damage or any repair is covered by warranty, or is caused or made necessary by the act of the Contractor or anyone for whom the Contractor is legally or contractually responsible, or is attributable to defects. The issuance of a certificate of substantial completion shall not void or alter any of the other terms of the contract documents, including but not limited to terms relating to warranties, or relieve the Contractor of its obligation to complete the work or remedy defective work or materials, unless such terms are expressly modified by the certificate of substantial completion.

Guarantee periods for equipment, workmanship and materials shall commence when the certificate of substantial completion is issued or from the completion and acceptance of equipment, workmanship or materials, which ever is later, unless otherwise specified in the supplemental general conditions or the certificate of substantial completion.

The rights of the Contractor regarding payments upon the issuance of the certificate of substantial completion shall be as provided in the payment article of these general conditions and the contract.

B. Final Completion.

The Contractor shall notify the architect and the College in writing when it has completed the project and all of the contract requirements. The architect and the College will then conduct an inspection and issue a certificate of final completion if the project and all contract requirements have been totally completed. If any items remain incomplete or unsatisfactory, the College will notify the Contractor in writing and list the incomplete or unsatisfactory items. The Contractor shall immediately complete and correct any unfinished items and notify the architect and College and request a follow-up inspection for final acceptance.

The certificate of final completion will not be issued until all documents required by the contract have been provided, including warranties, maintenance and operating instructions, certificates, insurance, shop drawings required and as-built drawings approved by the architect. Final completion must include leaving the entire project site and project clean, neat and orderly. All distortions, cracks, delaminating and deteriorations of finished surfaces must be remedied. All broken items shall be repaired. All paint spots, stains and plaster must be removed. All unused equipment and excess material shall be removed. The project and the site shall be clean and finished.

If the Contractor unreasonably delays completing and correcting items needed for the issuance of the certificate of final completion, the College may unilaterally issue a certificate of final completion which lists incomplete and defective items, and which deducts liquidated damages and the cost of remedying incomplete and defective items from the final amount due to the Contractor under the contract.

Final payment will not be made until the certificate of final completion is issued, and the final payment shall be subject to the payment provision in the contract and these general conditions.

ARTICLE 13. SUSPENSION AND TERMINATION OF CONTRACT.

A. Suspension.

The College shall have the right to stop or suspend the work in whole or in part at any time. The work may only be stopped or suspended by a written directive of the Owner's Representative, except in an emergency. The representative of the College may stop or suspend the work in whole or in part on an emergent basis, either verbally or in writing, but any such emergent suspension or stop work order shall be confirmed by a written directive from the Owner's Representative within 48 hours. The College may stop or suspend the work because of any conditions affecting health or safety on or off site, any dangerous condition, any environmental hazard, the convenience of the College, or the public interest. If a directive to stop or suspend all or part of the work includes directions to secure the site, the Contractor shall perform the work required in the directive. The Contractor shall also maintain the safety and security of the project during the suspension for the protection of the site, work in place, materials and equipment on site, persons on or near the site, and the College's property.

If all or part of the work is suspended in response to a problem or condition caused by the Contractor's performance of its contract, or parties other than the College itself, or conditions over which the College has no control, the Contractor will not be entitled to any additional compensation for the suspension. If the College directs the suspension of work because of the improper performance of the contract by the Contractor or those performing its contract, the Contractor will not be entitled to any extension of any contract dates or additional compensation by reason of the suspension. If a suspension is directed for reasons other than fault of the Contractor or others involved in its

performance of the contract, the Contractor will be entitled to an extension under and to the extent authorized in Article 9, and additional compensation under and to the extent authorized by Article 11.

B. Termination for Convenience.

The College may by a written directive terminate the contract at any time before completion for the College's convenience or where it concludes that it is in the public interest to do so. The Contractor shall complete any items of work specified in the notice of termination for convenience and any work necessary to make the site safe for all persons and property at or near the project site when the College terminates the contract for convenience under this Article.

Absent Contractor fault or violation of the contract, the Contractor shall be paid in full for all completed work, subject to the payment provisions in the contract and these general conditions. The Contractor will not be entitled to payment for costs and mark-ups for work or materials not provided before the termination, or costs for work and materials not provided unless the Contractor cannot avoid liability to pay those costs, or profit on the portion of the contract which will not be performed because of the termination, or other types of damages. The extra compensation payable to the Contractor in connection with a termination for convenience may include the cost of materials or equipment purchased for the project before termination but not installed if the Contractor cannot otherwise use or sell them.

The Contractor will also be entitled to reasonable costs in reasonable amounts for additional direct costs in connection with the termination, but not administrative, home office or overhead costs, lost profit, or consequential damages. In addition, any claims shall be subject to the provisions in the contract and general conditions regarding claims and the maintenance of cost records.

The Contractor shall also include provisions similar to this provision in subcontracts and supply contracts for the project. When a termination for convenience is directed by the College, the contract shall be closed out in accordance with the provisions of the contract and these general conditions regarding payment and project completion.

C. Termination for Cause.

The College may terminate the contract for cause if the Contractor commits substantial violations of the contract and contract documents, persistently fails to perform the work in accordance with the contract documents including the project schedule, fails to comply with applicable laws, rules or regulations, fails to pay subcontractors or suppliers to the extent reasonably required, become insolvent or becomes a debtor in a bankruptcy proceeding, fails to pay its debts, is found to have made false or misleading statements to the College in writing in obtaining the contract or payments, fails to comply with employment discrimination laws, fails to pay prevailing wages, fails to maintain or renew the required insurance, fails to maintain proper protection for the safety of persons or property on the site, fails to comply with reasonable and authorized directives of the College under the contract, or assigns its rights or interests under the contract or payments under the contract to any third party.

If the College terminates the contract for cause, it shall first send a notice of intent to terminate to the Contractor and the Contractor's surety. The notice shall direct the Contractor to remedy or eliminate the deficiency within a specified time if the problem is one that can be eliminated. If the Contractor fails to reasonably comply with the directive and notice, the College may after 10 days issue a notice of termination to the Contractor and its surety which terminates the contract effective immediately and specifies the reason for the termination.

If the contract is terminated the Contractor shall secure the site and take measures to leave the site safe for persons, material, work in place and equipment before departing the site, and shall remove all tools and equipment within 5 days of the termination effective date. The Contractor shall not remove any materials or equipment stored on site. When the contract is terminated, the Contractor shall deliver to any location designated by the College materials purchased for the project and paid for by the College, but not stored on site, together with all appropriate warranties and guaranties.

If the Contractor's surety does not takeover the completion in accordance with this Article, the College may appropriate any or all materials on the site which may be suitable and acceptable and may enter into an agreement for the completion of the project with another contractor, or use other methods to complete the project.

All damages, costs and charges incurred by the College together with the cost of completing the work, will be deducted from any monies due or which may become due to the Contractor for work completed by it before the termination. If such expenses exceed the sum available from the unpaid contract balance, the Contractor and its surety shall be liable and shall pay to the College the amount of such excess in addition to other damages.

The rights and remedies of the College in connection with a termination for cause shall be in addition to other rights and remedies which it has under law, the contract, and the Contractor's bond.

If the College terminates the contract for cause and it is subsequently determined by a court that the Contractor was not in default, or that the termination was legally unjustified, the termination will be deemed to be a termination for convenience under this Article, and the rights and remedies of the Contractor and its surety for the termination will be limited to those which exist in connection with a termination for convenience. If the College terminates the contract for cause, neither the Contractor nor the College may file a suit to recover on any claims arising out of the project before the project is substantially complete.

D. Surety Takeover Following Termination for Cause.

If the College terminates the Contractor for cause, the Contractor's performance bond surety may elect to takeover and complete the Contractor's work and obligations under its contract. If the surety elects to takeover the completion of the contract, it may only do so on the following conditions:

1. The surety must notify the College that it will takeover completion of the contract by a written notice of intent which is signed by a representative authorized to bind the surety within 5 calendar days of the surety's receipt of the College's notice of termination.

2. The surety and the College must execute a written takeover agreement within 10 days after the surety sends its notice of intent to takeover. In the agreement, the surety must agree to assume the obligation to complete the balance of the work under the contract and to perform all of the Contractor's obligations under the contract at the surety's sole cost and expense, and to utilize only contractors approved by the College which approval shall not be unreasonably withheld. The agreement shall provide that the surety is entitled to be paid the unpaid balance under the terminated Contractor's contract in accordance with and subject to the terms of the contract and general conditions.

3. The takeover agreement signed by the surety and the College must also provide that the surety is not relieved of any of its obligations under its payment and performance bond for the project, and that the College retains its right to withhold money for contract payments to compensate damages or for other reasons where authorized under the contract or the general conditions.

4. The takeover agreement signed by the surety and the College must also provide that it is without prejudice to and is subject to all of the rights and remedies of the College, the surety, and the defaulted Contractor, and the surety may not require the College to agree to a takeover agreement which seeks to extinguish any such rights.

5. The surety must also pay without delay all obligations of the terminated Contractor for work and materials on the project, subject to a reasonable allowance of time to investigate and verify claims.

ARTICLE 14. WARRANTY/DEFECTIVE WORK AND MATERIALS.

A. General Work One Year Warranty; HVAC Systems Two Year Warranty.

The Contractor warrants and guarantees for a one year period (or two year HVAC work) that all work, materials and equipment conform to the contract documents and will not fail or manifest defects, that the project and all its components will be fit for their intended functions, and that all material and equipment will be new and of good quality.

The general one year warranty period (or two year HVAC work) shall commence when the certificate of substantial completion is issued, and the one year period (or two year HVAC work) shall commence on that date for all components of the project, including any equipment activated and operated before substantial completion, such as HVAC systems, electrical systems and elevators.

During the one year warranty period (or two year HVAC work), the Contractor shall repair and remedy at its own expense any premature failure, defects or deficiencies in any work, materials or equipment which are discovered or which develop during the one year (or two year HVAC work) period, and shall do so within 5 days after receipt of a written warranty claim from the College. The Contractor shall also repair damages caused by any failure or defect covered by this warranty. A failure to provide the warranty service required shall constitute a breach of this warranty obligation as well as other applicable provisions of the contract. This warranty shall not cover failures caused by misuse or abuse by the College.

This general one year warranty (or two year HVAC work) is intended to provide the College with prompt warranty service for all aspects of the project for the one year period. It is not intended to limit or extinguish any additional warranties required by any of the contract documents, or provided by manufacturers of systems, equipment or materials provided under the contract. It is not intended to eliminate or reduce the College's rights and remedies under the contract and law for defects and deficiencies in the work, materials and equipment, the time period of the Contractor's general responsibility and liability.

B. Defective Work, Materials and Equipment.

Apart from the general one year warranty provided for in this Article, the Contractor shall be responsible for defective work, materials and equipment and any failure of these items to comply with the contract documents. This obligation shall extend beyond substantial completion, final completion and the general one year warranty in this Article.

If defects in materials or equipment or non-conforming items are discovered during construction and before completion, the Contractor shall promptly correct them at its own expense. If the Contractor fails to correct defective or non-conforming work, material or equipment in response to a written notice form the College, either during construction or after completion, the College may employ others to provide the remedial work and the Contractor and its surety shall be liable for the cost thereof and damages incurred. The Contractor and its surety shall also be liable for the cost of making good all work and material destroyed or damaged by defects or the correction of defects.

If any portion of the Contractor's contract monies remains in the custody of the College, either earned or unearned, the College may deduct money paid to others to remedy defects after notice is sent to the Contractor and damages when the Contractor fails to provide a remedy in response. The Contractor's responsibility for defects and non-conforming work, material and equipment shall not be limited in time except by law.

The Contractor's responsibility for defective work shall not be affected by either the performance or the lack of performance of inspections by the College or the architect. The issuance of payments, a certification of substantial completion or a certification of final completion shall not constitute acceptance of work, material or equipment which is deficient or not in compliance with the contract, or limit the Contractor's warranty or the other contract obligations.

ARTICLE 15. MISCELLANEOUS.

A. Insurance, Bonds, Indemnification.

The Contractor shall provide and/or maintain the insurance, bonds and indemnification required by the contract and law.

B. Prevailing Wage.

The Contractor and its subcontractors shall comply with the New Jersey Prevailing Wage Act, N.J.S.A. 34:11-56.25 through 56.57 and the provisions in the contract regarding prevailing wages.

C. Employment Discrimination.

The Contractor and its subcontractors shall comply with all laws prohibiting discrimination against employees, and shall comply with the provision in the contract regarding employment discrimination.

D. Patents.

If any design, device, material or process covered by patents or copyright is used in the work, the Contractor shall provide for such use by a suitable agreement with the patent or copyright owner. The Contractor shall bear all costs arising from the use of patented materials, equipment, or processes and all copyrighted materials used on or incorporated in the work. The Contractor shall defend, indemnify and save harmless the College from any and all claims for infringement by reason of the use of any such patented or copyrighted items.

E. Emergencies Affecting Safety.

If there is an emergency affecting the safety of persons or property, the Contractor shall take immediate action to prevent damage, injury or loss. The Contractor shall notify the College of the situation and all actions being taken immediately or as soon as possible. If, in the opinion of the Contractor, immediate action is not required, the Contractor shall notify the College of the emergency situation and proceed in accordance with the College's instructions. However, if loss, damage, injury or death occurs that could have been prevented by the Contractor's prompt and immediate action, the Contractor shall be liable for all costs, damages, claims, actions, suits, attorney's fees and other expenses which result.

Any additional compensation or extension of time claims by the Contractor on account of emergency work shall be determined in accordance with the changes provisions of the contract documents. The Contractor shall be responsible for emergencies and costs and delays resulting therefrom which could have been foreseen or prevented with normal diligence, planning, and supervision of the work, or which are caused by the Contractor's failure properly to perform the contract.

The Contractor shall provide the College with a list of the names and telephone numbers of its employees and employees of each subcontractor designated to be contacted in case of an emergency during non-working hours. A copy of this list will shall be displayed prominently at the site so that it is visible when the site is secured and shall be provided to the College's campus police department.

F. Contractor Compliance with Law.

The Contractor shall keep fully informed of all federal, state and local laws, ordinances, regulations and orders of agencies which have jurisdiction or authority which in any manner affect those employed on the project or the project. The Contractor shall at all times observe and comply with, and cause its agents and employees to observe and comply with, all such laws, ordinances and regulations, or orders. The Contractor shall also protect and indemnify the College and its representatives against any claim or liability arising from the violation of any laws, ordinances, regulations, or orders, whether by the Contractor or its employees, agents, subcontractors at any tier, suppliers or materialmen.

G. Environmental Protection - Contractor Duty to Comply with Law.

The Contractor shall comply with all applicable federal, state and local laws and regulations and all conditions of permits pertaining to the protection of the environment. Necessary precautions shall be taken to prevent pollution of streams, lakes, ponds, rivers, wetlands, groundwater, reservoirs, and property by chemicals, fuels, oils, bitumens, or other

harmful or hazardous materials as defined by law. Nor shall the Contractor pollute the atmosphere from particulate or gaseous matter in violation of law.

H. No Personal Liability of College Officials.

In carrying out any of the provisions of the Contract, or in exercising any right or authority granted to them by or in connection with the contract, there shall be no liability upon any officer or employee of the College, either personally or as officials of the College, it being agreed that in all such functions they act only as agents and representatives of the College.

I. Recovery of Monies by College from other Contracts with the Contractor.

When the contract documents authorize the College to withhold or deduct money from any monies due to the Contractor, or require the Contractor to pay or return monies for any reason, the College may in its discretion withhold any monies due the Contractor under any other contracts between the Contractor and the College. This right shall not affect the rights of the College against the Contractor or its surety under this contract, and the College shall not be obliged to exercise this right as to any other contract as a condition of exercising its rights against the Contractor or surety under this contract.

J. Buy American Requirement.

The Contractor shall comply with N.J.S.A. 52:32-1 and N.J.S.A. 52:33-1 et seq., which prohibit the use by the Contractor or subcontractors of materials or farm products produced and manufactured outside of the United States on any public work.

K. Modification of Contract.

No modification or amendment of the contract shall be effective unless it is in writing and signed by both the College and the Contractor.

L. State Sales Tax Exemption.

Materials, supplies or services for exclusive use in constructing the project are exempt from the State sales tax. Rentals of equipment are not exempt from any tax under the State Sales Tax Act.

M. Assignment of Contract Funds and Claims Prohibited.

The Contractor shall not transfer or assign to any party any contract funds, due or to become due, or claims of any nature it has against the College without the written approval of the College. The College in its sole discretion and considering primarily the interests of the College may elect either to grant or to deny such approval.

N. Independent Contractor Status.

The relationship of the Contractor to the College is that of an independent contractor. The Contractor agrees that it shall conduct itself consistent with such status, and shall not hold itself out as or claim to be an officer, employee or agent of the College. The Contractor shall not make any claim or demand for any right or privilege applicable to officers or employees of the College, including but not limited to, workers compensation, unemployment insurance benefits, social security coverage, or retirement benefits.

O. Third Party Beneficiary Rights Not Intended.

It is specifically agreed between the College and the Contractor that no provisions of the contract documents are intended to make the public or any member thereof a third party beneficiary of the contract, or to authorize anyone not a party to the contract to maintain a suit for personal injuries, property damage or other claims under the contract. It is also the intent of the College and the Contractor that no individual or firm which supplies materials, labor, services, or equipment to the Contractor for the performance of the work shall be a third party beneficiary of the contract.

P. Gifts to College Employees and Agents Prohibited.

The Contractor shall not give any gifts of any nature, nor any gratuity in any form, nor loan any money or anything of value to any College employee or relative thereof, or any agent of the College. The Contractor shall not rent or purchase any equipment or supplies of any kind from any College employee or relative thereof or any agent of the College.

Q. Contractor Claims: Procedures and Limitations.

Claims by the Contractor against the College shall be subject to the New Jersey Contractual Liability Act, N.J.S.A. 59:13-1, et seq. including the notice and time for suit provisions. For the purpose of determining the time within which The Contractor must file suit under the New Jersey Contractual Liability Act, 'completion of the contract' shall be deemed to have occurred upon achievement of substantial completion as defined in section 12A of these General Conditions.

The Contractor also agrees that it shall not be entitled to assert claims against the College for any compensation beyond that provided for in this contract by reason of the acts or omissions of any third parties, including but not limited to the project architect and any other contractor on the project. The Contractor may not assert claims for extra costs for home offices expenses, home office overhead, lost profits or revenue, or consequential damages as that term is defined in law. All claims shall also be subject to all other pertinent provisions of the contract and the contract documents including the general conditions. The Contractor also agrees that it may not assert any claims for extra costs or damages unless it maintains all the records of its estimated and actual costs as required by this Article. The Contractor also agrees that suits against the College must be pursued in the county where the project is located.

R. Cost Records a Condition of Receiving or Retaining Extra Compensation on Extras, Changes and Claims.

The Contractor shall maintain and retain weekly payroll, material, subcontractor, supplier, overhead and other cost and accounting records for the project, and for additional services or extras required by the College, including all costs which the Contractor is entitled to be paid under the contract. The Contractor shall require its subcontractors on the project to do likewise. The Contractor shall also maintain all estimates and takeoffs used in preparing and calculating its bid price for the contract and change orders. The records shall be maintained and shall be made available to the College or its representatives when requested. These records shall be maintained in accordance with generally accepted accounting principles and practices for a period of 3 years after final payment is received by the Contractor, or the duration of any dispute or law suit arising out of the project, whichever is later.

Any failure to maintain or produce the records required by this Article shall preclude the Contractor from claiming or being paid or retaining any payments or being paid on any claims which are based on costs, expenses or losses incurred by the Contractor or its subcontractors which should be reflected in the records required by this Article or good business practices. This record keeping requirement applies to records related to the basic contract compensation as well as extra compensation for change orders and claims of all kinds.

No claim by the Contractor against the College for payment, whether for contract work, extras, changes or claims which is based to any degree on costs which should be recorded in cost records required by this Article or good business practices may be asserted against the College to the extent the cost records do not exist or are not provided to the College upon demand.

The College reserves the right to audit the records of the Contractor and its subcontractors for up to 3 years after the final acceptance of the project, and to demand repayment by the Contractor and its surety of any overpayments discovered in an audit.

SECTION 23 0993 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 WARRANTY

A. Equipment shall be subject to the 2-year warranty requirements specified under Division 1.

1.2 DEFINITIONS

A. AHU: Air Handling Unit.

B. AI: Analog In (point to BAS).

C. AO: Analog Out (point from BAS).

D. BAS: Building Automation System.

E. CUP: Central Utility Plant.

F. DDC: Direct digital control.

G. DDCFP: Direct Digital Control Field Panels.

H. DDUC: Direct Digital Unit Controllers.

I. DI: Digital In (point to BAS).

J. DP: Differential Pressure.

K. DPT: Differential Pressure Transmitter

L. DO: Digital Out (point from BAS).

M. FTR: Finned Tube Radiation.

N. HOA: Hand-Off-Auto.

O. RH: Relative Humidity.

P. VAV: Variable air volume.

Q. VFD: Variable Frequency Drive.

1.3 SUMMARY

A. This Section includes control sequences for HVAC systems, subsystems, and equipment.

B. Related Sections include the following:

1. Section 230900 "Instrumentation and Control for HVAC" for control equipment and devices and for submittal requirements.
2. Section 230593 “Testing, Adjusting, and Balancing for HVAC.”
3. Section 230920 “Laboratory Airflow Control System.”

C. BAS Description

1. Graphics:

a. A graphic shall be setup for each major control system. All points in the system shall be able to be viewed and/or controlled from the appropriate system graphic. Floor plans shall also be developed for each floor showing individual zones by temperature sensor. Zone temperatures shall be indicated individually for each temperature sensor. The space set point shall be displayed next to the temperature. Each zone shall be individually selectable to show specific equipment related to that zone.
b. There shall be a macro level screen for each major control system that shows all of the major equipment with flows and temperatures. For example there shall be a screen that incorporates all of the air handlers and exhaust fans to provide the operator with a one screen overview of the entire airside of the system. Similar screens shall be developed for the cooling and heating systems. If the building contains laboratories each laboratory shall have a separate screen that shows all of the supply and exhaust flows for that individual laboratory.
c. There shall be spreadsheet type setups that permit all of the terminal units to be seen with their flow rates, temperature set points and temperature operating points shown. The points shown shall be live and change as the individual point varies.
d. The operator shall be able to navigate the graphics through a point and click interface. This shall not only allow navigation to each graphic but shall allow each trend and schedule to be selected for the related system.

2. Schedules:

a. Individual schedules shall be set up per the Owners Project Requirements. Each schedule shall be individually adjustable. All equipment in each scheduled zone will follow the designated schedule. All schedule times shall be adjustable through the front-end scheduling package.

3. Alarm Management:

a. Alarms shall be divided into 2 categories, Critical and Informational.
b. In general, alarms are listed with the associated equipment or space control sequence.
c. Unless noted otherwise, Critical Alarms shall consist of the following:

1) Equipment Safeties

a) High/Low Duct Static
b) Freezestat
c) Smoke Detection

2) Major Equipment Failure
a) AHU
b) EF
c) Unfired Steam Generator
d) CRAC
e) Building CHW Pumps
f) Building HW Pumps
g) Freeze Protection Pumps
h) HW Heat Exchangers
i) Domestic Water Heaters
j) Domestic Water Booster Pumps
k) Sump Pumps
l) Sewage Ejectors
m) Waste Ejectors

3) Loss of Controller Communication
4) Space temperature below 45° F or above 95° F
5) Generator fuel tank overflow alarm
6) Generator fuel tank leak detection alarm
7) Generator fuel tank low level alarm
8) Subject to review by the Architect, contractor shall designate any additional Critical alarms not listed as required by the Owner.

d. Critical alarms shall be setup to be triggered by events that would cause disruption to a major building system or indicate that mechanical damage may be eminent.
e. Critical and Informational alarms shall be indicated by red colored text on the system graphic or floor plan.
f. Critical alarms, when activated, shall annunciate at the front end and display on the system graphic panel. Critical alarms shall annunciate until the associated device has been either manually reset or returns to a non-alarm state.
g. Informational alarms shall be designated to annunciate at the front end workstation only. Informational alarms shall be cleared by either manual reset of the associated device or by BAS operator command. Informational alarms cleared via the BAS shall reactivate after an adjustable time period until the associated sensor, switch, relay, or other device has been manually reset or returns to a non-alarm state.
h. The system shall continuously monitor itself for system integrity. If any controller goes off-line, a critical alarm shall be sent to indicate the specific controller(s) that have lost communication.

D. Control Sequences & BAS Supervision

1. Sequences outlined shall, unless otherwise indicated, be performed by DDCFPs or locally mounted DDUC connected to a central BAS.

2. All of the BAS system including DDCFP's and DDUC's shall have an Uninterrupted Power Supply (UPS) to maintain the system control for a minimum of 1 hour in the event of a power outage.
3. The design intent is to monitor all stand-alone equipment for status and alarm; to monitor pressure, temperature, moisture and flow; and to control valves, dampers, variable frequency drives, AHUs, pumps, etc. Monitored data will be used to control and to start and stop equipment in accordance with the sequences listed herein.
4. Address identifiers for each point shall be coordinated with and approved by the Owner and Architect. Identifiers contained in the drawings are examples only.
5. Unless otherwise noted all set points, time delays and lead/lag sequences shall be adjustable by the operator through the BAS and through menu access at each DDCFP without any hardware or software modifications.
6. Ability to review all measured data, set points and functions shall be provided at BAS workstations and through an access port at all DDCFPs.
7. Provide menu driven capability to override automated start/stop or operating modes for each piece of equipment (including pumps, fans, AHUs, VAV boxes, etc.). If a sequence is overridden by manual input and the BAS attempts to make a change in the operating status or mode, an alarm shall be initiated at the BAS stating that the system was unable to change its status or mode due to user input. Where applicable, a manual input command will then be required from the user to instruct the BAS to start the next sequential piece of equipment. Safety devices shall function when manual switches are in both hand and auto positions.
8. All equipment controlled by the BAS shall be capable of manual operation through HOA switches located on the motor starters, VFDs, or equipment controllers. All modulating valves larger than NPS 2 and automatic dampers controlled by the BAS shall be capable of manual positioning (open, closed, manual, auto) via labeled potentiometers and switches. Two position motor operated valves and dampers shall be capable of manual positioning by either using the local/remote selector switch and manual open/closed push buttons, or mechanically by declutching the drive and using the operator handle. Safety devices shall function when manual switches are in both hand and auto positions.
9. Provide communications interface (including required software) between the BAS and each manufacturer's supplied panels. BAS shall be capable of reading and displaying all data noted and/or normally available from the equipment panel and shall be capable of resetting selective set points as noted in the sequences of operation. Interfaces shall be through BACNET compliant protocol where the BAS is required to control the operation of the equipment. Provide input/output interfaces as required.
10. Failsafe positions indicated are positions that devices will go to when the associated equipment is de-energized (i.e. NC = Normally Closed; NO = Normally Open).
11. Provide adequate dampening of all control loops to prevent hunting. Maximum response time shall be 30 seconds.
12. Whenever a unit is shut down due to one of its safeties, the BAS shall retain in memory the reading and set point of each associated device to help the operator in determining the cause of the shutdown.

13. Whenever an alarm is initiated, the BAS shall retain in memory the reading and set point of each associated device to help the operator in determining the cause of the alarm.
14. If any DDCFP, DDUC or equipment manufacturer's panel loses communications with the BAS, an alarm shall be initiated in the BAS indicating the fault. DDCFPs, DDUCs and equipment panels shall continue to control equipment based upon the last set point and operating parameters provided by the BAS.
15. In general, the following initial space temperature set points shall apply and are adjustable unless noted otherwise. Space relative humidity (RH) targets are listed for reference only and shall not imply direct space humidity control unless specifically denoted. AHU humidifiers are intended for bulk humidification to meet listed minimum RH during winter design conditions. AHU cooling coils are controlled to limit maximum space humidity during summer design conditions.

    a. Offices, Classrooms, Computer Labs, Conference Rooms, Toilet Rooms, and Common Areas in the STEM Building and Chemistry Addition:

        1) Occupied: 75° F 50% RH Summer, 72° F 35% RH Winter
        2) Unoccupied: 80° F 55% RH Summer, 65° F 25% RH Winter

    b. Laboratories, Laboratory Support Spaces, Shop Spaces, and similar critical spaces in the STEM Building and Chemistry Addition:

        1) Occupied: 75° F 50% RH Summer, 72° F 35% RH Winter
        2) Unoccupied: 80 ° F 55% RH Summer, 65° F 25% RH Winter

    c. Electrical Rooms: 85° F maximum, 65° F minimum
    d. Elev. Machine Rooms: 85° F maximum, 65° F minimum
    e. Tel / Data Rooms: 75° F maximum, 65° F minimum
    f. Mechanical Rooms: 85° F maximum, 65° F minimum

        1) STEM Building and Chemistry Addition main mechanical room ventilation thermostatically controlled to listed maximum temperature. During summer design outside air conditions mechanical room temperature may be higher than indicated maximum.

16. The occupied building schedules for each air handling unit system and zones served shall be confirmed with the owner but in general the unoccupied hours shall be from 8 pm to 5 am.
17. Additional Sequences: Refer to drawings for additional room control sequences which are not provided herein.
18. Coordinate with other trades for supervision and control requirements for the equipment provided by those trades.
19. Where control sequences are not provided but are required to support spaces or equipment, the control vendor shall propose sequences from the vendor's standard library for review and approval by the Engineer.
20. Where control sequences have been provided and do not incorporate all specific project parameters required to provide a complete and functional system the control vendor shall work with the Engineer to establish and incorporate these values into the submittal for approval. Project specific details, including but not

limited to, control set points, alarm set points, high limit values, dead band limits, limits which trigger events to begin or end, etc. are to be included.

21. Controls Contractor shall coordinate with the equipment supplier for the required interfaces specified for all equipment that is connected to the BAS.

1.4 CENTRAL HEATING AND COOLING CONTROL SEQUENCES

A. Campus Steam – Common Building Control Requirements

1. The following requirements shall apply to both the STEM Building and the Chemistry Addition steam systems unless specifically denoted otherwise.

2. System Description

a. High pressure steam (HPS) at 100 psig is provided year-round to the STEM Building and Chemistry Addition via the campus steam loop.
b. HPS is reduced at each building mechanical room to medium pressure (MPS) at 60 psig for unfired steam humidification and to low pressure (LPS) at 15 psig for generation of heating water and domestic and non-domestic hot water (STEM Building only).
c. Steam distribution and process condensate loads are handled in each building mechanical room by packaged condensate return units as indicated in the Contract Drawings.
d. A flow transmitter and BTU computer in the each building's main steam line calculates total steam energy consumption.

3. General

a. Each piece of equipment that constitutes the steam heating and humidification system shall be monitored by the BAS. Status reports shall be available through the BAS and failures shall be alarmed in the BAS.
b. All set points and time delays shall be adjustable through the DDC System without any program changes.
c. Interface screens shall allow set point adjustments from the central BAS.
d. Graphics display of the steam heating and humidification system shall include equipment status (enabled, on, off, override, in alarm), operating temperatures, system pressures, motor current draw, system flow rates, programmed control set points and actual readings of those values.

4. Steam System Start-up and Control

a. The steam system shall continuously operate year-round.
b. Refer to "Heating Water System" and "Unfired Steam Humidification System" control sequences for related steam component control requirements.

5. System Supervision And Safeties

a. The STEM Building and Chemistry Addition steam systems shall be supervised and managed by their individual building BAS with the following minimum input/output points.

1) Building entering HPS flow rate (AI).
2) Alarm indications shall be coordinated with and approved by the Owner and Architect.

6. BAS Workstation Display: Each individual building BAS shall indicate the following for the each STEM Building and Chemistry Addition steam system:

a. DDC system graphic.
b. Values associated with all analog and digital inputs and outputs listed above.
c. Current set points for the following:

1) All alarm set points for associated building's steam system.

B. STEM Building and Chemistry Addition Heating Water System Control Sequences

1. The following requirements shall apply to both the STEM Building and the Chemistry Addition heating water systems unless specifically denoted otherwise.

2. System Description

a. In both the STEM Building and Chemistry Addition, heating water is generated in the respective building's main mechanical room via steam-to-water heat exchangers.

1) HX-101/102: STEM Building Heating Water, 100% capacity each (lead/standby)
2) HX-201/202: Chemistry Addition Heating Water, 100% capacity each (lead/standby)

b. Heating water is distributed to each building's AHU preheat coils, system reheat coils, and terminal heating equipment by variable speed distribution pumps.
1) HWP-101/102: STEM Building Heating Water Pumps, 100% capacity each (lead/standby)
2) HWP-201/202: Chemistry Addition Heating Water Pumps, 100% capacity each (lead/standby)

c. A flow transmitter and BTU computer is used by the BAS to measure the heating water energy usage of each building.
d. The heating water system in each building shall operate year round.

3. General

a. Each piece of equipment that constitutes the heating water system shall be monitored by the BAS. Status reports shall be available through the BAS and failures shall be alarmed in the BAS.
b. All set points and time delays shall be adjustable through the DDC System without any program changes.
c. Interface screens shall allow set point adjustments from the central BAS.

d. Graphics display of the heating water system shall include equipment status (enabled, on, off, override, in alarm), operating temperatures, system pressures, component pressure differentials, VFD percent speed, motor current draw, system flow rates, VFD status, valve position, programmed control set points and actual readings of those values.

4. Heating Water System Start-up and Control

a. The heating water system shall be enabled by the BAS.
b. Upon BAS activation of the heating water system, the lead heating water pump VFD shall be energized and pump shall run continuously. Lead pump differential pressure pump control loop shall commence as described below.
c. Lead heat exchanger water isolation valve shall open.
d. Upon proving water flow by ~~differential pressure sensor indicating expected DP value across~~ water flow switch at lead heat exchanger, heating water temperature control loop shall commence as described below.

5. Heating Water System – Pump Control

a. The heating water system is designed such that one heating water pump shall operate at a time during heating water system operation.

1) Pumps shall operate in a lead/standby arrangement.

b. Heating Water Pump Differential Pressure Control:

1) The building heating water pump VFDs shall be controlled to maintain a minimum differential pressure set point initially set to 15 ft. w.g. (adjustable) at the remote DPT. This initial differential pressure setting shall be verified during testing and balancing.
2) Upon BAS activation of the heating water system, the lead heating water pump VFD shall be energized and the low flow differential pressure bypass valve shall be fully closed.
3) Lead pump VFD shall ramp-up until the system differential pressure set point is reached.
4) Upon a decrease in system differential pressure, the BAS shall signal the VFD to increase the pump speed.
5) Upon an increase in system differential pressure, the BAS shall signal the VFD to decrease the pump speed.
6) Once the lead pump VFD has reached its preset minimum speed, the BAS shall modulate the differential pressure bypass valve to maintain the pressure set point. If the system pressure decreases below set point, the bypass valve shall modulate closed. If the pressure remains below set point, the bypass valve shall remain closed and the operating pump shall increase speed and resume modulation as required to maintain set point.

6. Heating Water System – Startup and Temperature Control

a. Heating water supply temperature in the STEM Building and Chemistry Addition shall be controlled to maintain a set point of 160 ° F initially.
b. The heating water system is designed such that one heat exchanger shall operate at a time during heating water system operation.

    1) Heat exchangers shall operate in a lead/standby arrangement.
    2) Lead heat exchanger rotation shall be performed automatically as described in section “Heat Exchanger Alternation.”

c. Upon BAS activation of the heating water system, BAS shall monitor the building heating water supply and return temperatures.
d. Upon a drop in heating water supply temperature below set point and upon proving water flow by water flow switch at ~~differential pressure sensor indicating expected DP value across~~ lead heat exchanger, the lead heat exchanger 1/3 steam control valve shall modulate open until heating water supply temperature set point is reached.
e. Lead heat exchanger 1/3 steam control valve shall continue to modulate to maintain heating water supply temperature set point.
f. Upon the 1/3 steam control valve being fully open and the heating water supply temperature continues to drop, the lead heat exchanger 2/3 control valve shall modulate open until heating water supply temperature set point is reached.
g. The reverse sequence shall occur upon a continued rise in the supply temperature above set point.
h. Whenever both pumps are OFF, steam valve control loops shall be deactivated and heat exchanger steam valves shall close.

7. Heating Water Pump Alternation

a. The STEM Building and Chemistry Addition heating water pumps shall alternate to equalize equipment runtime. The lead pump shall be manually or automatically selected from the graphic panel. When in manual mode the lead and standby assignments shall be designated by the operator. When in automatic mode the lead and standby assignments shall be automatically rotated based on run-hours.
b. Pump lead and standby assignments shall be automatically rotated every 240 run-hours.

    1) During a pump rotation, lead pump speed shall decrease to its minimum. Standby pump shall be energized and increased to its minimum speed. Lead pump shall be de-energized and standby pump shall commence control as lead.

c. Pump status shall be proven by motor amperage draw and differential pressure switch across the pump. If the expected amperage draw is not sensed, or if the differential pressure switch fails to indicate differential pressure across the pump, the BAS shall designate that pump as a failure.

d. Upon failure of the lead pump, the failed pump shall be commanded off, an alarm shall be generated, and the standby pump shall ramp to the lead pump's speed at the time of failure. Standby pump shall be brought under speed control as described in section "Heating Water Pump Differential Pressure Control" in order to maintain system differential pressure.
e. If both the lead and standby pumps fail, a critical building alarm shall be generated.

8. Heat Exchanger Alternation

a. The STEM Building and Chemistry Addition heat exchangers shall alternate to equalize equipment runtime. The lead heat exchanger shall be manually or automatically selected from the graphic panel.
b. When in manual mode the lead and standby assignments shall be designated by the operator. An alarm shall be issued once the lead heat exchanger accumulates 240 run-hours.
c. When in automatic mode the lead and standby assignments shall be automatically rotated every 240 run-hours.
d. Status of lead heat exchanger shall be proven by waterside flow switch at ~~differential pressure sensor indicating expected DP value across~~ lead heat exchanger. If ~~measured DP value exceeds 6 ft. w.g. (adjustable), or if measured DP value is within expected range as determined by division 230593 during TAB~~ water flow switch is engaged but system HWS temperature fails to reach setpoint for a continuous period of 15 minutes (adjustable), BAS shall designate that heat exchanger as a failure.
e. Upon flow failure as sensed by water flow switch at ~~zero waterside differential pressure across~~ lead heat exchanger, or pump VFD current switch, BAS shall designate that heat exchanger as a failure.
f. Upon failure of the lead heat exchanger, that unit's steam isolation valves shall be commanded closed and an alarm shall be generated. The standby heat exchanger's waterside isolation valve shall open. The failed heat exchanger's waterside isolation valve shall then be commanded closed, and the standby heat exchanger shall commence startup sequence described in section "Heating Water System – Startup and Temperature Control."
g. If both the lead and standby heat exchangers fail, a critical building alarm shall be generated.

9. System Supervision And Safeties

a. The STEM Building and Chemistry Addition heating water system shall be supervised and managed by the BAS with the following minimum input/output points.

1) Heating water supply set point (AI).
2) Heating water supply set point adjust (AO).
3) Heating water supply temperature (AI).
4) Heating water return temperature (AI).
5) Heating water supply temperature alarm (DI).
6) System DP set point (AI).
7) System DP set point adjust (AO).

8) System DP (AI).
9) System differential pressure alarm if the pressure deviates from set point by more than 10 ft. w.g. (5 minute delay) (DI).
10) Common outdoor air temperature (AI).
11) Heat exchanger waterside DP (AI).
12) Heat exchanger waterside low flow alarm (DI).
13) Heat exchanger steam control valve status (DI).
14) Heat exchanger steam control valve position (percent) (AI).
15) Heat exchanger waterside isolation valve status (open/closed) (DI).

b. The STEM Building and Chemistry Addition heating water pumps shall be supervised and managed by the BAS with the following minimum input/output points.

1) Pump status (on/running/off), as confirmed by pump current sensor (AI).
2) Pump lead/standby assignment (DI).
3) Pump speed set point (DO).
4) Pump actual speed display (AI).
5) VFD trouble alarm (DI).
6) Pump motor current draw display (AI).
7) Alarms shall be provided as follows:

a) Pump Failure (commanded on but the status is off).
b) Running in hand: Commanded off but the status is on.
c) Lead pump failure to run: The lead pump is in failure and the standby pump is on.

10. BAS Workstation Display: Indicate the following for the heating water system:

a. DDC system graphic.
b. DDC system on/off/override indication.
c. Values associated with all analog and digital inputs and outputs listed above.
d. Current set points for the following:

1) Building heating water supply temperature set point.
2) Heating water system differential pressure set point.
3) All alarm set points for associated building's heating water system.

e. Refer to control diagrams on drawings for unit input/output schedules and additional information.

C. Campus Chilled Water – Common Building Control Requirements

1. The following requirements shall apply to both the STEM Building and the Chemistry Addition chilled water systems.

2. General

a. Each piece of equipment that constitutes the chilled water system shall be monitored by the BAS. Status reports shall be available through the BAS and failures shall be alarmed in the BAS.
b. All set points and time delays shall be adjustable through the DDC System without any program changes.
c. Interface screens shall allow set point adjustments from the central BAS.
d. Graphics display of the chilled water system shall include equipment status (enabled, on, off, in alarm), operating temperatures, system pressures, component pressure differentials, VFD percent speed, motor current draw and power consumption rates, system flow rates, VFD status, valve position, programmed control set points and actual readings of those values.

3. Chilled Water System – Temperature Control

a. The BAS shall monitor the temperature of the supply and return water to the building and from the campus loop.
b. Once the building chilled water pump control sequence has been initiated, the BAS shall modulate the building chilled water return deny valve to maintain the building chilled water return leaving the STEM Building and Chemistry Addition at a temperature set point of 57 °F (adjustable).
c. Upon deactivation of the chilled water pump control sequence, the BAS shall modulate the building chilled water return deny valve to its full open position, unless manually commanded closed at the valve or via the BAS.

4. Chilled Water Pump Alternation:

a. The STEM Building and Chemistry Addition chilled water pumps shall alternate to equalize equipment runtime. The lead (and lag in the case of the STEM Building) pumps shall be manually or automatically selected from the graphic panel. When in manual mode the lead, lag, and standby assignments shall be designated by the operator. When in automatic mode the lead, lag, and standby assignments shall be automatically rotated based on run-hours.
b. Pump lead, lag, and standby assignments shall be automatically rotated every 500 run-hours.

1) During a pump rotation, lead and lag pump speeds shall decrease in unison to their minimum. Standby pump shall be energized and increased to its minimum speed. Lead pump shall be de-energized. Lag pump shall commence control as lead, while standby pump commences control as lag.

c. Pump status shall be proven by motor amperage draw and differential pressure switch across the pump. If the expected amperage draw is not sensed, or if the differential pressure switch fails to indicate differential pressure across the pump, the BAS shall designate that pump as a failure.
d. Upon failure of the lead pump, the failed pump shall be commanded off, an alarm shall be generated, and the lag/standby pump shall ramp to the lead pump's speed at the time of failure. Standby pump shall be brought under

speed control as described in section "Heating Water Pump Differential Pressure Control" in order to maintain system differential pressure.

e. If both lead and lag pumps fail, the standby pump shall ramp to the lag pump's speed at the time of failure, and a critical building alarm shall be generated

5. System Supervision And Safeties

a. The STEM Building and Chemistry Addition chilled water systems shall be supervised and managed by their individual building BAS with the following minimum input/output points.

1) Building entering chilled water supply temperature (AI).
2) Building leaving chilled water return temperature (AI).
3) Building leaving chilled water return temperature adjust (AO).
4) System chilled water supply temperature (AI).
5) System chilled water return temperature (AI).
6) System DP set point (AI).
7) System DP set point adjust (AO).
8) System DP (AI).
9) System differential pressure alarm if the pressure deviates from set point by more than 10 ft w.g. (5 minute delay) (DI).
10) Common outdoor air temperature (AI).

b. The STEM Building and Chemistry Addition chilled water pumps shall be supervised and managed by their individual building BAS with the following minimum input/output points.

1) Pump status (on/running/off), as confirmed by pump current sensor (AI).
2) Pump lead/lag/standby assignment (DI).
3) Pump speed set point (DO).
4) Pump actual speed display (AI).
5) VFD trouble alarm (DI).
6) Pump motor current draw display (AI).
7) Alarms shall be provided as follows:

a) Pump Failure (commanded on but the status is off).
b) Running in hand: Commanded off but the status is on.
c) Lead pump failure to run: The lead pump is in failure and the lag pump has taken up lead status.

6. BAS Workstation Display: Each individual building BAS shall indicate the following for the each STEM Building and Chemistry Addition chilled water system:

a. DDC system graphic.
b. DDC system on/off/override indication.
c. Values associated with all analog and digital inputs and outputs listed above.
d. Current set points for the following:

1) Associated building chilled water return temperature set point.
2) Associated chilled water system differential pressure set point.
3) All alarm set points for associated building's chilled water system.

e. Refer to control diagrams on drawings for unit input/output schedules and additional information.

D. STEM Building Chilled Water System Control Sequence

1. System Description:

a. Chilled water is provided to the STEM Building from the campus chilled water loop originating in the Power House chiller plant.
b. The STEM Building chilled water system consists of three (3) secondary building chilled water pumps with variable frequency drives that serve the air handling unit cooling coils and terminal cooling equipment.

1) CHWP-101/102/103 – 50% design capacity each (lead/lag/standby)
2) Two pumps normally operate with one in standby.

c. The STEM Building chilled water system is classified as variable flow, constant pressure. The pump bypass allows the building chilled water pumps to be shut down during periods when the campus chiller plant pumps meet the STEM Building head requirements.
d. A control valve located in the return piping of the decoupler bridge connection (herein referred to as the building chilled water "deny" valve) modulates to maintain the building chilled water return leaving the STEM Building at a temperature of 57 °F (adjustable).
e. A flow transmitter and BTU computer is used by the BAS to measure the chilled water energy usage of the building.

2. STEM Building Chilled Water System Start-up and Control:

a. The STEM Building chilled water pump VFDs shall be controlled to maintain a minimum differential pressure set point initially set to 20 ft w.g. (adjustable) at the remote DPT. This initial differential pressure setting shall be verified during testing and balancing.
b. The STEM Building chilled water supply and return isolation valves shall be normally open unless manually commanded closed at the valves or via the BAS.
c. Upon a call for cooling from any building air handling unit, fan coil unit, chilled water mixing tank (CHWT-100) or other piece of equipment served by the chilled water system (i.e. any cooling coil valve opened 10% or more) the BAS shall fully close the building differential bypass valve and poll the chilled water loop remote DPT. If system differential pressure is determined to be equal to or greater than the loop pump speed control DP set point as reported by the remote DPT, then the BAS shall continue to monitor the loop differential pressure.
d. Upon a drop in chilled water loop differential pressure in excess of 5 ft w.g. below the minimum set point for an adjustable time period of 10 continuous

minutes, or if the chilled water loop differential pressure is determined to be at least 5 ft w.g. less than the loop pump speed control DP set point upon the initial call for cooling, then the BAS shall initiate the building chilled water system pump control sequence described below.

3. STEM Building Chilled Water System – Pump Control

   a. The building chilled water pumps shall be automatically controlled by the BAS.
   b. One building chilled water pump shall operate anytime the chilled water pump control sequence is initiated by the BAS. A second active pump shall be controlled in a lag capacity with the remaining pump as standby.
   c. Chilled Water Pump Differential Pressure Control

      1) Upon BAS initiating the building chilled water system pump control sequence, the differential pressure bypass valve shall be fully closed and the lead pump VFD shall be energized.
      2) Lead pump VFD shall ramp-up until the system differential pressure set point is reached.
      3) Upon a decrease in system differential pressure, the BAS shall signal the VFD to increase the pump speed.
      4) Upon continued chilled water demand, with the lead pump operating at 100 percent capacity for an adjustable time period of five minutes, the lag chilled water pump shall be energized. The lead pump speed shall be lowered to approximately 65 percent. Both pump VFDs shall ramp in unison to maintain system differential pressure.
      5) Upon a decrease in chilled water demand where two pumps are operating at 50 percent speed for an adjustable time period of fifteen minutes, the lag pump shall be deenergized and lead pump shall ramp to maintain system differential pressure.
      6) Upon an increase in system differential pressure when a single pump is operating, the BAS shall signal the VFD to decrease the pump speed.
      7) Once the remaining single pump VFD has reached its preset minimum speed, the BAS shall modulate the differential pressure bypass valve to maintain the pressure set point. If the system pressure decreases below set point, the bypass valve shall modulate closed. If the pressure remains below set point, the bypass valve shall remain closed and the operating pump shall increase speed and resume modulation as required to maintain set point.
      8) When differential bypass valve has remained in its preset maximum position and a single remaining pump has remained at its preset minimum speed for a continuous adjustable time period of 30 minutes, the single remaining pump shall be deenergized and differential bypass valve shall be fully closed. BAS shall attempt to allow system chilled water demand to be met via the building chilled water pump bypass. Upon a drop in chilled water loop differential pressure in excess of 5 ft w.g. below the minimum set point for a period of 10

continuous minutes, the BAS shall reinitiate the building chilled water system pump control sequence described in 230993-1.3.C.3.c.

E. STEM Building Process Chilled Water System Control Sequence

1. System Description:

   a. Process Chilled Water is provided via dedicated pumps in the STEM Building Penthouse. Loop temperature is normally controlled by diverting chilled water return flow through a mixing tank.
   b. When the building chilled water control loop is shut down because no chilled water coil valve, or CHWT-100 tank mixing valve, is open more than 10%, or when incoming campus loop temperature is above 62ºF (adjustable)~~during low ambient temperature conditions~~, a gasketed heat exchanger rejects heat from the Process Chilled Water loop to a dry cooler loop using a glycol solution.
   c. The STEM Building Process Chilled water system consists of two (2) pumps with variable frequency drives.

      1) PCWP-101/102 – 100% design capacity each (lead/standby)
      2) One pump normally operates with one in standby.

   d. The STEM Building Process Chilled Water system is classified as variable flow, constant pressure.

2. STEM Building Process Chilled Water System Start-up and Control:

   a. The STEM Building Process Chilled Water pump VFDs shall be controlled to maintain a minimum differential pressure set point initially set to 65 ft w.g. (adjustable) at the remote DPT. This initial differential pressure setting shall be verified during testing and balancing.
   b. During occupied mode, one pump shall operate continuously to maintain differential pressure set point.

3. STEM Building Process Chilled Water System – Pump Control

   a. The Process Chilled Water pumps shall be automatically controlled by the BAS.
   b. One Process Chilled Water pump shall operate anytime the chilled water pump control sequence is initiated by the BAS during occupied mode. The remaining pump shall be standby.
   c. Process Chilled Water Pump Differential Pressure Control

      1) Upon BAS initiating the building chilled water system pump control sequence, the differential pressure bypass valve shall be fully closed and the lead pump VFD shall be energized.
      2) Lead pump VFD shall ramp-up until the system differential pressure set point is reached.
      3) Upon a decrease in system differential pressure, the BAS shall signal the VFD to increase the lead pump speed.

4) Upon an increase in system differential pressure, the BAS shall signal the VFD to decrease the lead pump speed.
5) Once the lead pump VFD has reached its preset minimum speed, the BAS shall modulate the differential pressure bypass valve to maintain the pressure set point. If the system pressure decreases below set point, the bypass valve shall modulate closed. If the pressure remains below set point, the bypass valve shall remain closed and the operating pump shall increase speed and resume modulation as required to maintain set point.

4. CHWT-100 Temperature Control – Normal Mode

a. BAS shall monitor the CHWT-100 temperature via its temperature sensor.
b. When the STEM Building chilled water ~~pumps are active~~system is enabled (meaning any cooling coil or mixing tank valve is open 10% or more), BAS shall modulate the chilled water mixing tank 3-way valve to maintain a tank temperature of 57 °F (adjustable). If the 3-way valve modulates to 100% open to the tank while maintaining tank temperature setpoint, BAS shall further modulate open the system chilled water system DP bypass valve to a maximum of 20% open (adjustable) to maintain tank temperature setpoint.

5. Process Chilled Water Loop Temperature Control – ~~Winter Mode~~Backup Operation Utilizing Dry Cooler

a. If the CHWT-100 temperature remains above setpoint 68 ~~75~~ °F (adjustable) for an adjustable time period initially set to 15 minutes and the outdoor air temperature is less than the CHWT-100 actual temperature, ~~and the STEM Building chilled water pumps are inactive, DGCP~~DCGP-101/102 shall be activated, dry cooler DC-101 shall be enabled and the PHX-100 Temperature Control Loop commenced.
b. ~~DGCP~~DCGP-101/102 Pump Control (Lead/Standby)

1) Upon BAS initiating the DGCP-101/102 pump control sequence, the lead pump shall be activated.
2) Pump shall operate at constant speed to meet design flow and pressure requirements.
3) Upon lead pump failure, standby pump shall be activated.

c. PHX-100 Temperature Control

1) During Backup Operation Utilizing Dry Cooler~~Winter Mode~~, the PHX-100 3-way valve shall modulate to maintain PCWS temperature of 75 °F (adj.).

d. DC-101 Dry Cooler Control

1) During Winter Mode, the BAS shall enable DC-101 and its on-board controls shall stage fans to maintain GCWS temperature of 67 °F. Configure this setpoint on the dry cooler unit control module.

F. Chemistry Addition Chilled Water System Control Sequence

1. System Description:

   a. Chilled water is provided to the Chemistry Addition from the campus chilled water loop originating in the Power House chiller plant.
   b. The Chemistry Addition chilled water system consists of two (2) secondary building chilled water pumps with variable frequency drives that serve the air handling unit cooling coils and terminal cooling equipment.

      1) CHWP-201/202 – 100% design capacity each (lead/standby)
      2) One pump normally operate with one in standby.

   c. The Chemistry Addition chilled water system is classified as variable flow, constant pressure. The pump bypass allows the building chilled water pumps to be shut down during periods when the campus chiller plant pumps meet the Chemistry Addition head requirements.
   d. A control valve located in the return piping of the decoupler bridge connection (herein referred to as the building chilled water “deny” valve) modulates to maintain the building chilled water return leaving the Chemistry Addition at a temperature of 57 °F (adjustable).
   e. A flow transmitter and BTU computer is used by the BAS to measure the chilled water energy usage of the building.

2. Chemistry Addition Chilled Water System Start-up and Control:

   a. The Chemistry Addition chilled water pump VFDs shall be controlled to maintain a minimum differential pressure set point initially set to 20 ft w.g. (adjustable) at the remote DPT. This initial differential pressure setting shall be verified during testing and balancing.
   b. The Chemistry Addition chilled water supply and return isolation valves shall be normally open unless manually commanded closed at the valves or via the BAS.
   c. Upon a call for cooling from any building air handling unit, fan coil unit, or other piece of equipment served by the chilled water system (i.e. any cooling coil valve opened 10% or more) the BAS shall fully close the building differential bypass valve and poll the chilled water loop remote DPT. If system differential pressure is determined to be equal to or greater than the loop pump speed control DP set point as reported by the remote DPT, then the BAS shall continue to monitor the loop differential pressure.
   d. Upon a drop in chilled water loop differential pressure in excess of 5 ft w.g. below the minimum set point for a period of 10 continuous minutes, or if the chilled water loop differential pressure is determined to be at least 5 ft w.g. less than the loop pump speed control DP set point upon the initial call for cooling, then the BAS shall initiate the building chilled water system pump control sequence described below.

3. Chemistry Addition Chilled Water System – Pump Control

a. The building chilled water pumps shall be automatically controlled by the BAS.
b. One building chilled water pump shall operate anytime the chilled water pump control sequence is initiated by the BAS. The remaining pump shall operate as standby in the case of a lead pump failure.
c. Chilled Water Pump Differential Pressure Control

1) Upon BAS initiating the building chilled water system pump control sequence, the differential pressure bypass valve shall be fully closed and the lead pump VFD shall be energized.
2) Lead pump VFD shall ramp-up until the system differential pressure set point is reached.
3) Upon a decrease in system differential pressure, the BAS shall signal the VFD to increase the lead pump speed.
4) Upon an increase in system differential pressure, the BAS shall signal the VFD to decrease the lead pump speed.
5) Once the lead pump VFD has reached its preset minimum speed, the BAS shall modulate the differential pressure bypass valve to maintain the pressure set point. If the system pressure decreases below set point, the bypass valve shall modulate closed. If the pressure remains below set point, the bypass valve shall remain closed and the operating pump shall increase speed and resume modulation as required to maintain set point.
6) When differential bypass valve has remained in its preset maximum position and the lead pump has remained at its preset minimum speed for a continuous adjustable time period of 30 minutes, the lead pump shall be deenergized and differential bypass valve shall be fully closed. BAS shall attempt to allow system chilled water demand to be met via the building chilled water pump bypass. Upon a drop in chilled water loop differential pressure in excess of 5 ft w.g. below the minimum set point for a period of 10 continuous minutes, the BAS shall reinitiate the building chilled water system pump control sequence described in 230993-1.3.D.3.c.

G. STEM Building and Chemistry Addition Unfired Steam Humidification System Control Sequences

1. The following requirements shall apply to both the STEM Building and the Chemistry Addition unfired steam humidification systems unless specifically denoted otherwise.

2. System Description

a. In both the STEM Building and Chemistry Addition, clean steam for humidification is generated in the respective building's main mechanical room via steam-to-steam heat exchangers (unfired steam generators, USGs).

1) USG-100: STEM Building Humidification

2) USG-200: Chemistry Addition Humidification

3. General

a. Each piece of equipment that constitutes the humification system shall be monitored by the BAS. Status reports shall be available through the BAS and failures shall be alarmed in the BAS.
b. All set points and time delays shall be adjustable through the DDC System without any program changes.
c. Interface screens shall allow set point adjustments from the central BAS.
d. Graphics display of the humidification system shall include equipment status (enabled, on, off, override, in alarm), system pressures, valve positions, programmed control set points and actual readings of those values.

4. Humidification System Start-up and Control

a. The humidification system shall be enabled by the BAS when any humidifier control loop served by the unfired steam generator is active. The BAS shall send an on/off signal to the USG on board control panel.

5. Humidification System – Pressure Control

a. Humidification clean steam pressure in the STEM Building and Chemistry Addition shall be controlled through the on board USG control panel to maintain a set point of 15 psig initially (adjustable).
b. Upon BAS activation of the humidification system, BAS shall monitor the building clean steam supply pressure.
c. Upon a drop in clean steam supply pressure below set point, the USG controls modulates the steam control valve open until clean steam supply pressure set point is reached.
d. USG steam control valve continues to modulate to maintain clean steam supply pressure set point.
e. The reverse sequence occurs upon a continued rise in the clean steam supply pressure above set point.
f. The USG on board controls maintains reverse osmosis (RO) feedwater level within the heat exchanger.

6. System Supervision And Safeties

a. The STEM Building and Chemistry Addition humidification system shall be supervised by the BAS with the following minimum input/output points from the USG control panel.

1) System enable start/stop (DO).
2) Clean steam supply pressure set point (AO).
3) Clean steam supply pressure (AI).
4) Heat exchanger steam control valve status (DI).
5) Heat exchanger steam control valve position (percent) (AI).
6) Heat exchanger feedwater isolation valve status (open/closed) (DI).

7) Liquid high level switch (DI).
8) Liquid low level switch (DI).
9) High water level solenoid shutoff (DI).

7. BAS Workstation Display: Indicate the following for the humidification system:

a. DDC system graphic.
b. DDC system on/off/override indication.
c. Values associated with all analog and digital inputs and outputs listed above.
d. Current set points for the following:

1) Building clean steam supply pressure set point.
2) All alarm set points for associated building's humidification system.

e. Refer to control diagrams on drawings for unit input/output schedules and additional information.

1.5 AIR HANDLING UNIT CONTROL SEQUENCES

A. General

1. Unless noted otherwise, startup sequence for fans shall use VFD's brake function to hold or stop rotation of fanwheels during staged activation of manifolded fans.

B. System 1: Air Handling Units AHU-101/102 and Energy Recovery Unit ERU-100

1. AHU System Description

a. AHU-101/102 serve the STEM Building offices, laboratories, shop, and support spaces. The AHUs are classified as 100 percent outdoor air capacity with recirculation of air from non-lab spaces during normal operation.
b. AHU-101/102 are classified as variable volume, constant pressure with pressure-independent terminal units and reheat/terminal heating coils.
c. Each System 1 AHU contains hydronic preheat coils, chilled water cooling coils, unfired steam humidifiers, and two (2) variable volume supply air fans.
d. RF-101/102 are the System 1 return fans and shall operate in unison with each respective AHU's supply fans. RF-101/102 return air from the STEM Building offices, common areas, and spaces as indicated on the Airflow Diagrams.
e. During normal operation, outside air is preconditioned by the STEM Building energy recovery unit ERU-100. Full energy recovery unit bypass capabilities allow the ERU OA fans to be shut down during economizer mode.
f. The System 1 AHUs are scheduled to normally operate 24 hours a day.
g. The AHU-101/102 supply ductwork is manifolded on each floor such that both units normally operate at the same time, in parallel. When one unit shuts down automatically due to a failure or manually for maintenance, the remaining unit shall provide limited capacity to meet the System 1 demand. Refer to the System 1 Backup Mode sequence described below.

2. General

a. AHU-101/102 shall be interlocked through a hardwired interface with ERU-100 exhaust fans as specified hereafter.
b. Upon initial startup of System 1, ERU-100 exhaust fans and EF-103A/B (when manual space switch is set to occupied) shall be energized first, followed by ERU-100 OA fans, and then AHU-101/102. AHU-101 and AHU-102 shall be enabled sequentially as specified after ERU-100 operation is established. Supply and exhaust system static pressure set points shall be increased incrementally over an adjustable time period until respective system set points are reached.
c. When an AHU is offline via a BAS command, all its safeties shall be locked out except for the freezestat.
d. Sequences shall be performed by standalone DDCFPs dedicated to the AHU it serves. Provide one or more panels as may be required for the I/O count per AHU. Controls contractor shall verify final I/O count with actual installed equipment.
e. Provide graphic display of each AHU showing set points and actual readings, as well as component and system status.
f. Hand-Off-Auto (HOA) selector switch shall be provided at each VFD within the AHU/RF/ERU system. The BAS shall monitor the switch and shall provide an operator alarm when the unit is out of the “Auto” position. AHU activation and deactivation shall be handled by the BAS when the Supply and Return Fan VFD HOA switches are in the “Auto” position.

3. Air Handling Unit Fan Soft Start

a. Provide an unloaded fan start sequence (soft start) for each supply, exhaust, and return fan. This feature ensures the BAS slowly accelerates fan speed to a minimum speed upon initial startup. The VFD shall ramp fan speed to the control set point in a smooth, bumpless manner over a 5-minute time period.
b. The BAS shall decelerate fan speed to minimum and disable control loops when system shuts down. During system shutdown, the respective unit’s outside air, exhaust air, and smoke isolation dampers shall gradually close, to prevent a high static pressure condition.

4. System 1 Startup: ERU-100 & EF-103A/B Activation/Deactivation (Energy Recovery Mode)

a. ERU-100 exhaust fans and EF-103A/B shall normally operate anytime the System 1 AHUs are operational. EF-103A/B shall also only operate in accordance with its manual space occupancy switch.
b. Energy Recovery Mode shall be enabled at initial startup of System 1 and anytime System 1 is not operating in Economizer/Min OA Mode.
c. Upon initial startup of System 1 and when transitioning from Economizer/Min OA Mode, ERU-100 enthalpy wheel exhaust-side bypass dampers shall be proven in their closed positions.
d. If not already operating, System 1 Exhaust Fans shall be activated as specified. Refer to Section “System 1: Exhaust Fans EF-101A/B/C” and

"System 1: Exhaust Fans EF-103A/B" for exhaust fan activation/deactivation and control sequences.

e. Once the System 1 Exhaust Fans have been enabled, the AHU-101/102 OA and Return dampers shall be proven in the following positions:
   1) During initial startup of System 1, AHU-101/102 Economizer and Preconditioned OA dampers shall initially be closed. AHU-101/102 Return dampers shall open.
   2) When transitioning from Economizer/Min OA Mode, AHU-101/102 OA Economizer dampers shall remain open and under control as specified. AHU-101/102 Preconditioned OA dampers shall remain closed. AHU-101/102 Return dampers shall open.

f. BAS shall assign a primary ERU outside air fan (of two) based on predetermined operator selection or the lesser of the two fans' total runtime.

g. ERU-100 outside air fan VFDs shall be enabled sequentially. Provide an adjustable time delay of ten seconds between fan starts.

h. BAS shall signal to open the ERU-100 OA intake and discharge smoke isolation damper.

i. Upon proving open the ERU's OA damper via the respective damper's end switch inputs, BAS shall signal the primary outside air fan VFD to start.

j. VFD shall signal BAS with binary run permissive.

k. BAS shall ramp primary outside air fan VFD over an adjustable time period of five minutes to minimum speed as determined by the VFD manufacturer.

l. Once the primary outside air fan is confirmed operating via amperage feedback, the ERU secondary outside air fan shall be enabled in a similar manner.

m. Once both ERU outside air fans have been enabled and are operational as confirmed by BAS completing above startup sequence, the sequence shall continue as follows:

   1) During initial startup of System 1, BAS shall commence AHU-101/102 activation sequence as further described.
   2) When transitioning from Economizer/Min OA mode, AHU-101/102 Preconditioned OA dampers shall be commanded to their full open position. BAS shall then commence AHU-101/102 Supply Air Temperature Control (Energy Recovery Mode) and ERU-100 Outside Air Volume (Fan Speed) Control loops as further described. When total OA flow as sensed by the ERU-100 outside airflow measuring stations is approximately equal to total ERU-100 exhaust flow as sensed by the exhaust duct airflow measuring stations, then AHU-101/102 OA Economizer dampers shall be commanded fully closed.

n. Refer to System 1 AHU supply fan activation for ERU-100 outside air fan failure sequences.

5. Air Handling Unit Activation/Deactivation

   a. Upon initial startup, AHU-101 and AHU-102 supply smoke isolation dampers shall be closed. AHU-101 and AHU-102 OA economizer and Preconditioned

OA dampers shall be closed. AHU-101 and AHU-102 return air dampers shall be open.

b. System 1 AHUs and respective return fans shall be enabled sequentially.
c. If at initial startup, the outside air temperature is below 40° F, the preheat coil control loop shall be initiated to maintain a minimum AHU plenum temperature of 50° F. Preheat coil shall then modulate to maintain minimum discharge temperature of 50° F as startup sequence continues.
d. Upon enabling the first sequential start of either AHU-101 or AHU-102, BAS shall assign a primary AHU supply fan (of two per AHU) based on predetermined operator selection or the lesser of the two fans' total runtime.
e. The primary supply fan VFD shall open respective system Fire/Smoke dampers at shafts connected to that fan via interlock relays. The respective Return fan VFD shall open system Fire/Smoke dampers at shafts connected to that fan via interlock relays.
f. Limit switch contacts for respective system Fire/Smoke dampers at shafts connected to the fans shall close to enable supply and return fan VFDs.
g. Supply and return fan VFDs shall signal BAS with binary run permissive.
h. BAS shall signal the respective Supply and Return fan VFDs of the first AHU to start.
i. The AHU secondary supply fan shall be enabled in a similar manner. Provide an adjustable time delay of ten seconds between fan VFD starts.
j. BAS shall ramp primary and secondary supply fan VFDs, and AHU's respective return fan VFD in unison over an adjustable time period of five minutes to their minimum speeds as determined by Section 23 0593.
k. Supply smoke isolation damper shall open when differential pressure across the damper is approximately zero. Limit switch contacts shall transfer to indicate damper open status.
l. AHU Preconditioned OA damper shall be commanded to its full open position.
m. System 1 Temperature Control loops shall be enabled.
n. Second sequenced AHU shall be brought online in similar manner with adjustable time delay between starts.
o. Once both AHU-101 and AHU-102 have been enabled and are operational as confirmed by BAS completing above startup sequence, BAS shall ramp System 1 supply fans incrementally over an adjustable time period in unison with System 1 return and exhaust fans to their respective static pressure set points. System 1 Supply, Return, Outside Air, and Exhaust Air Volume (Fan Speed) Control shall commence as further described.
p. At initial startup, if a primary supply fan fails to start, the secondary supply fan shall be enabled and startup sequence continued as described above. An alarm shall be generated at the BAS and the system shall attempt to meet static pressure requirements as described in Supply Air Volume (Fan Speed) Control.
q. At initial startup, if a secondary supply fan fails to start, the operating fan shall continue to run. An alarm shall be generated at the BAS and the AHU startup sequence shall continue as described above. The system shall attempt to meet static pressure requirements as described in Supply Air Volume (Fan Speed) Control.

r. At initial startup, if both supply fans of the first-sequenced AHU fail to start, the unit shall be shut down and the second AHU shall commence startup as described above.

s. There are 2 situations in which the BAS shall initiate a restart of a failed supply fan.

1) If a VFD fault or a high static trip on the failed fan is detected, a restart shall occur automatically when the fault is cleared. The startup sequence for the failed fan shall commence as described above. If the fan restarts, the AHU operational sequence shall resume (either AHU startup or Fan Speed Control depending on when the supply fan failure occurred), and both fans shall resume normal operation. If the fan fails to start, the described failed fan cycle shall be repeated. If a fan fails to start after 3 attempts, the fan shall be locked out, and an alarm generated at the BAS. The system shall attempt to meet static pressure requirements as described in Supply Air Volume (Fan Speed) Control with a single supply fan operating.

2) If a supply fan fails and no fault is detected other than loss of fan motor amps at the time of failure, the operator shall have the ability to initiate the restart manually via the BAS operator workstation. When a restart is initiated in this manner, the AHU shall undergo a cycle restart as described above. Upon repeated failure of the supply fan to restart, the fan shall be locked out, and an alarm generated at the BAS. The system shall attempt to meet static pressure requirements as described in Supply Air Volume (Fan Speed) Control with a single supply fan operating.

t. If a System 1 AHU is commanded off by the BAS or because of a safety trip, the supply smoke and return isolation damper shall close and the supply and return fans shall be commanded off.

1) When a single System 1 AHU is off, the Preconditioned OA damper, OA Economizer damper, supply fan isolation dampers, and supply smoke and return isolation damper shall be closed. The associated humidifier automatic steam isolation and control valve, and the chilled water valve shall be closed.

2) The damper operators shall be powered from the local DDCFP and shall be operable at all times by both normal and standby power.

6. Supply Air Volume (Fan Speed) Control

a. The BAS shall continually monitor pressure feedback from the four (4) System 1 static pressure sensors located as shown on the Contract Drawings. On an adjustable time interval initially set to 30 seconds, the BAS shall select the static pressure sensor reading furthest below its predetermined static pressure set point, and shall assign that sensor as the controlling input for common Supply Fan Speed Control.

b. Initial static pressure set point shall be set to 1.5 in. w.g. (adjustable) at location of each static pressure sensor. Final settings shall be established in coordination with Section 23 0593.

c. Based on the assigned controlling static pressure sensor the BAS shall modulate the speed of all operating supply fans in unison by sending an output signal to the supply fan VFDs.
d. Supply fans shall not be ramped down below minimum speed as determined by Section 23 0593.

7. Return Air Volume (Fan Speed) Control (RF-101/102)

a. The BAS shall continually monitor pressure feedback from the RF-101/102 static pressure sensors located as shown in the Contract Drawings.
b. Initial static pressure set point shall be set to (-) 1.0 in. w.g. (adjustable) at location of each static pressure sensor. Final settings shall be established in coordination with Section 23 0593.
c. The BAS shall modulate the speed of the respective return fan by sending an output signal to the associated return fan VFD.
d. RF-101 and RF-102 speeds shall be controlled independently of one another based on each fans associated static pressure sensor.
e. Return fans shall not be ramped down below minimum speed as determined by Section 23 0593.

8. ERU-100 Outside Air Volume (Fan Speed) Control

a. The BAS shall continually monitor airflow feedback from the ERU-100 exhaust airflow stations indicated on the Contract Drawings. ERU-100 outside air fans shall be controlled in unison to track the sum of ERU-100 variable exhaust flows, plus a pre-established offset for STEM Building auxiliary exhaust and building pressurization as determined by Section 23 0593.
b. Upon failure to maintain outside air flow, an alarm shall be generated and outside air fans shall be commanded off. AHU-101/102 shall be commanded to Economizer/Min OA mode.
c. Outside air fans shall not be ramped down below minimum speed as determined by Section 23 0593.

9. AHU-101/102 Supply Air Temperature Control (Energy Recovery Mode)

a. Upon successful activation of AHU-101/102 during initial startup, or ERU-100 outside air fans during enabling of Energy Recovery Mode, BAS shall control AHU-101/102 Supply Air Temperature as follows.
b. BAS shall modulate heating and cooling coils to maintain AHU discharge temperature set point initially set to 55° F (adjustable).
c. Upon an increase in AHU discharge temperature, cooling coil valve shall modulate open. Upon a decrease in AHU discharge temperature, the reverse shall occur.
d. Upon a further temperature decrease, cooling coil valve shall close and preheat valve shall modulate open. Upon an increase in AHU discharge temperature the reverse shall occur.
e. ERU-100 Preconditioned outside air temperature control shall be managed by ERU-100 factory-provided controls to optimize recovered energy based

on outside air and System 1 exhaust flow and temperature/humidity conditions. This control shall be achieved by modulating the rotation of the ERU-100 total enthalpy recovery wheels.

1) During Winter Energy Recovery Mode (i.e. outside air temperature less than 42° F) ERU-100 factory-provided controls shall limit maximum Preconditioned outside air temperature to 52° F (adjustable).
2) During Summer Energy Recovery Mode (i.e. outside air temperature greater and 75° F or outside air enthalpy greater than 28 btu/lb) ERU-100 factory-provided controls shall operate to limit Preconditioned outside air enthalpy to the lowest achievable value given the exhaust and outside air conditions.

10. AHU-101/102 Supply Air Temperature Control (Economizer/Min OA Mode):

a. System 1 Economizer/Min OA Mode shall be enabled whenever the outdoor enthalpy is less than 28 btu/lb and outdoor dry bulb temperature is less than 75° F; and anytime the outdoor dry bulb temperature is greater than 42° F. System 1 Economizer/Min OA Mode shall be disabled whenever the following conditions exist:

1) Outdoor air enthalpy is greater than 28 btu/lb or outdoor air temperature is greater than 75° F (see Summer Energy Recovery Mode).
2) Outdoor air dry bulb temperature is less than 42° F (see Winter Energy Recovery Mode).

b. Transition From Summer Energy Recovery Mode:

1) When Economizer/Min OA Mode is enabled from Summery Energy Recover Mode, AHU-101/102 OA Economizer dampers shall be commanded fully open. At the same time, AHU-101/102 Return dampers shall be commanded fully closed.
2) Once the AHU-101/102 OA Economizer dampers have been proven open via their respective end switch inputs, ERU-100 outside air fans shall be commanded OFF, and AHU-101/102 Preconditioned OA dampers commanded fully closed.
3) ERU-100 exhaust-side wheel bypass dampers shall be commanded open.
4) AHU Discharge Temperature Control shall commence as specified.

c. Transition from Winter Energy Recovery Mode:

1) When Economizer/Min OA Mode is enabled from Winter Energy Recover Mode, AHU-101/102 OA Economizer dampers shall initially modulate toward their pre-established minimum position as determined by Section 23 0593. At the same time, AHU-101/102 Return dampers shall be commanded toward their full open position.

2) Once position feedback indicates that AHU-101/102 OA Economizer dampers have reached their minimum open position, and that AHU-101/102 Return dampers have reached their full open position, ERU-100 outside air fans shall be commanded OFF, and Preconditioned OA dampers shall be commanded fully closed.
3) ERU-100 exhaust-side wheel bypass dampers shall be commanded open.
4) AHU Discharge Temperature Control shall commence as specified.

d. AHU Discharge Temperature Control

1) During Economizer/Min OA Mode the BAS shall first attempt to meet the AHU discharge temperature set point by modulating the OA Economizer and Return dampers.
2) Upon an increase in AHU discharge temperature above its set point, OA Economizer dampers shall modulate toward their full open position. AHU-101/102 Return dampers shall simultaneously modulate toward their closed position.
3) Upon a decrease in temperature, AHU-101/102 Return air dampers shall modulate open while OA Economizer dampers modulate toward their pre-established minimum position as determined in coordination with Section 23 0593. Upon a discharge temperature increase above set point the reverse shall occur.
4) Upon an increase in AHU discharge temperature above its set point when OA Economizer dampers are fully open, and AHU-101/102 Return dampers are fully closed, the cooling coil valve shall modulate to maintain the AHU discharge temperature.
5) Upon a decrease in AHU discharge temperature below its set point when OA Economizer dampers are in their pre-established minimum position as determined in coordination with Section 23 0593, and AHU-101/102 Return dampers are fully open, the preheat coil valve shall modulate to maintain the AHU discharge temperature.
6) When Economizer/Min OA Mode is disabled, ERU-100 shall begin its activation sequence as specified.

11. RF-101/102 Relief Damper Control

a. A static pressure transmitter in the return fan discharge shall modulate relief damper open whenever static pressure rises above an adjustable set point initially set to 0.2” w.g. Upon a decrease in static pressure below set point the reverse shall occur. Whenever the unit is in unoccupied or warmup mode, or is de-energized, the relief damper shall be closed.

12. Humidification

a. Upon initial startup of AHU-101/102, each unit’s humidifier automatic steam isolation valve shall be commanded open. Whenever a unit is shut down or during unoccupied mode, the isolation valve shall be commanded closed.

b. During AHU initial startup, humidifier control loop shall be held inactive until respective AHU has sustained run status at static pressure set point for two minutes. Humidifier steam control valve shall then be controlled to maintain discharge humidity at 65% RH (adjustable).
c. Upon in increase in discharge air relative humidity above 85% RH (adjustable), humidifier steam valves shall be closed and an alarm generated at the BAS. A high limit humidity controller shall close humidifier automatic steam isolation valve through hard wired interlock upon high humidity condition.
d. The BAS or AHU controller shall disable the humidifier control loop any time the cooling coil valve is in a position besides fully closed, as indicated by the cooling coil valve's actuator position feedback.

13. Filter Status

a. Differential pressure sensor shall measure the pressure drop across the filter section and generate an alarm if it exceeds the high set point.

14. Standby Power Mode

a. All BAS panels and controls shall be on standby power. The BAS system shall be interfaced to sense a power failure.
b. Upon a power failure, a single supply fan from either AHU-101 or AHU-102 shall operate to maintain building pressurization. Fans that have de-energized shall remain off until normal power is re-established.
c. The single standby fan shall restart once the standby power system is energized.
d. Once the system is activated in the standby power mode the BAS shall globally command all associated System 1 supply terminal units and general exhaust boxes to their minimum positions.

15. System 1 Backup Mode

a. System 1 Backup Mode shall be activated anytime a single AHU is shut down manually or due to a safety trip.
b. During System 1 Backup Mode the remaining operational AHU shall attempt to meet the System 1 supply static pressure requirements. The following sequence shall occur.
c. The supply smoke isolation, OA Economizer, and Preconditioned OA dampers for the failed AHU shall be fully closed.
d. The Return Fan associated with the failed AHU (RF-101 for AHU-101, RF-102 for AHU-102) shall commence its respective shut down sequence.
e. The BAS shall issue a global command to close all STEM Building pressure-independent terminal units to their minimum scheduled occupied setting. Supply units tracking fume hood or point exhaust, and the associated exhaust devices, shall override this global command and remain under normal control. Additionally, all pressure-independent terminal units in the STEM Building basement shall be commanded fully closed.

f. The pressure-independent terminal units associated with the remaining operational Return Fan shall track the STEM Building Office, Classroom, and Computer lab supply VAV boxes. Refer to the airflow diagrams for spaces served by Return Fans. The remaining operational Return Fan shall modulate to meet its static pressure set point.
g. The remaining operational AHU supply fans shall ramp to meet system static pressure set point.
h. Once remaining operational AHU has continually met static pressure set point for an adjustable time period initially set to 10 minutes, individual labs and shop spaces shall be brought back into their respective space airflow control sequences as follows:
   1) Any STEM Building spaces containing a fume hood shall first be brought back into normal space airflow control.
   2) The BAS shall then poll remaining lab and shop space thermostats, and those spaces shall be brought back into normal space airflow control individually based on the greatest divergence from their respective temperature set point. An adjustable interval initially set to 5 minutes shall exist between spaces brought under normal airflow control.
   3) BAS shall continue to bring lab and shop spaces under normal space airflow control until the remaining operational AHU supply fans are operating at 5% below their maximum scheduled capacity as reported by respective supply airflow measuring station.
   4) Remaining operational Return Fan, and System 1 exhaust fan speed control shall commence as normal.
i. Upon reactivation of failed System 1 AHU, BAS shall issue a global command to bring all STEM Building pressure-independent terminal units to their minimum scheduled occupied setting. Reactivated System 1 AHU shall be brought back online as per the System 1 AHU Activation sequence.
j. Upon establishing stable run status of both System 1 AHUs for an adjustable time period initially set to 5 minutes, BAS shall commence normal airflow control of all STEM Building spaces.

16. Coil Freeze Protection Pumps

a. Where specified, coil circulating pumps shall operate to circulate water through respective coil at design flow during cold ambient conditions. Pumps are configured in lead/standby arrangement.
b. When the outside air temperature is 40 ºF or below and AHU is operating, lead circulating pump shall be activated.
c. BAS shall continually monitor pump status. Upon failure of lead pump as indicated by loss of flow or pump status, standby pump shall be activated.
d. Circulating pump shall remain operating when an AHU shuts down due to a safety trip.
e. Upon loss of building power, operating circulating pumps shall be re-enabled during standby power mode even when AHU fails to restart.
f. Lead/standby rotation shall be performed automatically every 240 run-hours.

17. Safeties:

    a. All AHU safety devices are hard-wired and independent from the BAS system. These devices shall shut down equipment through hard-wire interlocks and provide alarm status to the operator through the BAS. High/low duct static and smoke detector safeties described below shall apply to ERU-100 OA fans and RF-101/102, in addition to AHU-101/102 supply fans. Refer to M701 for device locations.

        1) Freeze Protection: A manual reset, low limit thermostat shall be provided on the entering side of the chilled water coil. If the device senses a freeze condition (38 ºF adjustable reading at any one foot section), the AHU and return fans shall stop, the unit's isolation dampers shall close, and an alarm shall be generated. The chilled water valve shall open to allow circulation of water through the coil. The preheat coil valve shall modulate to maintain a plenum temperature of 50 ºF.
        2) High Duct Static: A high static pressure condition downstream of supply, outside air, or return fan(s) shall cause the fan(s) to be de-energized and an alarm generated at BAS. Hardwire high static pressure overrides to their respective fan VFD control circuit to shut down the fan; provide separate alarm signals to BAS whenever the high static pressure set points are exceeded. High static pressure switches shall be manually reset. The high static pressure set point shall be equal to the respective duct pressure classification.
        3) Low Duct Static: A low static pressure condition upstream of a supply, outside air, or return fan(s) shall cause the fan(s) to be de-energized and an alarm generated at BAS. Hardwire low static pressure overrides to their respective fan VFD control circuit to shut down the fan; provide separate alarm signals to BAS whenever the low static pressure set points are exceeded. Low static pressure switches shall be manually reset. The low static pressure set point shall be equal to the respective duct pressure classification.
        4) Smoke Detection: BAS shall monitor supply, outside air, and return air smoke detector(s) provided by Division 28. Each smoke detector shall be interlocked with the respective fan's VFD, and generate an alarm to BAS through an interface relay and de-energize its respective fan. Associated fan smoke isolation dampers shall close. System shut down due to smoke detection shall require manual restart by the BAS Operator.
        5) Safety devices shall be hardwired to the respective fan's VFD. Hardwired safety devices must be active in "Hand", and "Auto" positions. When a safety is activated, the system shall shutdown in a controlled manner.

18. Alarms:

    a. All analog inputs shall have a sensor failure alarm.
    b. The following additional alarms shall annunciate at the front-end:

1) Auxiliary contacts in the supply fan VFD indicate trouble or failure (No delay).
2) Any system fan VFD HOA switch is not in the auto position.
3) Supply Air Temperature alarm, if supply air temperature deviates from set point more than 2.0℉ (15 minute delay).
4) Supply Air Humidity alarm, if supply air relative humidity rises above 85% RH and the unit is not in cooling mode (15 minute delay).
5) The BAS shall monitor and alarm the filter differential static pressures. The BAS shall initiate an alarm when the filter differential pressure reaches 0.25" less than the maximum filter pressure drop indicated on the schedule. A second alarm shall be initiated when the differential pressure has reached the maximum filter pressure drop reading. (15 minute delay).
6) Supply Duct Static Pressure alarm, if the supply duct static deviates from set point by more than 25% (15 minute delay).
7) AHU fan failure alarm (2 minute delay).
8) AHU/ERU supply, return, or outside air smoke condition.
9) AHU/ERU high duct static.
10) AHU/ERU low duct static.
11) AHU freezestat alarm.
12) Loss of HW circulating pump (freeze protection pump) status via current feedback or pump flow.
13) Measured Airflow Deviation alarm: BAS shall alarm when measured airflow by any AFMS providing controlling input deviates from the control set point by +/- 10% (adj.) for an adjustable time period of 5 minutes.

19. BAS Workstation Display: Indicate the following for each AHU

a. DDC system graphic.
b. DDC system on/off/override indication.
c. Value associated with all analog and digital inputs and outputs listed in the schedules shown on the drawings.

1) Valve and damper commanded values shall be available to view as a neatly organized, consolidated table of values. Where position feedback is indicated for respective valves and dampers, that feedback shall be visible adjacent to the commanded values.

d. Current set points for the following:

1) Supply duct static-pressure set point.
2) Exhaust air relative humidity set point.
3) Filter high pressure drop set points.
4) Supply air temperature set point.
5) AFMS airflow set points, where applicable.
6) All alarm set points.

20. STEM Penthouse Relief Air Control:

    a. STEM Penthouse static pressure shall be monitored through the BAS via a differential pressure sensor with an outdoor reference probe. BAS shall modulate wall relief damper to maintain space static pressure of 0.1 in. w.g. (adjustable).

21. Unoccupied Mode Control:

    a. System 1 shall be indexed to unoccupied mode in accordance with schedule coordinated with Owner.
    b. During unoccupied mode, System 1 Return fans shall be shut down and AHU Return isolation dampers closed.
    c. All System 1 terminal units shall initially modulate down to the unoccupied values specified on the Airflow Diagrams. Space temperature set points shall be reset to their specified unoccupied values.
    d. Terminal unit controls in spaces with point exhaust or fume hoods shall always override unoccupied settings when respective devices are active at time of unoccupied mode transition.
    e. Upon a call for heating or cooling in spaces served by RF-101/102, respective return fans shall be activated. AHU Return isolation dampers shall position in accordance with either Energy Recovery or Economizer/Min OA Modes as specified. Associated space supply terminal units shall open to their minimum values.
    f. Local zone thermostats shall allow manual override of unoccupied mode. Override period shall initially be two hours and shall be adjustable by operator. Anytime a space thermostat associated with RF-101/102 is indexed to override the unoccupied mode, all spaces associated with that Return fan shall be indexed to occupied mode.
    g. During unoccupied mode, System 1 Temperature and Fan Speed Control loops shall continue as in occupied mode to meet system demand.
    h. Refer to Terminal Unit Control Sequences for specific unoccupied mode control sequences.

22. Refer to control diagrams on drawings for unit input/output schedules and additional information.

C. System 2: Air Handling Units AHU-201/202

1. AHU System Description

    a. AHU-201/202 serve the Chemistry Addition laboratories and support spaces. The AHUs are classified as 100 percent outdoor air capacity.
    b. AHU-201/202 are classified as variable volume, constant pressure with pressure-independent terminal units and reheat/terminal heating coils.
    c. Each System 2 AHU contains hydronic preheat coils, chilled water cooling coils, unfired steam humidifiers, and a variable volume supply air fan.
    d. The System 2 AHUs are scheduled to normally operate 24 hours a day.
    e. The AHU-201/202 supply ductwork is manifolded at the penthouse level such that both units normally operate at the same time, in parallel. When one

unit shuts down automatically due to a failure or manually for maintenance, the remaining unit shall provide limited capacity to meet the System 2 demand. Refer to the System 2 Backup Mode sequence described below.

f. The Add/Alternate for AHU-201/202 includes a wrap-around refrigerant heat pipe to provide energy recovery during periods of dehumidification.

2. General

a. AHU-201/202 shall be interlocked through a hardwired interface with System 2 exhaust fans as specified hereafter.

b. Upon initial startup of System 2, exhaust fans shall be energized first, followed by AHU-201/202. AHU-201 and AHU-202 shall be enabled sequentially as specified after exhaust fan operation is established. Supply and exhaust system static pressure set points shall be increased incrementally over an adjustable time period until respective system set points are reached.

c. When an AHU is offline via a BAS command, all its safeties shall be locked out except for the freezestat.

d. Sequences shall be performed by standalone DDCFPs dedicated to the AHU it serves. Provide one or more panels as may be required for the I/O count per AHU. Controls contractor shall verify final I/O count with actual installed equipment.

e. Provide graphic display of each AHU showing set points and actual readings, as well as component and system status.

f. Hand-Off-Auto (HOA) selector switch shall be provided at each VFD within the AHU system. The BAS shall monitor the switch and shall provide an operator alarm when the unit is out of the “Auto” position. AHU activation and deactivation shall be handled by the BAS when the Supply Fan VFD HOA switches are in the “Auto” position.

g. Upon initial startup of System 2, exhaust fans shall be energized first, followed by air handling units. AHU-201 and AHU-202 shall be enabled sequentially as specified after ready status of System 2 exhaust fans is established. Supply and exhaust fan speeds shall be increased over an adjustable time ramp to respective system set points.

3. Air Handling Unit Fan Soft Start

a. Provide an unloaded fan start sequence (soft start) for each supply and exhaust fan. This feature ensures the BAS slowly accelerates fan speed to a minimum speed upon initial startup. The VFD shall ramp fan speed to the control set point in a smooth, bumpless manner over a 5-minute time period.

b. The BAS shall decelerate fan speed to minimum and disable control loops when system shuts down. During system shutdown, the respective unit’s outside air and smoke isolation dampers shall gradually close, to prevent a high static pressure condition.

4. Air Handling Unit Activation/Deactivation

a. System 2 exhaust fans shall normally operate anytime the System 2 AHUs are operational.

b. If not already operating, System 2 exhaust fans shall be activated as specified. Refer to Section “System 2: Exhaust Fans EF-201A/B/C” for exhaust fan activation/deactivation and control sequences.
c. Once the System 2 exhaust fans have been enabled, the AHU-201/202 OA and Supply dampers shall be proven in the following positions:

1) Supply smoke isolation dampers shall be closed.
2) OA isolation dampers shall be closed.

d. System 2 AHUs shall be enabled sequentially.
e. If at initial startup, the outside air temperature is below 40° F, the preheat coil control loop shall be initiated to maintain a minimum AHU plenum temperature of 50° F. Preheat coil shall then modulate to maintain minimum discharge temperature of 50° F as startup sequence continues.
f. BAS shall signal to open the first sequenced AHU’s OA damper.
g. Upon proving open the first sequenced AHU’s OA damper via the respective dampers’ end switch inputs, BAS shall signal the respective Supply fan VFD of the first AHU to start.
h. The supply fan VFD shall open respective system Fire/Smoke dampers at shafts connected to that fan via interlock relays.
i. Limit switch contacts for respective system Fire/Smoke dampers at shafts connected to the fans shall close to enable VFD.
j. VFD shall signal BAS with binary run permissive.
k. BAS shall ramp supply fan VFD to pre-established minimum speed as determined by Section 23 0593 over an adjustable time period of five minutes.
l. Supply smoke isolation damper shall open when differential pressure across the damper is approximately zero. Limit switch contacts shall transfer to indicate damper open status.
m. System 2 Temperature Control loops shall be enabled.
n. Second sequenced AHU shall be brought online in similar manner with adjustable time delay between starts.
o. Once both AHU-201 and AHU-202 have been enabled and are operational as confirmed by BAS completing above startup sequence, BAS shall ramp System 2 supply fans incrementally over an adjustable time period in unison with System 2 exhaust fans to their respective static pressure set points. System 2 Supply and Exhaust Air Volume (Fan Speed) Control shall commence as further described.
p. At initial startup, if the first sequenced AHU supply fan fails to start, the associated unit’s Supply and OA isolation dampers shall close, the secondary AHU’s supply fan shall be enabled and startup sequence continued as described above. An alarm shall be generated at the BAS and the system shall attempt to meet static pressure requirements as described in Supply Air Volume (Fan Speed) Control.
q. At initial startup, if the second sequenced AHU supply fan fails to start, the associated unit’s Supply and OA isolation dampers shall close and the operating AHU shall continue to run. An alarm shall be generated at the BAS and the AHU startup sequence shall continue as described above. The

system shall attempt to meet static pressure requirements as described in Supply Air Volume (Fan Speed) Control.

r. There are 2 situations in which the BAS shall initiate a restart of a failed AHU.

1) If a VFD fault or a high static trip on the failed fan is detected, a restart shall occur automatically when the fault is cleared. During an AHU restart the failed AHU supply isolation damper shall be closed. Upon proving damper closure via the associated damper's end switch contacts, the startup sequence for the failed AHU shall commence as described above. If the AHU supply fan restarts, the AHU operational sequence shall resume (either AHU startup or Fan Speed Control depending on when the supply fan failure occurred), and both AHUs shall resume normal operation. If the AHU supply fan fails to start, the described failed fan cycle shall be repeated. If a fan fails to start after 3 attempts, the fan shall be locked out, AHU supply isolation damper closed, and an alarm generated at the BAS. The system shall attempt to meet static pressure requirements as described in Supply Air Volume (Fan Speed) Control with a single AHU operating.

2) If an AHU supply fan fails and no fault is detected other than loss of fan motor amps at the time of failure, the operator shall have the ability to initiate the restart manually via the BAS operator workstation. When a restart is initiated in this manner, the AHU shall undergo a cycle restart as described above. Upon repeated failure of the AHU to restart, the AHU shall be locked out, supply isolation damper closed, and an alarm generated at the BAS. The system shall attempt to meet static pressure requirements as described in Supply Air Volume (Fan Speed) Control with a single AHU operating.

s. If a System 2 AHU is commanded off by the BAS or because of a safety trip, the Supply and OA isolation dampers shall close and the supply fan shall be commanded off.

1) When a single System 2 AHU is off, the OA damper, and supply smoke isolation damper shall be closed. The associated humidifier automatic steam isolation and control valve and the chilled water valve shall be closed.

2) The damper operators shall be powered from the local DDCFP and shall be operable at all times by both normal and standby power.

5. Supply Air Volume (Fan Speed) Control

a. The BAS shall continually monitor pressure feedback from the two (2) System 2 static pressure sensors located as shown in the Contract Drawings. On an adjustable time interval initially set to 30 seconds, the BAS shall select the static pressure sensor reading furthest below its predetermined static pressure set point, and shall assign that sensor as the controlling input for common Supply Fan Speed Control.

b. Initial static pressure set point shall be set to 1.5 in. w.g. (adjustable) at location of each static pressure sensor. Final settings shall be established in coordination with Section 23 0593.

c. Based on the assigned controlling static pressure sensor the BAS shall modulate the speed of all operating supply fans in unison by sending an output signal to the supply fan VFDs.
d. Supply fans shall not be ramped down below minimum speed as determined by Section 23 0593.

6. AHU-201/202 Supply Air Temperature Control

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a. BAS shall modulate heating and cooling coils to maintain AHU discharge temperature set point initially set to 55° F (adjustable).
b. Upon an increase in AHU discharge temperature, cooling coil valve shall modulate open. Upon a decrease in AHU discharge temperature, the reverse shall occur.
c. Upon a further temperature decrease, cooling coil valve shall close and preheat valve shall modulate open. Upon an increase in AHU discharge temperature the reverse shall occur.

7. Humidification

a. Upon initial startup of AHU-201/202, each unit's humidifier automatic steam isolation valve shall be commanded open. Whenever a unit is shut down or during unoccupied mode, the isolation valve shall be commanded closed.
b. During AHU initial startup, humidifier control loop shall be held inactive until respective AHU has sustained run status at static pressure set point for two minutes. Humidifier steam valve shall then be controlled to maintain discharge humidity at 65% RH (adjustable).
c. Upon in increase in discharge air relative humidity above 85% RH (adjustable), humidifier steam valves shall be closed and an alarm generated at the BAS. A high limit humidity controller shall close humidifier automatic steam isolation valve through hard wired interlock upon high humidity condition.
d. The BAS or AHU controller shall disable the humidifier control loop any time the cooling coil valve is in a position besides fully closed, as indicated by the cooling coil valve's actuator position feedback.

8. Filter Status

a. Differential pressure sensor shall measure the pressure drop across the filter section and generate an alarm if it exceeds the high set point.

9. Standby Power Mode

a. All BAS panels and controls shall be on standby power. The BAS system shall be interfaced to sense a power failure.
b. Upon a power failure, a single AHU (either AHU-201 or AHU-202) shall operate to maintain building pressurization. Fans that have de-energized shall remain off until normal power is re-established.
c. The singly AHU shall restart once the standby power system is energized.

d. Once the system is activated in the standby power mode the BAS shall globally command all associated System 2 supply terminal units and general exhaust boxes to their minimum positions.

10. System 2 Backup Mode

a. System 2 Backup Mode shall be activated anytime a single AHU is shut down manually or due to a safety trip.
b. During System 2 Backup Mode the remaining operational AHU shall attempt to meet the System 2 static pressure requirements. The following sequence shall occur.
c. The supply smoke isolation and OA dampers for the failed AHU shall be fully closed.
d. The BAS shall issue a global command to close all Chemistry Addition pressure-independent terminal units to their minimum scheduled occupied setting. Supply units tracking fume hood or point exhaust, and the associated exhaust devices, shall override this global command and remain under normal control.
e. The remaining operational AHU supply fan shall ramp to meet system static pressure set point.
f. Upon reactivation of failed System 2 AHU, reactivated AHU shall be brought back online as per the System 2 AHU Activation sequence.
g. Upon establishing stable run status of both System 2 AHUs for an adjustable time period initially set to 5 minutes, BAS shall commence normal airflow control of all Chemistry Addition spaces.

11. Coil Freeze Protection Pumps

a. Where specified, coil circulating pumps shall operate to circulate water through respective coil at design flow during cold ambient conditions. Pumps are configured in lead/standby arrangement.
b. When the outside air temperature is 40 ºF or below and AHU is operating, lead circulating pump shall be activated.
c. BAS shall continually monitor pump status. Upon failure of lead pump as indicated by loss of flow or pump status, standby pump shall be activated.
d. Circulating pump shall remain operating when an AHU shuts down due to a safety trip.
e. Upon loss of building power, operating circulating pumps shall be re-enabled during standby power mode even when AHU fails to restart.
f. Lead/standby rotation shall be performed automatically every 240 run-hours.

12. Safeties:

a. All AHU safety devices are hard-wired and independent from the BAS system. These devices shall shut down equipment through hard-wire interlocks and provide alarm status to the operator through the BAS. Refer to M702 for device locations.

1) Freeze Protection: A manual reset, low limit thermostat shall be provided on the entering side of the chilled water coil. If the device senses a freeze condition (38 ºF adjustable reading at any one foot section), the AHU shall stop, the unit's isolation dampers shall close, and an alarm shall be generated. The chilled water valve shall open to allow circulation of water through the coil. The preheat coil valve shall modulate to maintain a plenum temperature of 50 ºF.
2) High Duct Static: A high static pressure condition downstream of the supply fan shall cause the fan to be de-energized and an alarm generated at BAS. Hardwire high static pressure overrides to their respective fan VFD control circuit to shut down the fan; provide separate alarm signals to BAS whenever the high static pressure set points are exceeded. High static pressure switches shall be manually reset. The high static pressure set point shall be equal to the respective duct pressure classification.
3) Low Duct Static: A low static pressure condition upstream of the supply fan shall cause the fan to be de-energized and an alarm generated at BAS. Hardwire low static pressure overrides to their respective fan VFD control circuit to shut down the fan; provide separate alarm signals to BAS whenever the low static pressure set points are exceeded. Low static pressure switches shall be manually reset. The low static pressure set point shall be equal to the respective duct pressure classification.
4) Smoke Detection: BAS shall monitor supply air smoke detector(s) provided by Division 28. Each smoke detector shall be interlocked with the respective fan's VFD, and generate an alarm to BAS through an interface relay and de-energize its respective fan. Associated fan smoke isolation dampers shall close. System shut down due to smoke detection shall require manual restart by the BAS Operator.
5) Safety devices shall be hardwired to the respective fan's VFD. Hardwired safety devices must be active in "Hand", and "Auto" positions. When a safety is activated, the system shall shutdown in a controlled manner.

13. Alarms:

a. All analog inputs shall have a sensor failure alarm.
b. The following additional alarms shall annunciate at the front-end:

1) Auxiliary contacts in the supply fan VFD indicate trouble or failure (No delay).
2) Supply fan VFD HOA switch is not in the auto position.
3) Supply Air Temperature alarm, if supply air temperature deviates from set point more than 2.0 ℉ (15 minute delay).
4) Supply Air Humidity alarm, if supply air relative humidity rises above 85% RH and the unit is not in cooling mode (15 minute delay).
5) The BAS shall monitor and alarm the filter differential static pressures. The BAS shall initiate an alarm when the filter differential pressure reaches 0.25" less than the maximum filter pressure drop indicated on

the schedule. A second alarm shall be initiated when the differential pressure has reached the maximum filter pressure drop reading. (15 minute delay).

6) Supply Duct Static Pressure alarm, if the supply duct static deviates from set point by more than 25% (15 minute delay).
7) AHU fan failure alarm (2 minute delay).
8) AHU supply smoke condition.
9) AHU high duct static.
10) AHU low duct static.
11) AHU freezestat alarm.
12) Loss of HW circulating pump (freeze protection pump) status via current feedback or pump flow.
13) Measured Airflow Deviation alarm: BAS shall alarm when measured airflow by any AFMS providing controlling input deviates from the control set point by +/- 10% (adj.) for an adjustable time period of 5 minutes.

14. BAS Workstation Display: Indicate the following for each AHU

a. DDC system graphic.
b. DDC system on/off/override indication.
c. Value associated with all analog and digital inputs and outputs listed in the schedules shown on the drawings.

1) Valve and damper commanded values shall be available to view as a neatly organized, consolidated table of values. Where position feedback is indicated for respective valves and dampers, that feedback shall be visible adjacent to the commanded values.

d. Current set points for the following:

1) Supply duct static-pressure set point.
2) Exhaust air relative humidity set point.
3) Filter high pressure drop set points.
4) Supply air temperature set point.
5) AFMS airflow set points, where applicable.
6) All alarm set points.

15. Unoccupied Mode Control:

a. System 2 shall be indexed to unoccupied mode in accordance with schedule coordinated with Owner.
b. All System 2 terminal units shall initially modulate down to the unoccupied values specified on the Airflow Diagrams. Space temperature set points shall be reset to their specified unoccupied values.

c. Terminal unit controls in spaces with point exhaust or fume hoods shall always override unoccupied settings when respective devices are active at time of unoccupied mode transition.
d. Local zone thermostats shall allow manual override of unoccupied mode. Override period shall initially be two hours and shall be adjustable by operator.
e. During unoccupied mode, System 2 Temperature and Fan Speed Control loops shall continue as in occupied mode to meet system demand.
f. Refer to Terminal Unit Control Sequences for specific unoccupied mode control sequences.

16. Refer to control diagrams on drawings for unit input/output schedules and additional information.

D. System 3: AHU-301 – Forum

1. System Description

a. AHU-301 is a single zone, variable volume air handling unit with hot water preheat coil, chilled water cooling coil and variable volume supply air fan. System Return Fan (RF-301) is located external to the AHU in the Forum mechanical room. Space temperature shall be maintained using discharge air temperature reset and fan speed control.
b. The air handling unit serves the Forum.

2. General

a. The air handling unit shall be controlled in an occupied/unoccupied manner.
b. The BAS shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while achieving comfort conditions by the start of the scheduled occupancy. The start time shall automatically adjust based on changes in outside air temperature and zone temperature.

3. AHU-301 Activation/Deactivation

a. The supply and return fans shall be started and stopped by the BAS when the HOA switches are in the "Auto" position. The fans shall be started and stopped based on a Time of Day Schedule.
b. The supply fan VFD shall be enabled. The return fan VFD shall also be enabled through a hardwire interlock. Supply and return VFDs shall command open the supply and return isolation dampers, respectively. OA damper shall remain closed.
c. Once supply and return isolation dampers have been proven in their open position, the supply and return fan VFDs shall ramp up to minimum speed. After fan operation is confirmed via amperage feedback, the supply fan shall be controlled as described in the Supply Air Fan Control section and the return fan shall be controlled as described in the Return Air Fan Control section.

d. Once both supply and return fans are operating, the minimum outside air damper shall open to minimum position (occupied mode only). Maximum outside air damper shall initially remain closed.
e. Both supply and return fans shall run continuously during occupied hours.
f. If the supply or return fan fails to start after three attempts, the unit shall be locked out and an alarm initiated in the BAS.
g. If the AHU is commanded off by the BAS or because of a safety trip, the supply and return fans shall stop and all valves and dampers shall return to their normal positions, except the hot water coil valve which shall be closed.

4. Supply Air Fan Control

a. Supply air volume control shall be by the BAS which shall modulate the fan speed from its minimum airflow speed setting (4,500 cfm) up to its maximum airflow speed setting (11,000 cfm) as described in the Space Temperature Control section.
b. An Air Flow Measuring Station, located in the supply fan inlet, shall provide the BAS with air velocity signals. These signals shall be used by the BAS to calculate and display the supply cfm.

5. Return Air Fan Control

a. The BAS shall modulate the return fan VFD in unison with the supply fan VFD to maintain a fixed airflow differential of 700 cfm (adjustable) less than supply. During warm-up and unoccupied modes, the fixed differential shall be zero.
b. An Air Flow Measuring Station, located in the return fan inlet, shall provide the BAS with air velocity signals. The BAS shall calculate and display the return cfm and modulate the return fan VFD to meet the airflow set point as specified.

6. Space Temperature Control

a. The BAS shall use the zone temperature to automatically select heating or cooling mode.
b. Heating and cooling demand shall be calculated through independent heating and cooling PID outputs. These PIDs shall have individually adjustable interval, bias, and proportional, integral and, derivative parameters carefully tuned in each application for slow action to avoid hunting, particularly of fan speed drives.
c. The discharge air temperature shall first be reset depending on zone heating or cooling demand with fan operating at minimum airflow/speed setting. Then supply air fan shall modulate through its minimum and maximum CFM set point to maintain the zone temperature set point as described below. Return fan shall track supply fan accordingly as otherwise described in the Return Fan Control section.
d. Heating Mode: When zone temperature drops below heating set point (with 0.5 °F (adj) hysteresis), unit control shall be indexed to Heating Mode and cooling shall be disabled.

1) First Stage - Heating SAT reset: Heating PID output from 1- 20% (adj.) shall first reset SAT from Minimum 70 °F (adj.) to maximum of 85 °F (adj.) while supply air flow remains at specified minimum set point.
2) Second stage - Increase Airflow: Upon continued zone temperature below set point, Heating PID output increasing from 21-100% shall proportionally increase supply airflow set point from min to max cfm.
3) Reverse shall occur as zone temperature rises above heating set point, with hysteresis.

e. Deadband: When zone temperature is within deadband (allowing for cooling and heating mode hysteresis), unit shall continue DCV sequence as specified. Unit shall hold SAT set point from last mode, and supply fan shall hold minimum speed.
f. Cooling Mode: When zone temperature rises above cooling set point (with 0.5 °F (adj) hysteresis), unit control shall be indexed to Cooling Mode and heating shall be disabled.

1) First Stage - Cooling SAT reset: Cooling PID output from 1 to 20% (adj.) shall first reset SAT from Maximum 70 °F (adj.) down to minimum of 55 °F (adj.) while supply air flow remains at specified minimum set point.
2) Second stage - Increase Airflow: Upon continued zone temperature above set point, Cooling PID output increasing from 21-100% shall proportionally increase supply airflow set point from min to max cfm.
3) Reverse shall occur as zone temperature drops below cooling set point, with hysteresis.

7. Preheat Temperature Control

a. When enabled, the BAS shall modulate the heating control valve to maintain the SAT heating set point.
b. The heating control valve shall be enabled whenever:

1) Outside air temperature is less than 52°F (adj.).
2) AND the supply fan status is on.
3) AND the cooling is not active.
4) AND economizer is not active (Max and Min OA dampers are at minimum position and MAT is below SAT set point).
5) Or the unit is off and OAT is below 40 °F (adj.).

c. The BAS shall monitor the preheat coil leaving air temperature. When unit is stopped, and OAT is less than 40°F, the BAS shall close the OA, return, and supply isolation damper, and modulate the heating control valve to maintain a minimum AHU plenum temperature of 50°F degrees (adj.), with a low limit alarm at 40 °F (adj.).

8. Cooling Coil Temperature Control

a. When enabled, the BAS shall modulate the chilled water control valve last in sequence as required to maintain the SAT set point.

b. The chilled water control valve shall be enabled whenever:

1) SAT exceeds SAT set point.
2) AND outside air temperature is greater than the effective SAT set point minus 2.5°F (adj.) offset for fan heat, with a lower limit of 52 °F (adj.).
3) AND the economizer is either disabled or fully open.
4) AND the supply fan status is on.
5) AND the preheat coil valve is disabled.

9. Minimum Outside Air / Demand Control Ventilation

a. General: When in occupied mode, the BAS shall monitor the space CO2 level. The minimum OA flow set point shall normally be set to an absolute minimum value of 500 cfm, and shall be reset upwards to the design value of 1700 cfm as required to meet the specified space CO2 threshold level.
b. An airflow measuring station located at the minimum outside air damper shall continuously monitor the outside air volume in CFM.
c. Exhaust/relief damper shall initially remain closed in minimum OA mode.
d. Damper Control:

1) Upon a rise in space CO2 ppm above an adjustable threshold initially set to 900 ppm, BAS shall reset minimum OA flow set point upward in adjustable increments toward the design value.
2) BAS shall modulate minimum OA damper open while simultaneously modulating return damper closed until measured OA flow equals OA flow set point.
3) Upon a decrease in space CO2 ppm below the specified threshold the reverse shall occur until OA flow set point reaches the specified absolute minimum value.
4) If minimum OA set point cannot be achieved with minimum OA damper at maximum open position, the BAS shall attempt to increase OA flow by modulating return damper further closed. Upon an increase of minimum OA flow above the set point, the reverse shall occur.
5) A static pressure transmitter in the return fan discharge shall modulate relief damper open whenever static pressure rises above an adjustable set point initially set to 0.2” w.g. Upon a decrease in static pressure below set point the reverse shall occur. Whenever the unit is in unoccupied or warmup mode, or is de-energized, the relief damper shall be closed.

10. Filter Status

a. Differential pressure sensor shall measure the pressure drop across the filter section and generate an alarm if it exceeds the high set point.

11. Economizer Mode

a. System 3 Economizer Mode shall be enabled whenever the following conditions exist:

1) Outdoor enthalpy is less than 28 btu/lb.
2) AND outdoor dry bulb temperature is less than 75° F.
3) AND the outdoor dry bulb temperature is greater than 52° F.
4) The preheat control valve has been continuously disabled for at least 10 minutes (adjustable).

b. System 3 Economizer Mode shall be disabled whenever the following conditions exist:

1) Outdoor air enthalpy is greater than 28 btu/lb or outdoor air temperature is greater than 75° F.
2) Outdoor air dry bulb temperature is less than 52° F.
3) Anytime the preheat coil control loop is active.

c. AHU Discharge Temperature Control

1) During Economizer Mode the BAS shall first attempt to meet the AHU discharge temperature set point by modulating the Maximum OA and Return dampers. Minimum OA damper shall remain open.
2) Upon an increase in AHU discharge temperature above its set point, Maximum OA damper shall modulate toward its full open position. Return damper shall simultaneously modulate toward its closed position. Upon a decrease in temperature the reverse shall occur.
3) Upon an increase in AHU discharge temperature above its set point when Economizer dampers are fully open, and Return damper is fully closed, the cooling coil valve shall modulate to maintain the AHU discharge temperature.
4) When Economizer Mode is disabled, Maximum OA damper shall modulate to its closed position while Return damper modulates to its open position. Heating or Cooling Temperature Control modes shall commence as specified.

12. Finned Tube Radiation, Hydronic:

a. The finned tube radiation located at the perimeter of the Forum shall be controlled based on outside air temperature and three (3) perimeter temperature sensors as indicated on the Contract Drawings to offset perimeter radiant heat loss.
b. When the outside air temperature is below 45 °F (adj.), the finned tube radiation control sequence shall commence. When the outside temperature rises above 49 °F (adj.), the finned tube radiation control valves shall be commanded closed.
c. Upon BAS activation of Finned Tube Radiation heating mode, BAS shall modulate each zone's heating valve to meet adjustable temperature set point initially set to 72 °F.

13. Safeties:

a. All AHU safety devices are hard-wired and independent from the BAS system. These devices shall shut down equipment through hard-wire interlocks and provide alarm status to the operator through the BAS. High/low duct static and smoke detector safeties described below shall apply to RF-301, in addition to AHU-301. Refer to M703 for device locations.

1) Freeze Protection: A manual reset, low limit thermostat shall be provided on the entering side of the chilled water coil. If the device senses a freeze condition (38 ºF adjustable reading at any one foot section), the AHU and return fans shall stop, the unit's isolation dampers shall close, and an alarm shall be generated. The chilled water valve shall open to allow circulation of water through the coil. The preheat coil valve shall modulate to maintain a plenum temperature of 50 ºF.
2) High Duct Static: A high static pressure condition downstream of a supply or return fan shall cause the fan to be de-energized and an alarm generated at BAS. Hardwire high static pressure overrides to their respective fan VFD control circuit to shut down the fan; provide separate alarm signals to BAS whenever the high static pressure set points are exceeded. High static pressure switches shall be manually reset. The high static pressure set point shall be equal to the respective duct pressure classification.
3) Low Duct Static: A low static pressure condition upstream of a supply or return fan shall cause the fan to be de-energized and an alarm generated at BAS. Hardwire low static pressure overrides to their respective fan VFD control circuit to shut down the fan; provide separate alarm signals to BAS whenever the low static pressure set points are exceeded. Low static pressure switches shall be manually reset. The low static pressure set point shall be equal to the respective duct pressure classification.
4) Smoke Detection: BAS shall monitor supply smoke detector(s) provided by Division 28. Each smoke detector shall be interlocked with the respective fan's VFD, and generate an alarm to BAS through an interface relay and de-energize its respective fan. System shut down due to smoke detection shall require manual restart by the BAS Operator.
5) Safety devices shall be hardwired to the respective fan's VFD. Hardwired safety devices must be active in "Hand", and "Auto" positions. When a safety is activated, the system shall shutdown in a controlled manner.
6) Power Failure: The unit shall shut down upon loss of power. When normal power is resumed, the unit shall automatically restart as above.

14. Alarms:

a. All analog inputs shall have a sensor failure alarm.
b. The following additional alarms shall annunciate at the front-end:

1) Auxiliary contacts in the supply fan or return fan VFD indicate trouble or failure (No delay).
2) Supply fan or return fan VFD HOA switch is not in the auto position.
3) Supply Air Temperature alarm, if supply air temperature deviates from set point more than 2.0 °F (15 minute delay).
4) The BAS shall monitor and alarm the filter differential static pressure. The BAS shall initiate an alarm when the differential pressure has reached the maximum filter pressure drop reading. (15 minute delay).
5) AHU fan failure alarm.
6) Return fan failure alarm.
7) AHU supply smoke condition.
8) AHU freezestat alarm.
9) Measured Airflow Deviation alarm: BAS shall alarm when measured airflow by any AFMS providing controlling input deviates from the control set point by +/- 10% (adj.) for an adjustable time period of 5 minutes.

15. BAS Workstation Display: Indicate the following for each AHU

1) DDC system graphic.
2) DDC system on/off/override indication.
3) Value associated with all analog and digital inputs and outputs listed in the schedules shown on the drawings.

a) Valve and damper commanded values shall be available to view as a neatly organized, consolidated table of values. Where position feedback is indicated for respective valves and dampers, that feedback shall be visible adjacent to the commanded values.

4) Current set points for the following:

a) Filter high pressure drop set points.
b) Space temperature set point.
c) Discharge air temperature set point.
d) Occupancy mode.
e) AFMS airflow set points, where applicable.
All alarm set points

16. Unoccupied Mode Control

a. System 3 shall be indexed to unoccupied mode in accordance with schedule coordinated with Owner.
b. Supply and return fans shall be off until indexed on by space temperature requirements. OA and Relief dampers shall be closed. Relief air control loop shall be disabled, and unit shall operate on recirculated air only.
c. If the space temperature falls below its unoccupied temperature set point of 65 °F (adj.), the BAS shall energize the supply and return fans. Fans and

preheat coil control valve shall operate as in Heating Mode to maintain the set point.

d. If the space temperature rises above its unoccupied temperature set point of 80 °F (adj.), the BAS shall energize the supply and return fans. Fans and cooling coil control valve shall operate as in Cooling Mode to maintain the set point.
e. Override of unoccupied mode controls shall be enabled via the BAS.

17. Refer to control diagrams on drawings for unit input/output schedules and additional information.

E. System 4: Paint Booth Makeup Air Unit MAU-100

1. MAU System Description

a. MAU-100 serves the STEM Building paint booth. The MAU is classified as 100 percent outdoor air capacity.
b. MAU-100 is classified as a constant volume, chilled water makeup air unit.
c. MAU-100 contains a hydronic preheat coil, chilled water cooling coil, unfired steam humidifier, hydronic reheat coil, and a constant volume supply air fan.
d. MAU-100 shall be available to operate during occupied hours on an as-needed basis, as controlled by an ON/OFF toggle located adjacent to the paint booth. Anytime MAU-100 or EF-102A/B shuts down or fails to start due to a safety trip or fault, manual activation via the ON/OFF toggle shall be disabled until safety or fault has been cleared via the BAS interface.

2. General

a. MAU-100 shall be interlocked through a hardwired interface with System 4 exhaust fans as specified hereafter.
b. Upon initial startup of System 4, exhaust fans shall be energized first, followed by MAU-100. Supply and exhaust system airflow set points shall be increased incrementally over an adjustable time period until respective system set points are reached.
c. When MAU-100 is offline via a BAS command, all its safeties shall be locked out except for the freezestat.
d. Sequences shall be performed by standalone DDCFPs dedicated to the MAU. Provide one or more panels as may be required for the I/O count for the MAU. Controls contractor shall verify final I/O count with actual installed equipment.
e. Provide graphic display of MAU-100 showing set points and actual readings, as well as component and system status.
f. Hand-Off-Auto (HOA) selector switch shall be provided at each VFD within the MAU system. The BAS shall monitor the switch and shall provide an operator alarm when the unit is out of the “Auto” position. MAU activation and deactivation shall be handled by the BAS when the Supply Fan VFD HOA switches are in the “Auto” position.
g. Upon initial startup of System 4, exhaust fans shall be energized first, followed by makeup air unit. MAU-100 shall be enabled as specified after

ready status of System 4 exhaust fans is established. Supply and exhaust fan speeds shall be increased over an adjustable time ramp to respective system set points.

3. Air Handling Unit Fan Soft Start

   a. Provide an unloaded fan start sequence (soft start) for each supply and exhaust fan. This feature ensures the BAS slowly accelerates fan speed to a minimum speed upon initial startup. The VFD shall ramp fan speed to the control set point in a smooth, bumpless manner over a 5-minute time period.
   b. The BAS shall decelerate fan speed to minimum and disable control loops when system shuts down. During system shutdown, the respective unit's outside air and smoke isolation dampers shall gradually close, to prevent a high static pressure condition.

4. Makeup Air Unit Activation/Deactivation

   a. System 4 exhaust fans shall normally operate anytime MAU-100 is operational.
   b. If not already operating, System 4 exhaust fans shall be activated as specified. Refer to Section "System 4: Exhaust Fans EF-102A/B" for exhaust fan activation/deactivation and control sequences.
   c. Upon initial startup, MAU-100 supply smoke and OA isolation damper shall initially be closed.
   d. If at initial startup, the outside air temperature is below 40° F, the preheat coil control loop shall be initiated to maintain a minimum MAU plenum temperature of 50° F. Preheat coil shall then modulate to maintain minimum discharge temperature of 50° F as startup sequence continues.
   e. BAS shall signal to open the MAU's OA and supply smoke isolation dampers.
   f. Upon proving open the MAU's OA and supply smoke isolation dampers via the respective dampers' end switch inputs, BAS shall signal the Supply fan VFD to start.
   g. The supply fan VFD shall open respective system Fire/Smoke dampers at shafts connected to that fan via interlock relays.
   h. Limit switch contacts for respective system Fire/Smoke dampers at shafts connected to the fans shall close to enable VFD.
   i. VFD shall signal BAS with binary run permissive.
   j. BAS shall ramp supply fan VFD to pre-established minimum speed as determined by Section 23 0593 over an adjustable time period of five minutes.
   k. System 4 Temperature Control loops shall be enabled.
   l. Once MAU-100 has been enabled and is operational as confirmed by BAS completing above startup sequence, BAS shall ramp MAU-100 supply fan incrementally over an adjustable time period in unison with System 4 exhaust fans to their respective airflow set points. System 4 Supply and Exhaust Air Volume (Fan Speed) Control shall commence as further described.
   m. At initial startup, if the MAU supply fan fails to start, the Supply and OA isolation dampers shall close, an alarm shall be generated at the BAS, and

the System 4 exhaust fans shall be deactivated. Local visual panel at paint booth shall indicate system trouble status.

n. If the MAU is commanded off by the BAS or because of a safety trip, the Supply and OA isolation damper shall close and the supply fan shall be commanded off. System 4 exhaust fans shall be deactivated.

1) When the MAU is off, the OA damper, and supply smoke isolation damper shall be closed. The associated humidifier automatic steam isolation and control valve and the chilled water valve shall be closed.
2) The damper operators shall be powered from the local DDCFP and shall be operable at all times by both normal and standby power.

5. Supply Air Volume (Fan Speed) Control

a. The BAS shall monitor airflow feedback from the MAU supply airflow measuring station.
b. BAS shall modulate the speed of the supply fan by sending an output signal to the supply fan VFD in order to maintain the scheduled design flow. Final airflow settings shall be established in coordination with Section 23 0593 to consider system leakage and installed equipment requirements.
c. Supply fan shall not be ramped down below minimum speed as determined by Section 23 0593.

6. MAU-100 Supply Air Temperature Control

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a. BAS shall modulate heating and cooling coils to maintain AHU discharge temperature set point.
b. MAU and cooling coil discharge temperature set points shall be reset depending on temperature control mode as specified below.
c. Heating Mode:

1) When OAT is 56° F or less, preheat coil valve shall modulate to maintain the supply air discharge temperature set point.
2) SAT set point shall be reset based on the following schedule:

OAT ≤ 50° F	SAT = 65 ° F
50° F < OAT ≤ 56° F	65° F < SAT ≤ 72° F (linear reset)

d. OA Mode:

1) BAS shall disable preheat and cooling control valve loops when the following conditions are met:

a) OAT is greater than 56° F and equal to or less than 75° F.
b) Calculated OA enthalpy is below 28 btu/lb.
c) MAU is ON.

2) During OA Mode, BAS shall modulate the reheat control valve to maintain a supply air discharge temperature of 72° F.

e. Cooling Mode:

1) BAS shall enable Cooling Mode when the following conditions are met:

a) OAT exceeds 75° F.
b) OR calculated OA enthalpy is equal to or greater than 28 btu/lb.
c) MAU is ON.

2) During Cooling Mode, BAS shall modulate the cooling control valve to maintain a supply air discharge temperature of 72° F.

f. Dehumidification Mode:

1) The BAS shall continually monitor the MAU discharge relative humidity via the duct humidistat. If the RH exceeds 60% for an adjustable continuous time period initially set to 60 seconds, the Cooling Coil shall be activated. BAS shall modulate Cooling Coil control valve to maintain a Cooling Coil discharge air temperature of 56° F. Reheat coil valve shall modulate to maintain MAU supply air discharge temperature of 72° F.
2) Once measured RH has been below 50% for adjustable continuous time period initially set to 5 minutes, either OA or Cooling Mode shall resume as specified.

7. Humidification

a. Upon initial startup of MAU-100, the humidifier automatic steam isolation valve shall be commanded open. Whenever a unit is shut down or during unoccupied mode, the isolation valve shall be commanded closed.
b. During MAU initial startup, humidifier control loop shall be held inactive until respective AHU has sustained run status at airflow set point for two minutes. Humidifier steam valve shall then be controlled to maintain MAU discharge humidity at 30% RH (adjustable).
c. Upon in increase in discharge air relative humidity above 60% RH (adjustable), humidifier steam valves shall be closed and an alarm generated at the BAS. A high limit humidity controller shall close humidifier steam valve through hard wired interlock upon high humidity condition.
d. The BAS or MAU controller shall disable the humidifier control loop any time the cooling coil valve is in a position besides fully closed, as indicated by the cooling coil valve's actuator position feedback.

8. Filter Status

a. Differential pressure sensor shall measure the pressure drop across the filter section and generate an alarm if it exceeds the high set point.

9. Standby Power Mode

a. All BAS panels and controls shall be on standby power. The BAS system shall be interfaced to sense a power failure.
b. Upon a power failure, MAU-100 shall operate in a reduced capacity to maintain pressurization in the paint booth.
c. The MAU shall undergo restart cycle once the standby power system is energized.
d. Once the system is activated in the standby power mode the BAS shall operate System 4 supply and exhaust fans at their minimum airflow settings as established in coordination with Section 23 0593.

10. Coil Freeze Protection Pumps

a. Where specified, coil circulating pumps shall operate to circulate water through respective coil at design flow during cold ambient conditions. Pumps are configured in lead/standby arrangement.
b. When the outside air temperature is 40 ºF or below and AHU is operating, lead circulating pump shall be activated.
c. BAS shall continually monitor pump status. Upon failure of lead pump as indicated by loss of flow or pump status, standby pump shall be activated.
d. Circulating pump shall remain operating when an AHU shuts down due to a safety trip.
e. Upon loss of building power, operating circulating pumps shall be re-enabled during standby power mode even when MAU fails to restart.
f. Lead/standby rotation shall be performed automatically every 240 run-hours.

11. Safeties:

a. All AHU safety devices are hard-wired and independent from the BAS system. These devices shall shut down equipment through hard-wire interlocks and provide alarm status to the operator through the BAS. Refer to M703 for device locations.

1) Freeze Protection: A manual reset, low limit thermostat shall be provided on the entering side of the chilled water coil. If the device senses a freeze condition (38 ºF adjustable reading at any one foot section), the AHU shall stop, the unit's isolation dampers shall close, and an alarm shall be generated. The chilled water valve shall open to allow circulation of water through the coil. The preheat coil valve shall modulate to maintain a plenum temperature of 50 ºF.
2) High Duct Static: A high static pressure condition downstream of the supply shall cause the fan to be de-energized and an alarm generated at BAS. Hardwire high static pressure overrides to their respective fan VFD control circuit to shut down the fan; provide separate alarm signals to BAS whenever the high static pressure set points are exceeded. High static pressure switches shall be manually reset. The high static pressure set point shall be equal to the respective duct pressure classification.
3) Low Duct Static: A low static pressure condition upstream of the supply fan shall cause the fan to be de-energized and an alarm

generated at BAS. Hardwire low static pressure overrides to their respective fan VFD control circuit to shut down the fan; provide separate alarm signals to BAS whenever the low static pressure set points are exceeded. Low static pressure switches shall be manually reset. The low static pressure set point shall be equal to the respective duct pressure classification.

4) Smoke Detection: BAS shall monitor supply smoke detector(s) provided by Division 28. Each smoke detector shall be interlocked with the respective fan's VFD, and generate an alarm to BAS through an interface relay and de-energize its respective fan. System shut down due to smoke detection shall require manual restart by the BAS Operator.
5) Safety devices shall be hardwired to the respective fan's VFD. Hardwired safety devices must be active in "Hand", and "Auto" positions. When a safety is activated, the system shall shutdown in a controlled manner.

12. Alarms:

a. All analog inputs shall have a sensor failure alarm.
b. The following additional alarms shall annunciate at the front-end:

1) Auxiliary contacts in the supply fan VFD indicate trouble or failure (No delay).
2) Supply fan VFD HOA switch is not in the auto position.
3) Supply Air Temperature alarm, if supply air temperature deviates from set point more than 2.0 ºF (15 minute delay).
4) Supply Air Humidity alarm, if supply air relative humidity rises above 60% RH and the unit is not in cooling mode (15 minute delay).
5) The BAS shall monitor and alarm the filter differential static pressures. The BAS shall initiate an alarm when the filter differential pressure reaches 0.25" less than the maximum filter pressure drop indicated on the schedule. A second alarm shall be initiated when the differential pressure has reached the maximum filter pressure drop reading. (15 minute delay).
6) Supply Duct Static Pressure alarm, if the supply duct static deviates from pre-established operating value as determined in coordination with Section 23 0593, by more than 25% (15 minute delay).
7) MAU fan failure alarm (2 minute delay).
8) MAU supply smoke condition.
9) MAU high duct static.
10) MAU low duct static.
11) MAU freezestat alarm.
12) Loss of HW or CW circulating pump (freeze protection pump) status via current feedback or pump flow.
13) Measured Airflow Deviation alarm: BAS shall alarm when measured airflow by any AFMS providing controlling input deviates from the control set point by +/- 10% (adj.) for an adjustable time period of 5 minutes.

13. BAS Workstation Display: Indicate the following for each MAU

    a. DDC system graphic.
    b. DDC system on/off/override indication.
    c. Value associated with all analog and digital inputs and outputs listed in the schedules shown on the drawings.

        1) Valve and damper commanded values shall be available to view as a neatly organized, consolidated table of values. Where position feedback is indicated for respective valves and dampers, that feedback shall be visible adjacent to the commanded values.

    d. Current set points for the following:

        1) Supply fan airflow set point.
        2) Filter high pressure drop set points.
        3) Supply air temperature set point.
        4) AFMS airflow set points, where applicable.
        5) All alarm set points

14. Manual ON/OFF Toggle and Local Visual Panel: BAS contractor shall install a panel with manual ON/OFF toggle and visual display at the paint booth as indicated on the Contract Drawings. ON/OFF toggle shall activate or deactivate the paint booth exhaust and makeup air system. Green LED status indicator adjacent to toggle shall illuminate when EF-102A/B and MAU-100 have reached their respective airflow set points, and darken anytime the system has been shut down manually or by a BAS command. Visual display shall be read-only, and shall display the following information in a neatly organized graphic format:

    a. Ambient dry bulb temperature (ºF)
    b. Ambient relative humidity (% RH)
    c. Paint Booth dry bulb temperature (ºF)
    d. Paint Booth relative humidity (% RH)
    e. MAU-100 measured airflow (CFM)
    f. EF-102A/B measured airflow (CFM)
    g. System trouble status (failed start or BAS shutdown of either MAU-100 or EF-102A/B)

F. Refer to control diagrams on drawings for unit input/output schedules and additional information.

1.6 EXHAUST FAN CONTROL SEQUENCES

A. General

1. Unless noted otherwise, startup sequence for fans shall use VFD's brake function to hold or stop rotation of fanwheels during staged activation of manifolded fans.

B. System 1: Exhaust Fans EF-101A/B/C

1. System Description

a. The exhaust fans shall operate in unison to meet the STEM Building laboratory and shop space exhaust demand. Two (2) exhaust fans shall normally operate with one (1) in standby. Exhaust fan flow modulation shall be in a lead/lag/standby manner as further described.
b. Hardwire interlocks shall ensure the exhaust fans operate any time the System 1 AHUs are operational. If System 1 AHUs are shutdown manually or due to safety trips, exhaust fans shall operate at a reduced capacity to maintain building exhaust flow. This reduced flow shall be established by Section 23 0593 to prevent the building pressure from becoming excessively negative.
c. Exhaust fan control shall be managed by dedicated DDCFPs. Contractor shall provide multiple DDCFPs if required by total I/O points of final installed equipment.
d. EF-101A/B/C shall operate 24 hours a day.

2. General

a. When any fan is offline via a BAS command, the fan service disconnects, or via any of its safeties, its associated isolation damper shall close.
b. Provide graphic display of each laboratory exhaust fan showing set points and actual readings, as well as component and system status.

3. Exhaust Fan Activation: When EF-101A/B/C are commanded on by the BAS, the following start-up sequence shall occur:

a. Exhaust fans shall start sequentially with an adjustable time delay between fan starts.
b. Upon activation of the Exhaust System, the ERU-100 exhaust isolation dampers shall open. Limit switch contacts shall transfer to prove damper open status.
c. The lead fan shall then be commanded to start and ramp up to minimum start-up/shutdown speed of 25% (as determined in coordination with Section 23 0593) with the fan's isolation damper closed.
d. Once the fan speed feedback to the BAS confirms that the fan has reached minimum start-up speed, the respective fan isolation damper shall be commanded to the full open position.
e. Once the lead fan isolation damper is open, as confirmed by the end switch, the lag fan shall be commanded to start in an identical manner.
f. When both exhaust fans are enabled, System 1 air handling units shall be enabled as specified. Refer to section "System 1: Air Handling Units AHU-101/102 and Energy Recovery Unit ERU-100" for System 1 air handling unit activation and control sequences.
g. Once the System 1 air handling units have been enabled as specified, the lead and lag exhaust fan VFDs shall ramp in unison to meet the exhaust system static pressure set point.

h. Upon failure of a fan to respond to start command within an adjustable time period of thirty seconds, the failed fan shall be commanded off, an alarm generated, and the standby fan started.
i. Whenever a fan is de-energized its isolation damper shall close.
j. Upon failure of all three fans, System 1 air handling units shall be de-energized.

4. Exhaust Fan Deactivation: When a fan is commanded off by the BAS, the following shutdown sequence shall occur:

a. The fan shall ramp down to its minimum start-up/shutdown speed.
b. Once the fan has reached minimum start-up/shutdown speed as sensed by the BAS controller, the fan isolation damper shall close.
c. After an adjustable time delay initially set to 60 seconds, the fan shall be commanded off.

5. Exhaust Fan Control

a. EF-101A/B/C shall be started and stopped by the BAS when the VFD HOA switches are in the “Auto” position.

1) Two of the exhaust fans shall be available to operate at all times with one as standby.
2) Exhaust fans shall operate in a lead/lag/standby mode.

b. Under normal conditions, at least 1 fan and up to 2 fans (third fan is standby) shall operate continuously to maintain static pressure control. An adjustable time delay initially set to 60 seconds shall exist between the starting of successive exhaust fans. Once a fan has been started, the lag fans shall be staged on in accordance with the staging requirements described below.
c. If a fan or its VFD fails or requires maintenance, the associated fan shall be commanded OFF and the respective isolation damper shall close. An alarm shall be initiated and the standby exhaust fan shall start as described in the Exhaust Fan Activation section.
d. The BAS shall monitor the static pressure readings from the four (4) static pressure sensors located as shown on the Contract Drawings. Each sensor shall have an individually adjustable set point initially set to -1.5" w.g. Final set points shall be established in the field by Section 23 0593.
e. A high / low limit static pressure alarm shall initiate if any of the four (4) sensors reads below -3.0" w.g. or above -0.5" w.g. when the fans are in steady state operation.
f. The controlling static pressure sensor will be the sensor, which is most positive with respect to its set point. The BAS shall stage the exhaust fans and modulate their speeds in unison to maintain the static pressure set point at the lowest speed that satisfies each sensor and maintains the exit velocities.
g. If a single fan is running at its minimum operating speed and the static pressure is 10% (adj.) above set point, the BAS shall modulate the bypass air damper to maintain the static pressure set point.

h. If a single fan is running and the static pressure is below set point with fan VFD at 95% speed (adj.) or higher for more than 10 minutes (adj.) then a lag fan will be started as described in the Exhaust Fan Start-up section.
i. The BAS shall modulate the speeds of the operating fans in unison to maintain the static pressure set point.
j. If two fans are at their minimum operating speeds and the static pressure remains above set point for 10 minutes (adj.), one lag fan shall be deactivated as described in the Exhaust Fan Deactivation section.
k. The fan pressure control shall utilize a PID loop which shall be tuned to limit any system hunting. The Controls contractor shall verify system stability by providing speed trending for the fan combinations for a period of 48 hours. The bypass damper may be used during fan staging to prevent static pressure spikes and system instability.

6. Exhaust Fan Lead/Lag/Standby:

a. The three (3) exhaust fans shall be operated in a lead/lag/standby fashion. The lead exhaust fan shall be automatically or manually selected from the graphic panel. When in manual mode the lead, lag and standby assignments shall be designated by the operator. When in automatic mode the lead, lag and standby assignments shall be automatically rotated based on run-hours. Each time a fan is staged on or staged off, the operating fan(s) shall be sorted so that the operating fan with the highest run hours shall be next to stop. The non-operating fan(s) shall be sorted such that the fan with the least run hours is next to start.
b. If the lowest run-hours of the operating fan exceeds the highest run-hours of the non-operating fans by more than 168 hours (1 week), the lead position shall swap. The non-operating fan shall start and ramp up speed to match the operating fan. Once the fan speeds are matched, the new lag fan shall ramp down to minimum speed and shut-down.
c. If an exhaust fan fails to start in the designated sequence, the exhaust output shall be left energized and an alarm shall be generated as described in the alarm section. The next exhaust fan in line shall automatically start.

7. Reduced Exhaust Flow Mode

a. If the System 1 Supply AHUs are shut down manually or on safety trips, the exhaust fans shall be controlled in a reduced flow mode similar to standby power mode to prevent the building pressure from becoming excessively negative.
b. The BAS shall shut down one (1) exhaust fan and close its respective isolation damper. The remaining exhaust fan shall continue to modulate to maintain duct static pressure.
c. The BAS shall globally close all exhaust air terminal units with the exception of fume hood exhaust valves.
d. The system shall operate in this reduced exhaust flow mode until an air handling unit has been restarted.

8. Standby Power Mode

a. All BAS panels and controls shall be on standby power. The BAS system shall be interfaced to sense a power failure. All of the BAS panels shall also be on UPS power supplied by the Controls Contractor.
b. Upon a power failure, a single exhaust fan shall operate to maintain exhaust airflow to the fume hoods. All three exhaust fans (EF-101A/B/C) are designated as optional standby fans. However, only 1 exhaust fan shall operate, with the others as standby in case a fan fails to start or is out of service.
c. All other exhaust fan isolation dampers shall close and the fans shall shut down. Fans that have de-energized shall remain off until normal power is re-established.
d. The isolation dampers associated with the Standby Power fan shall remain open and the fan shall restart once the standby power system is energized.
e. Once the system is activated in the standby power mode the BAS shall globally close all exhaust valves with the exception of fume hood exhaust valves.

9. Safeties

a. A low static pressure condition upstream of the exhaust fan shall cause the fan to be de-energized and an alarm generated. Hardwire low static pressure overrides the fan VFD control circuit to shut down the fan; provide separate alarm signals to BAS whenever low static pressure set points are exceeded. Standby fan shall be indexed into operation. Low static pressure switch shall be manually reset. The low static pressure set point shall be equal to the respective duct pressure classification.
b. Safety devices shall be hardwired to the respective fan's VFD. Hardwired safety devices must be active in "Hand", and "Auto" positions. When a safety is activated, the system shall shutdown in a controlled manner.

10. Alarms

a. The following alarms shall initiate in the BAS.

1) The exhaust fan is commanded to run and the BAS senses no change in status based upon data furnished by the fan current meter (2 minute delay).
2) Auxiliary contacts in the exhaust fan VFD indicate trouble or failure (No delay).
3) Exhaust fan VFD HOA switch is not in the auto position.
4) Negative static pressure exceeds -5" w.g. or is less than -0.5" w.g. (5 minute delay).
5) Static safety trip (No delay).
~~5)~~6) Calculated fan exit velocity drops below 3000 fpm (adjustable).

11. BAS Workstation Display: Indicate the following for each exhaust fan:

a. DDC system graphic.
b. DDC system on/off/override indication.

c. Value associated with all analog and digital inputs and outputs listed in the schedules shown on the drawings.
d. Fan airflow and stack velocity calculated through fan manufacturer's data using high and low pressure taps for piezometer fan inlet airflow measuring station.
~~c.~~e. Low exhaust fan exit velocity.
~~d.~~f. Current set points for the following:

1) Exhaust duct static-pressure set point.
2) All alarm set points.

12. Refer to control diagrams on drawings for input/output schedules and additional information.

C. System 1: Exhaust Fans EF-103A/B (Surface Finishing)

1. System Description

a. The exhaust fans shall operate in a lead/standby capacity to meet the STEM Building Surface Finishing Room exhaust demand. One (1) exhaust fan shall normally operate with one (1) in standby. Exhaust fan flow modulation shall be in a lead/standby manner as further described.
b. Software interlocks shall ensure the exhaust fans operate any time the System 1 AHUs are operational during occupied mode. If System 1 AHUs are shutdown manually or due to safety trips, lead exhaust fan shall operate at a reduced capacity to maintain room exhaust flow. This reduced flow shall be established by Section 23 0593 to prevent the Surface Finishing Room pressure from becoming excessively negative.
c. Exhaust fan control shall be managed by dedicated DDCFPs. Contractor shall provide multiple DDCFPs if required by total I/O points of final installed equipment.
d. EF-103A/B ~~shall operate during occupied hours.~~system shall be provided with a wall-mounted illuminated push button in the Surface Finishing space, input to the BAS. When the push button is not engaged, it shall be unlit and the EF-103A/B system shall operate as described in the paragraph titled "Unoccupied Mode." When push button is engaged, it shall be lit and the EF-103A/B system shall operate as described in the remainder of paragraphs under "System 1: Exhaust Fans EF-103A/B (Surface Finishing)." Provide an adjacent light that illuminates when the system has achieved its design negative offset. Provide an adjustable time delay for the light to turn on/off, that is within the tolerance of the supply and exhaust air valve actuation, so that the light does not continually turn on/off as the system hunts.

2. General

a. When any fan is offline via a BAS command, the fan service disconnects, or via any of its safeties, its associated isolation damper shall close.
b. Provide graphic display of each laboratory exhaust fan showing set points and actual readings, as well as component and system status.

3. Exhaust Fan Activation: When EF-103A/B are commanded on by the BAS, the following start-up sequence shall occur:

   a. Upon activation of the Exhaust System, the exhaust isolation damper of the lead fan shall open. Limit switch contacts shall transfer to prove damper open status.
   b. The lead fan shall then be commanded to start and ramp up to minimum start-up/shutdown speed of 25% (as determined in coordination with Section 23 0593).
   c. ~~Once~~ If System 1: AHU-101/102 has not yet started in occupied mode, once the fan speed feedback to the BAS confirms that the exhaust fan has reached minimum start-up speed, AHU-101/102 startup sequence shall resume as described under section “System 1: AHU-101/102.”
   d. Once the System 1 AHUs have been enabled and are operational as confirmed by BAS completing their respective startup sequence, BAS shall ramp EF-103A/B incrementally over an adjustable time period in unison with AHU-101/102 and ERU-100 to their respective airflow set points. System 1 Supply and Exhaust Air Volume (Fan Speed) Control shall commence as further described.
   e. Upon failure of a fan to respond to start command within an adjustable time period of thirty seconds, the failed fan shall be commanded off, an alarm generated, and the standby fan started.
   f. Whenever a fan is de-energized its isolation damper shall close.
   g. Upon failure of both fans, an alarm shall be generated and the Surface Finishing supply air terminal unit shall close.

4. Exhaust Fan Deactivation: When a fan is commanded off by the BAS, the following shutdown sequence shall occur:

   a. The fan shall ramp down to its minimum start-up/shutdown speed.
   b. Once the fan has reached minimum start-up/shutdown speed as sensed by the BAS controller, the fan isolation damper shall close.
   c. After an adjustable time delay initially set to 60 seconds, the fan shall be commanded off.

5. Exhaust Fan Control

   a. EF-103A/B shall be started and stopped by the BAS when the VFD HOA switches are in the “Auto” position.
   b. If a fan or its VFD fails or requires maintenance, the associated fan shall be commanded OFF and the respective isolation damper shall close. An alarm shall be initiated and the standby exhaust fan shall start as described in the Exhaust Fan Activation section.
   c. The BAS shall monitor airflow feedback from the EF-103A/B airflow measuring stations. The VFD shall control fan speed to meet the scheduled exhaust airflow. Final set points shall be established in the field by Section 23 0593.
   d. A high / low limit static pressure alarm shall initiate if the duct static pressure sensor reads below -3" w.g. or above -0.5" w.g. when the fan is in steady state operation.

6. Exhaust Fan Lead/Standby:

   a. The two (2) exhaust fans shall be operated in a lead/standby fashion. The lead exhaust fan shall be automatically or manually selected from the graphic panel. When in manual mode the lead and standby assignments shall be designated by the operator. When in automatic mode the lead and standby assignments shall be automatically rotated based on run-hours.
   b. When the lead fan run-hours exceeds the standby fan run-hours by an adjustable time period of 168 hours (1 week), the BAS shall register a fan rotation request. Lead/standby rotation shall occur during the next System 1 occupancy cycle. Rotation shall not occur during system operation.

7. Reduced Exhaust Flow Mode

   a. If the System 1 AHUs are shut down manually or on safety trips, the exhaust fan shall be controlled in a reduced flow mode similar to standby power mode to prevent the Surface Finishing Room pressure from becoming excessively negative.
   b. The exhaust fan shall reduce to its minimum speed as determined by Section 23 0593.
   c. A visual alarm shall signal within the Surface Finishing Room to alert the occupants of a system fault.
   d. The system shall operate in this reduced exhaust flow mode until the System 1 AHUs have been restarted.

8. Standby Power Mode

   a. All BAS panels and controls shall be on standby power. The BAS system shall be interfaced to sense a power failure. All of the BAS panels shall also be on UPS power supplied by the Controls Contractor.
   b. Upon a power failure, the lead exhaust fan shall operate in a reduced capacity as determined in coordination with Section 23 0593 to maintain exhaust flow from the Surface Finishing Room.

9. Safeties

   a. A low static pressure condition upstream of the exhaust fan shall cause the fan to be de-energized and an alarm generated. Hardwire low static pressure overrides the fan VFD control circuit to shut down the fan; provide separate alarm signals to BAS whenever low static pressure set points are exceeded. Standby fan shall be indexed into operation. Low static pressure switch shall be manually reset. The low static pressure set point shall be equal to the respective duct pressure classification.
   b. Safety devices shall be hardwired to the respective fan's VFD. Hardwired safety devices must be active in "Hand", and "Auto" positions. When a safety is activated, the system shall shutdown in a controlled manner.

10. Alarms

   a. The following alarms shall initiate in the BAS.

1) The exhaust fan is commanded to run and the BAS senses no change in status based upon data furnished by the fan current meter (2 minute delay).
2) Auxiliary contacts in the exhaust fan VFD indicate trouble or failure (No delay).
3) Exhaust fan VFD HOA switch is not in the auto position.
4) Negative static pressure exceeds -4" w.g. or is less than -0.5" w.g. (5 minute delay).
5) Static safety trip (No delay).

11. BAS Workstation Display: Indicate the following for each exhaust fan:

a. DDC system graphic.
b. DDC system on/off/override indication.
c. Value associated with all analog and digital inputs and outputs listed in the schedules shown on the drawings.
d. Current set points for the following:

1) Exhaust airflow set point.
2) All alarm set points.

12. Unoccupied Mode

a. During unoccupied mode, EF-103A/B shall initially shut down. Supply air terminal unit shall close.
b. EF-103A/B shall be activated upon a call for heating or cooling. VFD shall control fan speed to meet scheduled unoccupied exhaust flow as sensed by the EF-103A/B airflow measuring stations.

13. Refer to control diagrams on drawings for input/output schedules and additional information.

D. System 2: Exhaust Fans EF-201A/B/C

1. System Description

a. The exhaust fans shall operate in unison to meet the Chemistry Addition laboratory exhaust demand. Two (2) exhaust fans shall normally operate with one (1) in standby. Exhaust fan flow modulation shall be in a lead/lag/standby manner as further described.
b. Hardwire interlocks shall ensure the exhaust fans operate any time the System 2 AHUs are operational. If System 2 AHUs are shutdown manually or due to safety trips, exhaust fans shall operate at a reduced capacity to maintain building exhaust flow. This reduced flow shall be established by Section 23 0593 to prevent the building pressure from becoming excessively negative.
c. Exhaust fan control shall be managed by dedicated DDCFPs. Contractor shall provide multiple DDCFPs if required by total I/O points of final installed equipment.
d. System 2 exhaust fans shall operate 24 hours a day.

2. General

   a. When any fan is offline via a BAS command, the fan service disconnects, or via any of its safeties, its associated isolation damper shall close.
   b. Provide graphic display of each laboratory exhaust fan showing set points and actual readings, as well as component and system status.

3. Exhaust Fan Activation: When the System 2 Exhaust Fans are commanded on by the BAS, the following start-up sequence shall occur:

   a. Exhaust fans shall start sequentially with an adjustable time delay between fan starts.
   b. Upon activation of the Exhaust System, the exhaust isolation dampers shall open. Limit switch contacts shall transfer to prove damper open status.
   c. The lead fan shall then be commanded to start and ramp up to minimum start-up/shutdown speed of 25% (as determined in coordination with Section 23 0593) with the fan's isolation damper closed.
   d. Once the fan speed feedback to the BAS confirms that the fan has reached minimum start-up speed, the respective fan isolation damper shall be commanded to the full open position.
   e. Once the lead fan isolation damper is open, as confirmed by the end switch, the lag fan shall be commanded to start in an identical manner.
   f. When both exhaust fans are enabled, System 2 air handling units shall be enabled as specified. Refer to section "System 2: Air Handling Units AHU-201/202" for System 2 air handling unit activation and control sequences.
   g. Once the System 1 air handling units have been enabled as specified, the lead and lag exhaust fan VFDs shall ramp in unison to meet the exhaust system static pressure set point.
   h. Upon failure of a fan to respond to start command within an adjustable time period of thirty seconds, the failed fan shall be commanded off, an alarm generated, and the standby fan started.
   i. Whenever a fan is de-energized its isolation damper shall close.
   j. Upon failure of all three fans, System 2 air handling units shall be de-energized.

4. Exhaust Fan Deactivation: When a fan is commanded off by the BAS, the following shutdown sequence shall occur:

   a. The fan shall ramp down to its minimum start-up/shutdown speed.
   b. Once the fan has reached minimum start-up/shutdown speed as sensed by the BAS controller, the fan isolation damper shall close.
   c. After an adjustable time delay initially set to 60 seconds, the fan shall be commanded off.

5. Exhaust Fan Control

   a. System 2 exhaust fans shall be started and stopped by the BAS when the VFD HOA switches are in the "Auto" position.

1) Two of the System 2 exhaust fans shall be available to operate at all times with one as standby.
2) Exhaust fans shall operate in a lead/lag/standby mode.

b. Under normal conditions, at least 1 fan and up to 2 fans (third fan is standby) shall operate continuously to maintain static pressure control. An adjustable time delay initially set to 60 seconds shall exist between the starting of successive exhaust fans. Once a fan has been started, the lag fans shall be staged on in accordance with the staging requirements described below.
c. If a fan or its VFD fails or requires maintenance, the associated fan shall be commanded OFF and the respective isolation damper shall close. An alarm shall be initiated and the standby exhaust fan shall start as described in the Exhaust Fan Activation section.
d. The BAS shall monitor the static pressure readings from the two (2) static pressure sensors located as shown on the Contract Drawings. Each sensor shall have an individually adjustable set point initially set to -1.5" w.g. Final set points shall be established in the field by Section 23 0593.
e. A high / low limit static pressure alarm shall initiate if any of the four (4) sensors reads below -3.0" w.g. or above -0.5" w.g. when the fans are in steady state operation.
f. The controlling static pressure sensor will be the sensor, which is most positive with respect to its set point. The BAS shall stage the exhaust fans and modulate their speeds in unison to maintain the static pressure set point at the lowest speed that satisfies each sensor and maintains the exit velocities.
g. If a single fan is running at its minimum operating speed and the static pressure is 10% (adj.) above set point, the BAS shall modulate the bypass air damper to maintain the static pressure set point.
h. If a single fan is running and the static pressure is below set point with fan VFD at 95% speed (adj.) or higher for more than 10 minutes (adj.) then the lag fan will be started as described in the Exhaust Fan Start-up section.
i. The BAS shall modulate the speeds of the operating fans in unison to maintain the static pressure set point.
j. If two fans are at their minimum operating speeds and the static pressure remains above set point for 10 minutes (adj.), the lag fan shall be deactivated as described in the Exhaust Fan Deactivation section.
k. The fan pressure control shall utilize a PID loop which shall be tuned to limit any system hunting. The Controls contractor shall verify system stability by providing speed trending for the fan combinations for a period of 48 hours. The bypass damper may be used during fan staging to prevent static pressure spikes and system instability.

6. Exhaust Fan Lead/Lag/Standby:

a. The three (3) exhaust fans shall be operated in a lead/lag/standby fashion. The lead exhaust fan shall be automatically or manually selected from the graphic panel. When in manual mode the lead, lag and standby assignments shall be designated by the operator. When in automatic mode the lead, lag and standby assignments shall be automatically rotated based on run-hours.

Each time a fan is staged on or staged off, the operating fan(s) shall be sorted so that the operating fan with the highest run hours shall be next to stop. The non-operating fan(s) shall be sorted such that the fan with the least run hours is next to start.

b. If the lowest run-hours of the operating fan exceeds the highest run-hours of the non-operating fans by more than 168 hours (1 week), the lead position shall swap. The non-operating fan shall start and ramp up speed to match the operating fan. Once the fan speeds are matched, the new lag fan shall ramp down to minimum speed and shut-down.

c. If an exhaust fan fails to start in the designated sequence, the exhaust output shall be left energized and an alarm shall be generated as described in the alarm section. The next exhaust fan in line shall automatically start.

7. Reduced Exhaust Flow Mode

a. If the System 2 Supply AHUs are shut down manually or on safety trips, the exhaust fans shall be controlled in a reduced flow mode similar to standby power mode to prevent the building pressure from becoming excessively negative.

b. The BAS shall shut down one (1) exhaust fan and close its respective isolation damper. The remaining exhaust fan shall continue to modulate to maintain duct static pressure.

c. The BAS shall globally close all exhaust air terminal units with the exception of fume hood exhaust valves.

d. The system shall operate in this reduced exhaust flow mode until an air handling unit has been restarted.

8. Standby Power Mode

a. All BAS panels and controls shall be on standby power. The BAS system shall be interfaced to sense a power failure. All of the BAS panels shall also be on UPS power supplied by the Controls Contractor.

b. Upon a power failure, a single System 2 exhaust fan shall operate to maintain exhaust airflow to the fume hoods. All three System 2 exhaust fans (EF-201A/B/C) are all designated as optional standby fans. However, only 1 exhaust fan shall operate, with the others as standby in case a fan fails to start or is out of service.

c. All other exhaust fan isolation dampers shall close and the fans shall shut down. Fans that have de-energized shall remain off until normal power is re-established.

d. The isolation dampers associated with the Standby Power fan shall remain open and the fan shall restart once the standby power system is energized.

e. Once the system is activated in the standby power mode the BAS shall globally close all exhaust valves with the exception of fume hood exhaust valves.

9. Safeties

a. A low static pressure condition upstream of the exhaust fan shall cause the fan to be de-energized and an alarm generated. Hardwire low static pressure

overrides the fan VFD control circuit to shut down the fan; provide separate alarm signals to BAS whenever low static pressure set points are exceeded. Standby fan shall be indexed into operation. Low static pressure switch shall be manually reset. The low static pressure set point shall be equal to the respective duct pressure classification.

b. Safety devices shall be hardwired to the respective fan's VFD. Hardwired safety devices must be active in "Hand", and "Auto" positions. When a safety is activated, the system shall shutdown in a controlled manner.

10. Alarms

a. The following alarms shall initiate in the BAS.

1) The exhaust fan is commanded to run and the BAS senses no change in status based upon data furnished by the fan current meter (2 minute delay).
2) Auxiliary contacts in the exhaust fan VFD indicate trouble or failure (No delay).
3) Exhaust fan VFD HOA switch is not in the auto position.
4) Negative static pressure exceeds -5" w.g. or is less than -0.5" w.g. (5 minute delay).
5) Static safety trip (No delay).
6) Calculated fan exit velocity drops below 3000 fpm (adjustable).

11. BAS Workstation Display: Indicate the following for each System 2 exhaust fan:

a. DDC system graphic.
b. DDC system on/off/override indication.
c. Value associated with all analog and digital inputs and outputs listed in the schedules shown on the drawings.
d. Fan airflow and stack velocity calculated through fan manufacturer's data using high and low pressure taps for piezometer fan inlet airflow measuring station.
e. Low exhaust fan exit velocity.
~~d.~~f. Current set points for the following:

1) Exhaust duct static-pressure set point.
2) All alarm set points.

12. Refer to control diagrams on drawings for input/output schedules and additional information.

E. System 4: Exhaust Fans EF-102A/B

1. System Description

a. The exhaust fans shall operate in a lead/standby capacity to meet the STEM Building paint booth exhaust demand. One (1) exhaust fan shall normally operate with one (1) in standby. Exhaust fan flow modulation shall be in a lead/standby manner as further described.

b. Hardwire interlocks shall ensure the exhaust fans operate any time the System 4 MAU is operational. If System 4 MAU is shutdown manually or due to safety trips, lead exhaust fan shall operate at a reduced capacity to maintain building exhaust flow. This reduced flow shall be established by Section 23 0593 to prevent the paint booth pressure from becoming excessively negative.
c. Exhaust fan control shall be managed by dedicated DDCFPs. Contractor shall provide multiple DDCFPs if required by total I/O points of final installed equipment.
d. System 4 exhaust fans shall be available to operate during occupied hours on an as-needed basis, as controlled by an ON/OFF toggle located adjacent to the paint booth. Anytime MAU-100 or EF-102A/B shuts down or fails to start due to a safety trip or fault, manual activation via the ON/OFF toggle shall be disabled until safety or fault has been cleared via the BAS interface.

2. General

a. When any fan is offline via a BAS command, the fan service disconnects, or via any of its safeties, its associated isolation damper shall close.
b. Provide graphic display of each laboratory exhaust fan showing set points and actual readings, as well as component and system status.

3. Exhaust Fan Activation: When the System 4 Exhaust Fans are commanded on by the BAS, the following start-up sequence shall occur:

a. Upon activation of the Exhaust System, the exhaust isolation damper of the lead fan shall open. Limit switch contacts shall transfer to prove damper open status.
b. The lead fan shall then be commanded to start and ramp up to minimum start-up/shutdown speed of 25% (as determined in coordination with Section 23 0593).
c. Once the fan speed feedback to the BAS confirms that the fan has reached minimum start-up speed, MAU-100 startup sequence shall commence as described under section “System 4: Paint Booth Makeup Air Unit MAU-100.”
d. Once MAU-100 has been enabled and is operational as confirmed by BAS completing its respective startup sequence, BAS shall ramp EF-102A/B incrementally over an adjustable time period in unison with MAU-100 supply fan to their respective airflow set points. System 4 Supply and Exhaust Air Volume (Fan Speed) Control shall commence as further described.
e. Upon failure of a fan to respond to start command within an adjustable time period of thirty seconds, the failed fan shall be commanded off, an alarm generated, and the standby fan started.
f. Whenever a fan is de-energized its isolation damper shall close.
g. Upon failure of both fans, MAU-100 shall be de-energized.

4. Exhaust Fan Deactivation: When a fan is commanded off by the BAS, the following shutdown sequence shall occur:

a. The fan shall ramp down to its minimum start-up/shutdown speed.

b. Once the fan has reached minimum start-up/shutdown speed as sensed by the BAS controller, the fan isolation damper shall close.
c. After an adjustable time delay initially set to 60 seconds, the fan shall be commanded off.

5. Exhaust Fan Control

a. System 4 exhaust fans shall be started and stopped by the BAS when the VFD HOA switches are in the “Auto” position.
b. If a fan or its VFD fails or requires maintenance, the associated fan shall be commanded OFF and the respective isolation damper shall close. An alarm shall be initiated and the standby exhaust fan shall start as described in the Exhaust Fan Activation section.
c. The BAS shall monitor airflow feedback from the EF-102A/B airflow measuring stations. The VFD shall control fan speed to meet the scheduled exhaust airflow. Final set points shall be established in the field by Section 23 0593.
d. A high / low limit static pressure alarm shall initiate if the duct static pressure sensor reads below -3" w.g. or above -0.5" w.g. when the fan is in steady state operation.

6. Exhaust Fan Lead/Standby:

a. The two (2) exhaust fans shall be operated in a lead/standby fashion. The lead exhaust fan shall be automatically or manually selected from the graphic panel. When in manual mode the lead and standby assignments shall be designated by the operator. When in automatic mode the lead and standby assignments shall be automatically rotated based on run-hours.
b. When the lead fan run-hours exceeds the standby fan run-hours by an adjustable time period of 168 hours (1 week), the BAS shall register a fan rotation request. Lead/standby rotation shall occur the next time System 4 exhaust fans and MAU-100 are commanded off either via the local ON/OFF switch or by a BAS command. Rotation shall not occur during system operation.

7. Reduced Exhaust Flow Mode

a. If the System 4 MAU is down manually or on safety trips, the exhaust fan shall be controlled in a reduced flow mode similar to standby power mode to prevent the paint booth pressure from becoming excessively negative.
b. The exhaust fan shall reduce to its minimum speed as determined by Section 23 0593.
c. A visual alarm shall signal within the paint booth enclosure to alert the occupants of a system fault.
d. The system shall operate in this reduced exhaust flow mode until the makeup air unit has been restarted.

8. Standby Power Mode

a. All BAS panels and controls shall be on standby power. The BAS system shall be interfaced to sense a power failure. All of the BAS panels shall also be on UPS power supplied by the Controls Contractor.
b. Upon a power failure, the lead System 4 exhaust fan shall operate in a reduced capacity as determined in coordination with Section 23 0593 to maintain exhaust flow from the paint booth.

9. Safeties

a. A low static pressure condition upstream of the exhaust fan shall cause the fan to be de-energized and an alarm generated. Hardwire low static pressure overrides the fan VFD control circuit to shut down the fan; provide separate alarm signals to BAS whenever low static pressure set points are exceeded. Standby fan shall be indexed into operation. Low static pressure switch shall be manually reset. The low static pressure set point shall be equal to the respective duct pressure classification.
b. Safety devices shall be hardwired to the respective fan's VFD. Hardwired safety devices must be active in "Hand", and "Auto" positions. When a safety is activated, the system shall shutdown in a controlled manner.

10. Alarms

a. The following alarms shall initiate in the BAS.

1) The exhaust fan is commanded to run and the BAS senses no change in status based upon data furnished by the fan current meter (2 minute delay).
2) Auxiliary contacts in the exhaust fan VFD indicate trouble or failure (No delay).
3) Exhaust fan VFD HOA switch is not in the auto position.
4) Negative static pressure exceeds -4" w.g. or is less than -0.5" w.g. (5 minute delay).
5) Static safety trip (No delay).

11. BAS Workstation Display: Indicate the following for each System 4 exhaust fan:

a. DDC system graphic.
b. DDC system on/off/override indication.
c. Value associated with all analog and digital inputs and outputs listed in the schedules shown on the drawings.
d. Current set points for the following:

1) Exhaust airflow set point.
2) All alarm set points.

12. Refer to control diagrams on drawings for input/output schedules and additional information.

1.7 GENERAL CONDITIONS FOR SPACE CONTROL (Applicable to All Constant and Variable Volume Space Ventilation Control)

A. All space ventilation control shall be pressure independent.

B. Space ventilation control in laboratories shall be accomplished with controllers employing discreet control point input and output to each terminal device function where specified and/or shown. Each terminal device shall be controlled through a discreet output. A discreet output signal shall not be linked to multiple terminal devices.

C. Where indicated on the drawings, exhaust terminal units shall be provided for point exhaust or ventilated equipment. Various devices may be manifolded as indicated. Exhaust terminal unit shall maintain constant exhaust flow as scheduled. Each exhaust terminal unit shall provide flow feedback to the LRC or BAS to be used in calculating volumetric offset and/or flow monitoring. Where indicated on the drawings, manual ON/OFF switch shall be provided to activate and deactivate respective exhaust terminal unit.

D. In laboratories subject to rapid fluctuations in ventilation rates due to fume hoods, point exhaust, and other ventilated equipment, control algorithms shall be tuned to prevent rapid swings in space temperature. Measures such as cascade algorithms and feed-forward controls shall be implemented where appropriate.

E. For VAV spaces with reheat, 1° F (adj.) deadband shall exist between reheat and cooling functions.

F. Air Flow Tracking:

1. Space ventilation control for laboratory spaces will employ venturi type air valves.
2. Space ventilation control for engineering, shop, miscellaneous support, and corridor spaces will employ blade type terminal boxes with mounted electronic Terminal Control Units (TCU).
3. Design CFM offset for each zone shall be established by algebraically summing all supply and exhaust flows for that zone. Total exhaust and supply air CFM shall be continuously measured and algebraically summed in each zone and compared to design CFM offset for each respective zone.
4. All flow control loops shall employ PID algorithms. All outputs shall contain adjustable time ramp response capability.
5. Upon a deviation in measured zone CFM offset greater than plus or minus 10 percent of design CFM offset, a pre-alarm warning shall be generated at the BAS operator console.
6. Upon a deviation in measured zone CFM offset greater than plus or minus 20 percent of design CFM offset, an alarm shall be generated at the BAS operator console.
7. Volumetric offset calculations shall include offset for any airflow not monitored by the LRC or BAS, to be determined in coordination with Section 23 0593. Such airflow may include ventilated flammable storage cabinets, equipment purge connections, or any other flow not controlled by a pressure-independent terminal unit.

G. General Space Control Application Requirements:

1. For spaces not specifically defined in control sequences, contractor shall follow air flow diagrams and schedules in applying control strategies.
2. Contractor shall follow air flow and space pressurization diagrams and shall coordinate all work with Section 23 0593 in establishing flow rates and CFM offset as required for the particular space ventilation application.

H. General Supply Terminal Unit Requirements

1. Each terminal unit shall use a "Smart sensor" to measure space temperature unless specifically denoted otherwise. The Smart sensor shall display the present temperature and allow user adjustments as limited by the front-end operator.
2. Alarms:

   a. All analog inputs shall have a sensor failure alarm.
   b. Space Temperature alarm, if the space temperature in any zone falls more than 5.0 °F below the heating set point during occupied mode (30 minute delay).
   c. Space Temperature alarm, if the space temperature in any zone rises more than 5.0 °F above the cooling set point during occupied mode (30 minute delay).

3. Critical Alarms:

   a. Space Temperature alarm, if the space temperature in any zone falls below 45.0 °F (30 minute delay).

4. BAS Workstation Display: Indicate the following for each unit:

   a. Room served.
   b. Room occupancy status (occupied/unoccupied/override).
   c. Room temperature.
   d. Room temperature set point (occupied and unoccupied).
   e. Min/max cfm set points.
   f. Discharge cfm.
   g. Discharge temperature.
   h. Current Discharge temperature set point.
   i. Damper position as percent open.
   j. Control valve position as percent open.
   k. Fintube control valve position as percent open (where applicable).

I. General Exhaust Terminal Unit Requirements

1. BAS Workstation Display: Indicate the following for each unit:

   a. Room served.
   b. Associated supply terminal unit(s) (airflow tracking).
   c. Room occupancy status (occupied/unoccupied/override).
   d. Min/max cfm set points.

e. Current CFM set point.
f. Exhaust air cfm.
g. Damper position as percent open.

1.8 GENERAL LABORATORY VAV CONTROL

A. Each general laboratory space shall have a dedicated laboratory airflow control system with local Laboratory Room Controller (LRC).

B. Some laboratories may contain more than one individual supply and general exhaust terminal unit. In these cases, LRC shall modulate those devices in unison.

C. Room Ventilation Control:

1. LRC shall modulate supply and general exhaust terminal units to maintain minimum ventilation rate indicated on airflow diagrams.
2. LRC shall monitor all supply, general exhaust, and point exhaust flow. Supply and exhaust flow rates shall be summed. LRC shall maintain design CFM offset between supply and exhaust flow to maintain space relative pressurization as indicated on airflow diagrams.

D. Space Temperature Control

1. Supply air discharge temperature shall be monitored by a duct temperature sensor at terminal unit discharge, downstream of the reheat coil. Space temperature shall be monitored by a temperature transmitter in each zone.
2. LRC shall reset supply discharge temperature set point to maintain respective space temperature set point. Discharge temperature shall be controlled by modulating the reheat coil valve.
3. Upon call for cooling when reheat coil valve is closed, the space airflow shall modulate as follows to maintain respective space temperature set point:

a. For spaces indicated as negatively pressurized relative to adjacent spaces, supply air shall track exhaust. Upon an increase in space temperature, LRC shall modulate exhaust air terminal valve open.
b. For spaces indicated as positively pressurized relative to adjacent spaces, exhaust air shall track supply. Upon an increase in space temperature, LRC shall modulate supply air terminal valve open.
c. Upon a decrease in space temperature, the reverse shall occur. Upon further temperature decrease, with terminal units at minimum scheduled flow, supply discharge temperature reset control shall resume.

4. Upon supply flow failure, exhaust terminal units shall be returned to minimum position. Upon exhaust flow failure, supply air terminal units shall close.

E. Unoccupied Mode Control

1. Space temperature set point shall be reset as specified. Airflow shall be reduced to scheduled unoccupied minimum values.

1.9 VAV FUME HOOD LABORATORY CONTROL

A. VAV control for fume hood laboratories shall be similar to general laboratory spaces except as described below.

B. VAV Fume Hood Control:

1. The fume hood sash sensor shall be calibrated to a linear signal between a calculated minimum and actual maximum sash positions. Minimum sash control position shall be determined by calculating the sash area (and therefore the sash height) required to achieve the design face velocity at the associated exhaust valve's scheduled minimum flow, plus a three percent (3%) leakage factor. Airflow shall not decrease further as sash is lowered below this position.
2. When sash is raised above the calculated minimum position, fume hood controller shall signal LRC to proportionally increase hood exhaust flow in order to maintain design face velocity.
3. Status LED on fume hood controller shall illuminate to signal normal operating state.
4. Emergency Override: Fume hood controller shall have a push-button switch to manually override hood exhaust flow to its scheduled maximum value. Fume hood controller shall illuminate red LED to indicate Emergency Override status and sound the audible alarm. Emergency Override status shall be cleared by depressing the same push-button switch.
5. The following conditions shall generate an audible and visual alarm. Audible alarms shall have push-button mute function. Silenced audible alarms shall be reactivated upon subsequent alarm condition.

    a. Flow feedback is 5% more or less than flow command.
    b. System pressure falls below expected value as determined in coordination with Section 23 0593.
    c. Hood sash raised above design height.

C. Room Ventilation Control:

1. LRC shall modulate supply, general exhaust, and fume hood exhaust terminal units to maintain minimum ventilation rate indicated on airflow diagrams.
2. LRC shall monitor all supply, general exhaust, fume hood exhaust, and point exhaust flow. Supply and exhaust flow rates shall be summed. LRC shall maintain design CFM offset between supply and exhaust flow to maintain space relative pressurization as indicated on airflow diagrams.

1.10 STEM SHOP AND GENERAL ENGINEERING VAV CONTROL

A. Unless noted otherwise, STEM Building shop and general engineering spaces served by blade-type terminal units shall be controlled as described.

B. Some spaces may contain more than one individual supply and general exhaust terminal unit. In these cases in general, BAS shall modulate those devices in unison. Where individual temperature sensors are indicated per terminal unit (such as Metal Fabrication and Assembly) the devices shall be controlled individually per zone.

C. In spaces where point exhaust or ventilated equipment is indicated, a dedicated room-level DDC controller shall be provided for volumetric offset control. Airflow summation calculations shall not be performed at the BAS or floor zone controller level.

D. Room Temperature and Ventilation Control:

1. BAS shall modulate supply and general exhaust terminal units to maintain minimum ventilation rate indicated on airflow diagrams.
2. For spaces indicated as negatively pressurized relative to adjacent spaces, supply air shall track exhaust. Upon an increase in space temperature, BAS shall modulate exhaust air terminal unit open.
3. For spaces indicated as positively pressurized relative to adjacent spaces, exhaust air shall track supply. Upon an increase in space temperature, BAS shall modulate supply air terminal valve open.
4. Upon a decrease in space temperature, the reverse shall occur. Upon further temperature decrease, with terminal units at minimum scheduled flow, reheat coil valve shall modulate to maintain space temperature set point.
5. Upon supply flow failure, exhaust terminal units shall return to their minimum positions.
6. Upon exhaust flow failure, supply terminal units shall return to their minimum positions.

E. Unoccupied Mode Control

1. Space temperature set point shall be reset as specified. Airflow shall be reduced to scheduled unoccupied minimum values.

1.11 GENERAL OFFICE, CLASSROOM, AND COMPUTER LAB VAV CONTROL

A. The sequence shall apply to additional spaces not listed with variable-volume supply terminal units unless denoted otherwise.

B. During occupied mode, supply air terminal unit shall initially position to maintain its minimum scheduled airflow.

C. Ventilation Control

1. STEM Building return terminal units shall track supply as described under “STEM BUILDING RETURN VAV CONTROL.”

D. Space Temperature Control:

1. BAS shall monitor space temperature and supply air discharge temperature via the respective temperature transmitters.
2. Upon an increase in space temperature above set point, supply air terminal shall increase airflow to the space. Upon a temperature decrease, the reverse shall occur.
3. Upon further temperature decrease, with supply terminal at minimum scheduled airflow setting, discharge temperature set point shall be reset upward to a

maximum of 95°F. Reheat coil valve shall modulate to maintain supply discharge temperature set point.

4. Upon a further decrease in space temperature once the discharge air temperature has reached its maximum setting, the airflow set point shall be reset upward toward the scheduled maximum airflow. Upon a temperature decrease the reverse shall occur.

E. Fintube Radiation Control

1. In spaces indicated with fintube radiation (FR), the above space temperature control sequence shall be modified as described.
2. FR control shall be activated when the ambient temperature is below 60°F (adj.).
3. When supply air terminal is at its minimum airflow setting and the space temperature decreases below set point, supply discharge temperature shall be reset toward a maximum equal to the space temperature set point. Reheat coil valve shall modulate to maintain discharge temperature.
4. Upon further decrease in temperature, FR control valve shall modulate open to maintain space temperature. Upon an increase in temperature the reverse shall occur.
5. If the fintube control valve has been modulated to its 100% open position, and the room's temperature continues to drop, supply discharge temperature shall be reset toward a maximum of 95°F. Reheat coil valve shall modulate to maintain supply discharge temperature set point.
6. The reverse sequence shall occur as the room's temperature begins to rise. Reheat valve shall be closed first, prior to closing fintube valve.

F. Unoccupied Mode Control

1. Space temperature set point shall be reset as specified. Supply air terminals shall close.
2. Upon a call for cooling or heating, supply air terminals shall open to minimum scheduled values and respective sequence shall commence as during occupied mode.
3. Upon a call for heating in spaces indicated with fintube radiation, FR control valve shall modulate open to maintain temperature set point prior to opening supply air terminals.

1.12 GENERAL CONSTANT VOLUME SPACE CONTROL

A. Spaces served by a constant volume supply terminal unit with reheat coil shall be controlled as described.

B. BAS shall monitor space temperature and supply air discharge temperature via the respective temperature transmitters.

C. Space Temperature Control

1. Discharge air temperature shall be reset toward a maximum of 95°F as required to maintain space temperature set point. Reheat coil valve shall modulate to maintain supply discharge temperature set point.

D. Unoccupied Mode

1. Space temperature set point shall be reset as specified. Sequence shall resume as during occupied mode.

1.13 CONSTANT VOLUME SPACE CONTROL (PRESSURIZATION ONLY)

A. Where indicated, spaces may be served by a constant volume supply terminal with no reheat coil for pressurization purposes only. Supply air terminal shall maintain the scheduled constant airflow setting at all times.

1.14 STEM BUILDING RETURN VAV CONTROL

A. There are several return VAV boxes located on the first and second floors which serve the north and south non-lab areas (Offices, Classrooms, Common Areas, and Computer Labs). The return VAV boxes shall track the supply VAV boxes within their respective zone as indicated on the airflow diagrams.

B. The BAS shall continually monitor the airflow feedback from supply VAV boxes within the non-lab areas. The return terminal unit controllers shall sum the supply airflows from the supply VAV boxes, and incorporate an offset as required for air transfer through doors and transfer openings (as determined by Section 23 0593). The return terminal unit controllers shall modulate the dampers to maintain the required return flow for each zone.

C. Unoccupied Mode

1. When AHU-101/102 are indexed into unoccupied mode, STEM return terminal units shall close.
2. Return terminal units shall remain in their closed position until RF-101/102 are activated due to a System 1 heating or cooling demand.
3. Once activated in unoccupied mode, return VAV control shall commence as during occupied mode.

D. BAS workstation Display: Indicate the following for each unit:

1. Terminal unit location.
2. Min/max cfm set points.
3. Current cfm set point.
4. Return air cfm.
5. Damper position as percent open

1.15 MAIN ELECTRICAL & MECHANICAL ROOM TEMPERATURE CONTROL

A. Control sequence shall apply to the following spaces:

1. STEM Building Main Elec 013
2. Chemistry Addition Electric Room C031
3. Chemistry Addition Pump & Steam Equipment Room C034

B. The BAS shall continuously monitor the space temperature via the space temperature transmitter. An alarm shall be generated anytime the space temperature decreases below 45°F or exceeds 95°F.

C. Upon and increase in space temperature above 80°F (adj.), BAS shall first energize associated room exhaust fan.

1. STEM Building Main Elec 013: EF-104
2. Chemistry Addition Electric Room C031: EF-202
3. Chemistry Addition Pump & Steam Equipment Room C034: EF-203

D. Whenever the fan is indexed to start, exhaust and outdoor intake dampers shall open.

E. Upon a continued increase in space temperature, electrical room FCU shall be enabled. FCU shall operate until space temperature decreases below 80°F.

1. STEM Building Main Elec 013: FCU-101
2. Chemistry Addition Electric Room C031: FCU-201
3. Chemistry Addition Pump & Steam Equipment Room C034: FCU-202

F. Upon a temperature decrease below 70°F (adj.), fan shall be de-energized. Exhaust and outdoor intake dampers shall close. Upon a fan failure with outdoor air temperature above 60°F, intake damper shall remain open. An alarm shall be generated upon fan failure.

G. Heating Mode:

1. Applies to STEM Building Main Elec 013 and Chemistry Addition Pump & Steam Equipment Room C034 only.
2. When space temperature falls below 55°F (adj.), BAS shall enable space unit heaters. Unit heaters shall be managed by factory mounted controls to meet space temperature set point of 65°F (adj).
3. Upon increase in space temperature above 70°F, unit heaters shall be disabled.

1.16 TYPICAL FLOOR ELECTRICAL ROOM VENTILATION AND TEMPERATURE CONTROL

A. The BAS shall continuously monitor the space temperature via the space temperature transmitter. An alarm shall be generated anytime the space temperature decreases below 45°F or exceeds 95°F.

B. Typical floor electrical rooms shall be conditioned by a split-system AC unit to maintain space temperature set point.

C. Ventilation shall be provided by a constant volume exhaust terminal unit as indicated on the Contract Drawings.

1.17 TYPICAL FLOOR TELECOM ROOM VENTILATION AND TEMPERATURE CONTROL

A. The BAS shall continuously monitor the space temperature via the space temperature transmitter. An alarm shall be generated anytime the space temperature decreases below 45°F or exceeds 95°F.

B. Typical floor telecom rooms shall be conditioned by a split-system AC unit to maintain space temperature set point.

C. Ventilation shall be provided by a constant volume supply terminal unit with no reheat as indicated on the Contract Drawings.

1.18 ENGINE TESTING LAB ROOM VENTILATION AND TEMPERATURE CONTROL

A. A dedicated room-level DDC controller shall manage ventilation and temperature control for the Engine Testing Lab.

B. Ventilation Control

1. BAS shall monitor the room differential pressure with respect to the adjacent space via the differential pressure transmitter indicated on the Contract Drawings.
2. Exhaust terminal unit serving space shall modulate to maintain a differential pressure of zero during Occupied Mode.
3. An alarm shall be generated if the room differential pressure as indicated by the DPT registers a value of (-) 0.05” w.g. or less.

C. Space Temperature Control

1. BAS shall modulate supply terminal unit to maintain minimum ventilation rate indicated on airflow diagrams.
2. Upon an increase in space temperature, BAS shall modulate supply air terminal valve open.
3. Upon a decrease in space temperature, the reverse shall occur. Upon further temperature decrease, with terminal unit at minimum scheduled flow, reheat coil valve shall modulate to maintain space temperature set point.
4. Upon supply flow failure, an alarm shall be generated.
5. Upon exhaust flow failure, supply terminal units shall return to their minimum positions.

D. Unoccupied Mode

1. When AHU-101/102 are indexed into unoccupied mode, supply and exhaust airflow control for the Engine Testing Lab shall revert to control sequence described under section “STEM SHOP AND GENERAL ENGINEERING VAV CONTROL.” Exhaust shall track supply.
2. Space temperature set point shall be reset as specified. Airflow shall be reduced to scheduled unoccupied minimum values.
3. When indexed back into occupied mode either by BAS command or by local override, differential pressure ventilation control shall resume as described.

1.19 SURFACE FINISHING ROOM VENTILATION AND TEMPERATURE CONTROL

A. A dedicated room-level DDC controller shall interface with the EF-~~102A~~103A/B exhaust fan control panels to manage ventilation and temperature control for the Surface Finishing Room.

B. Ventilation Control

1. BAS shall monitor exhaust flow feedback via the EF-102A/B airflow measuring stations.
2. The pressure-independent supply terminal unit shall modulate to maintain the airflow offset for the space as indicated on the Contract Drawings and verified by Section 23 0593.

C. Space Temperature Control

1. BAS shall modulate supply terminal unit to maintain minimum ventilation rate indicated on airflow diagrams.
2. Upon a decrease in temperature below the space temperature set point, reheat coil valve shall modulate to maintain space temperature set point.
3. Upon supply flow failure, an alarm shall be generated. EF-102A/B VFDs shall decrease fan speed to the minimum values determined by Section 23 0593.
4. Upon exhaust fan failure, supply terminal units shall close. An alarm shall be generated.

D. Exhaust Filter Differential Pressure Monitoring

1. BAS shall continually monitor differential pressure feedback via the differential pressure sensor across the exhaust filters.
2. Alarms shall be generated as described under section “EF-102A/B.”

E. Unoccupied Mode

1. Space temperature set point shall be reset as specified.
2. Room supply air terminal unit shall close and EF-103A/B shall be deactivated.
3. Upon a call for heating or cooling, EF-103A/B shall be activated, and supply and exhaust flows shall be reset to their scheduled unoccupied minimum values. Ventilation and Space Temperature Control sequences shall commence as specified.

1.20 MISCELLANEOUS TERMINAL AND UNITARY EQUIPMENT CONTROL SEQUENCES

A. General

1. In spaces with multiple unitary devices capable of providing heating and cooling, wide deadbands shall be established so as to prevent simultaneous heating and cooling.

a. EES 014: BAS shall monitor space temperature. Upon a decrease in space temperature below 55° F, space unit heater shall activate to maintain space

temperature. Unit heater shall be deactivated when space temperature is above 65° F. Upon increase in temperature above 85° F, space AC unit shall activate to maintain space temperature. AC unit shall be deactivated when space temperature is below 75° F.

b. Other similar spaces as indicated on the Contract Drawings.

B. Split-type DX AC Units

1. On a rise in space temperature above the cooling temperature set point, the BAS shall start the supply fan and the factory AC Unit controller shall control AC/ACCU to satisfy the space temperature. When the set point is satisfied, the AC Unit shall be commanded OFF.
2. Once the fan is started it shall run for a minimum of 15 minutes (adjustable).
3. The BAS shall monitor alarms from the condensate pump or condensate overflow switch. If an alarm is generated from either the condensate pump or the condensate overflow switch, the AC Unit shall be shut off.
4. BAS Workstation Display: Indicate the following for each unit:

   a. Room served.
   b. Room temperature.
   c. Room temperature set point.
   d. AC/ACCU Unit status (on/off).
   e. Discharge temperature.
   f. Condensate pump alarm (if applicable).
   g. Condensate overflow alarm (if applicable).

C. 2-Pipe Cooling-Only Fan Coil Units

1. On a rise in space temperature above the cooling temperature set point, the BAS shall start the supply fan and modulate the chilled water control valve to satisfy the space temperature. When the set point is satisfied, the chilled water control valve shall close and the fan shall stop.
2. Once the fan is started it shall run for a minimum of 15 minutes (adjustable).
3. The BAS shall monitor alarms from the condensate pump or condensate overflow switch. If an alarm is generated from either the condensate pump or the condensate overflow switch, the supply fan shall stop and the chilled water control valve shall be locked out.
4. BAS Workstation Display: Indicate the following for each unit:

   a. Room served.
   b. Room temperature.
   c. Room temperature set point.
   d. Fan Coil status (on/off).
   e. Discharge temperature.
   f. Control valve position as percent open.
   g. Condensate pump alarm (if applicable).
   h. Condensate overflow alarm (if applicable).

D. 4-Pipe Heating/Cooling Fan Coil Units

1. On a rise in space temperature above the cooling temperature set point, the BAS shall start the supply fan and modulate the chilled water control valve to satisfy the space temperature. When the set point is satisfied, the chilled water control valve shall close and the fan shall stop.
2. On a drop in space temperature below the heating temperature set point, the BAS shall start the supply fan and modulate the hot water control valve to satisfy space temperature. When the set point is satisfied, the hot water control valve shall close and the fan shall stop.
3. Once the fan is started by the BAS it shall run for a minimum of 15 minutes (adjustable).
4. BAS Workstation Display: Indicate the following for each unit:

    a. Room served.
    b. Room temperature.
    c. Room temperature set point.
    d. Fan Coil status (on/off).
    e. Discharge temperature.
    f. Control valve position as percent open.

E. Unit Heater/Cabinet Unit Heater Hydronic

1. When the room temperature drops below the heating set point of 65°F (adjustable), the fan shall be energized and the hot water valve shall open.
2. When the room temperature set point is satisfied, the hot water valve shall close and the fan shall stop after an adjustable time delay of 15 minutes.
3. A unit-mounted fan speed switch (Low-Medium-High) shall allow the operator to select the fan speed.
4. BAS Workstation Display: Indicate the following for each unit:

    a. Room served.
    b. Room temperature.
    c. Room temperature set point.
    d. Control valve position open/closed.

F. Finned Tube Radiation, Hydronic

1. The occupied/unoccupied mode is controlled by the BAS's global scheduling function.
2. Occupied Mode

    a. The hot water valve shall modulate to maintain the occupied room temperature set point.
    b. Refer to space temperature control sequences for staging of fintube and terminal heating coil during heating mode.

3. Unoccupied Mode

    a. The hot water valve shall cycle modulate to maintain unoccupied room temperature set point.

b. Refer to space temperature control sequences for staging of fintube and terminal heating coil during heating mode.

4. BAS Workstation Display: Indicate the following for each unit:

a. Room served.
b. Room occupancy status (occupied/unoccupied/override).
c. Room temperature.
d. Room temperature set point (occupied and unoccupied).
e. Control valve position as percent open.

G. Stand Alone Computer Room Air Conditioning Unit (CRAC-101/102)

1. The Computer Room AC unit shall be controlled locally (not via the BAS) by a manufacturer furnished unit mounted microprocessor controller.
2. The BAS shall monitor room temperature and humidity, CRAC unit status, and alarms via the computer room unit's BACnet interface.
3. All read/write points shall be available via the BAS front end.
4. BAS Operator shall be able to manually activate and deactivate Computer Room AC units and associated equipment.
5. When the Computer Room AC units are activated, factory microprocessor controls shall manage the CRAC unit supply fans, compressor, cooling water control valves, humidifier, dry cooler, cooling water pumps, and all other associated equipment. Factory-programmed control loops shall activate to maintain the space design temperature and humidity.
6. Outside air for room ventilation and pressurization shall be provided by a constant volume terminal unit without a reheat coil (Pressurization Only).
7. BAS shall supervise space smoke detection relay provided by Division 28. Upon detection of smoke as signaled by fire alarm system, BAS shall deactivate CRAC units. Unit controls shall remain online. CRAC units shall be reactivated by BAS operator command once fire alarm contact has been manually reset.
8. BAS Workstation Display: Indicate the following for each unit:

a. Room served.
b. Room temperature.
c. Room humidity.
d. Operating mode of CRAC units (cooling, humidification, dehumidification, energy saver).
e. High space temperature alarm.
f. Low space humidity alarm.

1.21 VARIABLE FREQUENCY DRIVE INTERFACE (TYPICAL FOR ALL)

A. The following VFD status and operating conditions shall be monitored through hardwired points:

1. Analog Inputs

a. Motor Current Amps (from current sensor)
b. Hand-Off-Auto Setting

2. Digital Inputs

   a. In Fault Condition

3. Digital Outputs

   a. Start/Stop

4. Analog Outputs

   a. VFD Speed

1.22 STANDBY POWER OPERATING MODE

A. All BAS system components, including DDCFPs and field devices, shall remain in continuous operation powered by internal battery power UPS. Under no circumstances shall the BAS lose power through an outage so long as standby power is available.

B. Loss of normal and standby power shall be logged into the BAS as an alarm. Coordinate with Division 21 for location of relays for input signals to the BAS to initiate this alarm.

C. All equipment not connected to standby power shall shut down and all devices shall return to their failsafe position.

D. General Standby Power Mode Startup Sequence

1. Makeup and radiator exhaust dampers shall be hardwire interlocked with generator factory controller such that dampers are commanded open when generator undergoes startup sequence.

2. Generator status shall be monitored. When generator is at full voltage and operating frequency, owner-optional standby loads shall be transferred in sequence based upon priorities listed below.

3. All equipment that is to be restarted under standby power shall initially be restarted as described under each system's operating sequence, with set points that existed at the time power was lost. Refer to system operating sequences for normal and standby power mode startup procedures.

E. The following HVAC equipment shall be connected to the respective new building standby power as owner-optional standby loads. BAS shall implement sequential startup of HVAC equipment with adjustable time delay between starts.

STEM Building

1. BAS System
2. Generator Room Heat Trace
3. HWP-101/102 (only 1 pump will operate)
4. All AHU/MAU freeze protection pumps

5. Unit Heaters
6. System 1 exhaust fans (only 1 fan will operate)
7. Paint Booth exhaust fans (only 1 fan will operate)
8. Surface Finishing exhaust fans (only 1 fan will operate)
9. MAU-100
10. System 1 supply fans (only 1 fan will operate)

Chemistry Addition

1. BAS System
2. Generator Room Heat Trace
3. HWP-201/202 (only 1 pump will operate)
4. All AHU/MAU freeze protection pumps
5. Unit Heaters
6. System 2 exhaust fans (only 1 fan will operate)
7. System 2 supply fans (only 1 fan will operate)

1.23 MONITORED DATA POINTS

A. Provide monitoring and trending software programming for input data points listed below. Trended data shall be organized by input data type and engineering measurement unit. Trend logs shall indicate time of sample and current value at that time. Software shall sum trend values for each data point each 24 hours.

B. All recorded data shall be downloaded from buffers to permanent storage media at appropriate intervals to avoid overflow and lost data.

C. Monitored Inputs

MONITORED POINT TYPE	UNITS
ELECTRIC SERVICE METERING	
STEM MSB	KWH
CHEM DPD	KWH
OUTDOOR PARAMETERS	
Outdoor Air Temp.	Deg F
Outdoor Relative Humidity	% RH
AIR HANDLING UNITS FLOW	

AHU-101/102 Economizer/Min OA Flow	CFM
AHU-101/102 Supply Air Flow	CFM
AHU-201/202 Supply Air Flow	CFM
AHU-301 Minimum OA Flow	CFM
AHU-301 Maximum OA Flow	CFM
AHU-401 Supply Air Flow	CFM
RF-101/102 Return Air Flow	CFM
ERU-100 Exhaust Air Flow	CFM
EF-102A/B Exhaust Air Flow	CFM
EF-103A/B Exhaust Air Flow	CFM
EF-201A/B/C Exhaust Air Flow	CFM
VARIABLE FREQUENCY DRIVES	
AHU Supply Fans (All)	KWH
AHU Return Fans (All)	KWH
ERU Supply Fans (All)	KWH
ERU Exhaust Fans (All)	KWH
EF-102A/B	KWH
EF-103A/B	KWH
Electric Room Exhaust Fans (All)	KWH
Mechanical Room Exhaust Fans (All)	KWH
Penthouse Supply Fans (All)	KWH
CHWP (All)	KWH
PCWP(All)	KWH
HWP (All)	KWH

AIR HANDLING UNITS TEMPERATURE	
AHU Discharge Temperature (All)	Deg F
AHU Discharge Humidity (All)	% RH
System 1 Return Temperature	Deg F
System 1 Exhaust Temperature	Deg F
System 1 Exhaust Humidity	% RH
System 2 Exhaust Temperature	Deg F
System 2 Exhaust Humidity	% RH
System 3 Return Temperature	Deg F
ENERGY RECOVERY UNITS	
ERU-100 Discharge Temperature	Deg F
ERU-100 Discharge Humidity	% RH
ERU-100 Wheel Exhaust Discharge Temperature	Deg F
ERU-100 Wheel Exhaust Humidity	% RH
HEATING WATER SYSTEM	
HW Supply Temperature (All)	Deg F
HW Return Temperature (All)	Deg F
BUILDING CHILLED WATER SYSTEM	
CHW Supply Temperature (All)	Deg F
CHW Return Temperature (All)	Deg F

PROCESS CHILLED WATER SYSTEM	
PCHW Supply Temperature	Deg F
PCHW Return Temperature	Deg F
CAMPUS THERMAL LOOPS	
Building Entering CHW Temperature (All)	Deg F
Building Leaving CHW Temperature (All)	Deg F
Building Entering CHW Flow (All)	GPM
Building Steam Supply Flow (All)	Lb/hr

1.24 ADDITIONAL CONTROL POINTS AND INTERFACE

A. General

1. Equipment provided under other trades or contracts shall be supervised by the BAS as noted herein. Contractor shall provide all wiring and termination to dry contacts, relays or alarm circuits, as may apply, except for those contained in the Fire Alarm System.
2. Connection to the Fire Alarm System shall be wired under this section of the Specifications but terminated under Division 26 whether specified therein or not. Relays or other devices required to complete the supervision of the Fire Alarm System shall also be provided under Division 21.
3. Refer to all other Sections of the Specifications and to drawings of all trades for additional points requiring supervision or control.
4. Where there are multiple numbers of each item of equipment, each shall be individually monitored.

B. Plumbing Systems

1. The following plumbing system components shall be supervised as noted.

   a. Reverse Osmosis System: Trouble alarm.
   b. Domestic water heaters: Trouble alarm.
   c. Domestic hot water booster pumps: On/off status, Trouble alarm. Use current meter to verify “on” status.

d. Potable and Non-potable hot water supply temperatures: Trouble alarm.
e. Sewage Ejectors: Trouble and High Level alarm.
f. Sump Pumps: Trouble and High Level alarm.
g. Storm Water pumps: Trouble and High Level alarm.
h. Special Waste Ejectors: Trouble and High Level alarm.
i. pH Neutralization System: Trouble alarm.
j. Lab Air Compressor: Trouble alarm.

C. Electrical – Power and Fire Detection

1. The following equipment furnished under Division 26 of these specifications shall be supervised in the manner indicated. Refer to individual electrical equipment specification Sections for additional electrical system requirements.

a. Emergency (Life Safety & Standby) Generator:

1) General trouble alarm.
2) Status – on/off.

b. Emergency Transfer Switch (multiple):

1) Trouble alarm.
2) Normal power available – status.
3) Emergency Power available – status.

D. Fuel Oil System

1. The fuel oil system in each building shall be monitored via each respective system's Remote Fill Station control panel. The following points shall be supervised via the BAS front end.

a. Fuel tank leak detection alarm
b. Fuel tank low fuel level indicator.
c. Fuel tank high level (overflow) alarm.
d. Fuel tank low level alarm.

2. Coordinate with day tank and Remote Fill Station manufacturers to establish appropriate interface for the specified BAS points.

E. Fire Protection Systems

1. Fire pumps shall be monitored by the BAS. The following points shall be supervised:

a. Pump run status (On/Running/Off)
b. Pump trouble alarm
c. Pump failure (commanded on but in "OFF" status)

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 0993

Bulletin NO. 28, March 21, 2019

RE: STEM Building and Chemistry Addition
The College of New Jersey
Ewing, NJ

EYP Project No. 1013016.01

FROM: EYP Architecture & Engineering of NJ, Inc.
1000 Potomac Street, NW
Washington, DC 20007

TO: TCNJ

THIS BULLETIN CONTAINS THE FOLLOWING CHANGES TO DRAWINGS AND SPECIFICATIONS:

Notes:
1. Revisions on Drawings are noted as Bulletin #28, dated 03/21/2019.
2. Revisions made relative to commissioning items are indicated parenthetically (Cx-#) in the narrative below.

CHANGES TO DRAWINGS

Description of Mechanical Drawing Revisions for Bulletin #28

Sheet M100B:
a. Clarified the location of a 2-position, 24-V motorized damper at the generator.

Sheet M100C:
a. Clarified the location of a 2-position, 24-V motorized damper at the generator.

Sheet M101D:
a. (Cx-11.08) Added switch and proof light to plan at Room 125 Surface Finishing to serve EF-103A/B.
b. (Cx-11.08) Added Keynote 9: “Provide Illuminated push button for EF-103A/B system activation. Provide signage indicating ‘EF-103A/B activation’. Provide additional light adjacent to push button with signage indicating ‘system achieving airflow setpoint’.

Sheet M401:
a. (Cx-17.05.) Added steam motive pump traps, SMPT-101 and SMPT-102 to serve heat exchangers HX-101 and HX-102.

Sheet M401C:
a. (Cx-17.05) Added steam motive pump traps, SMPT-201 and SMPT-202 to serve heat exchangers HX-201 and HX-202.

Sheet M503:
a. (Cx-17.01.C.-4/10/18) Added Detail 12 to clarify connections to typical glycol feeder tank.

Sheet M701:
a. (Cx-9.03) Detail 3: Added flow measuring stations to EF-101A/B/C diagram and points list to connect to piezometer already furnished with each fan.

b. (Cx-11.08) Added diagram and points list under new Detail 4 for EF-103A/B to support specified sequence of operation.

Sheet M702:

b. (Cx-9.03) Detail 2: Added flow measuring stations to EF-201A/B/C diagram and points list to connect to piezometer already furnished with each fan.

Sheet M704:

a. (Cx-11.05) Detail 1: Added BAS control diagram and associated points for control of unfired steam generator (USG-100).
b. (Cx-11.05) Detail 2: Added BAS control diagram and associated points for control of unfired steam generator (USG-200).
c. (Cx-17.04) Detail 3: Added paddle type flow switches to serve heat exchangers HX-101 and HX-102.
d. (Cx-17.04) Detail 4: Added paddle type flow switches to serve heat exchangers HX-201 and HX-202.

Sheet M705:

a. (Cx-11.03) Detail 1: Added diagram and points list for dry cooler DC-101 and pumps DCGP-101/2 and PCWP-101/2 to support specified sequence of operation.

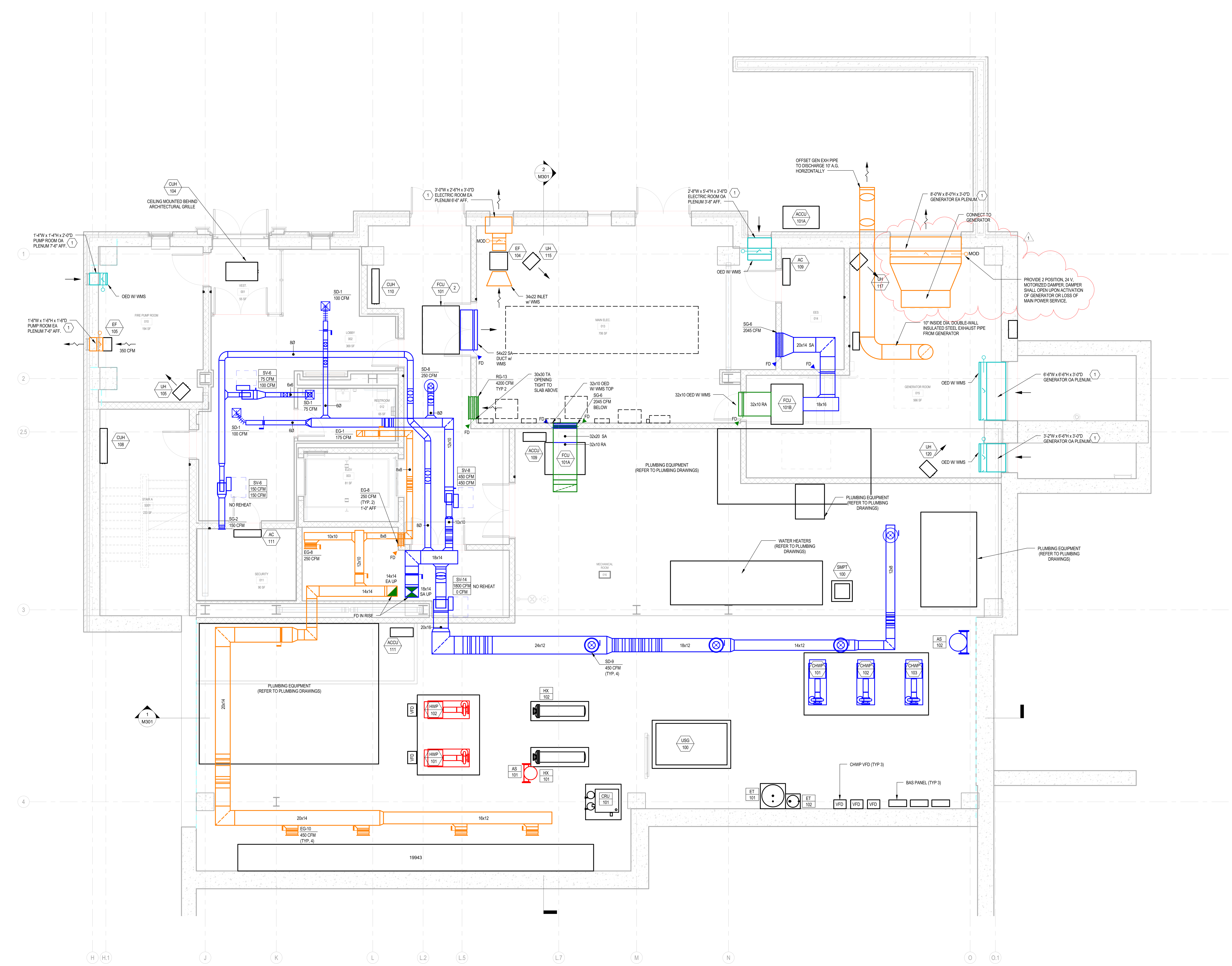
CHANGES TO SPECIFICATIONS

Description of Mechanical Specifications Revisions for Bulletin #28

Section 23 09 93 Sequence of Operations for HVAC Controls

a. (Cx-17.04) Paragraph 1.4.B.4.d.: Revised heat exchanger water proof from differential pressure to water flow switch.
b. (Cx-17.04) Paragraph 1.4.B.6.d.: Revised heat exchanger water proof from differential pressure to water flow switch.
c. (Cx-17.04) Paragraph 1.4.B.8.d.: Revised heat exchanger water proof from differential pressure to water flow switch.
d. (Cx-17.04) Paragraph 1.4.B.8.e.: Revised heat exchanger water proof from differential pressure to water flow switch.
e. (Cx-11.04) Paragraph 1.4.D.2.c.: Added CHWT-100 to clarify that it is an initiator of system start-up.
f. (Cx-11.04) Paragraph 1.4.E.1.b.: Clarified when chilled water control loop is considered shut down.
g. (Cx-11.04) Paragraph 1.4.E.4.b.: Clarified when chilled water system is enabled.
h. (Cx-11.04) Paragraph 1.4.E.5.: Clarified dry cooler sequence.
i. (Cx-11.05) Paragraph 1.4.: Added paragraph G. STEM Building and Chemistry Addition Unfired Steam Humidification System Control Sequences.
j. (Cx-11.08) Paragraph 1.5.B.2.b.: Added requirement for manual space switch for EF-103A/B energizing.
k. (Cx-11.08) Paragraph 1.5.B.4.a.: Added requirement for manual space switch for EF-103A/B energizing.
l. (Cx-9.03) Paragraph 1.6.B.10.a.: Added alarm for low exit velocity.
m. (Cx-9.03) Paragraph 1.6.B.11.: Added display for exit velocity.
n. (Cx-11.08) Paragraph 1.6.C.1.d.: Added requirements for manual space switch for EF-103A/B energizing and adjacent light indicating offset setpoint is reached.
o. (Cx-11.08) Paragraph 1.6.C.3.c.: Clarified EF-103A/B start-up sequence.
p. (Cx-9.03) Paragraph 1.6.D.10.a.: Added alarm for low exit velocity.
q. (Cx-9.03) Paragraph 1.6.D.11.: Added display for exit velocity.
r. (Cx-11.08) Paragraph 1.19.A.: Corrected fan tag to EF-103A/B.

END OF BULLETIN NO. 28



STEM BUILDING GROUND FLR MECHANICAL PLAN 1
1/4" = 1'-0"

EYP/

EYP Architecture & Engineering of NJ, Inc.
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New York, NY 10014
Telephone 917 981 6000
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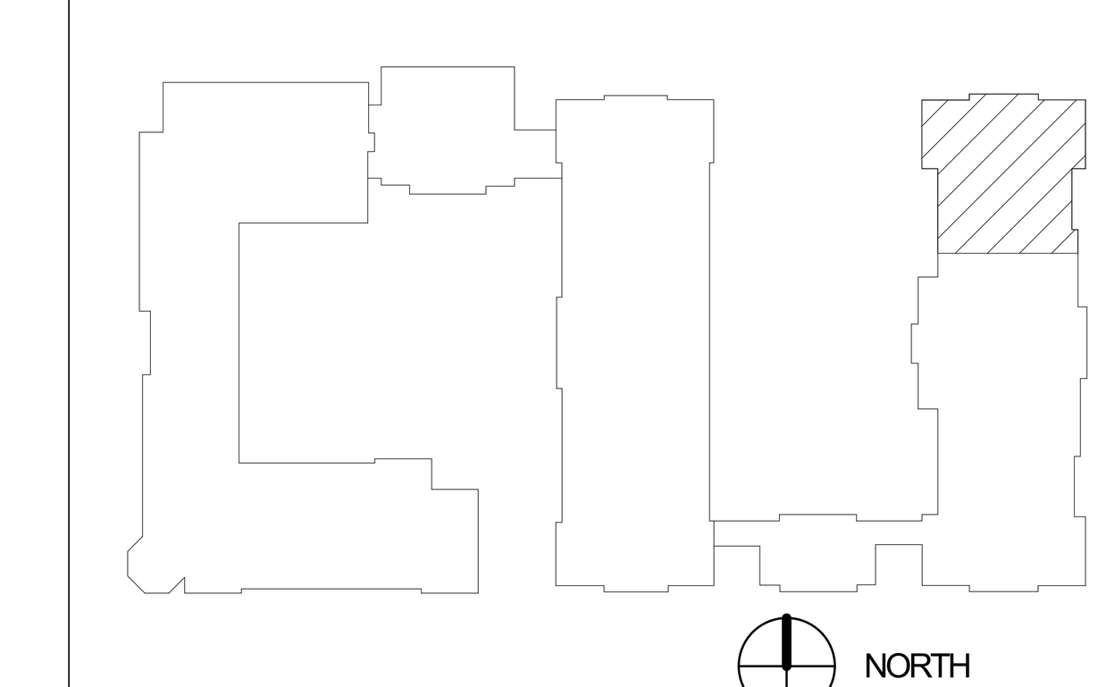
GENERAL NOTES:

1. ALL BRANCH DUCTWORK TO SUPPLY AND EXHAUST TERMINAL UNITS SHALL BE FULL SIZE OF TERMINAL INLET/OUTLET CONNECTIONS UNLESS OTHERWISE NOTED.
2. ALL BRANCH DUCTWORK TO DIFFUSERS SHALL BE FULL SIZE OF DIFFUSER NECK UNLESS OTHERWISE NOTED.
3. ALL BRANCH DUCTWORK TO FUME HOODS SHALL BE FULL SIZE OF FUME HOOD EXHAUST CONNECTION UNLESS OTHERWISE NOTED.

KEYNOTE LEGEND

1 DOUBLE WALL INSULATED PLENUM. REFER TO SPECIFICATION SECTION 233113.
2 INSTALL FCU IN BEAM POCKET. COORDINATE FCU, PIPING, AND ADJACENT SYSTEMS INSTALLATION TO ALLOW MAINTENANCE ACCESS VIA PANELS IN BOTTOM OF FCU CASING.



KEY PLAN:

#	DESCRIPTION	DATE
1	Bulletin #28	03/21/2019

STEM BUILDING & CHEMISTRY ADDITION

The College of New Jersey
2000 Pennington Road
Ewing Township, NJ 08628-0718

ISSUED FOR DCA

DATE:	15 MAY 2015
SCALE:	As indicated
EYP PROJECT NO.:	1013016.01
CLIENT PROJECT NO.:	
DESIGNED BY:	RDWL
DRAWN BY:	RDWL
CHECKED BY:	MD

JOHN BOYER
STATE OF NEW JERSEY JOHN T. BOYER No. GE49382
NJ PROFESSIONAL ENGINEER
LICENSE NO. 24GE04938200

STEM BUILDING GROUND FLR MECHANICAL PLAN

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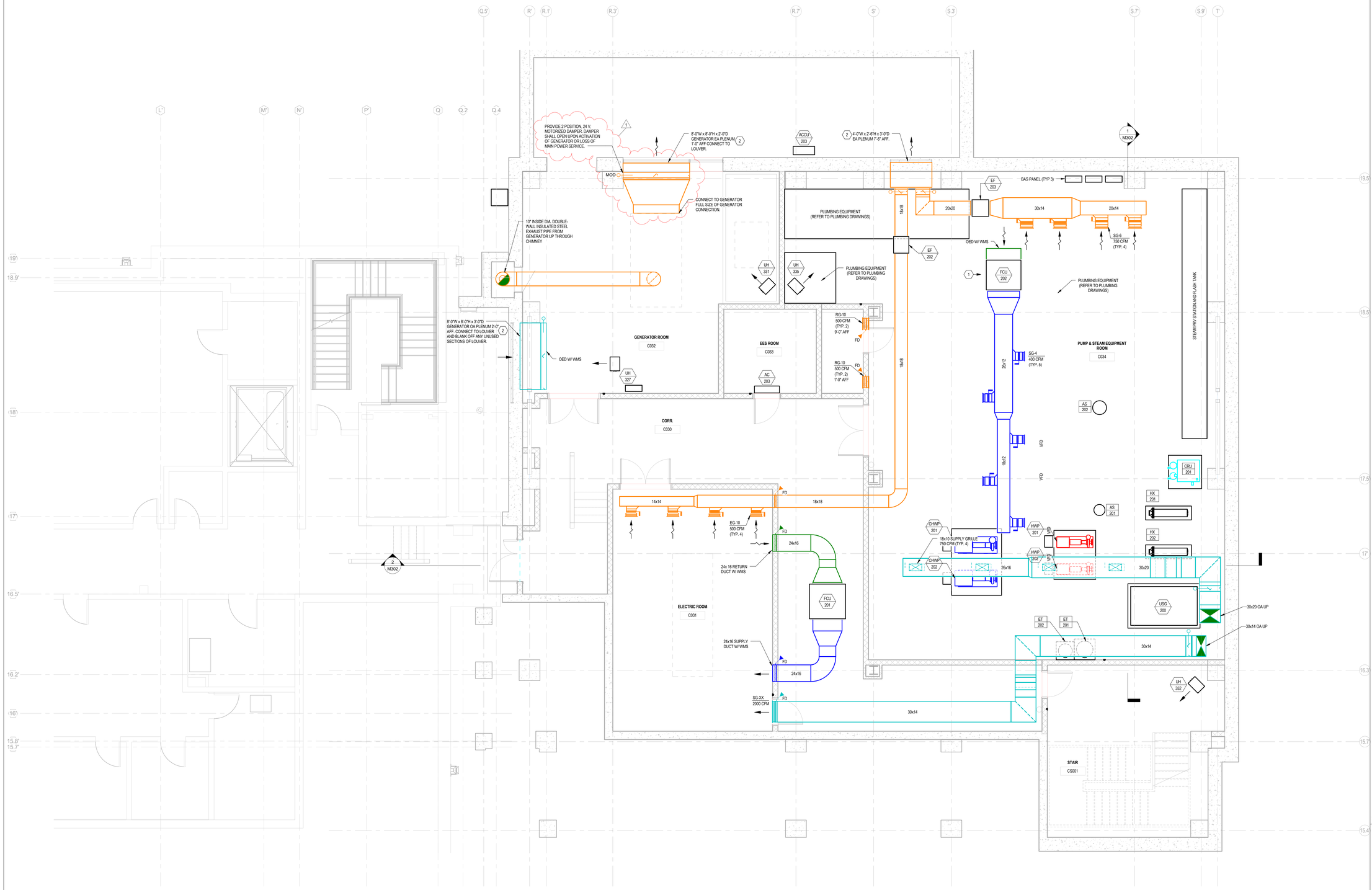

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2. ALL BRANCH DUCTWORK TO DIFFUSERS SHALL BE FULL SIZE OF DIFFUSER NECK UNLESS OTHERWISE NOTED.
3. ALL BRANCH DUCTWORK TO FUME HOODS SHALL BE FULL SIZE OF FUME HOOD EXHAUST CONNECTION UNLESS OTHERWISE NOTED.

KEYNOTE LEGEND

1 COORDINATE LOCATION AND HANDING OF FCU WITH PLUMBING EQUIPMENT AND OTHER WORK TO ALLOW MAINTENANCE ACCESS.
2 DOUBLE WALL INSULATED PLENUM. REFER TO SPECIFICATION SECTION 233113.

KEY PLAN:

NORTH

#	DESCRIPTION	DATE
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DRAWN BY: **RDWL**
MD

JOHN BOYER
NJ PROFESSIONAL ENGINEER
LICENSE NO. 24GE04938200

CHEMISTRY ADDITION BASEMENT MECHANICAL PLAN

CHEMISTRY ADDITION BASEMENT MECHANICAL PLAN 1
1/4" = 1'-0"

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VAV SCHEDULE - LEVEL 1 STEM- NORTH						
KEYED NUMBER	TAG	MAX CFM	MIN CFM	REHEAT COIL		
				CFM	LAT (°F)	GPM
S2	SV-10	880	355	355	95	1.5
S3	SV-10	880	355	355	90	1.0
S4	SV-14	2040	1030	1030	95	3.0
S5	SV-6	150	150			
S6	SV-8	300	300	300	80	1.0
S7	SV-12	1350	1350	1350	80	2.5
S8	SV-10	1000	815	815	80	1.5
S9	SV-10	1000	815	815	80	1.5
S10	LSV-12	1180	930	930	75	1.5
S11	LSV-8	590	460	460	75	1.0
S12	SV-10	1000	815	815	80	1.5
S13	LSV-12	960	740	740	75	1.5
S14	LSV-8	430	385	385	75	1.0
S15	SV-10	1000	815	815	80	1.5
S16	SV-10	1000	815	815	80	1.5

VAV SCHEDULE - LEVEL 1 STEM- NORTH						
KEYED NUMBER	TAG	MAX CFM	MIN CFM	REHEAT COIL		
				CFM	LAT (°F)	GPM
E1	EV-16	2235	600			
E2	EV-16	2570	1020			
E4	EV-14	1540	1250			
E5	LEV-210	1710	990			
E6	HV-10	600	265			
E7	EV-14	1540	1250			
E8	HV-8	600	265			
E9	LEV-8	430	385			
E10	LEV-10	795	240			
E11	EV-6	300	0			
E12	EV-14	1540	1250			
S1	SV-10	1010	510	510	75	1.0

GENERAL NOTES:

1. ALL BRANCH DUCTWORK TO SUPPLY AND EXHAUST TERMINAL UNITS SHALL BE FULL SIZE OF TERMINAL INLET/OUTLET CONNECTIONS UNLESS OTHERWISE NOTED.
2. ALL BRANCH DUCTWORK TO DIFFUSERS SHALL BE FULL SIZE OF DIFFUSER NECK UNLESS OTHERWISE NOTED.
3. ALL BRANCH DUCTWORK TO FUME HOODS SHALL BE FULL SIZE OF FUME HOOD EXHAUST CONNECTION UNLESS OTHERWISE NOTED.

KEYNOTE LEGEND

1 INSTALL MAGNAHELIC TYPE DP GAUGE ACROSS EXHAUST FILTERS. COORDINATE EXACT LOCATION OF FILTER CABINET AND ALL ASSOCIATED COMPONENTS WITH ARCHITECTURAL CEILING SYSTEM AND FINAL SPACE LAYOUT SUCH THAT GAUGE READING AND FILTER MAINTENANCE MAY BE PERFORMED FROM A LADDER IN THE SPACE. REFER TO SECTION 23 4100 FOR FILTER AND CABINET SPECIFICATIONS.

2 PROVIDE WALL SWITCH TO ACTIVATE EXHAUST TO SNORKELS. WHEN WALL SWITCH IS ACTIVATED THE SWITCH SHALL ILLUMINATE AND SHALL ADJUST ROOM SUPPLY TO COMPENSATE FOR EXHAUST. PROVIDE SIGN TO BE MOUNTED ABOVE SWITCH THAT STATES: TURN ON SWITCH TO ACTIVATE CAPTURE HOOD/SNORKEL EXHAUST WHEN RUNNING EQUIPMENT.

3 PAINT BOOTH BAS VISUAL PANEL AND MANUAL ON/OFF TOGGLE. REFER TO SECTION 230993 AND M703.

4 CONTRACTOR SHALL COORDINATE WITH PAINT BOOTH MANUFACTURER TO DETERMINE EXACT SUPPLY AND EXHAUST DUCT CONNECTION CONFIGURATION. WHERE REQUIRED TO MEET BUILDING CONSTRAINTS, PROVIDE CUSTOM PLENUM AND CONNECTION LOCATIONS TO ACCOMMODATE DUCT ROUTING AND CONNECTIONS INDICATED.

5 WRAP AIR TERMINAL UNIT, AND SOUND ATTENUATOR WHERE APPLICABLE, WITH MINIMUM 1 LB/SF REINFORCED FOIL-FACED ACOUSTICAL DUCT LAG. COORDINATE INSTALLATION WITH EQUIPMENT ACCESS AND OPERABILITY REQUIREMENTS. PROVIDING REMOVABLE SECTIONS WHERE APPROPRIATE. REFER TO DUCT LAG SCHEDULE M602 FOR PERFORMANCE REQUIREMENTS.

6 14x12 EA DUCT FROM SURFACE FINISHING ROOM UP INTO DEDICATED SHAFT ENCLOSURE.

7 16x6 - 16x12 - 16x18 PROPORTIONAL SPLIT IN VERTICAL EXHAUST RISER. INSTALL FSD IN 16x6 EA BRANCH AS INDICATED. WRAP 16x12 EA BRANCH WITH FIRE-RATED INSULATION AS SPECIFIED IN SECTION 23 0714, FROM SHAFT ENCLOSURE PENETRATION DOWN TO FIRST FLOOR SLAB.

8 WRAP 14x14 EA DUCT WITH FIRE-RATED INSULATION AS SPECIFIED IN SECTION 23 0714, FROM FIRST FLOOR SLAB PENETRATION BACK TO 12x16 EA DUCT PENETRATION AT SHAFT ENCLOSURE.

9 PROVIDE ILLUMINATED PUSH BUTTON FOR EF-103A/B ACTIVATION. PROVIDE SIGNAGE INDICATING "EF-103A/B SYSTEM ACTIVATION". PROVIDE ADDITIONAL LIGHT ADJACENT TO PUSH BUTTON WITH SIGNAGE INDICATING "SYSTEM ACHIEVING AIRFLOW SETPOINT".

KEY PLAN:

NORTH

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STEM BUILDING & CHEMISTRY ADDITION

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Ewing Township, NJ 08628-0718

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DRAWN BY:	RDWL
CHECKED BY:	MD

JOHN BOYER
NJ PROFESSIONAL ENGINEER
LICENSE NO. 24GE04938200

STEM BLDG 1ST FL DUCTWORK PARTIAL PLAN - NORTH

M101D

STEM BLDG 1ST FL DUCTWORK PARTIAL PLAN - NORTH
1/4" = 1'-0" 1

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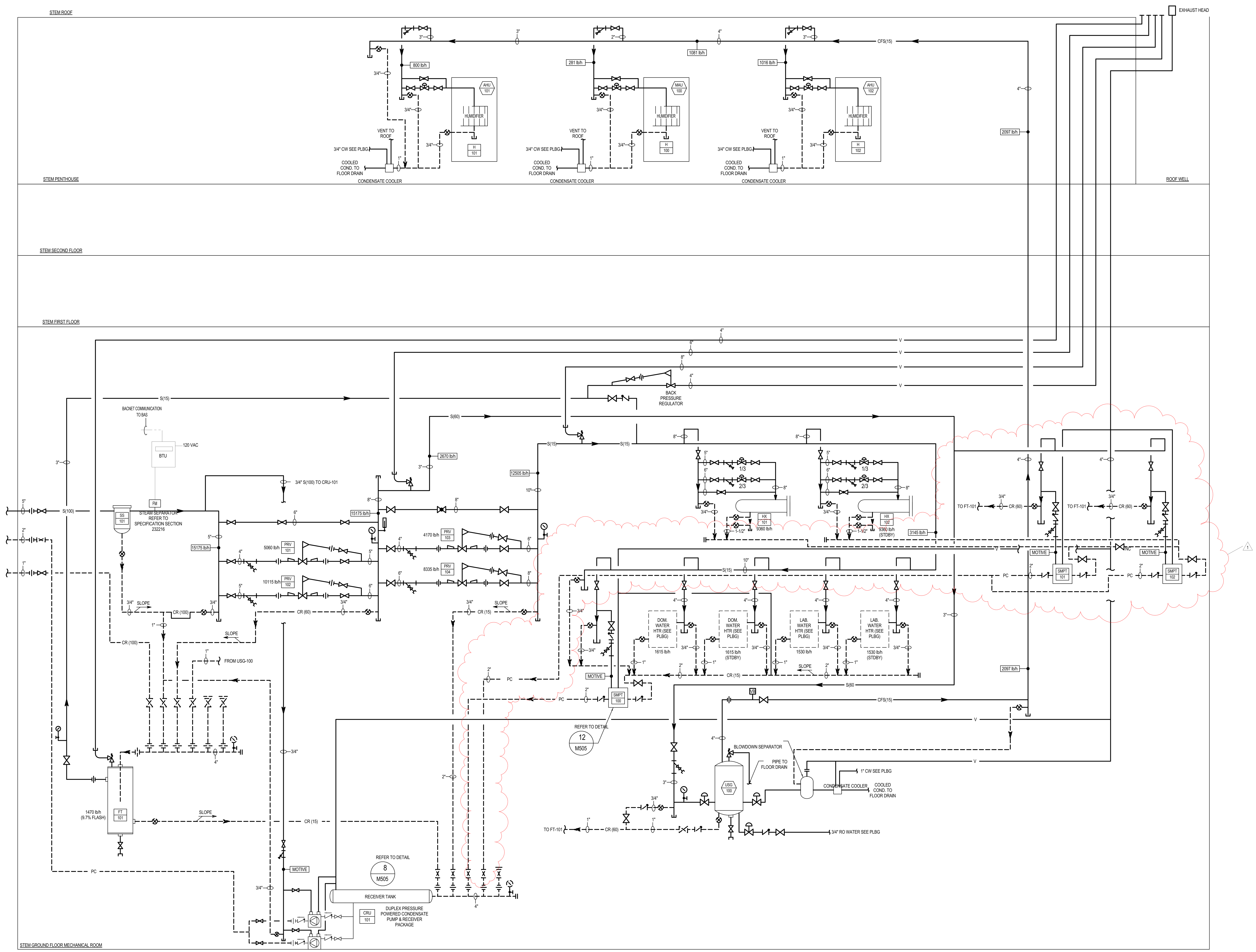

1 M401 M401 STEM BUILDING STEAM & CONDENSATE FLOW DIAGRAM

NO SCALE

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Telephone 917 981 6000
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STEM BUILDING & CHEMISTRY ADDITION

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DATE:	15 MAY 2015
SCALE:	12" = 1'-0"
EYP PROJECT NO.:	1013016.01
CLIENT PROJECT NO.:	
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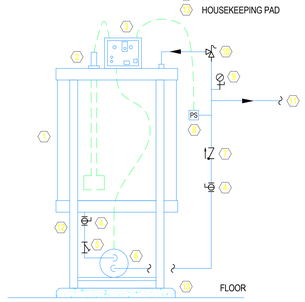
NJ PROFESSIONAL ENGINEER
LICENSE NO. 24GE04938200

STEM BUILDING STEAM & CONDENSATE FLOW DIAGRAM

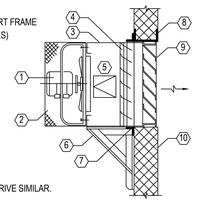
M401

1. CAPACITY GLYCOL-SOLUTION TANK
2. TANK LEVEL SENSOR
3. CONTROL PANEL
4. SHUT-OFF VALVE
5. STRAINER
6. GLYCOL SOLUTION FEEDER PUMP
7. CHECK VALVE
8. PRESSURE SWITCH
9. PRESSURE GAUGE
10. SYSTEM RELIEF VALVE PIPED TO TANK SET AT 112 PSIG
11. GLYCOL FEED TO SYSTEM
12. DRAIN VALVE W/ HOSE END
13. HOUSEKEEPING PAD



12 Typical Glycol Feeder Tank Piping Detail
M503 — NO SCALE

1. FAN & MOTOR ASSEMBLY
2. REMOVABLE WIRE MESH INLET GUARD
3. 18 GA. SHEET METAL WALL SLEEVE
4. MOTORIZED DAMPER
5. ACCESS DOOR (12x12)
6. WELDED ANGLE IRON SUPPORT FRAME
7. ANGLE IRON FRAME (ALL SIDES)
8. LINTEL
9. FIXED LOUVER
10. EXTERIOR WALL

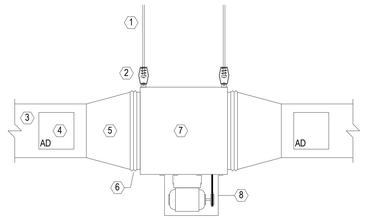


NOTES:

1. DIRECT DRIVE SHOWN; BELT DRIVE SIMILAR.

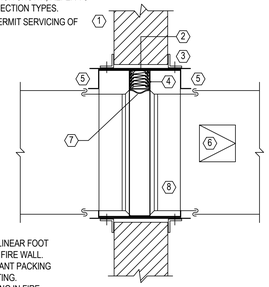
9 Sidewall Propeller Exhaust Fan Detail
M503 — NO SCALE

1. HANGER RODS TO STRUCTURE ABOVE
2. VIBRATION ISOLATORS
3. DUCTWORK, SIZE AS SHOWN ON PLANS
4. 24x24 ACCESS DOOR (BOTH SIDES) FOR ALL FANS W/DUCT CONNECTIONS LARGER THAN 36" ROUND OR SQUARE
5. TRANSITION, AS REQUIRED
6. FLEXIBLE CONNECTION
7. IN-LINE CENTRIFUGAL FAN
8. MOTOR COVER/BELT GUARD



6 Typical In-Line Fan Detail
M503 — NO SCALE

1. FIRE RATED WALL OR PARTITION
2. GALVANIZED STEEL SLEEVE, GAUGE AS PER SMACNA SCHEDULE 2 FOR FIRE DAMPERS.
3. RETAINING ANGLES: MIN. 1-1/2"x1-1/2"x0.054" (16 GA.) SECURE RETAINING ANGLES TO SLEEVE ONLY, NOT TO FIRE WALL. RETAINING ANGLES MUST LAP STRUCTURAL OPENING 1" MINIMUM AND COVER CORNERS OF OPENINGS.
4. APPROVED FIRE DAMPER (CURTAIN OR BLADE TYPE) WITH FUSIBLE LINK AND MOUNTING FRAME. VERTICAL DAMPER SHOWN. HORIZONTAL DAMPER INSTALLATION IS SIMILAR.
5. BREAKAWAY CONNECTION. SLIP CONNECTION SHOWN, REFER TO SMACNA FOR RANGE OF APPROVED CONNECTION TYPES.
6. ACCESS DOOR: SIZE AND LOCATION TO PERMIT SERVICING OF FUSIBLE LINK
7. FUSIBLE LINK
8. FIRE DAMPER FRAME

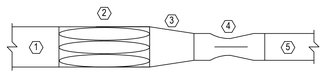


NOTES:

1. PROVIDE 1/8" MIN. CLEARANCE PER LINEAR FOOT OF OPENING BETWEEN SLEEVE AND FIRE WALL. FILL OPEN SPACE WITH FIRE-RESISTANT PACKING ON ALL SIDES TO MAINTAIN FIRE RATING.
2. PROVIDE OPERATOR CLOSURE SPRING IN FIRE DAMPERS THAT ARE MOUNTED HORIZONTALLY.

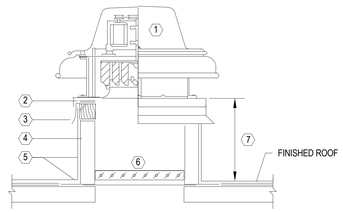
3 Typical Fire Damper Detail
M503 — NO SCALE

1. LOW PRESSURE EXHAUST AIR DUCT (SIZE AS SHOWN ON PLANS)
2. SOUND ATTENUATOR
3. TRANSITION AS REQUIRED
4. EXHAUST AIR VALVE
5. MEDIUM PRESSURE EXHAUST AIR DUCT (SIZE AS SHOWN ON PLANS)



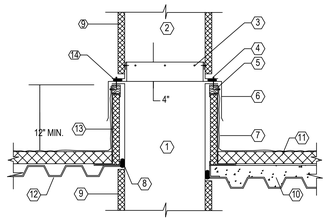
11 Typical Lab Exhaust Air Valve Detail
M503 — NO SCALE

1. CENTRIFUGAL EXHAUST FAN
2. GASKET
3. FLASHING
4. PREFABRICATED ROOF CURB
5. ROOFING - REFER TO ARCH. DRAWINGS
6. BACKDRAFT OR CONTROL DAMPER
7. 18" MINIMUM



8 Typical Centrifugal Roof Exhaust Fan Detail
M503 — NO SCALE

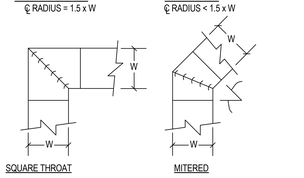
1. INTERIOR DUCTWORK
2. EXTERIOR DUCTWORK
3. FASTEN EXTERIOR DUCT TO FLASHING
4. FASTEN EXTERIOR DUCT TO CURB
5. PRESSURE TREATED WOOD NAILER
6. COUNTERFLASHING
7. ROOF MEMBRANE
8. PACK JOINT WITH MINERAL WOOL
9. DUCT INSULATION AND JACKET
10. COMPOSITE ROOF DECK
11. ROOF INSULATION
12. METAL ROOF DECK
13. PREFABRICATED ROOF CURB
14. CAULK ALL AROUND



NOTES:

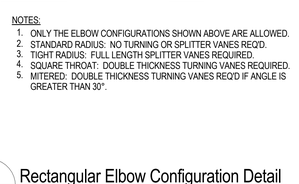
1. COORDINATE ALL FLASHING WITH ROOFING CONTRACTOR
2. ALL FASTENERS TO BE STAINLESS STEEL
3. SEE SPECIFICATIONS FOR DUCT INSULATION AND JACKET REQUIREMENTS

5 Typical Duct Penetration Through Roof Detail
M503 — NO SCALE



STANDARD RADIUS
℄ RADIUS = 1.5 x W

TIGHT RADIUS
℄ RADIUS < 1.5 x W



SQUARE THROAT

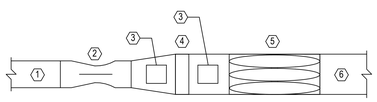
MITERED

NOTES:

1. ONLY THE ELBOW CONFIGURATIONS SHOWN ABOVE ARE ALLOWED.
2. STANDARD RADIUS: NO TURNING OR SPLITTER VANES REQ'D.
3. TIGHT RADIUS: FULL LENGTH SPLITTER VANES REQUIRED.
4. SQUARE THROAT: DOUBLE THICKNESS TURNING VANES REQUIRED.
5. MITERED: DOUBLE THICKNESS TURNING VANES REQ'D IF ANGLE IS GREATER THAN 30°.

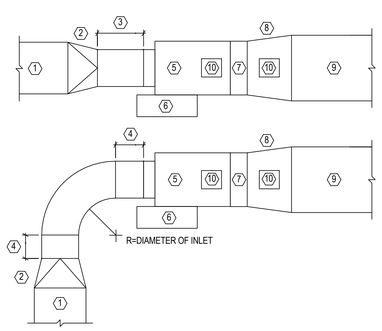
2 Rectangular Elbow Configuration Detail
M503 — NO SCALE

1. MEDIUM PRESSURE SUPPLY AIR DUCT (SIZE AS SHOWN ON PLANS)
2. SUPPLY AIR VALVE
3. PROVIDE ACCESS DOORS (8x8 MINIMUM)
4. REHEAT COIL (PROVIDE DUCT TRANSITIONS AS REQUIRED)
5. SOUND ATTENUATOR
6. LOW PRESSURE SUPPLY AIR DUCT (SIZE AS SHOWN ON PLANS)



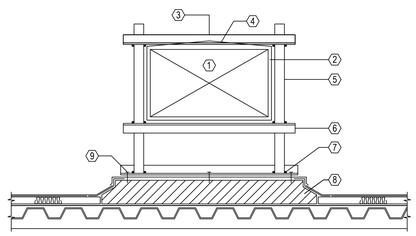
10 Typical Lab Supply Air Valve Detail
M503 — NO SCALE

1. MEDIUM PRESSURE SUPPLY AIR DUCT (SIZE AS SHOWN ON PLANS)
2. TRANSITION TO BOX INLET DIMENSION
3. MIN. 3 DUCT DIAMETERS STRAIGHT DUCT
4. MIN. 1-1/2 DUCT DIAMETERS STRAIGHT DUCT
5. SUPPLY TERMINAL UNIT
6. CONTROL BOX (PROVIDE RIGHT OR LEFT HAND CONFIGURATION AS REQUIRED)
7. REHEAT COIL (WHERE INDICATED)
8. TRANSITION TO DOWNSTREAM DUCTWORK
9. LOW PRESSURE SUPPLY AIR DUCT (SIZE AS SHOWN ON PLANS)
10. PROVIDE ACCESS DOORS (8x8 MINIMUM)



7 Typical VAV Air Terminal Unit Detail
M503 — NO SCALE

1. DUCTWORK
2. INSULATION AND WEATHERPROOF JACKET PER SPECIFICATIONS
3. DUCT HOLD DOWN ANGLE
4. PITCH INSULATION AS REQUIRED FOR DRAINAGE
5. DUCT SUPPORT ANGLE PER SMACNA
6. "C" CHANNEL
7. SUPPORT LEG WELD TO ANGLE
8. PREFABRICATED EQUIPMENT SUPPORT CURB PROVIDED BY DIVISION 23, INSTALLED BY GENERAL CONTRACTOR.
9. ANGLE IRON FASTENED TO EQUIPMENT SUPPORT CURB

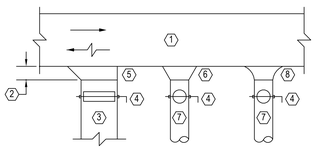


NOTES:

1. DUCT SUPPORTS SHALL BE PROVIDED BY HVAC CONTRACTOR.
2. PROVIDE CROSS BRACING AS REQUIRED FOR DUCT SUPPORTS HIGHER THAN 30" ABOVE ROOF.

4 Typical Roof Mounted Duct Support Detail
M503 — NO SCALE

1. MAIN SUPPLY, RETURN OR EXHAUST DUCT (LOW OR MEDIUM PRESSURE)
2. DISTANCE = (1/4) x DUCT WIDTH; 4" MINIMUM
3. RECTANGULAR BRANCH TAKE-OFF DUCT
4. VOLUME DAMPER
5. 45 DEGREE ENTRY FITTING
6. CONICAL DUCT TAKE-OFF FITTING
7. ROUND BRANCH TAKE-OFF DUCT
8. BELLMOUTH DUCT TAKE-OFF FITTING



NOTES:

1. SPIN-IN DUCT TAKE-OFF FITTINGS MAY BE USED IN LIEU OF CONICAL OR BELLMOUTH FITTINGS ONLY WHERE MAIN DUCT DIMENSIONS ARE NOT SUFFICIENT TO ALLOW THE USE OF A CONICAL OR BELLMOUTH.
2. SEAL ALL TAKE-OFF AND OTHER DUCT FITTINGS AIR TIGHT AS PER SPECIFICATION.
3. FABRICATE BRANCH DUCT TAKE-OFF FITTINGS PER LATEST EDITION OF SMACNA DUT CONSTRUCTION MANUAL, AS INDICATED ON PLANS, OR AS DESCRIBED IN THE SPECIFICATION.

1 Duct Branch Take-Off Detail
M503 — NO SCALE

EYP Architecture & Engineering of NJ, Inc.
225 Wyckoff Street - 2nd Floor
New York, NY 10014
Telephone 917 591 6000
Fax 917 981 6100
eypae.com

	DESCRIPTION	DATE
1	Bulletin #28	03/21/2019

STEM BUILDING & CHEMISTRY ADDITION

The College of New Jersey
2000 Pennington Road
Ewing Township, NJ 08628-0718

ISSUED FOR CONSTRUCTION

DATE:	15 MAY 2015
SCALE:	As indicated
EYP PROJECT NO.:	1013016.01
CLIENT PROJECT NO.:	
DESIGNED BY:	RDWL
DRAWN BY:	RDWL
CHECKED BY:	MD

JOHN BOYER
NJ PROFESSIONAL ENGINEER
LICENSE NO. 24GE04938200

MECHANICAL DETAILS

M503

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UNFIRED CHEMICAL FREE STEAM GENERATOR SCHEDULE

TAG	SERVICE	TYPE	CAPACITY (LBS/HR)	INCOMING STEAM		OUTGOING STEAM		BASIS OF DESIGN	REMARKS
				PRESS. (PSIG)	FLOW (LB/HR)	PRESS. (PSIG)	FLOW (LB/HR)		
USG-100	STEM BUILDING CFS	STEAM TO STEAM	2100	60	2673	15	2100	CEMLINE V-SERIES	-
USG-200	CHEM ADDITION CFS	STEAM TO STEAM	920	60	1180	15	920	CEMLINE V-SERIES	-
								SERVICE	

STEAM MOTIVE PACKAGED CONDENSATE RETURN UNIT SCHEDULE

P NO.

TAG	SERVICE	ASSOC. STEAM SYSTEM CAPACITY (LB/HR)	DUPLEX PUMPS (EACH)		RECEIVER			BASIS OF DESIGN	REMARKS
			FLOW (GPM)	DISCHARGE PRESSURE (PSIG)	CAPACITY (GALLONS)	INLET DIA. (IN.)	MATERIAL		
CRU-101	STEM BUILDING PRIMARY CONDENSATE	15,175	60	60	80	4	CAST IRON	ARMSTRONG	NOTE 1
CRU-201	CHEM ADDITION PRIMARY CONDENSATE	4,930	20	60	30	4	CAST IRON	ARMSTRONG	NOTE 1

1. ASME PACKAGE, PUMP AND RECEIVER INSULATION COVER, GAUGE GLASS, CYCLE COUNTER.

STEAM PRESSURE REDUCING VALVE SCHEDULE

TAG	SERVICE	TYPE	BODY SIZE (IN.)	INLET PRESS. (PSIG)	OUTLET PRESS. (PSIG)	REQ'D FLOW (LBS/HR)	SAFETY VALVE				BASIS OF DESIGN	REMARKS
							RELIEF SETTING (PSIG)	MINIMUM CAPACITY (LB/HR)	ORIFICE AREA (SQ. IN.)	VENT SIZE (IN.)		
PRV-101	STEM BUILDING MPS (1/3)	PILOT OPERATED	2	100	60	5060	72	18855	4.633	6"	SPIRAX SARCO SERIES 25P	-
PRV-102	STEM BUILDING MPS (2/3)	PILOT OPERATED	3	100	60	10115	-	-	-	-	SPIRAX SARCO SERIES 25P	-
PRV-103	STEM BUILDING LPS (1/3)	PILOT OPERATED	2-1/2	60	15	4170	25	16926	11.811	8"	SPIRAX SARCO SERIES 25P	-
PRV-104	STEM BUILDING LPS (2/3)	PILOT OPERATED	3	60	15	8335	-	-	-	-	SPIRAX SARCO SERIES 25P	-
PRV-201	CHEM ADDITION MPS (1/3)	PILOT OPERATED	1	100	60	1640	72	5275	1.374	3"	SPIRAX SARCO SERIES 25P	-
PRV-202	CHEM ADDITION MPS (2/3)	PILOT OPERATED	1-1/2	100	60	3290	-	-	-	-	SPIRAX SARCO SERIES 25P	-
PRV-203	CHEM ADDITION LPS (1/3)	PILOT OPERATED	1-1/4	60	15	1250	25	6380	3.846	5"	SPIRAX SARCO SERIES 25P	-
PRV-204	CHEM ADDITION LPS (2/3)	PILOT OPERATED	2	60	15	2500	-	-	-	-	SPIRAX SARCO SERIES 25P	

FLASH TANK SCHEDULE

TAG		TYPE	MIN. CAPACITY (LBS/HR)	INLET PRESS. (PSIG)	FLASH PRESS. (PSIG)	PERCENT FLASH (%)	MIN. TANK DIA. (IN)	CONDENSATE INLET DIA. (IN)	VENT DIA. (IN)	FLASH STEAM DISCHARGE DIA. (IN)	BASIS OF DESIGN	REMARKS
FT-100	STEM BUILDING FLASH RECOVERY	VERTICAL	1470	100	15	9.7	10	4	4	3	CEMLINE V20FST	NOTE 1
FT-200	CHEM ADDITION FLASH RECOVERY	VERTICAL	480	100	15	9.7	6	3	3	2	CEMLINE V8FST	NOTE 1

1. FACTORY ASME SAFETY RELIEF VALVE.

EXPANSION / COMPRESSION TANK SCHEDULE

TAG	SERVICE	TYPE	MAX. OPERATING PRESS. (PSIG)	SUCTION DIFFUSER DIA. (IN.)	MIN. OPERATING PRESS. (PSIG)	RELIEF SETTING (PSIG)	MIN OPERATING / MAKE-UP (PSIG)	FACTORY PRE-CHARGE (PSIG)	SYSTEM VOLUME (GALLONS)	MIN. ACCEPTANCE (GALLONS)	NOMINAL TANK SIZE (GALLONS)	BASIS OF DESIGN	REMARKS
ET-101	STEM BUILDING HW	VERTICAL - DIAPHRAGM	200	50	100	31	31	2,150	75.3	211	BELL & GOSSETT D-280V	-	
ET-102	STEM BUILDING CHW	VERTICAL - DIAPHRAGM	95	40	100	31	31	4,600	22.5	44.4	BELL & GOSSETT D -80V	-	
ET-201	CHEM ADDITION HW	VERTICAL - DIAPHRAGM	200	50	100	31	31	600	21	44.4	BELL & GOSSETT D-80V	-	
ET-202	CHEM ADDITION CHW	VERTICAL - DIAPHRAGM	95	40	100	31	31	970	4.8	21.7	BELL & GOSSETT D-40V	-	

PUMP SCHEDULE

P NO.

TAG	SERVICE	GPM	HEAD (FT. W.G.)			IMPELLER DIA. (IN.)	EFF. (%)	NPSH REQ'D (FT. W.G.)	RPM	MAX BHP	ELECTRICAL					BASIS OF DESIGN	REMARKS
											NOMINAL HP	VFD	VOLTS	PHASE	STANDBY POWER (Y/N)		
CHWP-101	STEM BUILDING CHW DIST.	650	100	5	4	10.75	77.9	9.1	1800	21.2	25	Y	460	3	N	BELL & GOSSETT E-1510 4GC	-
CHWP-102	STEM BUILDING CHW DIST.	650	100	5	4	10.75	77.9	9.1	1800	21.2	25	Y	460	3	N	BELL & GOSSETT E-1510 4GC	-
CHWP-103	STEM BUILDING CHW DIST. (STANDBY)	650	100	5	4	10.75	77.9	9.1	1800	21.2	25	Y	460	3	N	BELL & GOSSETT E-1510 4GC	-
PCWP-101	STEM BUILDING PROCESS CHW PUMP	56	150	1.5	1.25	5.875	53.8	11.2	3600	3.99	7.5	Y	460	3	N	BELL & GOSSETT E-1510 1-1/4AD	-
PCWP-102	STEM BUILDING PROCESS CHW PUMP (STANDBY)	56	150	1.5	1.25	5.875	53.8	11.2	3600	3.99	7.5	Y	460	3	N	BELL & GOSSETT E-1510 1-1/4AD	-
DCGP-101	DC-101 GLYCOL CIRC PUMP	60	50	1.25	1.25	3.875	65.8	10.9	1800	1.17	2.0	N	460	3	N	BELL & GOSSETT E-90 1-1/4AAB	NOTE 1
DCGP-102	DC-101 GLYCOL CIRC PUMP (STANDBY)	60	50	1.25	1.25	3.875	65.8	10.9	1800	1.17	2.0	N	460	3	N	BELL & GOSSETT E-90 1-1/4AAB	NOTE 1
DCGP-103	CRAC-101/102 GLYCOL COOLING PUMP	86	65	2	2	4.25	72.7	7.0	1800	1.97	3	N	460	3	N	BELL & GOSSETT E-90 2AAC	NOTE 1
DCGP-104	CRAC-101/102 GLYCOL COOLING PUMP (STANDBY)	86	65	2	2	4.25	72.7	7.0	1800	1.97	3	N	460	3	N	BELL & GOSSETT E-90 2AAC	NOTE 1
CHWP-201	CHEM ADDITION CHW DIST.	528	65	4	3	9	82.7	7.8	1800	10.7	15	Y	460	3	N	BELL & GOSSETT E-1510 3BD	-
CHWP-202	CHEM ADDITION CHW DIST. (STANDBY)	528	65	4	3	9	82.7	7.8	1800	10.7	15	Y	460	3	N	BELL & GOSSETT E-1510 3BD	-
HWP-101	STEM BUILDING HW DIST.	600	95	5	4	10.5	79.7	7.6	1800	18.3	20	Y	460	3	Y	BELL & GOSSETT E-1510 4EB	-
HWP-102	STEM BUILDING HW DIST. (STANDBY)	600	95	5	4	10.5	79.7	7.6	1800	18.3	20	Y	460	3	Y	BELL & GOSSETT E-1510 4EB	-
HWP-201	CHEM ADDITION HW DIST.	240	80	3	2	9.875	72.1	7.8	1800	6.82	10	Y	460	3	Y	BELL & GOSSETT E-1510 2EB	-
HWP-202	CHEM ADDITION HW DIST. (STANBY)	240	80	3	2	9.875	72.1	7.8	1800	6.82	10	Y	460	3	Y	BELL & GOSSETT E-1510 2EB	-
HCCP-100A/B	MAU-100 HEATING COIL CIRC PUMP	71	15	2	2	4.75	73.4	3.9	1800	0.37	1/2	N	115	1	Y	BELL & GOSSETT E-90 2AAC	NOTE 2
CCCP-100A/B	MAU-100 COOLING COIL CIRC PUMP	150	19	3	3	7.625	65.2	3.9	1150	1.13	1.5	N	115	1	N	BELL & GOSSETT 80 3X3X9-1/2B	NOTE 2
HCCP-101A/B	AHU-101 HEATING COIL CIRC PUMP	152	15	4	4	6.75	68.6	3.1	1150	0.86	1	N	115	1	Y	BELL & GOSSETT 80 4X4X7	NOTE 2
HCCP-102A/B	AHU-102 HEATING COIL CIRC PUMP	152	15	4	4	6.75	68.6	3.1	1150	0.86	1	N	115	1	Y	BELL & GOSSETT 80 4X4X7	NOTE 2
HCCP-201A/B	AHU-201 HEATING COIL CIRC PUMP	131	15	3	3	6.75	71.2	3	1150	.7	1	N	115	1	Y	BELL & GOSSETT 80 3X3X7B	NOTE 2
HCCP-202A/B	AHU-202 HEATING COIL CIRC PUMP	131	15	3	3	6.75	71.2	3	1150	.7	1	N	115	1	Y	BELL & GOSSETT 80 3X3X7B	NOTE 2

1. PUMP SELECTED FOR 40% PG SOLUTION.
2. COIL FREEZE PROTECTION PUMPS OPERATE IN LEAD/STANDBY ARRANGEMENT. SCHEDULE LINE REPRESENTS BOTH LEAD ("A") AND STANDBY ("B") PUMPS.

STEAM TO WATER HEAT EXCHANGER SCHEDULE

HX NO.

TAG	SERVICE	STEAM SIDE		WATER SIDE					BASIS OF DESIGN	REMARKS
		MAX FLOW (LB/HR)	INLET PRESS. (PSIG)	GPM	EWT (°F)	LWT (°F)	MAX WPD (FT. W.G.)	NO. PASSES		
HX-101	STEM BUILDING HEATING	9360	15	600	130	160	7.6	4	BELL & GOSSETT SU184-4	-
HX-102	STEM BUILDING HEATING (STANDBY)	9360	15	600	130	160	7.6	4	BELL & GOSSETT SU184-4	-
HX-201	CHEM ADDITION HEATING	3750	15	240	130	160	6.7	4	BELL & GOSSETT SU124-4	-
HX-202	CHEM ADDITION HEATING (STANDBY)	3750	15	240	130	160	6.7	4	BELL & GOSSETT SU124-4	-

AIR SEPARATOR SCHEDULE

AS NO.

TAG	SERVICE	GPM	MAX PD (FT.)	PIPE CONNECTION SIZE (IN)	BASIS OF DESIGN	REMARKS
AS-101	STEM BUILDING HW	600	1.5	6	B&G RL-6	-
AS-102	STEM BUILDING CHW	1300	2	8	B&G RL-8	-
AS-103	STEM BUILDING PCHW	56	1.5	2-1/2	B&G RL-2.5	-
AS-201	CHEM ADDITION HW	240	1.5	4	B&G RL-4	-
AS-202	CHEM ADDITION CHW	500	2	5	B&G RL-5	-

FINTUBE RADIATION SCHEDULE

FT NO.

TAG	SERVICE	CAPACITY (BTUH/LF)	AVERAGE WATER TEMP (°F)	ENTERING AIR TEMP (°F)	TUBE DIA. (IN.)	FLOW PER CIRCUIT (GPM)	FIN DATA			NO. TIERS	ENCLOSURE DATA			BASIS OF DESIGN	REMARKS
							HEIGHT (IN.)	WIDTH (IN.)	FINS/FT		TYPE	DEPTH (IN.)	HEIGHT (IN.)		
FR-1	REFER TO PLANS	400	145	70	3/4	3.3	4.25	4.25	32	1	WALL MOUNT	-	-	STERLING	NOTES 1, 2
FR-2	REFER TO PLANS	550	145	70	3/4	3.3	4.25	4.25	40	1	PEDESTAL	-	-	STERLING	NOTES 1, 2
FR-3	FORUM CURTAINWALL	860	145	70	3/4	3.3	4.25	4.25	50	1	BARE TRENCH	-	-	STERLING C45	NOTES 1, 2, 3
FR-4	FORUM TOILET ROOMS	813	145	70	3/4	-	-	-	-	-	WALL MOUNTED	8.625	3.375	RUNTAL R2F3	NOTES 1, 2, 3

1. REFER TO ARCHITECTURAL FLOOR PLANS FOR MOUNTING DETAILS.
2. LISTED MODEL NUMBERS SELECTED BASED ON DERATING FACTORS PUBLISHED IN MANUFACTURER'S LITERATURE. INSTALLED HEATING ELEMENTS SHALL HAVE LISTED CAPACITY GIVEN SCHEDULED FLOW, ENTERING AIR, AVERAGE WATER TEMPERATURE, AND MOUNTING HEIGHT CONDITIONS.
3. BARE ELEMENTS SHALL BE INSTALLED IN TRENCH ALONG PERIMETER CURTAINWALL. REFER TO FLOOR PLANS FOR MOUNTING DETAILS.
4. PROVIDE ACCESSORIES AND TRIM PIECES REQUIRED TO COVER PIPING CONNECTIONS.

STEAM MOTIVE CONDENSATE PUMP TRAP SCHEDULE

SMPT NO.

TAG	SERVICE	LOCATION	INLET PRESSURE (PSIG)	LIFT PRESSURE (PSIG)	CAPACITY (LBS/HR)	FILLING HEAD	BASIS OF DESIGN	REMARKS
SMPT-100	DOMESTIC WATER HEATERS	STEM MECHANICAL ROOM	15	5	6,100	12"	ARMSTRONG PT - 3508	NOTE 1
SMPT-101	STEM HEAT EXCHANGERS	STEM MECHANICAL ROOM	60	5	13,500	12"	ARMSTRONG PT - 3512	NOTE 1
SMPT-102	STEM HEAT EXCHANGERS	STEM MECHANICAL ROOM	60	5	13,500	12"	ARMSTRONG PT - 3512	NOTE 1
SMPT-201	CHEM ADD HEAT EXCHANGERS	CHEM ADDITION MECHANICAL ROOM	15	5	6,100	12"	ARMSTRONG PT - 3508	NOTE 1
SMPT-202	CHEM ADD HEAT EXCHANGERS	CHEM ADDITION MECHANICAL ROOM	15	5	6,100	12"	ARMSTRONG PT - 3508	NOTE 1

1. PROVIDE INSULATION JACKET ON PUMP TRAP

FAN COIL UNIT SCHEDULE

FCU NO.

TAG	AREA SERVED	UNIT LOCATION	TYPE	CFM	ESP (IN. WG)	FAN MOTOR			HEATING COIL							COOLING COIL SECTION									BASIS OF DESIGN	REMARKS
						HP	VOLTS	PHASE	TOTAL CAPACITY (MBH)	EAT (°F)	LAT (°F)	GPM	WPD (FT)	EWT (°F)	LWT (°F)	SENSIBLE CAPACITY (MBH)	TOTAL CAPACITY (MBH)	EAT		LAT		GPM	WPD (FT)	EWT (°F)	LWT (°F)		
																		DB (°F)	WB (°F)	DB (°F)	WB (°F)						
FCU-101	STEM ELEC ROOM	STEM GROUND FLOOR	HORIZONTAL	4200	0.30	5	480	3	-	-	-	-	-	-	-	137,200	214,800	85	70	54.0	53.6	35.7	13.8	45	57	PRICE BCH-40	NOTE: 1,2,3
FCU-201	CHEM ELECTRIC ROOM	CHEM BASEMENT	HORIZONTAL	2800	0.30	3	480	3	-	-	-	-	-	-	-	94,400	150,200	85	70	53	52.6	25.0	14.5	45	57	PRICE BCH-30	NOTE: 1,2,3
FCU-202	CHEM MECH ROOM	CHEM BASEMENT	HORIZONTAL	2000	0.30	2	480	3	-	-	-	-	-	-	-	64,800	100,800	85	70	54.3	53.9	16.8	7.1	45	57	PRICE BCH-20	NOTE: 1,2,3
FCU-203	CHEM STAIR	CHEM 2ND FL STAIR CEILING	HORIZONTAL	750	0.30	1/2	120	1	31,144	70	108	2.0	1.5	160	130	14,999	18,747	80	67	61.5	58.6	3.25	0.97	45	57	PRICE FCHG-40	NOTE: 1,2,3
FCU-301	FORUM BRIDGE	FORUM BRIDGE CEILING	HORIZONTAL	750	0.30	1/2	120	1	31,144	70	108	2.0	1.5	160	130	14,999	18,747	80	67	61.5	58.6	3.25	0.97	45	57	PRICE FCHG-40	NOTE: 1,2,3
FCU-302	FORUM BRIDGE	FORUM BRIDGE CEILING	HORIZONTAL	750	0.30	1/2	120	1	31,144	70	108	2.0	1.5	160	130	14,999	18,747	80	67	61.5	58.6	3.25	0.97	45	57	PRICE FCHG-40	NOTE: 1,2,3
FCU-303	FORUM BRIDGE	FORUM BRIDGE CEILING	HORIZONTAL	750	0.30	1/2	120	1	31,144	70	108	2.0	1.5	160	130	14,999	18,747	80	67	61.5	58.6	3.25	0.97	45	57	PRICE FCHG-40	NOTE: 1,2,3
FCU-304	FORUM BRIDGE	FORUM BRIDGE CEILING	HORIZONTAL	750	0.30	1/2	120	1	31,144	70	108	2.0	1.5	160	130	14,999	18,747	80	67	61.5	58.6	3.25	0.97	45	57	PRICE FCHG-40	NOTE: 1,2,3

1. PROVIDE WITH LITTLE GIANT CONDENSATE PUMP #VCMA-15ULS WITH JUNCTION BOX FOR HARD WIRED ELECTRICAL CONNECTION - SEE ELECTRICAL DRAWINGS.
2. PROVIDE WITH MERV 8 FILTER.
3. PROVIDE WITH CONDENSATE OVERFLOW SWITCH.

DRY COOLER SCHEDULE

DC NO.

TAG	SERVICE	NOMINAL CAPACITY (MBH)	FLUIDSIDE (40% PG SOLUTION)				AIRSIDE			ELECTRICAL				BASIS OF DESIGN	REMARKS
			GPM	EWT (°F)	LWT (°F)	WPD (FT. W.G.)	EAT (°F)	FAN SECTION		FLA	MCA	VOLTS	PHASE		
								QUANTITY	NOMINAL HP PER FAN						
DC-101	STEM BUILDING PROCESS COOLING	360	60	80	67	20	55	3	3/4	4.65	4.65	460	3	COLMAC COIL AFV-251	NOTE 1
DC-102	STEM BUILDING CRAC COOLING	395.6	86	120	111.6	8.6	95	6	1.4	13.1	14.6	460	3	GFORCE GHFC-14134	

1. DC-101 SELECTED FOR ECONOMIZER OPERATION AT 55 DEG AMBIENT. ACTUAL PERFORMANCE MAY VARY DEPENDING ON AMBIENT CONDITIONS.

CHILLED WATER MIXING TANK SCHEDULE

TAG	SERVICE	VOLUME (GAL)	OPERATING TEMP (°F)	VENT PIPE DIA. (IN.)	OVERFLOW PIPE DIA. (IN.)	BASIS OF DESIGN	REMARKS
CHWT-100	STEM BUILDING PROCESS COOLING	500	55	3/4	1	WESSELS CBT-500	NOTE 1

1. ASME SEC VIII U-STAMPED VESSEL, TEMPERATURE AND PRESSURE GAUGE, TAPPINGS AS INDICATED ON M403.

GASKETED PLATE HEAT EXCHANGER SCHEDULE

HEX NO.

TAG	SERVICE	HEAT EXCHANGED (MBH)	HOT SIDE (STEM PROCESS COOLING LOOP)				COLD SIDE (40% PG DRY COOLER LOOP)				NO. PASSES HOT / COLD	HEAT TRANSFER AREA (SF)	OPERATING WEIGHT (LB)	BASIS OF DESIGN	REMARKS
			GPM	EFT (°F)	LFT (°F)	MAX PD (PSI)	GPM	EFT (°F)	LFT (°F)	MAX PD (PSI)					
PHX-1	STEM PROCESS COOLING	360	36	95	75	0.1	60	67	80	0.4	1/1	181.1	250	GEA FP10X20L - 140	NOTES 1, 2

1. PCW LOOP TEMPERATURES INDICATED IN THIS SCHEDULE REFLECT WORST CASE OPERATING CONDITIONS. PCW LOOP SHALL NORMALLY OPERATE AT A 55 °F PCWS DURING ECONOMIZER.
2. PHX-1 SELECTED FOR ECONOMIZER OPERATION AT 55 DEG AMBIENT. PCW LOOP NORMALLY COOLED VIA BUILDING CHW LOOP.

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#	DESCRIPTION	DATE
1	Bulletin #28	03/21/2019

STEM BUILDING & CHEMISTRY ADDITION

The College of New Jersey
2000 Pennington Road
Ewing Township, NJ 08628-0718

ISSUED FOR CONSTRUCTION

DATE: 15 MAY 2015
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DESIGNED BY: RDWL
DRAWN BY: RDWL
CHECKED BY: MD

JOHN BOYER
NJ PROFESSIONAL ENGINEER
LICENSE NO. 24GE04938200

MECHANICAL SCHEDULES

M602

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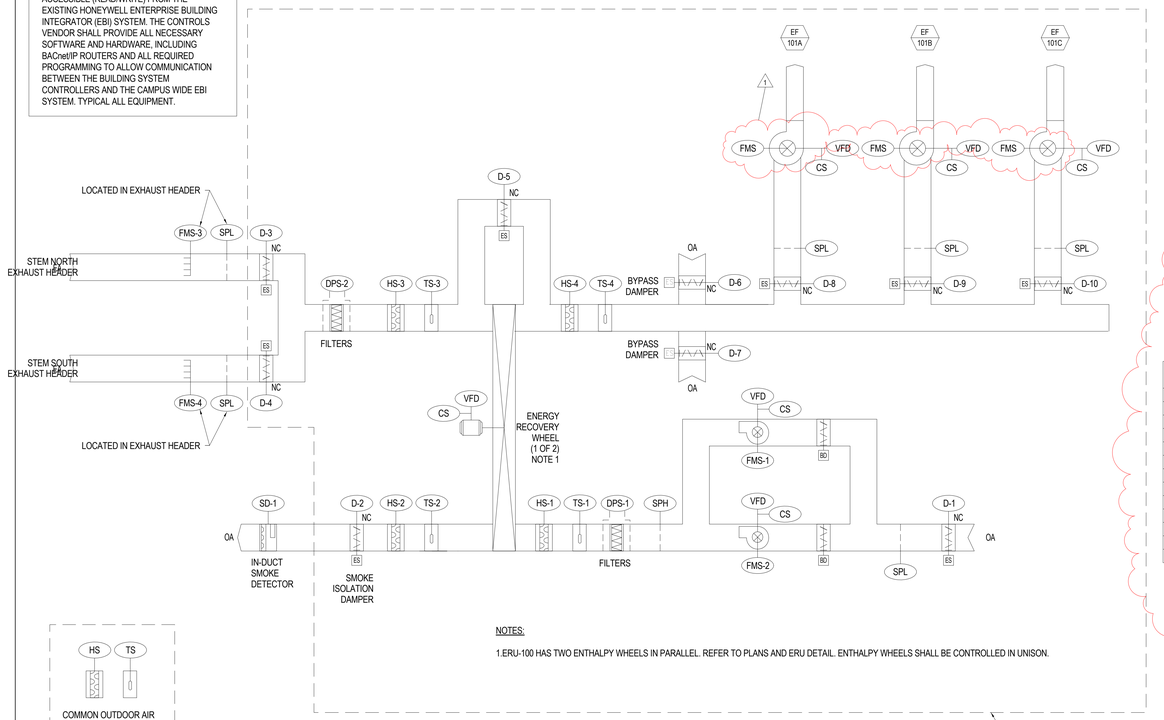
GENERAL NOTE:

ALL FACTORY INSTALLED DEVICES, BOTH HARDWARE AND SOFTWARE, SHALL BE ACCESSIBLE (READ/WRITE) FROM THE EXISTING HONEYWELL ENTERPRISE BUILDING INTEGRATOR (EBI) SYSTEM. THE CONTROLS VENDOR SHALL PROVIDE ALL NECESSARY SOFTWARE AND HARDWARE, INCLUDING BACnet/IP ROUTERS AND ALL REQUIRED PROGRAMMING TO ALLOW COMMUNICATION BETWEEN THE BUILDING SYSTEM CONTROLLERS AND THE CAMPUS WIDE EBI SYSTEM. TYPICAL ALL EQUIPMENT.

REFER TO SPECIFICATION FOR SEQUENCES OF OPERATION AND ALARMS.

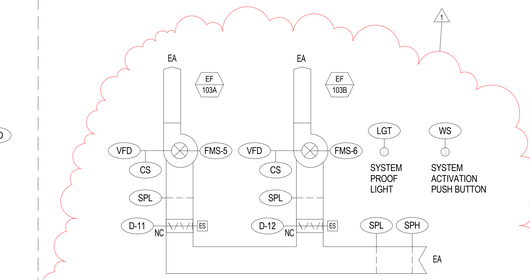


NOTES:

1.ERU-100 HAS TWO ENTHALPY WHEELS IN PARALLEL. REFER TO PLANS AND ERU DETAIL. ENTHALPY WHEELS SHALL BE CONTROLLED IN UNISON.

3 M701 STEM Building ERU-100 Control Diagram
NO SCALE

LIMITS OF AHU MANUFACTURER FACTORY INSTALLED CONTROL DEVICES



DDC CONTROL PANEL INPUT/OUTPUT SUMMARY (EF-103A/B)

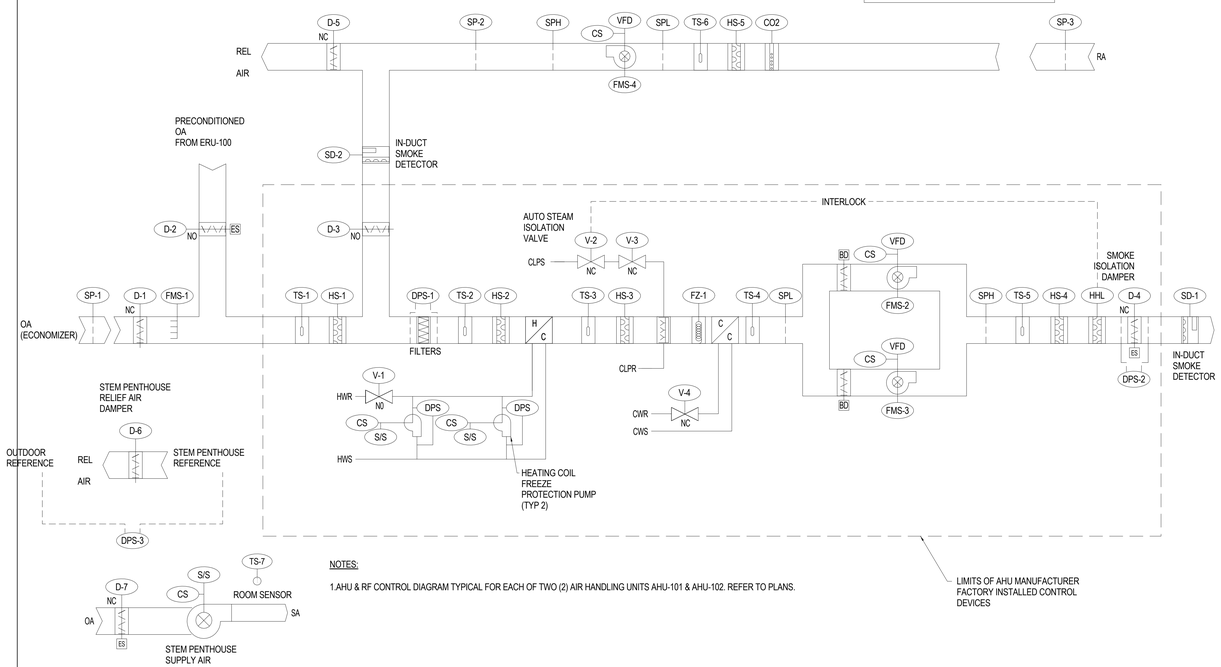
SYSTEM POINT	AI	AO	DI	DO	COMMENTS
D-11 EXHAUST FAN EF-103A DAMPER			X	X	OPEN/CLOSE, W/END SWITCH
D-12 EXHAUST FAN EF-103B DAMPER			X	X	OPEN/CLOSE, W/END SWITCH
FMS-5 EXHAUST FAN EF-103A CFM	X				
FMS-6 EXHAUST FAN EF-103B CFM	X				
SPL LOW STATIC PRESSURE LIMIT			3		
SPH HIGH STATIC PRESSURE LIMIT			1		
MANUAL SYSTEM ACTIVATION PUSH BUTTON			X		
SYSTEM PROOF LIGHT				X	
START/STOP EXHAUST FAN VFD	2			2	W/CURRENT SENSOR
MODULATE EXHAUST FAN VFD SPEED		2			
EXHAUST FAN VFD FAULT			2		

4 M701 STEM Building EF-103A/B Control Diagram
NO SCALE

DDC CONTROL PANEL INPUT/OUTPUT SUMMARY (TYPICAL FOR ERU-100)

SYSTEM POINT	AI	AO	DI	DO	COMMENTS
D-1 OA INTAKE DAMPER			X	X	OPEN/CLOSE, w/ END SWITCH
D-2 OUTSIDE AIR DISCHARGE SMOKE ISOLATION DAMPER			X	X	OPEN/CLOSE, w/ END SWITCH
D-3 STEM NORTH EXHAUST HEADER ISOLATION DAMPER			X	X	OPEN/CLOSE, w/ END SWITCH
D-4 STEM SOUTH EXHAUST HEADER ISOLATION DAMPER			X	X	OPEN/CLOSE, w/ END SWITCH
D-5 ENTHALPY WHEEL BYPASS DAMPER			X	X	OPEN/CLOSE, w/ END SWITCH
D-6 MODULATING OA BYPASS DAMPER (1 OF 2)	X	X			MODULATING, w/ POSITION FDBK
D-7 MODULATING OA BYPASS DAMPER (2 OF 2)	X	X			MODULATING, w/ POSITION FDBK
D-8 EXHAUST FAN 101A DAMPER			X	X	OPEN/CLOSE, w/ END SWITCH
D-9 EXHAUST FAN 101B DAMPER			X	X	OPEN/CLOSE, w/ END SWITCH
D-10 EXHAUST FAN 101C DAMPER			X	X	OPEN/CLOSE, w/ END SWITCH
DPS-1 OUTSIDE AIR FILTER DIFFERENTIAL PRESSURE	X				
DPS-2 EXHAUST AIR FILTER DIFFERENTIAL PRESSURE	X				
DPS-3 OA FAN ISOLATION DAMPER DIFFERENTIAL PRESSURE	X				
DPS-4 OA FAN ISOLATION DAMPER DIFFERENTIAL PRESSURE	X				
FMS-1 OA FAN CFM (1 OF 2)	X				
FMS-2 OA FAN CFM (2 OF 2)	X				
FMS-3 STEM NORTH EXHAUST HEADER CFM	X				
FMS-4 STEM SOUTH EXHAUST HEADER CFM	X				
HS-1 ENTHALPY WHEEL OA INLET AIR HUMIDITY	X				
HS-2 ENTHALPY WHEEL OA DISCHARGE AIR HUMIDITY	X				
HS-3 ENTHALPY WHEEL EXHAUST INLET AIR HUMIDITY	X				
HS-4 ENTHALPY WHEEL EXHAUST DISCHARGE AIR HUMIDITY	X				
SPH HIGH STATIC PRESSURE LIMIT			1		
SPL LOW STATIC PRESSURE LIMIT			6		
TS-1 ENERGY WHEEL OA INLET AIR TEMPERATURE	X				
TS-2 ENERGY WHEEL OA DISCHARGE AIR TEMPERATURE	X				
TS-3 ENERGY WHEEL EXHAUST INLET AIR TEMPERATURE	X				
TS-4 ENERGY WHEEL EXHAUST DISCHARGE AIR TEMPERATURE	X				
START/STOP OA FAN VFD	2			2	W/CURRENT SENSOR
OA FAN VFD HOA STATUS	2				
MODULATE OA FAN VFD SPEED		2			
OA FAN VFD FAULT			2		
START/STOP ENERGY RECOVERY WHEEL VFD	2			2	W/CURRENT SENSOR
ENERGY RECOVERY WHEEL VFD HOA STATUS	2				
MODULATE ERW VFD SPEED		2			
ENERGY RECOVERY WHEEL VFD FAULT			2		
WHEEL ROTATION DETECTION FAULT			2		
START/STOP EXHAUST FAN VFD	3			3	W/CURRENT SENSOR
EXHAUST FAN VFD HOA STATUS	3				
MODULATE EXHAUST FAN VFD SPEED		3			
EXHAUST FAN VFD FAULT			3		
EXHAUST FAN FMS	3				FROM FAN INLET PIEZOMETER

REFER TO SPECIFICATION SECTION 230993 FOR SEQUENCE OF OPERATION AND ALARMS



NOTES:

1.AHU & RF CONTROL DIAGRAM TYPICAL FOR EACH OF TWO (2) AIR HANDLING UNITS AHU-101 & AHU-102. REFER TO PLANS.

LIMITS OF AHU MANUFACTURER FACTORY INSTALLED CONTROL DEVICES

SP-4 SA — STEM 1ST FL NORTH
SP-5 SA — STEM 1ST FL SOUTH
SP-6 SA — STEM 2ND FL NORTH
SP-7 SA — STEM 2ND FL SOUTH

DDC CONTROL PANEL INPUT/OUTPUT SUMMARY (PENTHOUSE VENTILATION)

SYSTEM POINT	AI	AO	DI	DO	COMMENTS
START/STOP SUPPLY FAN				X	
FAN STATUS	X				VIA CURRENT SENSOR
TS-7 ROOM TEMPERATURE	X				
D-6 STEM PENTHOUSE RELIEF AIR DAMPER		X			MODULATING
D-7 STEM PENTHOUSE SUPPLY AIR DAMPER			X	X	OPEN/CLOSE, W/END SWITCH
DPS-3 STEM PENTHOUSE DIFFERENTIAL PRESSURE	X				

2 M701 STEM Building AHU-101 & 102 Control Diagram
NO SCALE

DDC CONTROL PANEL INPUT/OUTPUT SUMMARY (TYPICAL FOR AHU-101 & AHU-102)

SYSTEM POINT	AI	AO	DI	DO	COMMENTS
CO2 RETURN AIR CARBON DIOXIDE SENSOR	X				
D-1 AHU-101/102 OUTSIDE AIR DAMPER (ECONOMIZER)	X	X			MODULATING, w/ POSITION FDBK
D-2 AHU-101/102 PRECONDITIONED OUTSIDE AIR DAMPER		X	X		OPEN/CLOSE, w/ END SWITCH
D-3 AHU-101/102 RETURN AIR DAMPER	X	X			MODULATING, w/ POSITION FDBK
D-4 AHU-101/102 SUPPLY DISCHARGE SMOKE ISOLATION DAMPER		X	X		OPEN/CLOSE, w/ END SWITCH
D-5 ECONOMIZER RELIEF DAMPER		X			MODULATING
DPS PUMP DIFFERENTIAL PRESSSURE SWITCH			2		
DPS-1 FILTER DIFFERENTIAL PRESSURE	X				
DPS-2 SUPPLY SMOKE ISOLATION DAMPER DIFFERENTIAL PRESSURE	X				
FMS-1 OUTSIDE AIR CFM (ECONOMIZER)	X				
FMS-2 SUPPLY FAN CFM (1 OF 2)	X				
FMS-2 SUPPLY FAN CFM (1 OF 2)	X				
FMS-4 RETURN AIR CFM	X				
HHL HIGH LIMIT HUMIDISTAT			3		
HS-1 OUTSIDE AIR HUMIDITY	X				
HS-2 MIXED AIR HUMIDITY	X				
HS-3 HEATING COIL DISCHARGE AIR HUMIDITY	X				
HS-4 SUPPLY AIR HUMIDITY	X				
HS-5 RETURN AIR HUMIDITY	X				
FZ-1 FREEZESTAT			X		
SD-1 SMOKE DETECTOR			X		
SD-2 SMOKE DETECTOR			X		
SP-1 OUTSIDE AIR STATIC PRESSURE SENSOR (ECONOMIZER)	X				
SP-2 RETURN FAN DISCHARGE STATIC PRESSURE SENSOR	X				
SP-3 RETURN AIR STATIC PRESSURE SENSOR	X				
SP-4 SUPPLY AIR STATIC PRESSURE SENSOR	X				
SP-5 SUPPLY AIR STATIC PRESSURE SENSOR	X				
SP-6 SUPPLY AIR STATIC PRESSURE SENSOR	X				
SP-7 SUPPLY AIR STATIC PRESSURE SENSOR	X				
SPH HIGH STATIC PRESSURE LIMIT			2		
SPL LOW STATIC PRESSURE LIMIT			2		
TS-1 OUTSIDE AIR TEMPERATURE	X				
TS-2 MIXED AIR TEMPERATURE	X				
TS-3 HEATING COIL DISCHARGE AIR TEMPERATURE	X				
TS-4 COOLING COIL DISCHARGE AIR TEMPERATURE	X				
TS-5 AHU-101/102 SUPPLY AIR DISCHARGE TEMPERATURE	X				
TS-6 RETURN AIR TEMPERATURE	X				
V-1 HEATING COIL VALVE		X			
V-2 HUMIDIFIER AUTOMATIC STEAM ISOLATION VALVE		X	X		TWO POSITION, w/ POSITION FDBK
V-3 HUMIDIFIER CONTROL VALVE		X			
V-4 COOLING COIL VALVE	X	X			MODULATING, w/ POSITION FDBK
START/STOP HW CIRCULATING PUMP	2		2		w/ CURRENT SENSOR
START/STOP SUPPLY FAN VFD	2		2		w/ CURRENT SENSOR
MODULATE SUPPLY FAN VFD SPEED		2			
SUPPLY FAN VFD FAULT			2		
START/STOP RETURN FAN VFD	X		X		w/ CURRENT SENSOR
MODULATE RETURN FAN VFD SPEED		X			
RETURN FAN VFD FAULT			X		

AFMS	AIR FLOW MEASURING STATION
ALM	ALARM
AQS	AQUASTAT
CO2	CARBON DIOXIDE SENSOR
CS	CURRENT SENSOR
D-#	CONTROL DAMPER
DAT	DISCHARGE AIR TEMPERATURE
DPS	DIFFERENTIAL PRESSURE SENSOR
EAD	EXHAUST AIR DAMPER
ES	END SWITCH
FM	FLOW METER
FMS	FLOW MEASURING STATION
FZ	FREEZESTAT
HCV	HEATING CONTROL VALVE
HHL	HUMIDITY HIGH LIMIT
HS	HUMIDITY SENSOR
HWRT	HOT WATER RETURN TEMPERATURE
HWST	HOT WATER SUPPLY TEMPERATURE
HV	HOOD EXHAUST AIR VALVE
ISOD	ISOLATION DAMPER
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
OAD	OUTSIDE AIR DAMPER
OAT	OUTSIDE AIR TEMPERATURE
OFS	OVERFLOW SWITCH
PSL	PRESSURE SWITCH LOW
SAD	SUPPLY AIR DAMPER
SAT	SUPPLY AIR TEMPERATURE
SD (S)	SMOKE DETECTOR (DUCT)
SP	STATIC PRESSURE SENSOR
SPH	STATIC PRESSURE HIGH
SPL	STATIC PRESSURE LOW
S/S	START/STOP
SV	SUPPLY AIR VALVE
T	THERMOSTAT OR TEMPERATURE SENSOR MOUNT 48" AFF UNLESS OTHERWISE NOTED
TS-#	TEMPERATURE SENSOR
TSTAT	THERMOSTAT OR TEMPERATURE SENSOR
V-#	CONTROL VALVE
VFD	VARIABLE FREQUENCY DRIVE
WS	WALL SWITCH

1 M701 Controls Legend
NO SCALE

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#	DESCRIPTION	DATE
1	Bulletin #28	03/21/2019

STEM BUILDING & CHEMISTRY ADDITION

The College of New Jersey
2000 Pennington Road
Ewing Township, NJ 08628-0718

ISSUED FOR CONSTRUCTION

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EYP PROJECT NO.:	1013016.01
CLIENT PROJECT NO.:	
DESIGNED BY:	RL
DRAWN BY:	RL
CHECKED BY:	AH

JOHN BOYER
NJ PROFESSIONAL ENGINEER
LICENSE NO. 24GE04938200

MECHANICAL CONTROL DIAGRAMS SHEET 1

M701

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GENERAL NOTE:

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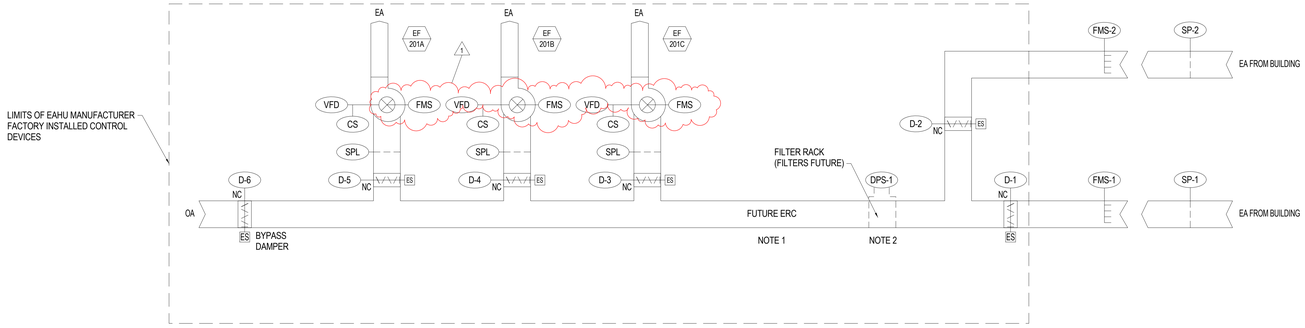
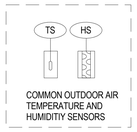




NOTES:

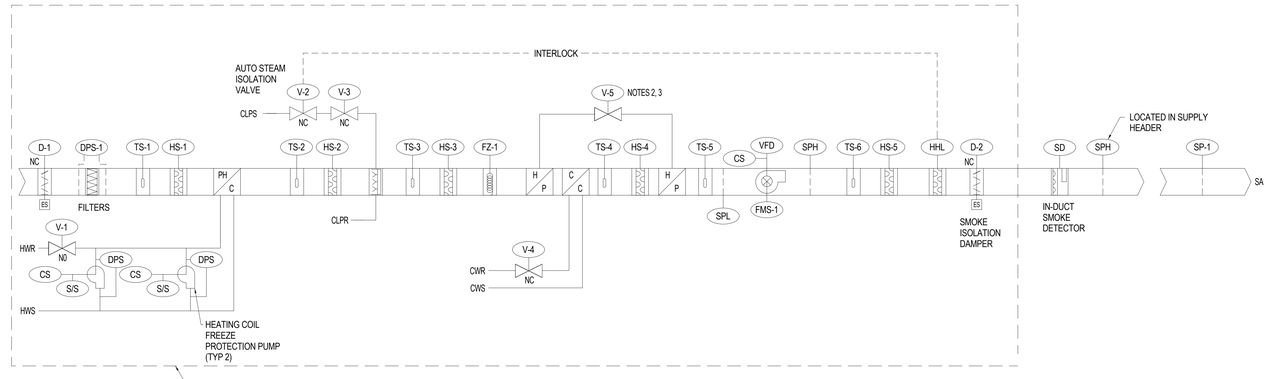
1.ERU-200 CASING ONLY. FILTERS AND ENERGY RECOVERY PROVIDED IN FUTURE. REFER TO PLANS AND DETAILS.
2.PROVIDE FULLY FUNCTIONAL DPS AT FILTER RACK FOR FUTURE FILTERS. BAS POINTS AND PROGRAMMING SHALL BE PROVIDED FOR FUTURE FILTER MONITORING.

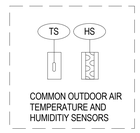
REFER TO SPECIFICATION SECTION 230993 FOR SEQUENCE OF OPERATION AND ALARMS

DDC CONTROL PANEL INPUT/OUTPUT SUMMARY

SYSTEM POINT	POINT AI	AO	DI	DO	COMMENTS
D-1 EXHAUST AIR DAMPER (1 OF 2)			X	X	OPEN/CLOSE, W/END SWITCH
D-2 EXHAUST AIR DAMPER (2 OF 2)			X	X	OPEN/CLOSE, W/END SWITCH
D-3 EXHAUST FAN 201A ISOLATION DAMPER			X	X	OPEN/CLOSE, W/END SWITCH
D-4 EXHAUST FAN 201B ISOLATION DAMPER			X	X	OPEN/CLOSE, W/END SWITCH
D-5 EXHAUST FAN 201C ISOLATION DAMPER			X	X	OPEN/CLOSE, W/END SWITCH
D-6 OUTDOOR AIR BYPASS DAMPER		X	X		MODULATING, W/END SWITCH
DPS-1 EXHAUST AIR FILTER DIFFERENTIAL PRESSURE	X				
FMS-1 CHEMISTRY ADDITION WEST EXHAUST MAIN CFM	X	X			
FMS-2 CHEMISTRY ADDITION EAST EXHAUST MAIN CFM	X	X			
SP-1 EXHAUST AIR STATIC PRESSURE SENSOR (FIRST FLOOR WEST)	X				
SP-2 EXHAUST AIR STATIC PRESSURE SENSOR (SECOND FLOOR EAST)	X				
SPL LOW STATIC PRESSURE LIMIT			3		
START/STOP EXHAUST FAN VFD	3			3	W/CURRENT SENSOR
EXHAUST FAN VFD HOA STATUS	3				
MODULATE EXHAUST FAN VFD SPEED		3			
EXHAUST FAN VFD FAULT			3		
EXHAUST FAN FMS	3				FROM FAN INLET PIEZOMETER

2 M702 Chemistry Addition Exhaust Control Diagram
NO SCALE





NOTES:

1.AHU CONTROL DIAGRAM TYPICAL FOR EACH OF TWO (2) AIR HANDLING UNITS AHU-201 & AHU-202. REFER TO PLANS.
2.FACTORY-PROVIDED V-5 SHALL THROTTLE HEAT PIPE REFRIGERANT FLOW TO MAINTAIN AHU DISCHARGE TEMP AS PER SA RESET CONTROL SEQUENCE.
3.REFRIGERANT HEAT PIPE PROVIDED AS ADD/ALTERNATE. TS-5 NOT REQUIRED FOR BASE BID.

1 M702 Chemistry Addition AHU-201 & 202 Control Diagram
NO SCALE

REFER TO SPECIFICATION SECTION 230993 FOR SEQUENCE OF OPERATION AND ALARMS

DDC CONTROL PANEL INPUT/OUTPUT SUMMARY (TYPICAL FOR AHU-201 AND AHU-202)

SYSTEM POINT	POINT AI	AO	DI	DO	COMMENTS
D-1 OUTDOOR AIR DAMPER			X	X	OPEN/CLOSE, W/END SWITCH
D-2 SUPPLY SMOKE ISOLATION DAMPER			X	X	OPEN/CLOSE, W/END SWITCH
DPS PUMP DIFFERENTIAL PRESSURE SWITCH			2		
DPS-1 SUPPLY AIR FILTER DIFFERENTIAL PRESSURE	X				
FMS-1 SUPPLY AIR FAN CFM	X	X			
FZ-1 FREEZESTAT			X		
HHL HUMIDITY HIGH LIMIT			X		
HS-1 PREHEAT COIL INLET AIR HUMIDITY	X				
HS-2 PREHEAT COIL DISCHARGE AIR HUMIDITY	X				
HS-3 HUMIDIFIER DISCHARGE AIR HUMIDITY	X				
HS-4 COOLING COIL DISCHARGE AIR HUMIDITY	X				
HS-5 SUPPLY AIR HUMIDITY	X				
SD-1 SUPPLY SMOKE DETECTOR			X		
SP-1 SUPPLY AIR STATIC PRESSURE SENSOR	X				
SPH HIGH STATIC PRESSURE LIMIT			2		
SPL LOW STATIC PRESSURE LIMIT			X		
TS-1 PREHEAT COIL INLET AIR TEMPERATURE	X				
TS-2 PREHEAT COIL DISCHARGE AIR TEMPERATURE	X				
TS-3 HUMIDIFIER DISCHARGE AIR TEMPERATURE	X				
TS-4 COOLING COIL DISCHARGE AIR TEMPERATURE	X				
TS-5 HEAT PIPE DISCHARGE AIR TEMPERATURE	X				HEAT PIPE PROVIDED AS ADD/ALTERNATE
TS-6 SUPPLY AIR TEMPERATURE					
V-1 PREHEAT COIL VALVE		X			
V-2 HUMIDIFIER AUTOMATIC STEAM ISOLATION VALVE		X	X		TWO POSITION, w/ POSITION FDBK
V-3 HUMIDIFIER CONTROL VALVE		X			
V-4 COOLING COIL VALVE	X	X			MODULATING, w/ POSITION FDBK
V-5 HEAT PIPE REFRIGERANT THROTTLING VALVE		X			HEAT PIPE PROVIDED AS ADD/ALTERNATE
START/STOP HW CIRCULATING PUMP	2			2	W/CURRENT SENSOR
START/STOP SUPPLY FAN VFD	X			X	W/CURRENT SENSOR
SUPPLY FAN VFD HOA STATUS	X				
MODULATE SUPPLY FAN VFD SPEED		X			
SUPPLY FAN VFD FAULT			X		
START/STOP STEAM HUMIDIFIER				X	HARDWIRE TO HUMIDIFIER CONTROL PANEL
HUMIDIFIER FAULT			X		HARDWIRE FROM HUMIDIFIER CONTROL PANEL
HUMIDIFIER DEMAND SIGNAL		X			HARDWIRE TO HUMIDIFIER CONTROL PANEL

DDC CONTROL PANEL INPUT/OUTPUT SUMMARY (PENTHOUSE VENTILATION)

SYSTEM POINT	POINT AI	AO	DI	DO	COMMENTS
START/STOP SUPPLY FAN				X	
FAN STATUS	X				VIA CURRENT SENSOR
TS-7 ROOM TEMPERATURE	X				
D-3 CHEM PENTHOUSE RELIEF AIR DAMPER		X			MODULATING
D-4 CHEM PENTHOUSE SUPPLY AIR DAMPER			X	X	OPEN/CLOSE, W/END SWITCH
DPS-2 CHEM PENTHOUSE DIFFERENTIAL PRESSURE	X				

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MECHANICAL CONTROL DIAGRAMS SHEET 2

M702

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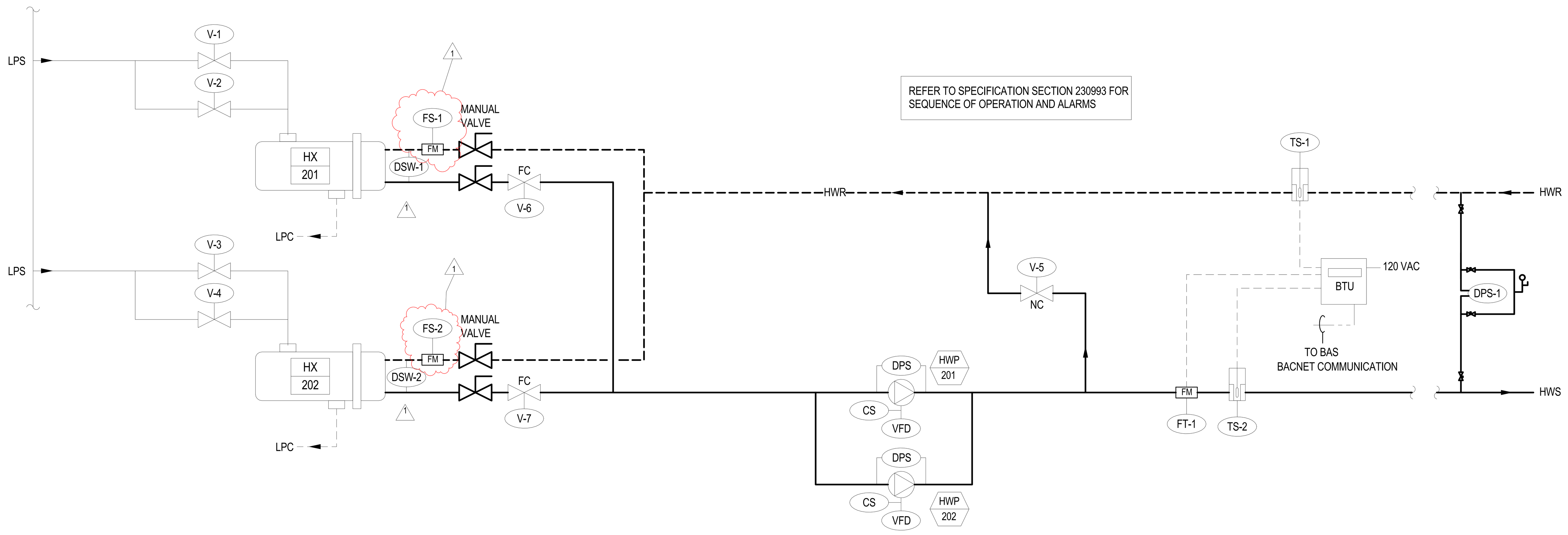

DDC CONTROL PANEL INPUT/OUTPUT SUMMARY

SYSTEM POINT	HARDWARE POINT AI	AO	DI	DO	COMMENTS
DPS-1 CHEMISTRY ADDITION HEATING WATER DIFFERENTIAL PRESSURE	X				
TS-1 CHEMISTRY ADDITION HEATING WATER SUPPLY TEMPERATURE	X				
TS-2 CHEMISTRY ADDITION HEATING WATER RETURN TEMPERATURE	X				
V-1 STEAM CONTROL VALVE (1/3)		X			
V-2 STEAM CONTROL VALVE (2/3)		X			
V-3 STEAM CONTROL VALVE (1/3)		X			
V-4 STEAM CONTROL VALVE (2/3)		X			
V-5 DIFFERENTIAL PRESSURE CONTROL VALVE		X			
V-6 HX-201 HW ISOLATION VALVE		X			
V-7 HX-202 HW ISOLATION VALVE		X			
DPW-1/2 HW FLOW DIFFERENTIAL PRESSURE SWITCH			2	1	
START/STOP HEATING WATER PUMP (HWP-201, 202) VFD				2	
HEATING WATER PUMP (HWP-201, 202) STATUS	2				
MODULATE HEATING WATER PUMP VFD SPEED		2			
HEATING WATER PUMP (HWP-201, 202) VFD FAULT			2		

DDC CONTROL PANEL INPUT/OUTPUT SUMMARY (cont'd)

SYSTEM POINT	HARDWARE POINT AI	AO	DI	DO	COMMENTS
FT-1 CHEMISTRY ADDITION HEATING WATER FLOW	X				
BTU METER HEAT RATE (BTU/HR)	X				
BTU METER PEAK DEMAND (BTU/HR)	X				
BTU METER TOTAL HEAT (BTU)	X				
FS-1 CHEMISTRY ADDITION HX-201 FLOW SWITCH			X		
FS-2 CHEMISTRY ADDITION HX-202 FLOW SWITCH			X		

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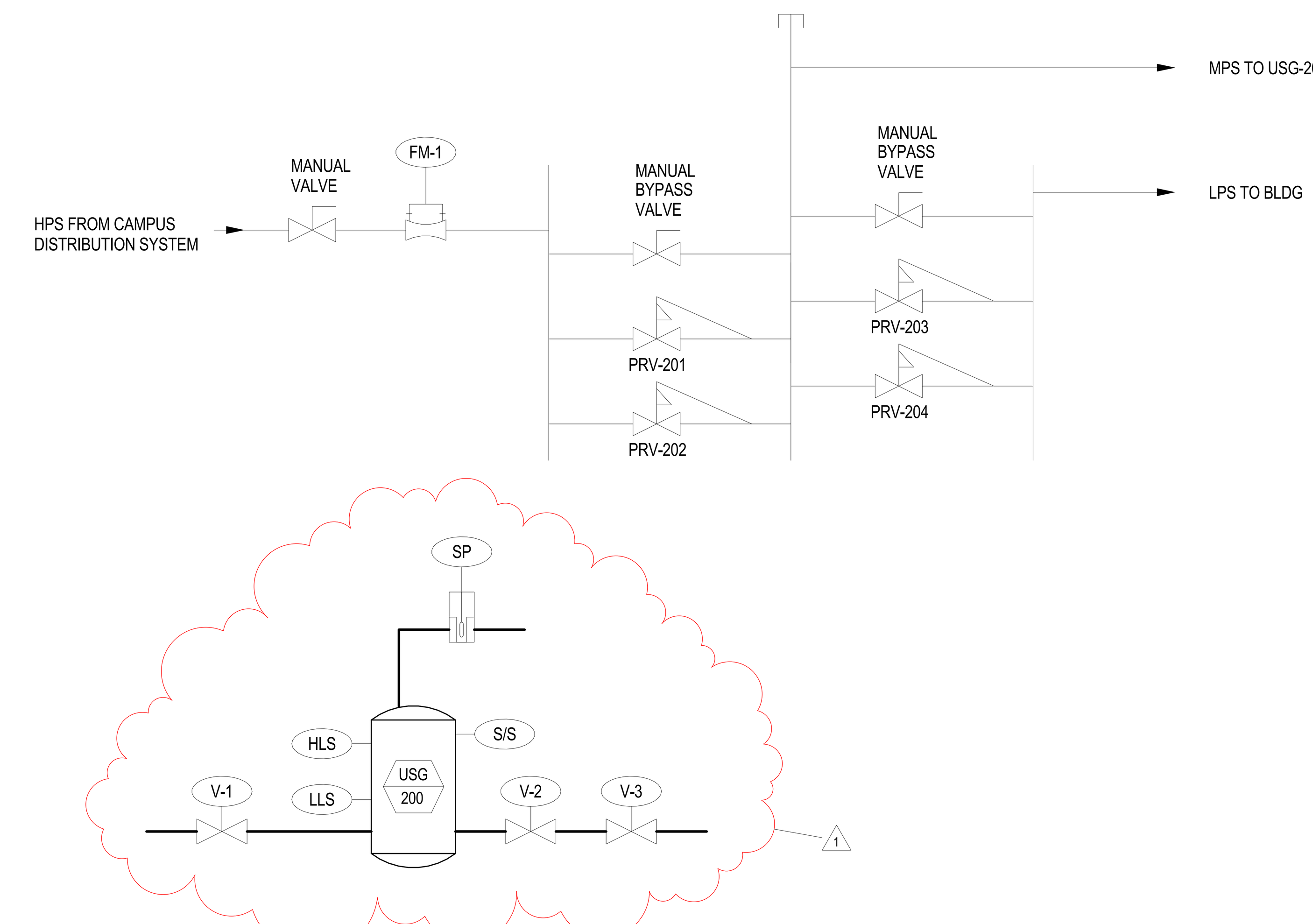
GENERAL NOTE:

ALL FACTORY INSTALLED DEVICES, BOTH HARDWARE AND SOFTWARE, SHALL BE ACCESSIBLE (READ/WRITE) FROM THE EXISTING HONEYWELL ENTERPRISE BUILDING INTEGRATOR (EBI) SYSTEM. THE CONTROLS VENDOR SHALL PROVIDE ALL NECESSARY SOFTWARE AND HARDWARE, INCLUDING BACnet/IP ROUTERS AND ALL REQUIRED PROGRAMMING TO ALLOW COMMUNICATION BETWEEN THE BUILDING SYSTEM CONTROLLERS AND THE CAMPUS WIDE EBI SYSTEM. TYPICAL ALL EQUIPMENT.

4 M704 **Chemistry Addition Hot Water System Control Diagram**
NO SCALE

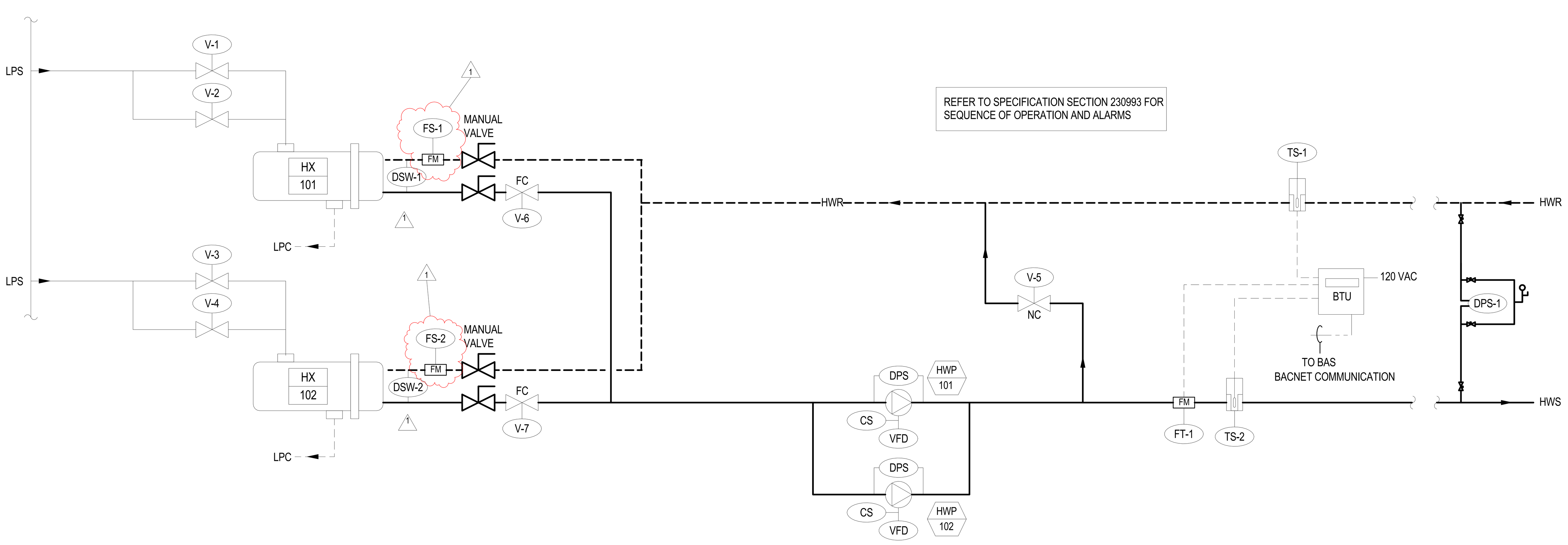


REFER TO SPECIFICATION SECTION 230993 FOR SEQUENCE OF OPERATION AND ALARMS

DDC CONTROL PANEL INPUT/OUTPUT SUMMARY

SYSTEM POINT	HARDWARE POINT AI	AO	DI	DO	COMMENTS
FM-1 STEAM FLOW METER	X				
USG ENABLE START/STOP				X	
CLEAN STEAM SUPPLY PRESSURE SETPOINT		X			BAS SEND TO USG CONTROLLER
CLEAN STEAM SUPPLY PRESSURE	X				
V-1 MEDIUM PRESSURE STEAM CONTROL VALVE STATUS			X		FROM USG CONTROLLER
V-1 MEDIUM PRESSURE STEAM CONTROL VALVE POSITION	X				FROM USG CONTROLLER
V-2 RO FEEDWATER VALVE STATUS			X		FROM USG CONTROLLER
LIQUID HIGH LEVEL SWITCH			X		FROM USG CONTROLLER
LIQUID LOW LEVEL SWITCH			X		FROM USG CONTROLLER
V-3 HIGH WATER LEVEL SOLENOID SHUTOFF			X		FROM USG CONTROLLER

2 M704 **Chemistry Addition Steam System Control Diagram**
NO SCALE



DDC CONTROL PANEL INPUT/OUTPUT SUMMARY

SYSTEM POINT	HARDWARE POINT AI	AO	DI	DO	COMMENTS
DPS-1 STEM BUILDING HEATING WATER DIFFERENTIAL PRESSURE	X				
TS-1 STEM BUILDING HEATING WATER SUPPLY TEMPERATURE	X				
TS-2 STEM BUILDING HEATING WATER RETURN TEMPERATURE	X				
V-1 STEAM CONTROL VALVE (1/3)		X			
V-2 STEAM CONTROL VALVE (2/3)		X			
V-3 STEAM CONTROL VALVE (1/3)		X			
V-4 STEAM CONTROL VALVE (2/3)		X			
V-5 DIFFERENTIAL PRESSURE CONTROL VALVE		X			
V-6 HX-101 HW ISOLATION VALVE		X			
V-7 HX-102 HW ISOLATION VALVE		X			
DPW-1/2 HW FLOW DIFFERENTIAL PRESSURE SWITCH			2	1	
START/STOP HEATING WATER PUMP (HWP-101, 102) VFD				2	
HEATING WATER PUMP (HWP-101, 102) STATUS	2				
MODULATE HEATING WATER PUMP VFD SPEED		2			
HEATING WATER PUMP (HWP-101, 102) VFD FAULT			2		

DDC CONTROL PANEL INPUT/OUTPUT SUMMARY (cont'd)

SYSTEM POINT	HARDWARE POINT AI	AO	DI	DO	COMMENTS
FT-1 STEM BUILDING HEATING WATER FLOW	X				
BTU METER HEAT RATE (BTU/HR)	X				
BTU METER PEAK DEMAND (BTU/HR)	X				
BTU METER TOTAL HEAT (BTU)	X				
FS-1 STEM BUILDING HX-101 FLOW SWITCH			X		
FS-2 STEM BUILDING HX-102 FLOW SWITCH			X		

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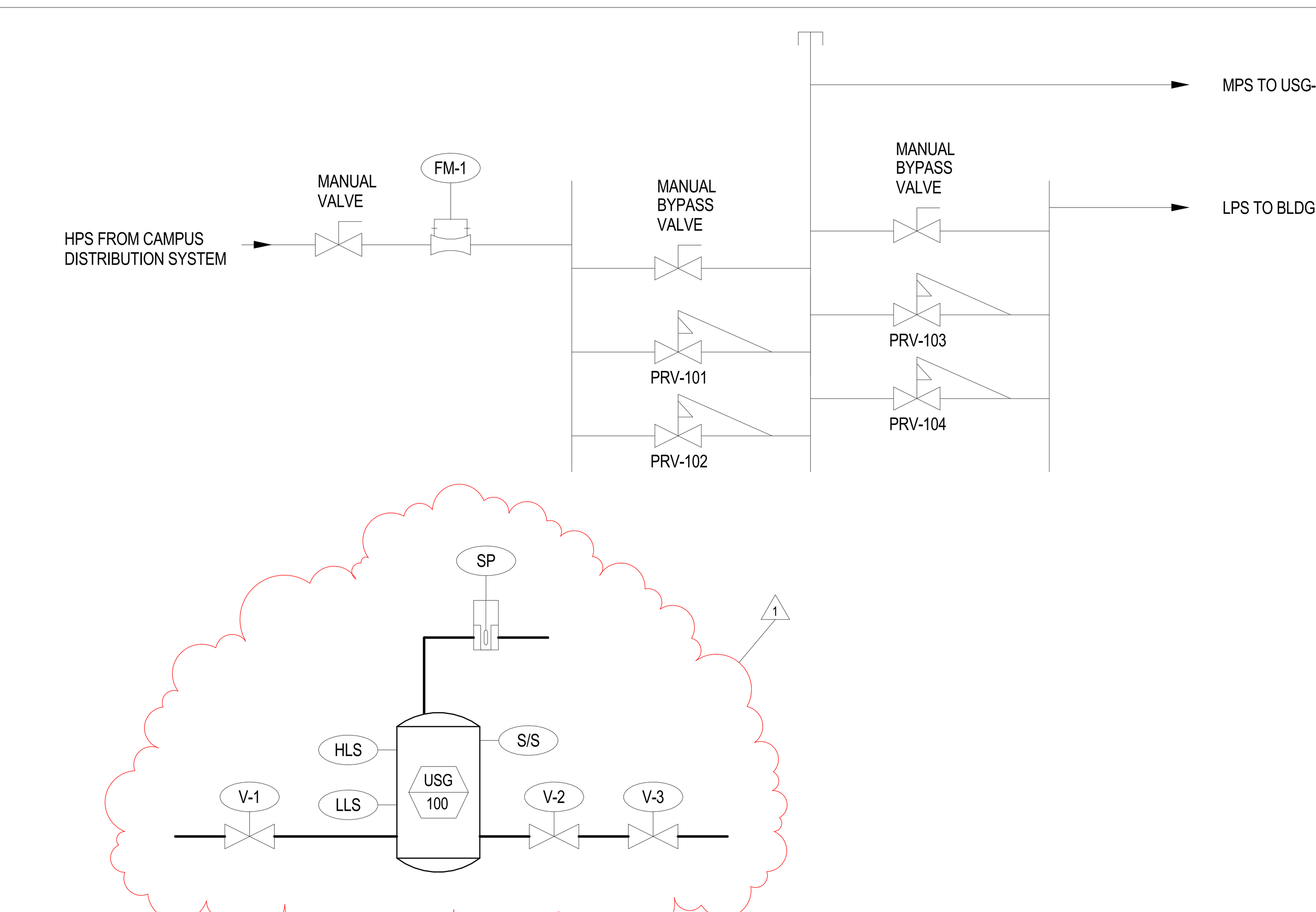
3 M704 **STEM Building Hot Water System Control Diagram**
NO SCALE



REFER TO SPECIFICATION SECTION 230993 FOR SEQUENCE OF OPERATION AND ALARMS

DDC CONTROL PANEL INPUT/OUTPUT SUMMARY

SYSTEM POINT	HARDWARE POINT AI	AO	DI	DO	COMMENTS
FM-1 STEAM FLOW METER	X				
USG ENABLE START/STOP				X	
CLEAN STEAM SUPPLY PRESSURE SETPOINT		X			BAS SEND TO USG CONTROLLER
CLEAN STEAM SUPPLY PRESSURE	X				
V-1 MEDIUM PRESSURE STEAM CONTROL VALVE STATUS			X		FROM USG CONTROLLER
V-1 MEDIUM PRESSURE STEAM CONTROL VALVE POSITION	X				FROM USG CONTROLLER
V-2 RO FEEDWATER VALVE STATUS			X		FROM USG CONTROLLER
LIQUID HIGH LEVEL SWITCH			X		FROM USG CONTROLLER
LIQUID LOW LEVEL SWITCH			X		FROM USG CONTROLLER
V-3 HIGH WATER LEVEL SOLENOID SHUTOFF			X		FROM USG CONTROLLER

1 M704 **STEM Building Steam System Control Diagram**
NO SCALE

EYP/
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New York, NY 10014
Telephone 917 981 6000
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eypae.com

#	DESCRIPTION	DATE
1	Bulletin #28	03/21/2019

STEM BUILDING & CHEMISTRY ADDITION

The College of New Jersey
2000 Pennington Road
Ewing Township, NJ 08628-0718

ISSUED FOR CONSTRUCTION

DATE:	15 MAY 2015
SCALE:	12" = 1'-0"
EYP PROJECT NO.:	1013016.01
CLIENT PROJECT NO.:	
DESIGNED BY:	RL
DRAWN BY:	RL
CHECKED BY:	AH

JOHN BOYER
NJ PROFESSIONAL ENGINEER
LICENSE NO. 24GE04938200

MECHANICAL CONTROL DIAGRAMS SHEET 4

M704