



REQUEST

FOR

BIDS

BUILDING AUTOMATION AND

CONTROLS SYSTEM

at

GREAT BAY COMMUNITY COLLEGE

30 Corporate Drive, Portsmouth, NH 03801

A COMPONENT OF THE

Community College System of New Hampshire

Project# GBC 19-02

FEBRUARY 26, 2019

DOCUMENT 00015

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END OF SECTION

SECTION 00010 - INVITATION TO BID – CCSNH

Electronic Bids per the Project Manual Technical Specifications will be accepted by email to Matthew Moore, Director of Capital Planning and Development at memoore@ccsnh.edu until **Tuesday, March 19th, 2019 at 3:00pm** for the following project:

**Building Automation and Controls System
At Great Bay Community College
320 Corporate Drive, Portsmouth, NH 03801
A component of the Community College System of New Hampshire
26 College Drive, Concord, NH
Project # GBC 19-02**

Description: This project involves furnishing, installing, configuring, and testing a new campus-wide Building Automation System (BAS) with graphical user interface for the Great Bay Community College Campus (Main Building, Student Success Center, and Maintenance Building).

Plans and specifications will be available from the Community College System of New Hampshire, **February 26, 2019 on the CCSNH website** www.ccsnh.edu/open-bids

Plans and specifications will also be available at the following printers:

- Signature Press and Blueprinting, Inc., 45 Londonderry Turnpike, Rte. 28 Bypass, Hooksett, NH 03106;
- Construction Summary of NH: Inc., 734 Chestnut Street, Manchester, NH 03104;
- Infinite Imaging: 933 Islington Street, Portsmouth, NH 03801
- McGraw-Hill Construction, Dodge Plan Room: 880 Second Street, Manchester, NH 03102;
- Minuteman Press: 109 Gosling Road, Newington, NH 03801;
- Works in Progress, 20 Farrell Street, Suite 103, South Burlington, VT 05403
- Community College System of New Hampshire website
www.ccsnh.edu/open-bids

BIDDERS SHOULD ACT PROMPTLY AND SUBMIT ALL QUESTIONS IN WRITING TO: MATTHEW MOORE, DIRECTOR OF CAPITAL PLANNING AND DEVELOPMENT, E-MAIL memoore@ccsnh.edu .

A mandatory site visit will not be held, to schedule a non-mandatory visit contact Dylan Follansbee at dfollansbee@ccsnh.edu (603)427-7642.

Project substantial completion date is **August 1, 2019.**

Proposals must be completed in both words and figures on forms furnished by the College, or on previously-approved, substantially-identical forms generated by computer software, which shall be submitted electronically in an e-mail titled: **“Bid for: GBC 19-02 GBCC Building Automation and Controls System ”** received by MATTHEW MOORE at memoore@ccsnh.edu as specified no later than **3:00 PM, Tuesday, MARCH 19th, 2019.**

Companies, corporations or trade names, except sole proprietorships must be registered with the Secretary of State (Corporate Division, Telephone No. 603/271-3244) in order to do business with the State of New Hampshire.

Bidders must show three recent years' experience with installations of a similar complexity and cost and prior experience with installations of the materials within 50 miles of the project site.

The successful bidder will be required to comply with State of New Hampshire RSA#21-1:81-a. The successful bidder will be required to furnish a 100% payment and 100% performance bond prior to execution of contract.

The award will be based on the proposal that best meets the needs of the college. Factors included will be the cost, completeness of the proposal, quality of the technology provided, and experience of the contractor and installation team. The college reserves the right to waive any informality in or to reject any or all proposals.

Category	Possible Points*
1. Cost of Base Proposal	70
2. Quality of the related projects/areas of expertise/experience	30
<hr/>	
Grand Total	100*

***Maximum points for the best and so forth. Difference between scores is based on how close they are to one another.**

The College reserves the right to waive any and all informalities in its best interest.

All contract documents can be found on the CCSNH website at www.ccsnh.edu/open-bids. Before your submission, always check for any addenda or other materials that may have been issued which would affect the invitation to bid by checking the CCSNH website at www.ccsnh.edu/open-bids.

The right is reserved to waive any informalities in or to reject any or all proposals.



Matthew Moore, PE,
Director of Capital Planning & Development
Community College System of New Hampshire

END OF DOCUMENT

DOCUMENT 001153 - REQUEST FOR QUALIFICATIONS

1.1 PURPOSE, LAWS, AND REGULATIONS

- A. The purpose of the Prequalification Procedure described in this Document is to provide Owner with a mechanism to evaluate and determine whether Prospective Bidders are qualified to participate in the construction of Project. Evaluation will be limited to that office of the Prospective Bidder that is proposed to perform the Work.

1.2 DEFINITIONS

- A. Prospective Bidder: A Prospective Bidder is a person or entity who submits a Submittal of Qualifications to Owner.

1.3 QUALIFICATION PROCEDURES

- A. Prospective Bidders shall complete all required forms and attachments described in the Prequalification Documents, entering "Not Applicable" where information does not apply. Absence of any of the forms included in the Prequalification Documents will be reason for possible disqualification.
- B. Status of Prospective Bidders:
 - 1. Proprietors submitting bids shall indicate their status as proprietors.
 - 2. Prospective Bidders submitting qualifications for partnerships shall indicate their status as partners and shall submit a certified copy of the power of attorney authorizing the executor of the submittal to bind the partnership.
 - 3. Prospective Bidders submitting qualifications for corporations shall indicate their status as corporations and shall submit a certified copy of the board of directors' authorization for the Prospective Bidder to bind the corporation and shall affix the corporate seal on the submittal.
 - 4. Prospective Bidders shall provide the following:
 - a. Names and addresses of proprietors, of all members of a partnership, or of the corporation's officers.
 - b. Name of jurisdiction where the partnership is registered or where the corporation is incorporated. Corporations must be licensed to do business in Project state at the time of executing the Contract.

1.4 WITHDRAWAL

- A. A Qualification Statement may be withdrawn on personal request received from the Prospective Bidder.

1.5 QUALIFICATION STATEMENT

- A. The undersigned submits answers to the following questions to enable the Community College System of New Hampshire to judge experience and ability in the work proposed to be done.

1. The work, if awarded to you, will have the resident personal supervision of whom? State his/her name, title, and their special qualifications.

2. (a) Provide a brief history of your firm. (b) Demonstrate that your firm has provided satisfactory work on similar projects.

a) _____

b) _____

3. How many years has your organization been in business as a contractor under the name in which you propose to execute this contract?

4. Has your present organization ever failed to complete any work awarded to it? If so, state when, where and why:

5. Provide three (3) Examples of Experience with full responsibility for work of a similar size to this project and within 50 miles of the project site.

Qualifications to perform the work: List Three**Experience with full responsibility for work of a similar size and within 50 miles of the project site.****Bidders are to provide evidence of qualifications with the bid.**

NAME OF REFERENCE PROJECT _____

Location of Project _____

Date work performed _____

Name of Owner
Contact Name & Phone Number _____

Description of Project _____

Approx. Contract value _____

NAME OF REFERENCE PROJECT _____

Location of Project _____

Date work performed _____

Name of Owner
Contact Name & Phone Number _____

Description of Project _____

Approx. Contract value _____

NAME OF REFERENCE PROJECT _____

Location of Project _____

Date work performed _____

Name of Owner
Contact Name & Phone Number _____

Description of Project _____

Approx. Contract value _____

DOCUMENT 00204

INSTRUCTIONS TO BIDDERS – Community College System of New Hampshire (CCSNH)
Issued 2-05-2004; Revised as noted

Revised 4/17/18

PART	ITEM
1	DEFINITIONS
2	PREPARATION AND SUBMISSION OF BIDS
3	RECEIPT AND OPENING OF BIDS
4	WITHDRAWAL OF BIDS
5	PROPOSAL GUARANTY (intentionally omitted)
6	CONDITIONS AT SITE OR BUILDING
7	EXPLANATION TO BIDDERS
8	REJECTION OF BIDS
9	CONTRACT BOND
10	CONTRACTOR'S AND SUBCONTRACTOR'S INSURANCE
11	BIDDING DOCUMENTS
12	SUBSTITUTIONS
13	AWARD OF CONTRACT
14	PERMITS AND FEES

PART 1 DEFINITIONS

- 1.1 Refer to Document 00708: General Conditions – CCSNH:

PART 2 PREPARATION AND SUBMISSION OF BIDS

- 2.1 The Bidder is required to bid on all items called for in the Proposal. If Alternates are included, the Bidder shall set forth in the space provided the amount to be added to or deducted from the Lump Sum Base Bid or the Lump Sum Grand Total. If an Alternate called for does not involve a change in price, the Bidder shall so indicate in the space provided.
- 2.2 Bids shall be submitted upon the Proposal Form furnished and shall be signed in ink. The Bidder shall specify a unit price, both in words and figures, for each item called for in the Lump Sum Grand Total Proposal. All of the words and figures shall be in ink or typed. If a unit price or a Lump Sum Grand Total already entered by the Bidder on the Proposal Form is to be altered, it should be crossed out with ink, the new unit price and the Lump Sum Grand Total bid entered above or below it and initialed by the Bidder; also in ink. In case of discrepancy between the prices written in words and those written in figures, the prices written in words shall govern. Bids containing any conditions, omissions, unexplained erasures or alterations, or items not called for in the Proposal or irregularities of any kind may be rejected by the Chancellor as being incomplete non-conforming, or non-responsive.
- 2.3 Each bid must contain the full business address of the Bidder and be signed by him/her with his/her usual signature.
- A. Bids by a partnership of any form must furnish the full names of all partners, and must be signed in the partnership name by one of the members of the partnership or by an authorized representative, followed by the designation of the person signing. All Contracts with partnerships must include a certificate of authorization demonstrating that the partner(s) or authorized individuals have been authorized by the partnership to enter into the Contract on behalf of the partnership.
- B. Bids by a corporation of any form must be signed with the legal name of the corporation, followed by the name of the State of incorporation and by the signature and designation of the president, secretary or other person authorized to bind it in the matter. The name of each person signing shall also be typed or printed below the signature. *[A bid by a person who affixes to his/her signature, the word "President," "Secretary," "Agent" or other designation, without disclosing whom he/she is representing if other than the contracting entity noted above, may be held to the bid of the individual signing.]*
- C. Bids by proprietorships (individuals), or by individuals with a registered trade name, or doing business under an assumed name (aka d/b/a), shall be executed by the individual in their name, with reference to the trade name or assumed name.

- 2.4 Bids to be scanned and transmitted by electronic mail to memmoore@ccsnh.edu no later than the bid deadline.

PART 3 RECEIPT AND OPENING OF BIDS

- 3.1 The bid opening officer will decide when the specified time has arrived, and no bid received or presented thereafter will be considered. No responsibility or liability will be attached to any officer for the premature opening of a bid not properly addressed and identified.

PART 4 WITHDRAWAL OF BIDS

- 4.1 A bid may be withdrawn upon written request received from the bidder at the Director of Capital Planning and Development office at 26 College Drive, Concord, NH 03301-7407, with reasonable time prior to the time fixed for opening. Negligence on the part of the bidder in preparing the bid confers no right for the withdrawal of the bid after it has been opened.

PART 5 PROPOSAL GUARANTY (intentionally omitted)

PART 6 CONDITIONS AT SITE OR BUILDING

- 6.1 Bidders shall visit the site and be responsible for having ascertained pertinent local conditions; such as location, accessibility and general character of the site or building, the character and extent of existing work within or adjacent to the site, and any other work being performed thereon at the time of submitting the bid.

PART 7 EXPLANATION TO BIDDERS

- 7.1 No oral explanation in regard to the meaning of the Bidding Documents will be made and no oral instructions will be given before the award of the Contract. Discrepancies, omissions or doubts as to the meanings of Bidding Documents shall be communicated in writing to the Director of Capital Planning and Development for interpretation no later than five (5) working days before the hour and date set for the bid opening. Any interpretations will be in the form of an Addendum to the Bidding Documents that will be forwarded to all Bidders of record and sent to all other locations identified in the Invitation to Bid where documents are made available.

PART 8 REJECTION OF BIDS

- 8.1 The Chancellor reserves the right to reject any or all bids, to waive technicalities or to advertise for new bids, if in his/her judgment, the best interests of the State will be promoted thereby. The Chancellor reserves the right to reject the bid of a Bidder who is not in a position to perform the Contract.
- 8.2 The Chancellor reserves the right to waive any informality in bids received, if in the best interest of the CCSNH.
- 8.3 The Chancellor reserves the right to reject any Bidders not meeting all stated requirements.

PART 9 CONTRACT BOND

- 9.1 The successful Bidder, at the time of the execution of the Contract, must deposit with the Chancellor, Surety in the sum equal to one hundred percent (100%) of the amount of the Contract as required by RSA 447:16. The form of Bond shall be that provided for by the CCSNH and the Surety shall be acceptable to the Chancellor. The Contract Bond must be written by a Company licensed to do business in New Hampshire at the time the policy is issued. In addition, the Company issuing the bond shall be listed on the current list of "Surety Companies Acceptable on Federal Bonds" as published by the U.S. Department of the Treasury, Financial Management Services, Circular Number 570. see <http://www.fms.treas.gov/c570/index.html>

PART 10 CONTRACTOR'S AND SUBCONTRACTOR'S INSURANCE

- 10.1 The Contractor shall deliver to the Chancellor at the time of submitting a signed Contract, certificates of all insurance required hereunder. The certificates of insurance shall contain a description of the project, including the project name and number, and shall state that the companies issuing insurance will mail to the Chancellor thirty (30) days notice of cancellation, alteration of material change of any listed policies or ten (10) days in cases of non-payment of premium. The Contractor shall keep in force the insurance required herein for the period of the Contract, through the Warranty period, and Owners and Contractors Protective (OCP) Liability coverage shall be kept in force through the date of Substantial Completion, or longer at the Director of Capital Planning and Development's direction. The Contractor shall have a continuing duty to provide new certificates of insurance as policies are amended or renewed. At the request of the Chancellor, the Contractor shall promptly make available a copy of any and all listed insurance policies. The required insurance must be written by a Company licensed to do business in the State of New Hampshire at the time the policy is issued. In addition, the company must have a rating of no less than A- based on the current A.M. Best with a size of VIII and satisfying and the terms and conditions described below or the minimum limits required of the Prime Contractor under the Contract Documents.
- 10.2 Prior to the start of the Contractor's Work, the Contractor and any subcontractors, consultants or third parties approved to perform Services pursuant to this contract, will carry, in full force and effect during the entire term of this Agreement, insurance with a carrier rated at minimum "A-" by A.M. Best with a size of VIII and satisfying and the terms and conditions described below or the minimum limits required of Prime Contractor under the Contract Documents.
- A. Commercial General Liability (CGL) with limits of Insurance of not less than \$1,000,000 each occurrence and \$2,000,000 Annual Aggregate.
- .1) If the CGL coverage contains a General Aggregate Limit, such General Aggregate shall apply separately to each project.
 - .2) CGL coverage shall be written on ISO Occurrence form CG 00 01 (10/93) or a substitute form providing equivalent coverage and shall cover liability arising from premises, operations, independent contractors, products- completed operations, and personal and advertising injury.
 - .3) Owner and all other parties required of the Contractor, shall be included as insured's on the CGL, using ISO Additional Insured Endorsement CG 20 10 (11/85) or CG 2010 (10/93) **AND** CG 20 37 (10/01) or CG2033(10/01) **AND** CG2037 (10/01) or an endorsement providing equivalent coverage to the additional insured's. This insurance for the additional insured's shall be as broad as the coverage provided for the named insured Contractor. It shall apply as Primary and non-contributing Insurance before any other insurance or self-insurance, including any deductible, maintained by, or provided to, the additional insured.
 - .4) Contractor shall maintain CGL coverage for itself and all additional insured's for the duration of the project and maintain Completed Operations coverage for itself and each additional insured for at least 7 years after completion of the Work.

- .5) If Contractor is performing snow removal the policy must include the addition of CG 22 92 12 07 for Snow Removal Operations Coverage or equivalent

10.3 Commercial Automobile Liability

- .1) Business Auto Liability with limits of at least \$1,000,000 for each accident.
- .2) Business Auto coverage must include coverage for liability arising out of all owned, leased, hired and non-owned automobiles.
- .3) Owner and all other parties required of the Contractor, shall be included as additional insured's on the auto policy.

10.4 Commercial Umbrella

- .1) Umbrella limits must be at least \$2,000,000.
- .2) Umbrella coverage must include as insured's all entities that are additional insured's on the CGL and coverage shall be as broad as provided on the underlying coverages.

10.5 Workers Compensation and Employers Liability

- .1) Employers Liability Insurance limits of at least \$500,000 each accident for bodily injury by accident and \$500,000 each employee for injury by disease.
- .2) Where applicable, U.S. Longshore and Harborworkers Compensation Act Endorsement shall be attached to the policy.
- .3) Where applicable, the Maritime Coverage Endorsement shall be attached to the Policy.
- .4) All employees, including the Owner, partners and officers, shall provide proof of workers' compensation coverage prior to working on the job site.

10.6 Waiver of Subrogation

- .1) To the fullest extent permitted by law, Contractor waives all rights against Owner and Architect and their agents, officers, directors and employees for recovery of damages to the extent these damages are covered by commercial general liability, commercial umbrella liability, business auto liability or workers compensation and employers liability insurance where acceptable by law.

10.7 Pollution Liability Insurance

- .1) Pollution Limits with at least \$1,000,000 each occurrence, claim or wrongful act with an aggregate of \$1,000,000 for bodily injury, property damage, pollution or environmental harm arising out of the work, asbestos, lead, or silica related claims, claims arising out of microbial matter or bacteria, testing, monitoring, measuring operations or laboratory analyses, or liability arising out of treatment facility. If a motor vehicle is used in connection with the work,

the business automobile policy will include coverage at least as broad as ISO CA 99 48 and be endorsed to include Motor Carrier Act Endorsement MCS 90.

.2) The policy must meet all other insurance requirements applicable to general liability, including, but not limited to additional insured, waiver of subrogation and cancellation notification.

.3) If there is a retroactive date, claims made will apply back to the first date of services provided to the Owner.

.4) The coverage shall be effective for 5 years following completion of the engagement.

.5) Proof of Pollution Liability Insurance shall be provided on a certificate acceptable to the Owner.

- 10.8 Attached to each certificate of insurance shall be a copy of the Additional Insured Endorsement that is part of the Contractor's Commercial General Liability Policy. These certificates and the insurance policies required shall contain a provision that coverage afforded under the policies will not be canceled or allowed to expire until at least 30 days prior written notice has been given to the Owner. Any subcontractors, consultants or third parties performing services for Contractor as contemplated herein, shall also maintain insurance as required above. Notwithstanding the foregoing, the Owner, in its sole and absolute discretion and taking into account the scope and character of the Services to be provided by Contractor, may reduce the required liability insurance minimums. Such reduction in the required liability insurance minimum of Contractor

shall be evidence by a written instrument specifically referencing this Exhibit I and signed by the Owner.

- 10.9 The Contractor shall require each Subcontractor employed on the Project to maintain the coverage listed above unless the Contractor's insurance covers activities of the Subcontractor on the Project.
- 10.10 No operations under this Contract shall commence until certificates of insurance attesting to the above listed requirements have been filed with the Chancellor and a Notice to Proceed is issued.
- A. If blasting and/or demolition is required by the Contract, the Contractor or subcontractor shall obtain the respective coverage for those activities, and shall furnish to the Chancellor a Certificate of Insurance evidencing the required coverages prior to commencement of any operations involving blasting or demolition or both.
- B. From time to time, CCSNH may ask the contractor to secure Owner's and Contractor's Protective Liability (OCP) coverage for the benefit of the Community College System of New Hampshire.
1. Limits of Liability:
- a. \$2,000,000 Each Occurrence
- b. \$3,000,000 Aggregate
- ***** [OR] *****
- c. \$2,000,000 Bodily Injury & Property
- C. Property and Builder's Risk Insurance (Fire and Extended Coverage):
1. The Community College System of New Hampshire shall insure the work included in the Contract, including extras and change orders, on an "All Risk" basis, on one hundred percent (100%) completed value basis of the Contract, as modified. Builder's Risk coverage shall include materials located at the Contractor's premises, on-site, in-transit, and at any temporary site. The policy by its own terms or by endorsement shall specifically permit partial or beneficiary occupancy prior to completion or acceptance of the entire work. The policies shall be in the names of the Community College System of New Hampshire and the Contractor. The policies shall provide for the inclusion of the names of all other Contractors, Subcontractors, and others employed on the premises as insureds. The policies shall stipulate that the insurance companies shall have no right of subrogation against any Contractors, Subcontractors or other parties employed on the premises.
2. CCSNH is not responsible to insure Contractor's owned or leased equipment/property.
- D. General Insurance Conditions
1. Failure to secure and maintain, or add by endorsement, Owner and all subsidiaries, agents, and employees as required shall not act as a defense to the enforcement of the terms of this Contract. Any such insurance policy shall apply separately to each insured against whom claim is made or suit is brought and shall contain no provision which excludes coverage of a claim made by one insured under the policy against another insured under the policy.
2. Each policy shall contain a clause prohibiting cancellation or modifications of the policy earlier than thirty (30) days or ten (10) days in cases of non-payment of premium after written notice thereof has been received by CCSNH.

E. Indemnification:

1. To the fullest extent of the law the Contractor shall indemnify, defend, and hold harmless the Community College System of New Hampshire, its Officers, and its agents and employees from and against any and all claims, liabilities, suits or penalties arising out of (or which may be claimed to arise out of) acts or omissions of the Contractor or subcontractors in the performance of work covered by the Contract. This covenant shall survive the termination of the Contract. Notwithstanding the foregoing, nothing herein contained shall be deemed to constitute a waiver of the sovereign immunity of the Community College System of New Hampshire, which immunity is hereby reserved by the Community College System of New Hampshire. The covenant in paragraph I shall survive the termination of this Agreement.

F. Additional Insurance for Design/Build Contracts:

1. In addition to the insurance requirements listed in the above paragraphs, the Designer/Builder Team shall provide the following coverage.
 - a. The Designer/Builder Team, or the Designer shall purchase and maintain professional liability coverage for this project. The coverage shall provide the CCSNH with protection against design errors and omissions and shall have an annual aggregate limit of no less than \$2,000,000. The coverage shall be maintained through the legal statute of repose period, currently stipulated to be three (3) years from the date of Substantial Completion. If the professional liability coverage is maintained by other than the firm holding the prime contract with the CCSNH for this project, the prime contractor shall provide evidence of indemnifications, approved by the CCSNH, that indicate that this insurance coverage is in place and available for the protection of the CCSNH. The indemnification may not create a re-assignment of contractual responsibilities between the CCSNH and the prime contractor.

PART 11 BIDDING DOCUMENTS

- 11.1 Bidders shall use only complete sets of Bidding Documents in preparation of bids; the CCSNH assumes no responsibility for mistakes due to the use of incomplete sets of Bidding Documents.

PART 12 SUBSTITUTIONS

- 12.1 Where Bidding Documents stipulate particular Products, substitution requests will ONLY be considered before receipt of Bids. Refer to specification section 01600 – Product Requirements.

PART 13 AWARD OF CONTRACT

- 13.1 The Contract will be Awarded as soon as possible to the Responsible Bidder on the basis of the Highest Score, see Score Sheet in Section 00300.
 - A. The CCSNH may request a Negotiated Price from the Highest Score Responsible Bidder.

- 13.2 The signed Contract, together with the Contract Bond, and certificate of insurance shall be returned to the CCSNH within 10 days after the date of notice that the Proposal has been accepted.
- A. If the successful bidder fails to execute the Contract and submit acceptable bond and required attachments within 20 days after the date of notice of acceptance of the Proposal, the CCSNH may cancel the notice of award. Contract award may then be made to the next lowest responsible bidder or the Work may be re-advertised.
- 13.3 Prior to the issuance of Notice to Proceed, each Bidder shall be prepared, if so requested by the Chancellor, to present evidence of his/her experience, qualifications, and financial ability to carry out the terms of the Contract.
- 13.4 A Contract that has been Awarded with required attachments is not executed until submitted and approved by the CCSNH Board of Trustees, if required, and issuance of the Notice to Proceed by the CCSNH.

PART 14 PERMITS AND FEES

- 14.1 CCSNH shall secure and pay for all Permits and Fees required by the Work of this Contract.

END OF DOCUMENT 002004

SECTION 00300 – BID PROPOSAL FORM – CCSNH**PROPOSAL – STIPULATED BASE LUMP SUM GRAND TOTAL BID – GENERAL CONSTRUCTION**

PROPOSAL TO: **Received no later than 3:00 PM,
Tuesday, March 19th, 2019.**
Matthew Moore, PE
memooore@ccsnh.edu
Director of Capital Planning & Development
Community College System of New Hampshire
26 College Drive
Concord, New Hampshire 03301

SUBJECT: Project # GBC 19-02
GBCC Building Automation and Controls System

1. **CERTIFICATION:** The undersigned Prime Contractor

Name of Firm: _____

Signature: _____

Name and Title: _____
(Contractor's Name Printed Here)

certifies that they have examined and fully comprehend the requirements and intent of the Bidding and Contract Documents for this Project, including any and all Addenda issued, and also certifies that they have visited the location of the Project work and examined all conditions at the site which will affect the work.

2. **BASE BID (STIPULATED LUMP SUM GRAND TOTAL)**

The undersigned Contractor proposes to furnish all labor, materials, equipment, services and related items necessary for, or incidental to, the proper execution and completion of the Work in strict conformance with the Bidding and Contract Documents, on or before the time of completion specified, for the Stipulated Sum for Materials plus Labor of:

LUMP SUM GRAND TOTAL BID AMOUNT:

(Words)

_____ DOLLARS (\$_____) (Figures)

Provide a breakout below of the Materials and Labor costs contained in the Total Base Bid Amount above to satisfy the Owner's insurance requirements.

MATERIALS:

(Words)

DOLLARS (\$_____) (Figures)

LABOR:

(Words)

DOLLARS (\$_____) (Figures)

3. ADDENDUM RECEIPT

The undersigned Contractor acknowledges the receipt of the following Addenda to the Bidding and Contract Documents, but he agrees that he is bound by all Addenda, whether or not listed herein:

Addendum No. _____ Dated: _____

Addendum No. _____ Dated: _____

Addendum No. _____ Dated: _____

STATEMENT OF NON-COLLUSION

By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of his knowledge and belief: (1) The prices in this bid have been arrived at independently without collusion, consultation, communications, or agreement, for the purpose of restricting competition as to any matter relating to such prices with any other bidder or with any competitor; (2) Unless required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any other competitor, and (3) No attempt has been made or will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.

SIGNATURE: _____

NAME: _____

TITLE: _____

DATE: _____

PHONE: _____

EMAIL: _____

Corporate Seal:

DOCUMENT 00708

GENERAL CONDITIONS – COMMUNITY COLLEGE SYSTEM OF NEW HAMPSHIRE (CCSNH)

PART	ITEM
1	DEFINITIONS
2	CONTRACT DOCUMENTS
3	NOTICE
4	ACCESS TO THE WORK
5	ACCIDENT PROTECTION
6	HAZARDOUS MATERIALS
7	SUBCONTRACTS
8	RESPONSIBILITY OF CONTRACTOR TO ACT IN EMERGENCY
9	MUTUAL RESPONSIBILITY OF CONTRACTORS
10	PAYMENTS TO CONTRACTOR
11	CONTRACTOR'S TITLE TO MATERIALS
12	CHANGES IN WORK
13	ASSIGNMENTS
14	SUPERINTENDENCE BY CONTRACTOR
15	FAILURE TO COMPLETE WORK ON TIME
16	SUBSTANTIAL COMPLETION AND FINAL INSPECTION
17	DEFAULT AND TERMINATION OF CONTRACT
18	TERMINATION OF CONTRACT WITHOUT FAULT
19	ASSIGNMENT PROVISION

PART 1 DEFINITIONS

- A. **Addendum.** Written and/or graphic information issued before opening *Proposals* that modifies or interprets the *Bidding Documents* by additions, deletions, clarifications or corrections.
- B. **Advertisement.** A public announcement in the form of an *Invitation to Bid*, inviting *Bids* for *Work* to be performed and/or *Materials* to be furnished.
- C. **Alteration Order.** A written agreement between the *Contractor* and the *Community College System of New Hampshire* that amends the *Contract* and identifies *Work* that affects either the *Contract Sum*, *Completion Date*, *Credit*, or any combination thereof.
- D. **Alternate.** A proposed change in the *Work* described in the *Contract Documents* providing the *Community College System of New Hampshire* with an option to select between alternative materials, products or systems, or to add or delete portions of *Work*.
- E. **Architect.** As defined in RSA 310-A:28, a person who, by reason of having acquired through professional education and practical experience an advanced training in building construction and architectural design and an extensive knowledge of building standards created to safeguard the public from hazards such as fire, panic, structural failure, and unsanitary conditions, is technically and legally qualified to practice architecture and who is licensed by the State of New Hampshire Board of Licensure for Architects to engage in the practice of architecture. The Architect has no contractual agreement with the *Contractor* and therefore shall not directly interact with the *Contractor*.
- F. **Award.** The acceptance of a *Bid* prior to execution of *Contract*.
- G. **Bid.** A complete and properly signed *Proposal*, submitted in accordance with the *Bidding Requirements*, to perform the *Work* for the amount or amounts stipulated therein.
- H. **Bid Bond.** One form of a *Proposal Guaranty* executed by the *Bidder* and a *Surety* to guarantee that the *Bidder* will enter into a *Contract* within a specified time.
- I. **Bid Opening Officer.** An authorized representative of the Community College System of New Hampshire, who is responsible for opening and reading of *Bids*.
- J. **Bidder.** A *Corporation*, *Partnership*, or *Proprietorship* submitting a *Proposal*, subsequent to meeting the Community College System of New Hampshire's *Bidding Requirements*.
- K. **Bidding Documents.** Collectively, the *Invitation to Bid*, *Bidding Requirements*, *Specifications*, *Drawings*, and *Addendum*.
- L. **Bidding Requirements.** The documents that contain information regarding bidding procedures with which a *Bidder* must conform and a *Proposal* that a *Bidder* shall use to submit a *Bid*.
- M. **Builders Risk Insurance.** A specialized form of property insurance that provides coverage for loss or damage during the course of construction.

- N. **Calendar Day.** A day shown on the calendar.
- O. **Certificate of Occupancy.** A document issued by the Office of the State Fire Marshal or its authorized representative certifying that all of, or a designated portion of a building, is approved for its designated use.
- P. **Certificate of Full or Partial Substantial Completion.** A document prepared by the *Community College System of New Hampshire* when the *Project* reaches *Substantial Completion* and only issued after review and acceptance of the *Contractor's Request for Certificate of Full or Partial Substantial Completion*.
- Q. **Chancellor.** The Chancellor of the Community College System of New Hampshire.
- R. **Change Order.** A written agreement between the *Contractor* and the *Community College System of New Hampshire* that identifies *Work* to be completed as part of an Allowance Item. Any change that affects either the *Contract Sum*, *Contract Time* or *Credit* shall be processed as an *Change Order*.
- S. **Clerk of the Works.** An authorized representative identified by the *Community College System of New Hampshire*, responsible for observing construction on the *Community College System of New Hampshire's* behalf for conformance with the *Contract Documents*.
- T. **College.** The college who is responsible for the facility and/or will occupy the facility after and/or during the *Work*. The College(s) has/have no contractual agreement with the *Contractor* and therefore shall not direct the *Contractor* in any way.
- U. **Commercial General Liability Insurance.** A broad form of liability insurance covering claims for bodily injury and property damage which combines under one policy coverage for business liability exposures, except those specifically excluded.
- V. **Completion Date.** The last day of the time allotted or the specific date established as identified in the *Contract Documents* for *Substantial Completion* of the *Work*, including any authorized extensions.
- W. **Consultant.** The *Architect*, *Engineer*, and/or professional engaged to develop/provide *Drawings*, *Specifications* and/or other services for the *Project*. The Consultant has no contractual agreement with the *Contractor* and therefore all interaction between any Consultant and the *Contractor* shall be done thru the *Contract Representative*.
- X. **Contract.** The written agreement between the *Community College System of New Hampshire* and the *Contractor* setting forth the obligations of the parties as outlined in the *Contract Documents*.
- Y. **Contract Representative.** The *Community College System of New Hampshire's* appointed representative is the CCSNH Director of Capital Planning and Development having specific authority to act on the *Community College System of New Hampshire's* behalf and shall be responsible for general supervision, control, and direction over all matters pertaining to design, construction, maintenance standards, preservation, and administration of the *Contract*. The *Architect* does not have such authority.

- Z. **Contract Bond.** The approved form of security to the Community College System of New Hampshire (political subdivision) in compliance with RSA 447:16 executed by the *Contractor* and their *Surety* or Sureties, guaranteeing complete execution of the contract and all supplemental agreements pertaining thereto including the payment of all legal debts pertaining to the construction of the *Project*.
- AA. **Contract Documents.** Collectively, the *Invitation To Bid*, *Bidding Requirements*, *Contract Bond*, *Specifications*, *Drawings*, *Addendum*, and other documents included in the *Contract*, and modifications, clarifications, authorized *Alteration Orders* and *Change Orders* issued after the execution of the *Contract*, to complete the *Project*. All documents shall be written in English.
- BB. **Contract Sum.** The amount stated in the *Contract*. This sum shall be derived from the *Lump Sum Base Bid*, *Lump Sum Grand Total*, or *Negotiated Price*; modified to reflect the acceptance of any *Alternates*. The *Notice to Proceed* shall state the amount that the *Community College System of New Hampshire* is obligated to pay the *Contractor*.
- CC. **Contractor.** The *Corporation*, *Partnership*, or *Proprietorship*, or any combination thereof, contracting with the Community College System of New Hampshire for performance of prescribed work.
- DD. **Contractor's Request for Certificate of Full or Partial Substantial Completion.** A document prepared by the *Contractor* when the *Project* reaches *Substantial Completion*.
- EE. **Contractual Liability.** Liability assumed by the *Contractor* under a *Contract*.
- FF. **Corporation.** A legal entity organized under the laws of a particular jurisdiction who is legally authorized to do business in the State.
- GG. **Credit.** Any Change that results in a reduction in the *Contract Sum* or *Lump Sum Grand Total* Items. All credits shall be processed by an *Alteration Order* and may include modifications to *Lump Sum Grand Total* Items.
- HH. **Day.** Unless designated as a *Working Day*, or unless otherwise indicated, this term will mean a *Calendar Day*.
- II. **Drawings (Plans).** The graphic and pictorial documents or reproductions thereof, which show the location, character, dimensions, and details of the prescribed work.
- JJ. **Final Completion.** Term denoting that the *Work* has been completed in accordance with the terms and conditions of the *Contract Documents* and all *Punch List* items have been completed.
- KK. **Final Payment.** Payment made by the *Community College System of New Hampshire* to the *Contractor*, upon *Final Completion*.
- LL. **General Conditions.** The part of the *Contract Documents* establishing the rights, responsibilities and relationships of the parties.

- MM. **Hazardous Material.** Shall include any material regulated by federal or state law and shall include but not limited to asbestos, toxic or hazardous waste, PCBs, combustible gases and materials, petroleum or radioactive material, or any other substances under any conditions and in such quantities as would pose a substantial danger to persons or property exposed to such substances.
- NN. **Indemnification.** A contractual obligation by which one person or entity agrees to reimburse others for loss or damage arising from specified liabilities.
- OO. **Invitation to Bid.** A portion of the *Bidding Documents*; the *Advertisement for Proposals* for *Work* or *Materials* on which *Bids* are requested. The *Advertisement* will indicate the time and place of the opening of *Proposals*, the type and location of *Work* to be performed, the character and quantity of the *Material* to be furnished and provide information on how to obtain *Drawings*, *Specifications* and *Proposal*.
- PP. **Liability Insurance.** A contract under which an insurance company agrees to protect a person or entity against claims arising from a real or alleged failure to fulfill an obligation or duty to a third party who is a named or an incidental beneficiary.
- QQ. **Lump Sum Base Bid.** One type of *Proposal* where the *Bid* is established by a single item price to perform all *Work* excluding any *Alternates* that may or may not become part of the *Contract*.
- RR. **Lump Sum Grand Total.** One type of *Proposal* where the *Bid* is established as a total of various items to perform all *Work* excluding any *Alternates* that may or may not become part of the *Contract*.
- SS. **Low Bid.** The *Bid* stating the lowest price proposed for performance of the *Work*, conforming to the *Bidding Documents*.
- TT. **Lowest Responsible Bidder.** The *Bidder* who submits the lowest bona fide *Bid* and is considered by the Community College System of New Hampshire to be fully responsible and qualified to perform the *Work* for which the *Bid* is submitted.
- UU. **Material(s).** Any substance and/or product specified for use in the construction of the *Project* and its appurtenances.
- VV. **Negotiated Price.** A *Proposal* modified by the *Lowest Responsible Bidder* thru communication with the Community College System of New Hampshire in which changes are made to the *Proposal* and/or *Completion Date* as required to meet budget, funding or scheduling requirements.
- WW. **Notice to Proceed.** A written notice to the *Contractor* to proceed with a portion of or all of the *Contract Work*; including the beginning of *Contract* time when applicable. The Notice to Proceed shall act as the final step in awarding the *Contract* or portion thereof.
- XX. **Occurrence Policy.** An insurance policy that covers acts or omissions occurring during the policy term, regardless of when a claim against the insured is first asserted, even if the policy is no longer in existence.

- YY. **Owner's Protective Liability Coverage.** Third-party legal liability insurance coverage protecting the *Community College System of New Hampshire* from claims arising from the construction process.
- ZZ. **Partnership.** An association of two or more persons or entities to conduct a business that shares profits and losses at a certain proportion.
- AAA. **Professional Engineer.** Referred to as Engineer. As defined in RSA 310-A:2, a person who by reason of advanced knowledge of mathematics and the physical sciences, acquired by professional education and practical experience, is technically and legally qualified to practice engineering, and who is licensed by or otherwise authorized by State of New Hampshire Professional Engineers Board to engage in the practice of engineering. The Engineer has no contractual agreement with the *Contractor* and therefore shall not directly interact with the *Contractor*.
- BBB. **Project.** The total construction of the *Work* to be performed.
- CCC. **Proposal.** A *Bidder's* offer, on *Community College System of New Hampshire* prescribed forms, to perform stated work at the quoted price(s).
- DDD. **Proposal Guaranty.** The security furnished with a *Proposal*, which shall be a *Bid Bond*, certified check or cashier's check and which provide that the *Bidder* if awarded the *Contract* will execute such *Contract* in accordance with the requirements of the *Bidding Documents*.
- EEE. **Proprietorship (Individual).** A form of business organization that is owned entirely by one person.
- FFF. **Provide.** To furnish and install a product, materials, systems, and/or equipment, complete in place, fully tested and approved.
- GGG. **Punch List.** A written document attached to the *Certificate of Substantial Completion* listing items to be completed or corrected prior to the *Community College System of New Hampshire* approval of *Final Payment*.
- HHH. **Specifications.** The volume that is part of the *Contract Documents* which contain the *General Conditions*, *Supplementary General Conditions*, *Invitation to Bid*, and individual sections that consist of written requirements for material, equipment, construction systems, standards and workmanship, and other documents or reports as applicable.
- III. **State.** The State of New Hampshire.
- JJJ. **Subcontractor.** A *Corporation*, *Partnership*, *Proprietorship*, Joint Venture or any combination thereof, to whom the *Contractor* sublets any part of the *Contract*.
- KKK. **Substantial Completion.** As determined by an inspection by the *Contract Representative* that the work or portion thereof is substantially complete, in accordance with the *Contract Documents*, such that the *Community College System of New Hampshire* may occupy or utilize the *Work* for its intended use without disruption or interference by the *Contractor* in completing or correcting any remaining unfinished or unacceptable *Work*.

- LLL. **Substitution.** A *Material*, product or item of equipment in place of that specified.
- MMM. **Superintendent.** The *Contractor's* authorized representative responsible for field supervision, coordination, and completion of the *Work*.
- NNN. **Supplementary General Conditions.** A part of the *Contract Documents* which supplements and may also modify, change, add to or delete from provisions of the *General Conditions*.
- OOO. **Surety.** A *Corporation, Partnership, or Proprietorship* other than the *Contractor*, executing a bond furnished by the *Contractor*.
- PPP. **Umbrella Liability Insurance.** Insurance providing coverage in an amount above existing liability policies.
- QQQ. **Unit Price.** An amount stated in a *Lump Sum Grand Total Bid* as a price per unit for an item or portion of the contract or for specific materials and/or services described in the *Contract Documents*.
- RRR. **Work.** The construction and services required by the *Contract Documents* to furnish all labor, materials, equipment, and incidentals necessary to complete the duties, obligations, and requirements imposed by the *Contract*.
- SSS. **Workers' Compensation Insurance.** Insurance covering the liability of an employer to employees for compensation and other benefits required by workers' compensation laws with respect to injury, sickness, disease or death arising from their employment.
- TTT. **Working Day.** Any calendar day, except Saturdays, Sundays, and Contract designated legal holidays.

PART 2 CONTRACT DOCUMENTS

- 2.1 The Contract Documents consist of the Invitation to Bid, Contract Agreement, General Conditions, Supplementary General Conditions, Drawings and Specifications, including all Addenda issued prior to execution of the Contract, wage scales where applicable, Bonds where required, insurance certificates, other documents listed in the Agreement and Modifications issued after the execution of the Contract, Change Orders and Alteration Orders issued in accordance with Part 12 of the General Conditions.
- A. Hierarchy of the Contract Documents shall be interpreted according to the following classes:
1. Community College System of New Hampshire approved modifications to the Contract Documents after execution of the Contract.
 2. Addenda.
 3. Supplemental General Conditions.
 4. General Conditions.
 5. Division 1 – General Requirements.
 6. Remaining Specifications.
 7. Larger Scale Drawings & Details.
 8. Remaining Drawings.
- 2.2 A fully executed Contract shall not be in effect until the contract is approved and an issuance of the Notice to Proceed by the Community College System of New Hampshire.
- 2.3 This Contract is executed in a number of counterparts, each of which is an original and constitutes the entire agreement between the parties. This Contract shall be construed according to the laws of the State. No portion of this Contract shall be understood to waive the sovereign immunity of the *Community College System of New Hampshire*. This Contract shall not be amended, except as specified in Parts 13 and 20.
- 2.4 The Contract Documents are complementary and anything called for by one of the Contract Documents and not called for by the others shall be of like effect as if required by all.
- 2.5 Should the Contract Documents contain inconsistencies within a class identified in Item 2.1A, the Contractor shall provide the better quality or greater quantity of work and/or materials. The Contractor shall identify any perceived discrepancies to the Contract Representative prior to proceeding.
- 2.6 The Contractors and all Subcontractors shall refer to all of the Contract Documents, including those not specifically showing the work of their specialized trades, and shall perform all work reasonably inferable from them as being necessary to produce the intended results in compliance with applicable Federal, State, and Local codes.
- 2.7 All indications or notations which apply to one of a number of similar situations, materials or processes shall be deemed to apply to all such situations, materials or processes wherever they appear in the work, except where a contrary result is clearly indicated by the Contract Documents.
- 2.8 Where codes, standards, requirements, and publications of public and private bodies are referred to in the Contract Documents, such references shall be understood to be to the latest final and complete

revision at the time of receiving Bids unless specifically identified, except where otherwise indicated.

- 2.9 Where no explicit quality or standards for materials or workmanship is established for work, such work is to be consistent with the best quality workmanship standards of the applicable trade.
- 2.10 All manufactured articles, materials, and equipment shall be applied, assembled, installed, connected, erected, tested, cleaned, and conditioned in accordance with the manufacturer's written or printed directions and instructions, unless specifically indicated otherwise in the Contract Documents.
- 2.11 The Drawings are made to scale as identified therein, but all working dimensions shall be taken from the figured dimensions and by actual measurements at the job; in no case by scaling. The Contractor shall study and compare all of the Drawings and verify all figures before laying out or constructing work. The Contractor shall be responsible for errors in his/her work that might have been avoided thereby. Whether or not an error is believed to exist, deviation from the Drawings and the dimensions given thereon shall be made only after approval in writing from the Contract Representative.
- 2.12 All Drawings and Specifications and copies thereof are the property of the Community College System of New Hampshire and shall not be used by the Contractor or Subcontractor on other Projects.

PART 3 NOTICE

- 3.1 Any written notice by either party to the Contract shall be sufficiently given if delivered to or at the last known business address of the person, partnership or corporation constituting the other party to the Contract, or to his/her, their, or its duly authorized agent, representative, or officer, or when sent by registered mail to such last known business address. The last known business address shall be that location which is last provided in writing.
- 3.2 The parties shall provide their physical location/address, mailing address, telephone number, fax number, and, where available, pager number(s), email address(es), and other methods of contact for all persons associated with the Contract.

PART 4 ACCESS TO THE WORK

- 4.1 The Contractor shall provide for access to the work, at all times, for observation and/or inspection by the Community College System of New Hampshire, Architect, Consultant, Engineer and government officials having jurisdiction. The Contractor shall provide proper facilities for such access and inspection.

PART 5 ACCIDENT PROTECTION

- 5.1 It is a condition of this Contract, and shall be made a condition of each subcontract entered into pursuant to the Contract, that the Contractor, any Subcontractors, or Independent Contractors shall not require any laborer or mechanic employed in the performance of the Contract to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous to the laborer's health or safety as determined by construction safety and health standards of the Occupational Safety and Health Administration, United States Department of Labor, which standards include, by reference, the established Federal Safety and Health Regulations for Construction. These standards and regulations comprise Part 1910 and Part 1926 respectively of Title 29 of the Code of Federal Regulations, as may be revised from time to time. In the event any revisions in the Code of Federal Regulations are published, such revisions will be deemed to supersede the appropriate Part 1910 and Part 1926, and be effective as of the date set forth in the revised regulation.

PART 6 HAZARDOUS MATERIALS

- 6.1 The Contractor shall also be aware of laws and regulations relating to hazardous materials that may be encountered during construction operations, either within project limits or at material sites off the project. The health and safety of employees, the general public, and the potential of damage to the overall environment is possible if hazardous materials are not recognized, reported, and the appropriate action taken to dispose of, remove from the site, or otherwise contain the possible contaminants.
- 6.2 If any abnormal condition is encountered or exposed that indicates the presence of a hazardous material or toxic waste, construction operations shall be immediately suspended in the area and the Contract Representative notified. No further work shall be conducted in the area of the contaminated material until the site has been investigated and the Community College System of New Hampshire has given approval to continue the work in the area. The Contractor shall fully cooperate with the Community College System of New Hampshire and perform any remedial work as directed. Work shall continue in other areas of the Project unless otherwise directed.
- 6.3 Exposure to hazardous materials may result from contact with, but not necessarily limited to, such items as drums, barrels, and other containers, waste such as cars, batteries, and building construction debris. Containers leaking unknown chemicals or liquids, abandoned cars leaking petroleum products, batteries leaking acid, construction debris which may include asbestos, or any other source of suspected hazardous material found within excavation areas or stockpiled on land within construction limits shall be referred to the Department of Environmental Services and Contract Representative so that a proper identification of the materials may be made and disposal procedures initiated as required.
- 6.4 Disposition of the hazardous material or toxic waste shall be made under the requirements and regulations of the Department of Environmental Services. Work required to dispose of these materials and any remedial work shall be performed under a Supplemental Agreement or Contract item, if included in the Contract.

PART 7 SUBCONTRACTS

- 7.1 Nothing contained in the Specifications or Drawings shall be construed as creating any contractual relationship between any Subcontractor and the Community College System of New Hampshire. The Sections of the Specifications are not intended to control the Contractor in dividing the work among Subcontractors or to limit the work performed by any trade.
- 7.2 The Contractor shall be as fully responsible for the acts and omissions of Subcontractors and of persons employed by them, as he/she is for the acts and omissions of persons directly employed by him/her.
- 7.3 The Contractor shall, without additional expense to the Community College System of New Hampshire, utilize the services of specialty Subcontractors, as required to complete the work.
- 7.4 The Contract Representative will not undertake efforts to settle or resolve any differences between the Contractor and Subcontractors or between Subcontractors.
- 7.5 The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind Subcontractors to the Contractor by the terms of the General Conditions and other Contract Documents insofar as applicable to the work of Subcontractors and to give the Contractor the same power to terminate any subcontract that the Contract Representative may exercise over the Contractor under any provisions of the Contract Documents.

PART 8 RESPONSIBILITY OF CONTRACTOR TO ACT IN EMERGENCY

- 8.1 In case of any emergency that threatens loss or injury of property, and/or safety of life, the Contractor shall act as the situation may warrant. He/she shall notify the Contract Representative thereof immediately thereafter. Any compensation claimed by the Contractor together with substantiating documents in regard to expense, shall be submitted to the Contract Representative and the amount of compensation shall be determined by agreement.
- 8.2 In the event the Community College System of New Hampshire learns of an emergency that threatens loss or injury of property, and/or safety of life, the Community College System of New Hampshire shall notify the Contractor using the contact information provided pursuant to PART 3 herein. The Community College System of New Hampshire may, but shall have no duty to take reasonable steps to mitigate the damage or loss to the Contractor. In either event, the Community College System of New Hampshire shall have no duty to undertake any specific acts and shall have no liability for actions or inactions taken absent gross negligence.

PART 9 MUTUAL RESPONSIBILITY OF CONTRACTORS

- 9.1 If the Contractor or any of his/her Subcontractors or employees causes loss or damage to any separate Contractor or Subcontractor on the work, the Contractor or Subcontractor agrees to settle with such separate Contractor or Subcontractor by agreement, if he/she will so settle. If such separate Contractor or Subcontractor sues the Community College System of New Hampshire because of any loss so sustained, the Contract Representative shall notify the Contractor and/or their Subcontractors, who shall indemnify and hold harmless the Community College System of New Hampshire against any expenses or judgment arising therefrom.

PART 10 PAYMENTS TO CONTRACTOR

- 10.1 The Community College System of New Hampshire will process payments to the Contractor each month on the basis of duly certified and approved estimates of the work performed during the preceding period. In preparing estimates, the material delivered on the site and any preparatory work done may be taken into consideration. Payments will only be approved in an amount no greater than the percentage of project completion, as determined by the Contract Representative.
- 10.2 At least ten (10) days before the end of the billing period, the Contractor shall submit to the Contract Representative, an itemized Requisition for Payment, supported by such data substantiating the Contractor's right to payment as the Contract Representative may require. If payment is to be made for 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, such payment shall be conditional upon inspection and/or observation by the Community College System of New Hampshire and submission by the Contractor of bills of sale or such other procedure satisfactory to the Contract Representative to establish the Community College System of New Hampshire's title to such materials or equipment or otherwise protect the Community College System of New Hampshire's interest including applicable insurance and transportation to the site.
- 10.3 Immediately upon receipt of the Monthly Requisition for Payment, Contractor shall post same at the Contractor's Field Office or project site in a location where Subcontractors have clear access.
- 10.4 Retainage:
- A. Contract Payment Withheld: A 5% retainage shall be withheld from each Progress Payment until issuance of a Certificate of Substantial Completion. The balance remaining after the specified percentage has been retained, less all previous payments, will be certified for payment on each partial estimate.
- ***** [OR] *****
- B. Irrevocable Letter of Credit: In lieu of retainage for Projects amounting to Five Hundred Thousand (\$500,000.00) or more, the Contractor, with the approval of the Community College System of New Hampshire, may provide the Community College System of New Hampshire with a Letter of Credit in an amount equal to five percent (5%) of the total adjusted Contract amount at the time of such request. Any such Letter of Credit must be irrevocable (that is, it may be modified or revoked only with the consent of the Community College System of New Hampshire). It shall have a termination date at least one hundred twenty (120) days after the completion date specified in the underlying Contract, or as may be altered in accordance with the Contract Documents, whichever is later. The Letter of Credit shall authorize the Community College System of New Hampshire to require the issuing financial institution to deposit with the Community College System of New Hampshire an amount equal to the retainage that would have been deducted from payment to the Contractor, as specified in 10.4.A.1. The Community College System of New Hampshire may utilize the amount so deposited in the same manner as retainage.
- 10.5 Retainage will be released at Final Payment.
- A. After the Certificate of Substantial Completion has been issued, upon written application by the Contractor and with the approval of the Surety, the Contract Representative may release a portion of the retained amount.

10.6 Payment for Material On Hand:

- A. Partial payments are made for materials to be incorporated in the Work, provided the materials meet the requirements of the Contract and are delivered on, or in the vicinity of, the Project site and stored in acceptable places. Partial payments will not exceed 90 percent of the Contract unit price for the item or the amount supported by copies of paid invoices, freight bills, or other supporting documents required by the Community College System of New Hampshire. The quantity paid will not exceed the corresponding quantity estimate in the Contract. No partial payment will be made on living or perishable materials until incorporated in the Work.
- B. When material payments exceed \$100,000 or 10 percent (10%) of the total contract amount, whichever is less, notarized copies of paid invoices or copies of canceled checks for all such materials must be submitted to the Contract Representative within 45 days of the end date of the estimate on which the material allowance was paid. Failure to provide such documentation will result in the deduction of such material allowance from future estimates until documentation is provided.
- C. All material and work covered by partial payments made shall thereupon become the sole property of the Community College System of New Hampshire, but this provision shall not be construed as relieving the Contractor of the sole responsibility of all materials and work upon which payments have been made or the restoration of any damaged work or as a waiver of the right of the Community College System of New Hampshire to require the fulfillment of all the terms of the Contract.

10.7 Payment for Material Not on Hand:

- A. Upon receipt of a written request by the Contractor, partial payment may be made for acceptable, fully-fabricated, nonperishable materials not delivered that are unique to the Project provided the materials meet the requirements of the Contract and are stored in excess of 30 days at locations approved by the Community College System of New Hampshire, and provided all required certificates of compliance, mill test reports, shop inspector's acceptance and any other required materials certification have been furnished. Materials shall be identifiable and accessible for inspection. Storage areas shall provide adequate protection so that such materials will meet the Contract requirements upon delivery to the site.
- B. Partial payment will be based on the actual cost to the Contractor as indicated on invoices furnished to the Contract Representative. When material payments exceed \$100,000 or 10 percent of the total contract amount, whichever is less, notarized copies of paid invoices or copies of canceled checks for all such materials must be submitted to the Contract Representative within 45 days of the end date of the estimate on which the material allowance was paid. Failure to provide such documentation will result in the deduction of such material allowance from future estimates until documentation is provided. Payment shall not exceed 90 percent of the bid price. NO payment will be made on materials for any item in the contract whose total dollar value is less than \$5,000. Approval of partial payment will not constitute final acceptance of the materials for use in completing items of work.

10.8 Release of Claims:

- A. Neither the final payment nor any part of the retained percentage shall become due until the Contractor shall deliver a complete release of all claims arising under and by virtue of this Contract, including claims for all Subcontractors and suppliers of either materials or labor, plus a release of the Contract Bond and a statement that all Subcontractors and suppliers have been paid. The Commissioner, may pay any and all such claims, in whole or in part, and deduct the amount or amounts so paid from any partial or final payment.

10.9 Final Payment:

- A. Application for Final Payment received from the Contractor will be processed for payment not less than 90 days after project acceptance and final completion unless accompanied by a release of the Contract Bond. This payment shall be the amount of the Contract, amended by approved alteration orders, less previous payments minus liquidated damages, additional penalties or holdbacks. All prior partial estimates and payments shall be subject to correction in the final estimate and payment.

10.10 Acceptance of Final Payment Constitutes Release:

- A. The acceptance of the Final Payment by the Contractor shall be and shall operate as a release to the Contractor of all claims and of all liability to the Community College System of New Hampshire for all things done or furnished in connection with this work. No payment, however, final or otherwise, shall operate to release the Contractor and its Sureties from any obligations under this Contract or the Contract Bond. Acceptance of Final Payment shall not impact any warranties provided by the Contractor with respect to this project.

PART 11 CONTRACTOR'S TITLE TO MATERIALS

- 11.1 No materials or supplies for the work shall be purchased by the Contractor or any Subcontractor subject to any chattel mortgage or under a conditional sale or other agreement by which an interest is retained by the seller. The Contractor warrants that good title has been obtained for all materials and supplies for which partial payment has been accepted. If any claim is made with respect to materials provided by the Contractor, Subcontractors, or Independent Contractors, the Contractor shall defend any such claim and shall pay any judgment or settlement thereon.

PART 12 CHANGES IN WORK

- 12.1 No charge for any extra work or material will be allowed without a fully executed Alteration Order. (Refer to Specification Section 01200-Price and Payment Procedures)
- 12.2 The Commissioner may at any time, by a written order, and without notice to the Sureties, make changes in the Drawings and Specifications and Completion Date of the Contract and within the general scope thereof.
- 12.3 If any part of the work as installed be at variance with the Contract requirements, the Contract Representative may allow all or any part of such work to remain in place, if found to be in the best interest of the Community College System of New Hampshire, subject to proper adjustment in the

Contract Price. Acceptance of installed work in one instance or in any instance does not constitute a waiver of Specifications, General Conditions or contract requirements.

- 12.4 The Contractor shall hold the Community College System of New Hampshire and its officers, agents, servants, and employees harmless from liability of any nature including cost and expenses, for or on account of any patented or unpatented invention, process, article or applicable items manufactured or used in the performance of the Contract, including its use, unless otherwise specifically stipulated in the Contract Documents.

PART 13 ASSIGNMENTS

- 13.1 The Contractor shall not assign the whole or any part of this Contract or any monies due or to become due, hereunder, without the written consent of the Commissioner and of all Sureties executing any Bonds on behalf of the Contractor if in connection with said Contract.

PART 14 SUPERINTENDENCE BY CONTRACTOR

- 14.1 The Contractor shall have on the project site, at all times when work is being performed, a competent English speaking Superintendent capable of reading and thoroughly understanding the contract documents and thoroughly experienced in the type of work being performed, satisfactory to the Community College System of New Hampshire. The Contractor shall not change superintendents without permission from the Contract Representative and shall submit a request in writing with justification for such a change.
- A. The Superintendent shall be responsible for verifying that all materials, installation, coordination, and workmanship are in conformance with the contract documents.
 - B. Unless the Contract Representative has granted prior written approval, the Superintendent shall not, himself, engage in "hands-on" construction work.
 - C. In the event the Superintendent fails or refuses to perform functions mentioned above as determined by the Contract Representative, the Contractor agrees to a stipulated penalty of \$1,200.00 per day, in addition to any liquidated damages provided hereunder.

PART 15 FAILURE TO COMPLETE WORK ON TIME

- 15.1 If the Contractor fails to complete all of the work or sections of the Project, if sections are indicated, within the time specified in the Contract or within any additional time allowed, for each working day the Liquidated Damages identified in 16.3 will be deducted from any money due the Contractor. This deduction will be made, not as a penalty, but as fixed, agreed liquidated damages for inconvenience to the Community College System of New Hampshire and for reimbursing the Community College System of New Hampshire the cost of the Administration of the Contract, including personnel, time, engineering and inspection. Should the amount of money otherwise due the Contractor be less than the amount of such liquidated damages, the Contractor and its Surety shall be liable to the Community College System of New Hampshire for such deficiency.
- 15.2 If the Community College System of New Hampshire permits the Contractor to continue and finish the work after the time fixed for its completion, it shall in no way operate as a waiver on the part of the Community College System of New Hampshire of any of its rights under the Contract. When the final acceptance has been duly made by the Contract Representative, any liquidated damage charges shall end.

- 15.3 The fixed, agreed, liquidated damages shall be assessed in accordance with the following schedule:

Original Contract Amount, Plus Any Extras, Alteration Orders, and Alternates		Amount of Liquidated Damages Per Working Day
From More Than:	To and Including:	
\$0	\$25,000.00	\$200.00
\$25,000.00	\$50,000.00	\$250.00
\$50,000.00	\$100,000.00	\$400.00
\$100,000.00	\$500,000.00	\$450.00
\$500,000.00	\$1,000,000.00	\$800.00
\$1,000,000.00	\$2,000,000.00	\$1,200.00
\$2,000,000.00	\$5,000,000.00	\$1,600.00
\$5,000,000.00	\$10,000,000.00	\$2,000.00
\$10,000,000.00	and above	\$2,400.00

PART 16 SUBSTANTIAL COMPLETION AND FINAL INSPECTION

Revised 12/08/04

- 16.1 The Contractor shall provide a signed Substantial Completion Application to the Contract Representative when the work is believed to be substantially complete, in accordance with specification section 01700, accompanied by a list of items, referred to as the Punch List, to be completed or corrected. The failure to include any items of such list does not alter the responsibility of the Contractor to complete all work in accordance with the Contract Documents. On the basis of an inspection by the Contract Representative who determines that the work is substantially complete, a Certificate of Substantial Completion will be issued.
- A. The Certificate of Substantial Completion shall:
1. Include any modifications to the Punch List or value as determined by the Contract Representative.
 2. Establish the Date of Substantial Completion.
 - a. Warranties required by the Contract Documents shall commence on the Date of Substantial Completion unless otherwise provided in the Certificate of Substantial Completion.
 3. Identify the responsibilities of the Community College System of New Hampshire and the Contractor for security, maintenance, heat, utilities, and damage to the work and insurance.
 4. Fix the time limit within which the Contractor shall complete the items listed herein.
- 16.2 Partial Occupancy or Use: The Community College System of New Hampshire may take occupancy or use of completed or partially completed portions of the work upon written agreement between the Commissioner and the Contractor. Said partial occupancy or use shall have the approval of the insurer and Code enforcement authorities having jurisdiction. Said partial occupancy or use, (whether substantial completion has been obtained or not) provided the Contract Representative and Contractor have agreed upon written terms detailing each of the entities responsibilities in their entirety, may be exercised under these General Conditions.
- A. A Written agreement shall stipulate the time period for completion of all Work and the commencement date for all applicable contract warranties. Said written agreement shall be preceded by a Contractor generated listing of all incomplete Work, meeting with the approval of the Contract Representative, before partial occupancy or use is taken by the Community College System of New Hampshire with prior approval of the Division.
- 16.3 If the Contractor fails to complete the items on the "punch list," by the date specified on the Substantial Completion Certificate, then in addition to the corrective measures listed in the Certificate of Substantial Completion, the Community College System of New Hampshire may use the monies still due the Contractor to have such items completed and the Contractor shall lose any claim to the monies so used. The Surety may be notified of any delay or failure to complete the work.
- 16.4 Upon written notice that the work is ready for final inspection and acceptance, the Contract Representative shall promptly make such inspection, to determine the work is acceptable under the Contract Documents and the Contract fully performed. The Contractor shall submit a request for payment, specifically identifying Final Payment. The Contractor shall provide all certificates and reports, as required, throughout the contract and shall coordinate their preparation and submission

prior to request for final payment. Failure to submit such certificates and reports shall be considered default of contract.

PART 17 DEFAULT AND TERMINATION OF CONTRACT

17.1 If the Contractor:

- A. Fails to begin work under Contract within the time identified in specification section 01100.
- B. Fails to perform the work with sufficient workers and equipment, or with sufficient materials to assume prompt completion of said work, or
- C. Performs the work unsuitably or neglects or refuses to remove materials or to perform anew such work as may be rejected as unacceptable and unsuitable, or
- D. Discontinues the prosecution of the work, or
- E. Fails to resume work, which has been discontinued, within a reasonable time after notice to do so, or
- F. Becomes insolvent or has declared bankruptcy, or commits any act of bankruptcy or insolvency, or
- G. Makes an assignment for the benefit of creditors, or
- H. For any other causes whatsoever, fails to carry on the work in an acceptable manner.

17.2 The Commissioner will give notice, in writing, to the Contractor and his Surety for such delay, neglect, and default for any item identified above.

- A. Upon receipt of Notification of Default and the Contractor or Surety does not proceed in accordance with said Notification, then the Commissioner will Terminate the Contract. Upon which, the Commissioner shall have full power and authority, without violating the Contract, to assume the prosecution of the work. The Commissioner may enter into one or more agreements for the completion of said Contract according to the terms and conditions thereof, or use such other methods as will be required for the completion of said Contract in an acceptable manner.
 - 1. All extra costs and charges incurred by the Community College System of New Hampshire as a result of such delay, neglect or default, together with the cost of completing the work under the Contract will be deducted from any monies due or which may become due said Contractor. If such expenses exceed the sum that would have been payable under the Contract, then the Contractor and the Surety shall be liable and shall pay to the Community College System of New Hampshire, the amount of such excess.

PART 18 TERMINATION OF CONTRACT WITHOUT FAULT

18.1 Except in cases controlled by the preceding section, the Commissioner, for any cause, including, but not limited to an order of any Federal authority or petition of the Contractor due to circumstances beyond its control may, by written notice to the Contractor and the Surety, with the

concurrence of the Governor and Council, terminate the Contract or any portion thereof subject to the Condition(s) A, B, C, and D provided below.

18.2 Notwithstanding anything to the contrary contained in these conditions, it is understood and agreed by the parties hereto that all obligations of the Community College System of New Hampshire hereunder, including the continuance of payments, are contingent upon the availability and continued appropriation of State and/or Federal Funds, and in no event shall the Community College System of New Hampshire be liable for any payments hereunder in excess of such available or appropriated funds. In the event of a reduction, termination or failure to appropriate any or all such available funds or appropriations or a reduction of expenditures of Community College System of New Hampshire funds by the Advisory Budget Control Committee, the Commissioner may, by written notice to the Contractor and Surety, immediately terminate this Contract in whole or in part in accordance with the following conditions:

- A. When a Contract, or portion thereof, is terminated before completion of all items of work in the Contract, payment will be made for the actual items of work completed. Payment of items of work not completed at time of termination shall be the greater of the following amounts:
 - 1. A percentage of the Contract unit price, which percentage shall be the percentage of completion of the particular item at time of termination.
 - 2. Such amount as shall be mutually agreed upon by the parties. No claim for loss of anticipated profits on items or units of work not completed will be allowed.
- B. Reimbursement for organization of the work and mobilization, when not otherwise included in the Contract, shall be made where the volume of work completed is too small to compensate the Contractor for these expenses under the Contract; the intent being that an equitable settlement be made with the Contractor.
- C. Acceptable materials, obtained or ordered by the Contractor for the work, and that are not incorporated in the work shall, at the option of the Contractor, be purchased from the Contractor based upon the delivered cost of the materials at such points of delivery as may be designated by the Contract Representative. The Contractor shall do everything possible to cancel unfilled orders.
- D. Termination of a Contract, or a portion thereof, shall not relieve the Contractor of its responsibilities for the work completed nor shall it relieve the Surety of its obligations for and concerning any claims arising out of the work performed.

PART 19 ASSIGNMENT PROVISION

19.1 The Contractor hereby agrees that it will assign to the Community College System of New Hampshire, all causes of action that it may acquire under the anti-trust laws of New Hampshire and the United States as a result of conspiracies, combinations of contracts in restraint of trade which affect the price of goods or services obtained by the Community College System of New Hampshire under this Contract, if so requested by the Community College System of New Hampshire.

END OF SECTION

SECTION 01100

SUMMARY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Contract description.
- B. Work by College.
- C. College supplied products.
- D. Contractor's use of site.
- E. Work sequence.
- F. College occupancy.
- G. Specification Conventions.

1.2 CONTRACT DESCRIPTION

- A. Work of his project consists of providing Building Automation and Controls System at Great Bay Community College.
- B. This project involves furnishing, installing, configuring, and testing a new campus-wide Building Automation System (BAS) with graphical user interface.
- C. College Campus (Main Building, Student Success Center, and Maintenance Building).
- D. Perform Work of Contract under stipulated lump sum grand total contract with the College in accordance with Conditions of Contract.
- E. The Contractor shall, except as otherwise specifically stated in the Contract Documents, provide and pay for all materials, labor, tools, equipment, water, heat, fuel, light, power, transportation, superintendence, temporary construction of every nature, and all other services and facilities of every nature whatsoever necessary to execute, complete, and deliver the work within the specified time.

1.3 WORK BY COLLEGE

1. NONE

1.4 COLLEGE SUPPLIED PRODUCTS

1. NONE

1.5 CONTRACTOR'S USE OF SITE [AND PREMISES]

- A. Limit use of site and premises to allow:
 1. College occupancy.
 2. Work by Others and Work by College.
- B. Access to Site: Limited to Normal working hours.
- C. Construction Operations: Limited to areas as designated in the plans and specifications.
- D. Time Restrictions for Performing Work: Normal working hours of [7:30] am to [4:30] pm, Monday through Friday with the following restrictions:
 1. No access during the following observed holidays:
 - a. New Year's Day.
 - b. Martin Luther King Jr. Civil Rights Day.
 - c. Washington's Birthday.
 - d. Memorial Day.
 - e. Independence Day.
 - f. Labor Day.
 - g. Veterans' Day.
 - h. Thanksgiving Day.
 - i. Day after Thanksgiving.
 - j. Christmas Day.
 2. Access for work outside of normal working hours shall be requested in writing to the Contract Representative, at least one week in advance. The Contract Representative may accept or reject the request.
- E. Utility Outages and Shutdown: Shall be coordinated with the building users to minimize disruption of services, and may require work to take place outside of normal working hours with request and approval.

1.6 WORK SEQUENCE

- A. Work shall commence within 7, days after issuance of Notice to Proceed. Failure to comply shall constitute Default of Contract.
- B. Construct Work to accommodate College's occupancy requirements during construction period, coordinate construction schedule and operations with CCSNH Contract Administrator:

1.7 COLLEGE OCCUPANCY

- A. The College intends to occupy the campus during the Project. The Contractor's guarantee of work identified in Section 1700 shall not commence until the Contractor is granted a Certificate of Substantial Completion.
- B. Cooperate with College to minimize conflict, and to facilitate College's operations.
- C. Schedule the Work to accommodate College occupancy.
- D. Partial Occupancy. The College will be permitted to partially occupy the premises as phases of the project are completed. Warranties for items contained within the areas subject to partial occupancy shall commence upon the College's use of those premises identified in the Partial Occupancy. Warranties on systems extending beyond the area subject to the Partial Occupancy shall not commence until all areas utilizing those system(s) are complete and fully functional.

1.9 SPECIFICATION CONVENTIONS

- E. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words "shall be" are included by inference where a colon (:) is used within sentences or phrases.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01200

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Allowances (intentionally omitted).
- B. Testing and inspection allowances. (intentionally omitted)
- C. Schedule of values.
- D. Requisition for payment.
- E. Change procedures.
- F. Defect assessment.
- G. Unit prices.
- H. Alternates (intentionally omitted).

1.2 ALLOWANCES (intentionally omitted).

1.3 TESTING AND INSPECTION ALLOWANCES (intentionally omitted)

1.4 SCHEDULE OF VALUES

- A. Submit printed schedule on AIA Form G703 - Continuation Sheet for G702. Contractor's standard form or electronic media printout will be considered.
- B. Submit Schedule of Values in duplicate within 15 days after date of issuance of Notice to Proceed. Failure to submit within specified time period will constitute Default of Contract.
- C. Format: Utilize Table of Contents of these Specifications. Identify each line item with number and title of major specification Section. Identify bonds and insurance, allowances, and alternates
- D. Include a separate line item for the amount of each Allowance and Alternates specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by unit cost to achieve total for each item.
- E. Revise schedule to list approved Change Orders, with each Requisitions For Payment.

1.5 REQUISITION FOR PAYMENT

- A. Submit one copy of each application.
- B. Content and Format: Items on the Requisition for Payment shall be consistent with the items on the Proposal Form. Utilize the Schedule of Values as documentation for payment items.
- C. Submit updated construction schedule with each Requisition for Payment.
- D. Payment Period: Submit at intervals stipulated in Document 00708 General Conditions. CCSNH
- E. Substantiating Data: When the Contract Representative requires substantiating information, submit data justifying dollar amounts in question.
- F. Include the following with Requisition for Payment, payment will not be processed if any items are missing or incomplete:
 - 1. Record documents as specified in Section 01700, for review by the Contract Representative, which will be returned to Contractor.
 - 2. Affidavits attesting to off-site stored products.
 - 3. Construction progress schedules, revised and current as specified in Section 01330.

1.6 CHANGE PROCEDURES

- A. Submittals: Submit name of individual authorized to receive change documents, and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.
- B. The Contract Representative will advise of minor changes in the Work not involving adjustment to Contract Sum/Price or Contract Time, or that may be necessary to carry out the work included in the Contract, by issuing supplemental instructions.
- C. The Contract Representative may issue a Proposal Request including a detailed description of proposed change(s) with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change. The Contractor will prepare and submit estimate within ten days.
- D. Contractor may propose changes by submitting a request for change(s) to the Contract Representative, describing proposed change and its full effect on the Work. Each request shall be a separate item and sequentially numbered. Include a statement describing reason for the change, and effect on Contract Sum/Price and Contract Time with full documentation and a statement describing effect on Work by separate or other Contractors.
- E. Stipulated Sum/Price Change Order: Based on Proposal Request and Contractor's fixed price quotation or Contractor's request for Change Order as approved by the Contract

Representative. Submit the breakdown of the following items on a Stipulated Sum/Price Change Order Form for review and approval by the Contract Representative:

1. The Contractor shall include the following indirect costs for work performed by the General Contractor as part the Contractors' price:
 - a. Worker's Compensation and Employee Liability.
 - b. Unemployment and Social Security Taxes.
2. In addition to the above indirect costs the General Contractor shall be allowed the following markups:
 - a. Ten percent (10%). Said ten percent (10%) shall be all inclusive for overhead, supervision, and profit for Work performed by the General Contractor
 - b. Five percent (5%) on that part of work performed by Subcontractors.
 - c. The same percentages above shall apply to Subcontractors.
3. On any change that involves a net credit to the State, no allowance for overhead, supervision and profit shall be figured.
4. Extension of Contract Time: State any requests for extension of Contract Time with justification for such a request.

F. Unit Price Change Order: For contract unit prices and quantities, the Change Order will be executed on fixed unit price basis. For unit costs or quantities of units of work which are not pre-determined, execute Work under Construction Change Directive. Changes in Contract Sum/Price or Contract Time will be computed as specified for Time and Material Change Order.

G. Construction Change Directive : The Contract Representative may issue directive, signed by the Bureau Administrator or Assistant Administrator, instructing the Contractor to proceed with change in the Work, for subsequent inclusion in a Time and Material Change Order. Document will describe changes in the Work, and designate method of determining any change in Contract Sum/Price or Contract Time. Promptly execute change. Failure to comply will result in Default of Contract.

H. Time and Material Change Order: Submit itemized account and supporting data within 10 days of completion of change. The Contract Representative will determine change allowable in Contract Sum/Price and Contract Time as provided in Contract Documents.

1. Maintain detailed records of work done on Time and Material basis. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work.
2. Document each quotation for change in cost or time with sufficient data to allow evaluation of quotation. If acceptable, a Change Order for a Not to Exceed Amount will be prepared.
3. The Contractor as payment in full, including superintendence and overhead, shall accept the compensation herein provided and profit, for extra work performed. For all such work, the Contractor shall furnish certified copies of the payrolls on forms provided for that purpose, invoices of all materials, and such other information as may be required by the Contract Representative. Submit the breakdown of items on a Bureau Time and Material Change Order Form for review and approval by the Contract Representative:
 - a. Labor (Actual wage + 40%): The Construction Superintendent is responsible for logging the time for each individual. For all laborers and

- foremen engaged on the specific operation and entered directly on the Contractor's payroll, the Contractor will receive the actual rate of wage for each and every hour said laborers and Foremen are actually engaged in such work to which will be added an amount equal to forty percent (40%) of the sum thereof, which percentage shall include the cost percentages of the following items as applied to the labor cost involved:
- 1) Contract Bond Premium.
 - 2) Public Liability Insurance.
 - 3) Worker's Compensation Insurance.
 - 4) Federal Social Security.
 - 5) Unemployment Compensation Taxes
- b. Materials (Actual Cost + 10%): For all materials entering permanently into the work plus freight charges thereon, and for all labor not entered directly on his payroll, the Contractor will receive the actual cost, as shown by original receipted bills forwarded to the Contract Representative, to which cost will be added an amount equal to ten percent (10%) of the sum thereof. Bills presented by the Contractor for material taken back from his stock will be subject to the ten percent (10%) allowance if approved by the Contract Representative.
- c. Equipment (Reasonable Rental Charge + 0%): For any trucks, machinery or special equipment, other than small tools, the Contractor will receive a reasonable rental charge to which sum no percentage will be added. This rental charge shall be agreed upon in writing before the work is begun and shall include an operator and all fuel, lubricants, and the upkeep of the equipment.
4. In addition to the above costs the General Contractor shall be allowed the following markups:
- a. Ten percent (10%). Said ten percent (10%) shall be all inclusive for overhead, supervision, and profit for Work performed by the General Contractor
 - b. Five percent (5%) on that part of work performed by Subcontractors.
 - c. The same percentages above shall apply to Subcontractors.
5. Extension of Contract Time: State any requests for extension of Contract Time with justification for such a request.
- I. Any Changes that result in a credit to any portion of the contract and/or a change in the Contract Time must be processed as an Change Order except as provided for in Item 1.2E.
- J. Execution of Change Orders: CCSNH Contract Representative will issue Change Orders per the following procedures.
1. The Contract Representative reviews cost for Change in Work. If needed the Contract Representative will request additional items, back-up information, and request any possible changes or clarifications.
 2. Contract Representative will prepare a Change Order.
 3. Contract Representative will issue the Change Order to the Contractor for review and signature.
 4. Contractor submits signed Change Order to the Contract Representative.

5. The Contract Representative completes the Change Order with the signature of the College Representative
 6. A fully signed and executed Change Order is issued to Contract Representative, Clerk of the Works, and Contractor.
- K. Execution of Change Orders: The Contractor is responsible for preparing and updating a spreadsheet log itemizing all Proposed Changes. A separate spreadsheet shall be completed for each Allowance Item. The spreadsheet shall include columns for Proposed Change Number, Description, Amount of Change, (or initial order of magnitude), Status, and Approved Amounts. In addition a current balance remaining shall be included. Change Orders will be processed per the following procedures:
1. The Contract Representative reviews cost for Change in Work with the College and Consultant(s). If needed the Contract Representative will request additional items, back-up information, and request any possible changes or clarifications.
 2. Contract Representative and College Representative signs Change Order.
 3. Contractor can proceed with Change Order Work with direction from the Contract Representative.
 4. Fully signed and executed Change Order is issued to the Contract Representative, Clerk of the Works, and Contractor.
- L. Correlation Of Contractor Submittals:
1. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as separate line item and adjust Contract Sum/Price.
 2. Promptly revise progress schedules to reflect change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
 3. Promptly enter changes in Project Record Documents.
- 1.7 DEFECT ASSESSMENT
- A. Replace the Work, or portions of the Work, not conforming to specified requirements.
 - B. If, in the opinion of the Contract Representative, it is not practical to remove and replace the Work, the Contract Representative will direct appropriate remedy or adjust payment.
 - C. The defective Work may remain, but unit sum/price will be adjusted to new sum/price at discretion of the Contract Representative.
 - D. Defective Work will be repaired to instructions of and acceptance by the Contract Representative, and unit sum/price will be adjusted to new sum/price at discretion of the Contract Representative.
 - E. Authority of the Contract Representative to assess defects and identify payment adjustments, is final.
 - F. Non-Payment For Rejected Products: Payment will not be made for rejected products for any of the following:
 1. Products wasted or disposed of in a manner that is not acceptable.
 2. Products determined as unacceptable before or after placement.

3. Products not completely unloaded from transporting vehicle.
4. Products placed beyond lines and levels of required Work.
5. Products remaining on hand after completion of the Work.
6. Loading, hauling, and disposing of rejected products.

1.8 UNIT PRICES

A. NONE

1.9 ALTERNATES (intentionally omitted)

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01300

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Coordination and project conditions.
- B. Permits and fees.
- C. Field engineering.
- D. Preconstruction meeting.
- E. Site mobilization meeting.
- F. Progress meetings.
- G. Pre-installation meetings.
- H. Cutting and patching.
- I. Notification of Subcontractors and Workmen's Compensation Insurance (SB 78)
- J. Special procedures.

1.2 COORDINATION AND PROJECT CONDITIONS

- A. Coordinate scheduling, submittals, and Work of various sections of the Specifications to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. The Contractor shall comply with the "Underground Utility Damage Prevention System" by notification to DIG-SAFE SYSTEM of intent to excavate near or around any underground utility installations in public ways. The Contractor shall call 1-800/225-4977 at least seventy-two (72) hours in advance of starting any excavation. Saturday, Sundays, and legal holidays are not included in the computation of the required seventy-two (72) hour notice.
- C. Prior to any Work, the Contractor shall hire an independent company to locate utilities potentially affected by the Work and as shown and/or identified in the Contract Documents. All utilities shall be identified by the Contractor on the Record Drawings.
- D. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, operating equipment.

- E. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.
- G. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion [and for portions of Work designated for State's [partial] occupancy].
- H. After State occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of State's activities.

1.3 PERMITS AND FEES

- A. The CCSNH shall obtain and pay for all permits, and impact fees as may be required by law for construction of CCSNH's facility. The Contractor shall pay for all fees and charges, and use of the property other than the site of the work for storage of materials or other purposes.
- B. The Contractor shall pay all applicable Federal, State, and Local sales and other taxes, except taxes and assessments on the real property comprising the site of the Project.

1.4 FIELD ENGINEERING (not used)

1.5 PRECONSTRUCTION MEETING

- A. The Contract Representative will schedule meeting at the Project site prior to Contractor occupancy.
- B. Attendance required (unless otherwise waived): Contract Representative, Clerk of the Works, Contractor, Contractor's Superintendent, and major Subcontractors.
- C. Potential Agenda Topics:
 - 1. Distribution of Contract Documents.
 - 2. Submission of list of Subcontractors, insurance carriers, subcontracting relationship, list of products, schedule of values, and progress schedule.
 - 3. Designation of personnel representing parties in Contract.
 - 4. Use of premises by CCSNH and Contractor.
 - 5. College's requirements and partial occupancy.
 - 6. Construction facilities and controls provided by CCSNH.
 - 7. Temporary utilities provided by CCSNH
 - 8. Security and housekeeping procedures.
 - 9. Schedules.
 - 10. Application for payment procedures.
 - 11. Procedures for maintaining record documents.

12. Requirements for start-up of equipment.
 13. Inspection and acceptance of equipment put into service during construction period.
- D. Contract Representative shall record minutes and distribute copies within two days after meeting to participants, with one copy to each person in attendance and one to those affected by decisions made.

1.6 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the Work at weekly intervals.
- B. Attendance required (unless otherwise waived): Contract Representative, Clerk of the Works, Contractor, Contractor's Superintendent, and major Subcontractors.
- C. Potential Agenda Topics:
1. Review minutes of previous meetings.
 2. Review of Work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems impeding planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Review of off-site fabrication and delivery schedules.
 7. Maintenance of progress schedule.
 8. Corrective measures to regain projected schedules.
 9. Planned progress during succeeding work period.
 10. Coordination of projected progress.
 11. Maintenance of quality and work standards.
 12. Effect of proposed changes on progress schedule and coordination.
 13. Other business relating to Work.
- D. Contract Representative shall record minutes and distribute copies within two days after meeting to participants, with one copy to each person in attendance and one to those affected by decisions made.

1.7 PRE-INSTALLATION MEETING(S)

- A. When required in individual specification sections, convene pre-installation meetings at Project site prior to commencing work of specific section.
- B. Require attendance of parties directly affecting, or affected by, Work of specific section.
- C. Notify the Contract Representative seven days in advance of meeting date.
- D. Contractor shall prepare agenda and preside at meeting:
1. Review conditions of installation, preparation and installation procedures.
 2. Review coordination with related work.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 CUTTING AND PATCHING

- A. Employ skilled and experienced installer to perform cutting and patching.
- B. Submit written request in advance of cutting or altering elements affecting:
 - 1. Structural integrity of element.
 - 2. Integrity of weather-exposed or moisture-resistant elements.
 - 3. Efficiency, maintenance, or safety of element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of CCSNH or separate contractor.
- C. Execute cutting, fitting, and patching [including excavation and fill,] to complete Work, and to:
 - 1. Fit the several parts together, to integrate with other Work.
 - 2. Uncover Work to install or correct ill-timed Work.
 - 3. Remove and replace defective and non-conforming Work.
 - 4. Remove samples of installed Work for testing.
 - 5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.
- D. Execute work by methods to avoid damage to other Work, and to provide proper surfaces to receive patching and finishing.
- E. Cut masonry and concrete materials using masonry saw or core drill.
- F. Restore Work with new products in accordance with requirements of Contract Documents.
- G. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- H. Maintain integrity of wall, ceiling, roof, or floor construction; completely seal voids.
- I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with material in accordance with design and code requirements, to full thickness of penetrated element.
- J. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for assembly, refinish entire unit.
- K. Identify hazardous substances or conditions exposed during the Work to the Contract Representative for decision or remedy.

3.2 SPECIAL PROCEDURES

- A. Materials: As specified in product sections; match existing with new products [and salvaged products] for patching and extending work.
- B. Employ skilled and experienced installer to perform alteration work.
- C. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion.
- D. Remove unsuitable material not marked for salvage, including rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.
- E. Remove debris and abandoned items from area and from concealed spaces.
- F. Prepare surface and remove surface finishes to permit installation of new work and finishes.
- G. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.
- H. Remove, cut, and patch Work in manner to minimize damage and to permit restoring products and finishes to original condition.
- I. Refinish existing visible surfaces to remain in renovated rooms and spaces, to original condition for each material, with neat transition to adjacent finishes.
- J. Where new Work abuts or aligns with existing, provide smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.
- K. When finished surfaces are cut so that smooth transition with new Work is not possible, terminate existing surface along straight line at natural line of division and submit recommendation to Contract Representative for review.
- L. Where change of plane of **1/4 inch** or more occurs, submit recommendation for providing smooth transition to Contract Representative for review.
- M. Trim existing doors to clear new floor finish. Refinish trim to original condition.
- N. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections.
- O. Finish surfaces as specified in individual product sections.

END OF SECTION

SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Submittal procedures.
- B. Construction progress schedules.
- C. Subcontractor list.
- D. Proposed products list.
- E. Product data.
- F. Shop drawings.
- G. Samples.
- H. Design data.
- I. Test reports.
- J. Certificates.
- K. Manufacturer's instructions.
- L. Manufacturer's field reports.
- M. Erection drawings.
- N. Construction photographs.

1.2 SUBMITTAL PROCEDURES

- A. Transmit each submittal with CCSNH accepted form.
- B. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.
- C. Identify Project, Contractor, subcontractor and supplier; pertinent drawing and detail number, and specification section number, appropriate to submittal.

- D. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents. Incomplete items or items submitted without the Contractor's signed stamp of approval thereon will be returned rejected.
- E. Schedule submittals to expedite Project. Coordinate submission of related items. Deliver to:
 - Contract Representative
 - Matthew Moore
 - memmoore@ccsnh.edu
 - Director of Capital Projects & Planning
 - Community College System of New Hampshire
 - 26 College Drive
 - Concord, NH 03301
- F. For each submittal for review, allow 14 days excluding delivery time to and from Contract Representative.
 - 1. All shop drawings to be returned to Contractor from the Contract Representative. Direct return of shop drawings from Architect or Engineer to Contractor is not permitted.
- G. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of completed Work.
- H. Allow space on submittals for Contractor and Architect or Engineer review stamps.
- I. When revised for resubmission, identify changes made since previous submission.
- J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.
- K. Submittals not requested will not be recognized or processed.
- L. Work shall not begin until [All] submittal items have been approved and returned to General Contractor by the Contract Representative.

1.3 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit initial schedules at PreConstruction Meeting.
- B. Submit revised Progress Schedules with each Application for Payment.
- C. Distribute copies of reviewed schedules to Project site file, subcontractors, suppliers, and other concerned parties.
- D. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

- E. Submit horizontal bar chart with separate line for each major portion of Work or operation\ and section of Work, identifying first work day of each week.
- F. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate early and late start, early and late finish, float dates, and duration.
- G. Indicate estimated percentage of completion for each item of Work at each submission.
- H. Submit separate schedule of submittal dates for shop drawings, product data, and samples, including CCSNH furnished products and dates reviewed submittals will be required from Contract Representative. Indicate decision dates for selection of finishes. Selection of finishes cannot occur until ALL finish items are submitted and products are approved.
- I. Indicate delivery dates for furnished products.
- J. Revisions To Schedules:
 - 1. Indicate progress of each activity to date of submittal, and projected completion date of each activity.
 - 2. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.
 - 3. Prepare narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect including effect of changes on schedules of separate contractors.

1.4 SUBCONTRACTOR LIST

- A. Submit list, at the PreConstruction Meeting, of subcontractors setting forth in detail the work for which they will be responsible. In addition, the General Contractor shall identify what work will be performed with the Bidder's own forces.
- B. Provide Subcontractor and Insurance information as required under SB 78.
 - 1. Subcontractor list is to include subcontracting relationship and the carrier of Workmen Compensation Insurance for all subcontractors, all tiers.
 - 2. Proof of Insurance is to be provided within 36 hours of request.
 - 3. Changes and additional to Subcontractor and Insurance is to be provided to the CCSNH within 36 hours of occurrence.
 - 4. The CCSNH will post this information in a publicly accessible website for the duration of the contract.

1.5 PRODUCT DATA

- A. Product Data: Submit for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Submit electronic copies to the Contract Representative. The copy for the CCSNH is separate from the copy the Contractor to provide as part of close out procedures.

- C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- E. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01700.

1.6 SHOP DRAWINGS

- A. Shop Drawings: Submit for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Submit an electronic copy to the Contract Representative. The copy for the CCSNH is separate from the copy the Contractor to provide as part of close out procedures.
- D. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01700.

1.7 SAMPLES

- A. Samples: Submit for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Samples For Selection as Specified in Product Sections:
 - 1. Submit to Contract Representative for aesthetic, color, or finish selection.
 - 2. Submit samples of finishes from full range of manufacturers' standard colors, in custom colors selected, textures, and patterns for Contract Representative and System approval.
- C. Submit samples to illustrate functional and aesthetic characteristics of Products, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- D. Include identification on each sample, with full Project information.
- E. Submit number of samples specified in individual specification sections; Contract Representative will retain one sample and Architect or Engineer will retain one sample.
- F. Reviewed samples which may be used in the Work are indicated in individual specification sections.
- G. Samples will not be used for testing purposes unless specifically stated in specification section.
- H. After review, produce duplicates and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes described in Section 01700.

1.8 DESIGN DATA

- A. Submit for Contract Representative's knowledge.
- B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.9 TEST REPORTS

- A. Submit for Contract Representative's knowledge.
- B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.10 CERTIFICATES

- A. When specified in individual specification sections, submit certification by manufacturer, installation/application subcontractor, or Contractor, to Contract Representative in quantities specified for Product Data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to the Contract Representative.

1.11 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, [start-up,] adjusting, and finishing, to the Contract Representative in quantities specified for Product Data.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.12 MANUFACTURER'S FIELD REPORTS

- A. Submit reports for Contract Representative's and System's benefit.
- B. Submit report in duplicate within 7 days of observation to the Contract Representative for information.
- C. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.13 ERECTION DRAWINGS

- A. Submit to the Architect and Contract Representative for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

- B. Data indicating inappropriate or unacceptable Work may be subject to action by the Architect, Engineer, or Contract Representative.

1.14 CONSTRUCTION PHOTOGRAPHS

- A. Provide photographs of construction throughout progress of Work produced by an experienced] photographer, acceptable to the Contract Representative.
- B. Twice monthly submit photographs.
- C. Photographs: Submit digital images on 3-1/2" diskettes or on compact discs.
- D. Take multiple site photographs from differing directions and interior photographs indicating relative progress of the Work, three (3) days maximum prior to submitting.
- E. Identify each image. Identify name of Project, contract number phase orientation of view, date and time of view.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01600

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Products.
- B. Product delivery requirements.
- C. Product storage and handling requirements.
- D. Product options.
- E. Product substitution procedures.
- F. Equipment electrical characteristics and components.

1.2 PRODUCTS

- A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.
- B. All materials and equipment shall be new, except as specifically permitted by Contract Documents.
- C. Furnish interchangeable components from same manufacturer for components being replaced.
- D. The use of asbestos containing materials shall be prohibited.

1.3 PRODUCT DELIVERY REQUIREMENTS

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

- A. Store and protect products in accordance with manufacturers' instructions.
- B. Store with seals and labels intact and legible.

- C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- D. For exterior storage of fabricated products, place on sloped supports above ground.
- E. Provide bonded off-site storage and protection when site does not permit on-site storage or protection only with prior approval from the Contract Representative.
- F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- G. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.
- H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.5 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers with or without provision for substitutions: Products of one of manufacturers named and meeting specifications, no options or substitutions allowed. Submit request for substitution for any manufacturer not named in accordance with the following article.

1.6 PRODUCT SUBSTITUTION PROCEDURES

- A. Where Bidding Documents stipulate particular Products, substitution requests will ONLY be considered before receipt of Bids. Submit requests per the requirements specified in this section.
 - 1. All requests shall be submitted to the Contract Representative not later than five (5) business days before the hour and day set for bid opening. Incomplete requests or requests received after this deadline will not be considered.
 - 2. All requests that are approved and are acceptable to the Department will be issued as part of an Addendum to each Bidder who has received a set of bidding documents, so that all Bidders may avail themselves of the change in submitting their Proposals.
- B. Substitutions [may] be considered after bid opening when a product becomes unavailable through no fault of the Contractor. The Contractor shall apply to the Contract Representative, in writing, within ten (10) days of his realizing his inability to furnish the article specified, describing completely the substitution he desires to make. The Contractor shall include a dated written statement from the manufacturer outlining an explanation for the unavailability of the product. Substitutions for reasons of lead times, i.e., the time between when the Contractor orders necessary materials from the vendor

and anticipated delivery, will only be reviewed if the lead time is more than the length of the contract time. The Department may extend the contract time to accommodate the product specified. No additional costs from the Contractor will be considered due to the fact that the Contractor shall verify lead times and coordinate with contract time during the bidding phase.

- C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- D. A request constitutes a representation that Bidder:
 - 1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
 - 2. Will provide same warranty for Substitution as for specified product.
 - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to the State.
 - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
 - 5. Will reimburse Department and Architect and/or Engineer for review or redesign services associated with re-approval by authorities having jurisdiction.
- E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.
- F. Substitution Submittal Procedure:
 - 1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
 - 2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
 - 3. The Department will notify Bidders in writing of decision to accept by issuing an addendum.

PART 2 PRODUCTS

- A. Not used

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01700

EXECUTION REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Closeout procedures.
- B. Final cleaning.
- C. Protecting installed construction.
- D. Project record documents.
- E. Manual for materials and finishes.
- F. Product warranties and product bonds.
- G. Guarantee of work.

1.2 CLOSEOUT PROCEDURES

- A. Submit a signed Substantial Completion Application attesting that the Contract Documents have been reviewed, Work has been inspected, and that all Work is complete in accordance with Contract Documents and ready for Contract Representative review. The Substantial Completion Application for use by the Contractor is attached to the end of this specification section. The Contract Representative may modify this Agreement to accommodate any changes in Work.
 - 1. Provide submittals to the Contract Representative as required by the Contract Documents and as required by authorities having jurisdiction.
- B. Only after completion of all Punch List items and submission of all items the Contractor shall submit a Final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- C. College will occupy portions of building as specified in Section 01100.

1.3 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
- B. Clean debris from roofs, gutters, downspouts, and drainage systems.
- C. Clean site; sweep paved areas, rake clean landscaped surfaces.
- D. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.4 PROTECTING INSTALLED CONSTRUCTION

- A. Protect installed Work and provide special protection where specified in individual specification sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Prohibit traffic from landscaped areas.

1.5 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed Shop Drawings, Product Data, and Samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by State.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress, not less than weekly.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish [first] [main] floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4. Field changes of dimension and detail.

5. Details not on original Contract drawings.

G. Submit documents to the Contract Representative at time of Substantial Completion.

1.6 MANUAL FOR MATERIALS AND FINISHES

- A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. The Contract Representative will review draft and return one copy with comments.
- B. For equipment, or component parts of equipment put into service during construction and operated by State, submit documents within ten days after acceptance.
- C. Submit one copy of completed volumes (15) fifteen days prior to Substantial Completion. Draft copy be reviewed and returned after Substantial Completion, with Architect/Engineer comments. Revise content of document sets as required prior to final submission.
- D. Submit one set of revised final volumes in final form prior to final inspection, and one electronic version.
- E. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Include information for re-ordering custom manufactured products.
- F. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- G. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.
- H. Additional Requirements: As specified in individual product specification sections.
- I. Include listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.7 PRODUCT WARRANTIES AND PRODUCT BONDS

- A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after Substantial Completion. All warranties start dates shall be the Substantial Completion Date, if project is phased all warranties to start at the date of Substantial Completion of each phase.
- B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.
- C. Verify documents are in proper form, contain full information, and are notarized.

- D. Co-execute submittals when required.
- E. Include Table of Contents and assemble in three D side ring binder with durable plastic cover.
- F. Submit prior to final Application for Payment.
- G. Time Of Submittals:
 - 1. For equipment or component parts of equipment put into service during construction with State's permission, submit documents within (10) ten days after acceptance.
 - 2. Make other submittals within (10) ten days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within (10) ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

1.8 GUARANTEE OF WORK

- A. Except as otherwise specified, all work shall be guaranteed by the Contractor against defects resulting from the use of inferior materials, equipment or workmanship for one (1) year from the Date of Substantial Completion of the work.
- B. If, within any guarantee period, repairs or changes are required in connection with guaranteed work, which in the opinion of the Contract Representative, is rendered necessary as a result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the terms of the Contract shall, promptly upon receipt of notice from the Commissioner, and at his own expense:
 - 1. Place in satisfactory condition in every particular, all such guaranteed work, correct all defects therein.
 - 2. Make good all damage to the building or site, or equipment or contents thereof, which in the opinion of the Contract Representative, is the result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the terms of the Contract.
 - 3. Make good any work or material, or the equipment and contents of said building or site disturbed in fulfilling any such guarantee.
- C. In any case, wherein fulfilling the requirements of the Contract or of any guarantee, embraced in or required thereby, the Contractor disturbs any work guaranteed under another contract, he shall restore such disturbed work to a condition satisfactory to the Contract Representative and guarantee such restored work to the same extent as it was guaranteed under such other contracts.
- D. If the Contractor, after notice, fails to proceed promptly to comply with the terms of the guarantee, the Commissioner may have the defects corrected and the Contractor and his/her Surety shall be liable for all expense incurred.
- E. All special guarantees applicable to definite parts of the work that may be stipulated in the Specifications or other papers forming a part of the Contract shall be subject to the term of this paragraph during the first year of the life of such special guarantee.

- F. Failure to adhere to guarantee terms may result in suspension or barring from the prequalification list, or, alternatively, the requirement of a Letter of Credit or other guaranty equal to a percentage of the Contract amount.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION



Project #GBC 19-02

EXHIBIT "A"

FOR

Building Automation and Controls System

AT

Great Bay Community College

A COMPONENT OF THE

Community College System of New Hampshire

PROJECT MANUAL

Attached to this exhibit:

- Project Specifications
- Project Drawings



47A York Street

Portland, ME 04101

(207) 553-7753

COMMUNITY COLLEGE SYSTEM OF NEW HAMPSHIRE

Great Bay Community College Building Automation System Replacement

Community College System of New Hampshire

26 College Drive

Concord, NH 03301-7407

Technical Specifications Issued for Bid

February 25, 2019

Prepared for:



26 College Drive

Concord, NH 03301-7407

Division	Section Title
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SPECIFICATIONS GROUP

Facility Services Subgroup

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

230923	DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC	47
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DIVISION 26 - ELECTRICAL

260519	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES	5
260526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS	3
260529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS	4
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APPENDIX A	AS-BUILT GBCC CONTROLS DRAWINGS – FOR REFERENCE ONLY	47
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SECTION 230923 - DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. This project involves furnishing, installing, configuring, and testing a new campus-wide Building Automation System (BAS) with graphical user interface for the Great Bay Community College Campus (Main Building, Student Success Center, and Maintenance Building).
- B. All four existing network controllers (JACEs) on this campus will be replaced as part of this project. Existing field controllers will remain and must be integrated into the new BAS.
- C. Provide direct digital controls (DDC) to the Maintenance Building and connect that building to the BAS. Refer to Drawings for more information.
- D. The new BAS shall be integrated into the Owner's central server, which utilizes a Niagara N4 platform. Contractor shall coordinate with the manager of the central server to receive access information necessary to integrate the GBCC campus DDC network onto the existing server.
- E. The BAS shall perform supervisory monitoring and supervisory control of campus-wide building control systems using the Tridium Niagara N4 Framework.
- F. Contractor shall integrate existing DDC controllers and provide new DDC controllers, where specified in the construction drawings, including all components, software and applications required to meet the sequence of operation and the design/performance intent of the systems.
- G. Contractor shall verify all existing DDC control points in order to create control drawings and graphics.
- H. Refer to Appendix A for as-built controls drawings for the GBCC campus. These drawings are for reference only. All existing conditions must be field verified by the contractor. As-built mechanical drawings are available on-site in the Maintenance Building, coordinate with Owner to review.
- I. The network controllers and Building Automation System (BAS) software installed as part of this project shall be the latest versions offered by the manufacturer and the manufacturer must demonstrate to the extent possible that these products will be supported with both parts and service for a minimum of 10 years.
- J. The changeover between the existing Building Automation Systems in the Main Campus and Student Success Center and the new BAS must occur within a consecutive one-week long period, during normal business hours.
- K. The contractor must be responsible for the Network Area Controllers (NAC, also referred to as a JACE), software and programming of the NAC, graphical user interface software (GUI),

development of all graphical screens, Web browser pages, setup of schedules, logs and alarms, network management and connection of the NAC to the local or wide area network.

- L. The contractor must be responsible for any new open protocol controllers (OPC), control devices, control panels, controller programming, controller programming software, controller input/output and power wiring and controller network wiring.
- M. Refer to Drawing M-501 for a list of required existing Alerton field device and field controller modifications (Not in Contract, by others).
- N. Furnish all labor, materials, equipment, and service necessary for a complete and operating Building Automation System (BAS), utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only.
- O. All labor, material, equipment and software not specifically referred to herein or on the Drawings, that is required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.
- P. Contractor shall coordinate phasing with the Owner. If there will be any system or utility outages as a result of the work, this must be communicated and coordinated with the Owner at least three weeks in advance.
- Q. Contractor must meet all Owner requirements for graphics, alarms, and network integration. Provide log-in credentials to all parties required by the Owner.
- R. The prime controls contractor must perform all low voltage and controls-related work, including installation, programming, and testing. Subcontractors are not permitted for low voltage and controls-related work.

1.2 SYSTEM DESCRIPTION

- A. The intent of this specification is to provide an open NiCS (Niagara Interoperability and Compatibility Statement) Building Automation System (BAS) based on an approved, open platform and a network of freely programmable interoperable open protocol BACnet digital controllers. The Interoperable BACnet controllers shall be fully programmable via the embedded software tool requiring only a web browser to complete the programming process. All new JACEs and Controllers shall be fully programmable or configurable from within any vendor's version of the BAS software. Controllers that require a separate programming tool are not acceptable.
- B. Open source as referred to herein shall mean that the Network Area Controller and the Interoperable Digital BACnet Controller (IDC) products are available from multiple contractor and vendor sources, affording the owner freedom of choice and competitive bidding for the initial installation of the BAS and future system expansions and modifications not limited by contractor, vendor or networking protocol. No territorially restricted OEM brands, single vendor or "branch only" products are acceptable. All products must be available for purchase by any qualified contractor that the owner chooses to do the installation and any further expansion or modifications.

- C. The Building Automation System consists of a high-speed, peer-to-peer network of servers, routers, network switches and stand-alone supervisory controllers. This network provides the capability to integrate BACnet, LonWorks, MODBUS, OPC and other open and proprietary communication protocols into one open, interoperable system.
 - 1. A web based controller and server with a network interface card gathers data from this system and generates web pages accessible through a web browser on each workstation connected to the network. Operators are able to perform normal and expanded operator functions through this web browser interface.
 - 2. The system installed in this project including all associated equipment, licenses, and accessories, shall tie into the existing Community College Statewide Niagara N4 Server. Each network controller shall communicate to other open and legacy protocol systems/devices installed in the facility.
 - 3. The BAS is comprised of supervisory controllers which are based on a hierarchical architecture incorporating Niagara N4 Framework™. All new and replacement equipment shall be compliant with the Niagara N4 Framework.
- D. The Building Automation System must be comprised of Network Area Controller or Controllers (JACE) within each facility. From herein, NAC must refer to a JACE. The NAC must connect to the Owner's local or wide area network, depending on configuration. Access to the system, either locally in each building, or remotely from a central site or sites, must be accomplished through standard Web browsers, via the local area network. Each NAC must communicate to Open Protocol controllers.
- E. The BAS Installation shall be integrated into the existing cloud-based Niagara N4 Supervisor. The Niagara Supervisor provides the communication between the NAC and web browsers.
- F. The BAS must provide full graphic software capable of complete system operation for up to 34 simultaneous workstations.
- G. The BAS shall provide full graphic operator interface to include the following graphics as a minimum:
 - 1. Home page to include Outside Air Temperature, Outside Air Relative Humidity, Enthalpy, etc.
 - 2. Graphic floor plans accurately depicting rooms, walls, hallways, and showing accurate locations of space sensors and major mechanical equipment.
 - 3. Detail graphics for each mechanical system.
 - 4. Provide access to corresponding system drawings, technical literature, and sequences of operations directly from each system graphic.
- H. The BAS must provide automated alarming software capable of sending messages to email compatible cellular telephones via the Owner's e-mail service. The email alarm paging system must be able to segregate users, time schedules, and equipment, and be capable of being programmed by the Owner.
- I. The system shall perform supervisory monitoring and control functions including but not limited to Scheduling, Alarm Handling, Trending, Overrides, Report Generation, and Electrical Demand Limiting as specified.
- J. The system shall include a Graphical User Interface which shall allow for graphical navigation between systems, graphical representations of systems, access to real-time data for systems,

ability to override points in a system, and access to all supervisory monitoring and control functions. Contractor shall utilize the existing standard graphic package and point naming convention for ease of owner use.

- K. The contractor must provide the appropriate quantity of legal copies of all software used to install and configure the BAS. The Owner must be named the license holder for all software associated with any and all incremental work in the project.
- L. Provide sufficient documentation and data, including rights to documentation and data, such that the owner or their agents can execute work to repair, replace, upgrade, and expand the system without subsequent or future dependence on the Contractor.
- M. The intent of this specification is to provide an open source BAS based on the Niagara N4 Platform. Any new field level controllers shall be fully programmable via the embedded Niagara Workbench tool requiring only a web browser. Products requiring a licensed, off site, non-embedded programming tool are not acceptable as this reduces the owner's options in contractors for future service.

1.3 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.4 SUMMARY

- A. Section Includes:
 - 1. DDC system for monitoring and controlling of HVAC systems.
- B. Related Requirements:
 - 1. Raceways:
 - a. Section 260533 "Raceways and Boxes for Electrical Systems" for raceways for low-voltage control cable.

1.5 DEFINITIONS

- A. Algorithm: A logical procedure for solving a recurrent mathematical problem. A prescribed set of well-defined rules or processes for solving a problem in a finite number of steps.
- B. Analog: A continuously varying signal value, such as current, flow, pressure, or temperature.
- C. BACnet Specific Definitions:
 - 1. BACnet: Building Automation Network Protocol, ASHRAE 135. A communications protocol allowing devices to communicate data over and services over a network.
 - 2. BACnet Interoperability Building Blocks (BIBBs): BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBs are combined to build the BACnet functional requirements for a device.

3. BACnet/IP: Defines and allows using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number.
 4. BACnet Testing Laboratories (BTL): Organization responsible for testing products for compliance with ASHRAE 135, operated under direction of BACnet International.
 5. PICS (Protocol Implementation Conformance Statement): Written document that identifies the particular options specified by BACnet that are implemented in a device.
- D. Binary: Two-state signal where a high signal level represents "ON" or "OPEN" condition and a low signal level represents "OFF" or "CLOSED" condition. "Digital" is sometimes used interchangeably with "Binary" to indicate a two-state signal.
- E. Controller: Generic term for any standalone, microprocessor-based, digital controller residing on a network, used for local or global control. Three types of controllers are indicated: Network Controller, Programmable Application Controller, and Application-Specific Controller.
- F. Control System Integrator: An entity that assists in expansion of existing enterprise system and support of additional operator interfaces to I/O being added to existing enterprise system.
- G. COV: Changes of value.
- H. DDC: Direct Digital Controls.
- I. DDC System Provider: Authorized representative of, and trained by, DDC system manufacturer and responsible for execution of DDC system Work indicated.
- J. Distributed Control: Processing of system data is decentralized and control decisions are made at subsystem level. System operational programs and information are provided to remote subsystems and status is reported back. On loss of communication, subsystems shall be capable of operating in a standalone mode using the last best available data.
- K. Gateway: Bidirectional protocol translator that connects control systems that use different communication protocols.
- L. I/O: System through which information is received and transmitted. I/O refers to analog input (AI), binary input (BI), analog output (AO) and binary output (BO). Analog signals are continuous and represent control influences such as flow, level, moisture, pressure, and temperature. Binary signals convert electronic signals to digital pulses (values) and generally represent two-position operating and alarm status. "Digital," (DI and (DO), is sometimes used interchangeably with "Binary," (BI) and (BO), respectively.
- M. JACE: Java Application Control Engine.
- N. LAN: Local area network.
- O. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
- P. Mobile Device: A data-enabled phone or tablet computer capable of connecting to a cellular data network and running a native control application or accessing a web interface.

- Q. MS/TP: Master-slave/token-passing, IEE 8802-3. Datalink protocol LAN option that uses twisted-pair wire for low-speed communication.
- R. MTBF: Mean time between failures.
- S. Network Controller: Digital controller, which supports a family of programmable application controllers and application-specific controllers, that communicates on peer-to-peer network for transmission of global data.
- T. Network Repeater: Device that receives data packet from one network and rebroadcasts it to another network. No routing information is added to protocol.
- U. Peer to Peer: Networking architecture that treats all network stations as equal partners.
- V. POT: Portable operator's terminal.
- W. RAM: Random access memory.
- X. Router: Device connecting two or more networks at network layer.
- Y. Server: Computer used to maintain system configuration, historical and programming database.
- Z. SQL: Structured Query Language.
- AA. USB: Universal Serial Bus.
- BB. User Datagram Protocol (UDP): This protocol assumes that the IP is used as the underlying protocol.
- CC. VAV: Variable air volume.
- DD. WAN: Wide-area network.

1.6 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.7 ACTION SUBMITTALS

- A. Product Data: For each type of product include the following:
 - 1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
 - 3. Product description with complete technical data, performance curves, and product specification sheets.

4. Installation, operation and maintenance instructions including factors affecting performance.
 5. Bill of materials of indicating quantity, manufacturer, and extended model number for each unique product.
 - a. DDC controllers.
 - b. Enclosures.
 - c. Electrical power devices.
 - d. Accessories.
 - e. Instruments.
 - f. Control dampers and actuators.
 - g. Control valves and actuators.
 6. When manufacturer's product datasheets apply to a product series rather than a specific product model, clearly indicate and highlight only applicable information.
- B. Software Submittal:
1. Description and technical data of all software provided, and cross-referenced to products in which software will be installed.
 2. Include a flow diagram and an outline of each subroutine that indicates each program variable name and units of measure.
 3. Description of operator interface to alphanumeric and graphic programming.
 4. Description of each network communication protocol.
 5. Description of system database, including all data included in database, database capacity and limitations to expand database.
 6. Description of each application program and device drivers to be generated, including specific information on data acquisition and control strategies showing their relationship to system timing, speed, processing burden and system throughout.
 7. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
 - a. Refer to Appendix A for as-built sequence of operations.
- C. Shop Drawings:
1. General Requirements:
 - a. Include cover drawing with Project name, location, Owner, Engineer, Contractor and issue date with each Shop Drawings submission.
 - b. Include a drawing index sheet listing each drawing number and title that matches information in each title block.
 2. DDC system network riser diagram indicating the following:
 - a. Each device connected to network with unique identification for each.
 - b. Interconnection of each different network in DDC system.
 - c. For each network, indicate communication protocol, speed and physical means of interconnecting network devices, such as copper cable type, or optical fiber cable type. Indicate raceway type and size for each.
 3. DDC system electrical power riser diagram indicating the following:

- a. Each point of connection to field power with requirements (volts/phase/hertz/amperes/connection type) listed for each.
 - b. Each control power supply.
 - c. Each product requiring power with requirements (volts/phase/hertz/amperes/connection type) listed for each.
 - d. Power wiring type and size, race type, and size for each.
 4. Monitoring and control signal diagrams indicating the following:
 - a. Control signal cable and wiring between controllers and I/O.
 - b. Point-to-point schematic wiring diagrams for each product.
- D. System Description:
1. Full description of DDC system architecture, network configuration, operator interfaces and peripherals, servers, controller types and applications, routers and other network devices, and power supplies.
 2. Complete listing and description of each report, log and trend for format and timing and events which initiate generation.
 3. System and product operation under each potential failure condition including, but not limited to, the following:
 - a. Loss of power.
 - b. Loss of network communication signal.
 - c. Loss of controller signals to inputs and outpoints.
 - d. Server failure.
 - e. Network failure.
 - f. Controller failure.
 - g. Instrument failure.
 - h. Control damper and valve actuator failure.
 4. Complete bibliography of documentation and media to be delivered to Owner.
 5. Description of testing plans and procedures.
 6. Description of Owner training.
- E. Delegated-Design Submittal: For DDC system products and installation indicated as being delegated.
1. Supporting documentation showing DDC system design complies with performance requirements indicated, including calculations and other documentation necessary to prove compliance.
 2. Schedule and design calculations for control dampers and actuators.
 - a. Flow at Project design and minimum flow conditions.
 - b. Face velocity at Project design and minimum airflow conditions.
 - c. Maximum close-off pressure.
 - d. Torque required at worst case condition for sizing actuator.
 - e. Actuator selection indicating torque provided.
 - f. Actuator signal to control damper (on, close or modulate).
 - g. Actuator position on loss of power.

- h. Actuator position on loss of control signal.
- 3. Schedule and design calculations for control valves and actuators.
 - a. Flow at Project design and minimum flow conditions.
 - b. Maximum close-off pressure.
 - c. Torque required at worst case condition for sizing actuator.
 - d. Actuator selection indicating torque provided.
 - e. Actuator signal to control damper (on, close or modulate).
 - f. Actuator position on loss of power.
 - g. Actuator position on loss of control signal.
- 4. Schedule and design calculations for selecting flow instruments.
 - a. Instrument flow range.
 - b. Project design and minimum flow conditions with corresponding accuracy, control signal to transmitter and output signal for remote control.
 - c. Extreme points of extended flow range with corresponding accuracy, control signal to transmitter and output signal for remote control.
 - d. Pressure-differential loss across instrument at Project design flow conditions.
 - e. Where flow sensors are mated with pressure transmitters, provide information for each instrument separately and as an operating pair.

1.8 INFORMATIONAL SUBMITTALS

- A. Manufacturer's qualification data.
- B. Product Certificates:
 - 1. Data Communications Protocol Certificates: Certifying that each proposed DDC system component complies with ASHRAE 135.
- C. Product Test Reports: For each product that requires testing to be performed by a qualified testing agency.
- D. Field quality-control reports.
- E. Sample Warranty: For manufacturer's warranty.

1.9 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For DDC system to include in operation and maintenance manuals. Provide one hardcopy of the O&M manual, an electronic PDF copy of the O&M manual on a flash drive, and one separate full-size set of as-built control drawings.
 - 1. Include the following:
 - a. Project Record Drawings of as-built versions of submittal Shop Drawings.

- b. Testing reports and checklists of completed final versions of reports, checklists, and trend logs.
- c. As-built versions of submittal Product Data.
- d. Names, addresses, e-mail addresses and 24-hour telephone numbers of Installer and service representatives for DDC system and products.
- e. Operator's manual with procedures for operating control systems including logging on and off, handling alarms, producing point reports, trending data, overriding computer control and changing set points and variables.
- f. Programming manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
- g. Engineering, installation, and maintenance manuals that explain how to:
 - 1) Design and install new points, panels, and other hardware.
 - 2) Perform preventive maintenance and calibration.
 - 3) Debug hardware problems.
 - 4) Repair or replace hardware.
- h. Documentation of all programs created using custom programming language including set points, tuning parameters, and object database.
- i. Backup copy of graphic files, programs, and database on electronic media such as DVDs.
- j. List of recommended spare parts with part numbers and suppliers.
- k. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
- l. Complete original-issue copies of furnished software, including operating systems, custom programming language, and graphics software.
- m. Licenses, guarantees, and warranty documents.
- n. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
- o. Owner training materials.

1.10 QUALITY ASSURANCE

- A. The Contractor must be a direct, wholly owned branch of a national control's manufacturer, or a representative not a wholesale distributor.
- B. Quality of Compliance: Control systems shall be installed by trained control mechanics regularly employed in installation and calibration of BAS equipment by the manufacturer of the proposed equipment to be installed.
- C. Contractor Requirements
 - 1. Contractor must be an authorized and approved representative of, and trained by, the DDC system manufacturer.
 - 2. Each person assigned to Project shall have demonstrated past experience.
 - 3. Staffing resources of competent and experienced full-time employees that are assigned to execute work according to schedule.

4. Service and maintenance staff assigned to support Project during warranty period.
5. The BAS Contractor shall have an established 24-hour emergency service organization. A dedicated telephone number shall be provided to the Owner for requesting emergency service. The BAS Contractor shall guarantee that within a maximum of four hours, the electronic service technicians shall be on site.

D. DDC System Manufacturer Qualifications:

1. Nationally recognized manufacturer of DDC systems and products.
2. DDC systems with similar requirements to those indicated for a continuous period of five years within time of bid.
3. DDC systems and products that have been successfully tested and in use on at least ten past projects.
4. Having complete published catalog literature, installation, operation and maintenance manuals for all products intended for use.
5. Having full-time in-house employees for the following:
 - a. Product research and development.
 - b. Product and application engineering.
 - c. Product manufacturing, testing and quality control.
 - d. Technical support for DDC system installation training and troubleshooting of installations.
 - e. Owner operator training.

1.11 SOFTWARE LICENSE AGREEMENT

- A. The Owner shall be the named license holder of all software associated with any and all work on the project.
- B. The Owner shall agree to the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.
- C. The Owner must receive ownership of all job specific software configuration documentation, data files, and application-level software developed for the project. This must include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and /or configured for use within Niagara N4 Framework (Niagara) based controllers and/or servers and any related LAN / WAN / Intranet and all connected routers and devices.

1.12 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace products that fail in materials or workmanship within specified warranty period.
 1. Failures shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner.

2. Include updates or upgrades to software and firmware if necessary to resolve deficiencies.
 - a. Install updates only after receiving Owner's written authorization.
3. Warranty service shall occur during normal business hours and commence within 16 hours of Owner's warranty service request.
4. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. System must operate on an open licensed JACE, no Appliance may be used.
 1. Tridium Vykon
 2. Distech
 3. Johnson Controls Facility Explorer
 4. Approved equal.
 - a. Substitute manufacturers must be submitted during the bid process and no substitutes will be accepted after the contract is awarded.

2.2 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

- A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate ANSI/ASHRAE Standard 135-2001 BACnet™ technology, MODBUS™, OPC, and other open and non-proprietary communication protocols into one open, interoperable system.
- B. The supplied computer software must employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-2001 and Open Protocol to assure interoperability between all system components is required. For each Open Protocol device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of Open Protocol devices must be via Ethernet, and/or RS-485, and/or RS-232.
- C. All components and controllers supplied under this Division shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.
- D. The supplied system must incorporate the ability to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. Systems requiring proprietary database and user interface programs shall not be acceptable.
- E. A hierarchical topology is required to assure reasonable system response times and to manage

the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.

2.3 NETWORK AREA CONTROLLER (NAC)

- A. The contractor must supply one or more Network Area Controllers (NAC, also referred to as JACE) as part of this contract. Number of area controllers required is dependent on the type and quantity of devices installed in the building. It is the responsibility of the contractor to field verify the quantity and type of devices.
- B. The Network Area Controller (NAC) must provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. It must be capable of executing application control programs to provide:
 - 1. Calendar functions
 - 2. Scheduling
 - 3. Trending
 - 4. Alarm monitoring and routing
 - 5. Time synchronization
 - 6. Integration of Open Protocol controller data
 - 7. Network Management functions for Open Protocol based devices
- C. The Network Area Controller must provide the following hardware features as a minimum:
 - 1. One Ethernet Port – 10/100 Mbps
 - 2. One RS-232 port
 - 3. One RS-485 port if Open Protocol controllers are used.
 - 4. Battery Backup
 - 5. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity)
 - 6. The NAC must be capable of operation over a temperature range of 32 to 122°F
 - 7. The NAC must be capable of withstanding storage temperatures of between 0 and 158°F
 - 8. The NAC must be capable of operation over a humidity range of 5 to 95% RH, non-condensing
- D. The NAC must support standard Web browser access via the Intranet/Internet. It must support a minimum of 32 simultaneous users.
- E. Event Alarm Notification and actions
 - 1. The NAC must provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
 - 2. The NAC must be able to route any alarm condition to any defined user location.
 - 3. Alarm generation must be selectable for annunciation type and acknowledgement requirements including, but not limited to:
 - a. In alarm

- b. Return to normal
 - c. Fault condition
 - 4. Provide for the creation of a minimum of eight alarm classes for the purpose of routing types and/or classes of alarms, i.e.: security, HVAC, Fire, etc.
 - 5. Provide timed (schedule) routing of alarms by class, object, group, or node.
 - 6. Provide alarm generation from binary object “runtime” and/or event counts for equipment maintenance. The user must be able to reset runtime or event count values with appropriate password control.
- F. Controller and network failures must be treated as alarms and annunciated.
- G. Alarms must be capable of being annunciated in any of the following manners as defined by the user:
- 1. Screen message text
 - 2. Email of the complete alarm message to multiple recipients via the Owner’s e-mail service. Provide the ability to route and email alarms based on:
 - a. Day of week
 - b. Time of day
 - c. Recipient
 - 3. Pagers via paging services that initiate a page on receipt of email message via the Owner’s e-mail service
 - 4. Graphic with flashing alarm object(s)
- H. The following must be recorded by the NAC for each alarm (at a minimum):
- 1. Time and date
 - 2. Location (building, floor, zone, office number, etc.)
 - 3. Equipment (air handler #, access way, etc.)
 - 4. Acknowledge time, date, and user who issued acknowledgement.
 - 5. Number of occurrences since last acknowledgement.
- I. Alarm actions may be initiated by user defined programmable objects created for that purpose.
- J. Defined users must be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
- K. A log of all alarms must be maintained by the NAC and/or a server (if configured in the system) and must be available for review by the user.
- L. Provide a “query” feature to allow review of specific alarms by user defined parameters.
- M. A separate log for system alerts (controller failures, network failures, etc.) must be provided and available for review by the user.

- N. An Error Log to record invalid property changes or commands must be provided and available for review by the user.

2.4 DATA COLLECTION AND STORAGE

- A. The NAC must have the ability to collect data for any property of any object and store this data for future use.
- B. The data collection must be performed by log objects, resident in the NAC that must have, at a minimum, the following configurable properties:
 - 1. Designating the log as interval or deviation.
 - 2. For interval logs, the object must be configured for time of day, day of week and the sample collection interval.
 - 3. For deviation logs, the object must be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
 - 4. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
 - 5. Each log must have the ability to have its data cleared on a time-based event or by a user-defined event or action.
- C. All log data must be stored in a relational database in the NAC and the data must be accessed from a server (if the system is so configured) or a standard Web browser.
- D. All log data must be available to the user in the following data formats:
 - 1. HTML
 - 2. XML
 - 3. Plain Text
 - 4. Comma or tab separated values
 - 5. PDF
- E. Systems that do not provide log data in HTML and XML formats at a minimum must not be acceptable.
- F. The NAC must have the ability to archive its log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:
 - 1. Archive on time of day
 - 2. Archive on user-defined number of data stores in the log (buffer size)
 - 3. Archive when log has reached its user-defined capacity of data stores
 - 4. Provide ability to clear logs once archived

2.5 AUDIT LOG

- A. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log

entry, provide the following data:

1. Time and date
2. User ID
3. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

2.6 DATABASE BACKUP AND STORAGE

- A. The NAC must have the ability to automatically backup its database. The database must be backed up based on a user-defined time interval.
- B. Copies of the current database and, at the most recently saved database must be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.
- C. The NAC database must be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2.7 GRAPHICAL USER INTERFACE SOFTWARE

- A. The GUI must employ browser-like functionality for ease of navigation. It must include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars must employ buttons, commands and navigation to permit the operator to perform tasks with a minimal knowledge of the HVAC Control System and basic computing skills. These must include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.
- B. Real-Time Displays. The GUI, must at a minimum, support the following graphical features and functions:

1. Graphic screens must be developed using any drawing package capable of generating a GIF, PNG, or JPG file format. Use of proprietary graphic file formats must not be acceptable. In addition to, or in lieu of, a graphic background the GUI must support the use of scanned pictures.
 2. Graphic screens must have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.
 3. Graphics must support layering and each graphic object must be configurable for assignment to a layer. A minimum of six layers must be supported.
 4. Modifying common application objects, such as schedules, calendars, and set points must be accomplished in a graphical manner.
 - a. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
 - b. Holidays must be set by using a graphical calendar without requiring any keyboard entry from the operator.
 5. Commands to start and stop binary objects must be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No text entry must be required.
 6. Adjustments to analog objects, such as set points, must be done by right-clicking the selected object and using a graphical slider to adjust the value. No text entry must be required
- C. System Configuration. At a minimum, the GUI must permit the operator to perform the following tasks, with proper password access:
1. Create, delete, or modify control strategies.
 2. Add or delete objects to the system.
 3. Tune control loops through the adjustment of control loop parameters.
 4. Enable or disable control strategies.
 5. Generate hard copy records or control strategies on a printer.
 - a. Select points to be alarm-able and define the alarm state.
 - b. Select points to be trended over a period of time and initiate the recording of values automatically.
- D. On-Line Help. Provide a context sensitive on-line help system to assist the operator in operation and editing of the system. On-line help must be available for all applications and must provide the relevant data for the currently displayed screen. Additional help information must be available through the use of hypertext. All system documentation and help files must be in HTML format.
- E. Security. Each operator must be required to log on to the system with a user name and password in order to view, edit, add, or delete data. System security must be selectable for each operator. The system administrator must have the ability to set passwords and security levels for all other operators. Each operator password must be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator must automatically be logged off the system if no keyboard or mouse activity is detected for a specified time. This auto log-off time must be set per operator password. All system security data must be stored in an encrypted format.
- F. System Diagnostics. The system must automatically monitor the operation of all network connections, building management panels, and controllers. The failure of any device must be annunciated to the operator.
- G. Alarm Console

1. The system must be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console may be enabled or disabled by the system administrator.
2. When the Alarm Console is enabled, a separate alarm notification window will supersede all other windows on the desktop and must not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and unacknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator must not be acceptable.

2.8 WEB BROWSER CLIENTS

- A. The system must be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer, Firefox, etc. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers must not be acceptable.
- B. The Web browser software must run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the BAS, must not be acceptable.
- C. The Web browser must provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface (if used). Systems that require different graphic views, different means of graphic generation, or that require different means of interacting with objects such as schedules, or logs, must not be permitted.
- D. The Web browser client must support at a minimum, the following functions:
 1. User log-on identification and password must be required. If an unauthorized user attempts access, a blank web page must be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access must be implemented.
 2. Graphical screens developed for the GUI must be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI must be supported by the Web browser interface.
 3. HTML programming must not be required to display system graphics or data on a Web page. HTML editing of the Web page must be allowed if the user desires a specific look or format.
 4. Storage of the graphical screens must be in the Network Area Controller (NAC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
 5. Real-time values displayed on a Web page must update automatically without requiring a manual "refresh" of the Web page.
 6. Users must have administrator-defined access privileges. Depending on the access privileges assigned, the user must be able to perform the following:
 - a. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.

- 1) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
 - 2) Holidays must be set by using a graphical calendar, without requiring any keyboard entry from the operator.
 - 3) Commands to start and stop binary objects must be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No text entry must be required.
 - 4) View logs and charts
 - 5) View and acknowledge alarms
 - 6) Setup and execute SQL queries on log and archive information
7. The system must provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to set a specific home page for each user. From the home page, links to other views, or pages in the system must be possible, if allowed by the system administrator.
 8. Graphic screens on the Web Browser client must support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.9 SYSTEM CONFIGURATION TOOL

- A. The Graphical User Interface software (GUI) must provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access to the programming functions and features of the GUI must be through password access as assigned by the system administrator.
- B. A library of control, application, and graphic objects must be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens must be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display. Systems requiring separate software tools or processes to create applications and user interface displays must not be acceptable.
- C. Programming Methods
 1. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user's application. Objects must be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects must maintain their connections to other objects regardless of where they are positioned on the page and must show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.
 2. Configuration of each object will be done through the object's property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming,

scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.

3. The software must provide the ability to view the logic in a monitor mode. When on-line, the monitor mode must provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode must allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
4. The system must support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, must be maintained during duplication.

2.10 LIBRARY

- A. A standard library of objects must be included for development and setup of application logic, user interface displays, system services, and communication networks.
- B. The objects in this library must be capable of being copied and pasted into the user's database and must be organized according to their function. In addition, the user must have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.
- C. In addition to the standard libraries specified here, the supplier of the system must maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated objects and applications as they are developed.
- D. All control objects must conform to the control objects specified in the Open Protocol specification.
- E. The library must include applications or objects for the following functions, at a minimum:
 1. Scheduling Object. The schedule must conform to the schedule object as defined in the Open Protocol specification, providing 7-day plus holiday & temporary scheduling features and a minimum of 10 on/off events per day. Data entry to be by graphical sliders to speed creation and selection of on-off events.
 2. Calendar Object. The calendar must conform to the calendar object as defined in the Open Protocol specification, providing 12-month calendar features to allow for holiday or special event data entry. Data entry to be by graphical "point-and-click" selection. This object must be "linkable" to any or all scheduling objects for effective event control.
 3. Duty Cycling Object. Provide a universal duty cycle object to allow repetitive on/off time control of equipment as an energy conserving measure. Any number of these objects may be created to control equipment at varying intervals
 4. Temperature Override Object. Provide a temperature override object that is capable of overriding equipment turned off by other energy saving programs (scheduling, duty cycling etc.) to maintain occupant comfort or for equipment freeze protection.
 5. Start-Stop Time Optimization Object. Provide a start-stop time optimization object to provide the capability of starting equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled un-occupancy time just far enough ahead to take advantage of the building's "flywheel" effect for energy savings.

- Provide automatic tuning of all start / stop time object properties based on the previous day's performance.
6. Demand Limiting Object. Provide a comprehensive demand-limiting object that is capable of controlling demand for any selected energy utility (electric, oil, and gas). The object must provide the capability of monitoring a demand value and predicting (by use of a sliding window prediction algorithm) the demand at the end of the user defined interval period (1-60 minutes). This object must also accommodate a utility meter time sync pulse for fixed interval demand control. Upon a prediction that will exceed the user defined demand limit (supply a minimum of 6 per day), the demand limiting object must issue shed commands to either turn off user specified loads or modify equipment set points to effect the desired energy reduction. If the list of sheddable equipment is not enough to reduce the demand to below the set point, a message must be displayed on the users screen (as an alarm) instructing the user to take manual actions to maintain the desired demand. The shed lists are specified by the user and must be selectable to be shed in either a fixed or rotating order to control which equipment is shed the most often. Upon suitable reductions in demand, the demand-limiting object must restore the equipment that was shed in the reverse order in which it was shed. Each sheddable object must have a minimum and maximum shed time property to affect both equipment protection and occupant comfort.
- F. The library must include control objects for the following functions. All control objects must conform to the objects as specified in the Open Protocol specification.
1. Analog Input Object - Minimum requirement is to comply with the Open Protocol standard for data sharing. Allow high, low and failure limits to be assigned for alarming. Also, provide a time delay filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.
 2. Analog Output Object - Minimum requirement is to comply with the Open Protocol standard for data sharing.
 3. Binary Input Object - Minimum requirement is to comply with the Open Protocol standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment run-time by counting the amount of time the hardware input is in an "on" condition. The user must be able to specify either input condition as the "on" condition.
 4. Binary Output Object - Minimum requirement is to comply with the Open Protocol standard for data sharing. Properties to enable minimum on and off times for equipment protection as well as interstart delay must be provided. The Open Protocol Command Prioritization priority scheme must be incorporated to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide sixteen levels of priority as a minimum. Systems not employing the Open Protocol method of contention resolution must not be acceptable.
 5. PID Control Loop Object - Minimum requirement is to comply with the Open Protocol standard for data sharing. Each individual property must be adjustable as well as to be disabled to allow proportional control only, or proportional with integral control, as well as proportional, integral and derivative control.
 6. Comparison Object - Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.

7. Math Object - Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.
 8. Custom Programming Objects - Provide a blank object template for the creation of new custom objects to meet specific user application requirements. This object must provide a simple BASIC-like programming language that is used to define object behavior. Provide a library of functions including math and logic functions, string manipulation, and e-mail as a minimum. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for re-use.
 9. Interlock Object - Provide an interlock object that provides a means of coordination of objects within a piece of equipment such as an Air Handler or other similar types of equipment. An example is to link the return fan to the supply fan such that when the supply fan is started, the return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming thereby eliminating nuisance alarms during the off period.
 10. Temperature Override Object - Provide an object whose purpose is to provide the capability of overriding a binary output to an "On" state in the event a user specified high or low limit value is exceeded. This object is to be linked to the desired binary output object as well as to an analog object for temperature monitoring, to cause the override to be enabled. This object will execute a Start command at the Temperature Override level of start/stop command priority unless changed by the user.
 11. Composite Object - Provide a container object that allows a collection of objects representing an application to be encapsulated to protect the application from tampering, or to more easily represent large applications. This object must have the ability to allow the user to select the appropriate parameters of the "contained" application that are represented on the graphical shell of this container.
- G. The object library must include objects to support the integration of devices connected to the Network Area Controller (NAC). At a minimum, provide the following as part of the standard library included with the programming software:
1. For Open Protocol devices, provide the following objects at a minimum:
 - a. Analog In
 - b. Analog Out
 - c. Analog Value
 - d. Binary
 - e. Binary In
 - f. Binary Out
 - g. Binary Value
 - h. Multi-State In
 - i. Multi-State Out
 - j. Multi-State Value
 - k. Schedule Export

- l. Calendar Export
 - m. Trend Export
 - n. Device
 2. For each Open Protocol object, provide the ability to assign the object an Open Protocol device and object instance number.
 3. For Open Protocol devices, provide the following support at a minimum
 - a. Segmentation
 - b. Segmented Request
 - c. Segmented Response
 - d. Application Services
 - e. Read Property
 - f. Read Property Multiple
 - g. Write Property
 - h. Who-has
 - i. I-have
 - j. Who-is
 - k. I-am
 - l. Media Types
 - m. Ethernet
 - n. Open Protocol IP Annex J
 - o. MSTP
 - p. Open Protocol Broadcast Management Device (BBMD) function
 - q. Routing

2.11 DDE DEVICE INTEGRATION

- A. The Network Area Controller must support the integration of device data via Dynamic Data Exchange (DDE), over the Ethernet Network. The Network Area Controller must act as a DDE client to another software application that functions as a DDE server.
- B. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of these devices into the BAS. Objects provided must include at a minimum:
 1. DDE Generic AI Object
 2. DDE Generic AO Object
 3. DDE Generic BO Object
 4. DDE Generic BI Object

2.12 PERFORMANCE REQUIREMENTS

- A. DDC System Speed:
 1. Response Time of Connected I/O:
 - a. AI point values connected to DDC system shall be updated at least every five seconds for use by DDC controllers. Points used globally shall also comply with this requirement.

- b. BI point values connected to DDC system shall be updated at least every five seconds for use by DDC controllers. Points used globally shall also comply with this requirement.
 - c. AO points connected to DDC system shall begin to respond to controller output commands within two second(s). Global commands shall also comply with this requirement.
 - d. BO point values connected to DDC system shall respond to controller output commands within two second(s). Global commands shall also comply with this requirement.
- 2. Display of Connected I/O:
 - a. Analog point COV connected to DDC system shall be updated and displayed at least every 10 seconds for use by operator.
 - b. Binary point COV connected to DDC system shall be updated and displayed at least every 10 seconds for use by operator.
 - c. Alarms of analog and digital points connected to DDC system shall be displayed within 45 seconds of activation or change of state.
 - d. Graphic display refresh shall update within eight seconds.
 - e. Point change of values and alarms displayed from workstation to workstation when multiple operators are viewing from multiple workstations shall not exceed graphic refresh rate indicated.
- B. Network Bandwidth: Design each network of DDC system to include at least 30 percent available spare bandwidth with DDC system operating under normal and heavy load conditions indicated. Calculate bandwidth usage, and apply a safety factor to ensure that requirement is satisfied when subjected to testing under worst case conditions.
- C. DDC System Data Storage:
 - 1. Include capability to archive not less than 24 consecutive months of historical data for all I/O points connected to system, including alarms, event histories, transaction logs, trends and other information indicated.
 - 2. Cloud Storage:
 - a. Connect to existing Niagara N4 cloud-based server. Cloud storage shall use IT industry standard database platforms and be capable of functions described in "DDC Data Access" Paragraph.
- D. DDC Data Access:
 - 1. When logged into the system, operator shall be able to also interact with any DDC controller connected to DDC system as required for functional operation of DDC system.
 - 2. System(s) shall be used for application configuration; for archiving, reporting and trending of data; for operator transaction archiving and reporting; for network information management; for alarm annunciation; and for operator interface tasks and controls application management.
- E. Future Expandability:

1. DDC system size shall be expandable to an ultimate capacity of at least two times total I/O points indicated.
2. Additional DDC controllers, I/O and associated wiring shall be all that is needed to achieve ultimate capacity. Initial network infrastructure shall be designed and installed to support ultimate capacity.
3. Operator interfaces installed initially shall not require hardware and software additions and revisions for ultimate capacity.

F. Environmental Conditions for Controllers:

1. Products shall operate without performance degradation under ambient environmental temperature, pressure and humidity conditions encountered for installed location.
 - a. If product alone cannot comply with requirement, install product in a protective enclosure that is isolated and protected from conditions impacting performance. Enclosure shall be internally insulated, electrically heated, cooled and ventilated as required by product and application.
2. Products shall be protected with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Products not available with integral enclosures complying with requirements indicated shall be housed in protective secondary enclosures. Installed location shall dictate the following NEMA 250 enclosure requirements:
 - a. Indoors, Heated and Air Conditioned: Type 1.
 - b. Mechanical Equipment Rooms:
 - 1) Chiller and Boiler Rooms: Type 12.
 - 2) Air-Moving Equipment Rooms: Type 1.

G. Environmental Conditions for Instruments and Actuators:

1. Instruments and actuators shall operate without performance degradation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified and encountered for installed location.
 - a. If instruments and actuators alone cannot comply with requirement, install instruments and actuators in protective enclosures that are isolated and protected from conditions impacting performance. Enclosure shall be internally insulated, electrically heated and ventilated as required by instrument and application.
2. Instruments, actuators and accessories shall be protected with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Instruments and actuators not available with integral enclosures complying with requirements indicated shall be housed in protective secondary enclosures. Installed location shall dictate the following NEMA 250 enclosure requirements:
 - a. Outdoors, Protected: Type 2.
 - b. Outdoors, Unprotected: Type 4.
 - c. Indoors, Heated with Filtered Ventilation: Type 1.
 - d. Indoors, Heated and Air-conditioned: Type 1.

e. Mechanical Equipment Rooms:

- 1) Chiller and Boiler Rooms: Type 12.
- 2) Air-Moving Equipment Rooms: Type 1.

H. DDC System Reliability:

1. Design, install and configure DDC controllers, to yield a MTBF of at least 40,000 hours, based on a confidence level of at least 90 percent. MTBF value shall include any failure for any reason to any part of products indicated.
2. If required to comply with MTBF indicated, include DDC system and product redundancy to maintain DCC system, and associated systems and equipment that are being controlled, operational and under automatic control.
3. Critical systems and equipment that require a higher degree of DDC system redundancy than MTBF indicated shall be indicated on Drawings.

I. Electric Power Quality:

1. Power-Line Surges:

- a. Protect susceptible DDC system products connected to ac power circuits from power-line surges to comply with requirements of IEEE C62.41.
- b. Do not use fuses for surge protection.
- c. Test protection in the normal mode and in the common mode, using the following two waveforms:
 - 1) 10-by-1000-mic.sec. waveform with a peak voltage of 1500 V and a peak current of 60 A.
 - 2) 8-by-20-mic.sec. waveform with a peak voltage of 1000 V and a peak current of 500 A.

2. Ground Fault: Protect products from ground fault by providing suitable grounding. Products shall not fail due to ground fault condition.

2.13 NETWORK COMMUNICATION PROTOCOL

- A. Network communication protocol(s) used throughout entire DDC system shall be open to Owner and available to other companies for use in making future modifications to DDC system.

B. ASHRAE 135 Protocol:

1. ASHRAE 135 communication protocol shall be sole and native protocol used throughout entire DDC system.
2. DDC system shall not use new gateways. Network controllers must be capable of integrating all existing field devices.
3. Controllers and other network devices shall be tested and listed by BACnet Testing Laboratories.

2.14 DDC CONTROLLERS

- A. DDC system shall consist of a combination of network controllers, programmable application controllers and application-specific controllers to satisfy performance requirements indicated.
- B. DDC controllers shall perform monitoring, control, energy optimization and other requirements indicated.
- C. DDC controllers shall use a multitasking, multiuser, real-time digital control microprocessor with a distributed network database and intelligence.
- D. Each DDC controller shall be capable of full and complete operation as a completely independent unit and as a part of a DDC system wide distributed network.
- E. Environment Requirements:
 - 1. Controller hardware shall be suitable for the anticipated ambient conditions.
- F. Power and Noise Immunity:
 - 1. Controller shall operate at 90 to 110 percent of nominal voltage rating and shall perform an orderly shutdown below 80 percent of nominal voltage.
 - 2. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios with up to 5 W of power located within 36 inches of enclosure.
- G. DDC Controller Spare Processing Capacity:
 - 1. Include spare processing memory for each controller. RAM, PROM, or EEPROM will implement requirements indicated with the following spare memory:
 - a. Network Controllers: 50 percent.
 - b. Programmable Application Controllers: Not less than 60 percent.
 - c. Application-Specific Controllers: Not less than 70 percent.
 - 2. Memory shall support DDC controller's operating system and database and shall include the following:
 - a. Monitoring and control.
 - b. Energy management, operation and optimization applications.
 - c. Alarm management.
 - d. Historical trend data of all connected I/O points.
 - e. Maintenance applications.
 - f. Operator interfaces.
 - g. Monitoring of manual overrides.
- H. DDC Controller Spare I/O Point Capacity: Include spare I/O point capacity for each controller as follows:
 - 1. Network Controllers:

- a. 20 percent of each AI, AO, BI, and BO point connected to controller.
 - b. Minimum Spare I/O Points per Controller:
 - 1) AIs: Two.
 - 2) AOs: Two.
 - 3) BIs: Three.
 - 4) BOs: Three.
2. Programmable Application Controllers:
- a. 20 percent of each AI, AO, BI, and BO point connected to controller.
 - b. Minimum Spare I/O Points per Controller:
 - 1) AIs: Two.
 - 2) AOs: Two.
 - 3) BIs: Three.
 - 4) BOs: Three.
3. Application-Specific Controllers:
- a. 10 percent of each AI, AO, BI, and BO point connected to controller.
 - b. Minimum Spare I/O Points per Controller:
 - 1) AIs: One.
 - 2) AOs: One.
 - 3) BIs: One.
 - 4) BOs: One.
- I. Maintenance and Support: Include the following features to facilitate maintenance and support:
- 1. Mount microprocessor components on circuit cards for ease of removal and replacement.
 - 2. Means to quickly and easily disconnect controller from network.
 - 3. Means to quickly and easily access connect to field test equipment.
 - 4. Visual indication that controller electric power is on, of communication fault or trouble, and that controller is receiving and sending signals to network.
- J. Input and Output Point Interface:
- 1. Hardwired input and output points shall connect to network, programmable application and application-specific controllers.
 - 2. Input and output points shall be protected so shorting of point to itself, to another point, or to ground will not damage controller.
 - 3. Input and output points shall be protected from voltage up to 24 V of any duration so that contact will not damage controller.
- 2.15 NETWORK CONTROLLERS
- A. General Network Controller Requirements:
- 1. Include adequate number of controllers to achieve performance indicated.

2. System shall consist of one or more independent, standalone, microprocessor-based network controllers to manage global strategies indicated.
3. Controller shall have enough memory to support its operating system, database, and programming requirements.
4. Data shall be shared between networked controllers and other network devices.
5. Operating system of controller shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
6. Controllers that perform scheduling shall have a real-time clock.
7. Controller shall continually check status of its processor and memory circuits. If an abnormal operation is detected, controller shall assume a predetermined failure mode and generate an alarm notification.
8. Controllers shall be fully programmable.

B. Operator Interface:

1. Controller shall be equipped with a service communications port for connection to a portable operator's workstation.

C. Serviceability:

1. Controller shall be equipped with diagnostic LEDs or other form of local visual indication of power, communication, and processor.
2. Wiring and cable connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
3. Controller shall maintain BIOS and programming information in event of a power loss for at least 96 hours.

2.16 PROGRAMMABLE APPLICATION CONTROLLERS

A. General Programmable Application Controller Requirements:

1. Include adequate number of controllers to achieve performance indicated.
2. Controller shall have enough memory to support its operating system, database, and programming requirements.
3. Data shall be shared between networked controllers and other network devices.
4. Operating system of controller shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
5. Controllers that perform scheduling shall have a real-time clock.
6. Controller shall continually check status of its processor and memory circuits. If an abnormal operation is detected, controller shall assume a predetermined failure mode and generate an alarm notification.
7. Controllers shall be fully programmable.

B. Communication:

1. Programmable application controllers shall communicate with other devices on network.

C. Operator Interface:

1. Controller shall be equipped with a service communications port for connection to a portable operator's workstation.

D. Serviceability:

1. Controller shall be equipped with diagnostic LEDs or other form of local visual indication of power, communication, and processor.
2. Wiring and cable connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
3. Controller shall maintain BIOS and programming information in event of a power loss

2.17 CONTROLLER SOFTWARE

A. General Controller Software Requirements:

1. Software applications shall reside and operate in controllers. Editing of applications shall occur at operator workstations via web access.
2. I/O points shall be identified by up to 30-character point name and up to 16-character point descriptor.
3. Control functions shall be executed within controllers using DDC algorithms.
4. Controllers shall be configured to use stored default values to ensure fail-safe operation. Default values shall be used when there is a failure of a connected input instrument or loss of communication of a global point value.

B. Security:

1. Operator access shall be secured using individual security passwords and user names.
2. Passwords shall restrict operator to points, applications, and system functions as assigned by system manager.
3. Operator log-on and log-off attempts shall be recorded.
4. System shall protect itself from unauthorized use by automatically logging off after last keystroke. The delay time shall be operator-definable.

C. Scheduling: Include capability to schedule each point or group of points in system. Each schedule shall consist of the following:

1. Weekly Schedule:

- a. Include separate schedules for each day of week.
- b. Each schedule should include the capability for start, stop, optimal start, optimal stop, and night economizer.
- c. Each schedule may consist of up to 10 events.
- d. When a group of objects are scheduled together, include capability to adjust start and stop times for each member.

2. Exception Schedules:

- a. Include ability for operator to designate any day of the year as an exception schedule.

- b. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed, it will be discarded and replaced by regular schedule for that day of week.
 - 3. Holiday Schedules:
 - a. Include capability for operator to define up to 99 special or holiday schedules.
 - b. Schedules may be placed on scheduling calendar and will be repeated each year.
 - c. Operator shall be able to define length of each holiday period.
- D. System Coordination:
 - 1. Include standard application for proper coordination of equipment.
 - 2. Application shall include operator with a method of grouping together equipment based on function and location.
 - 3. Group may then be used for scheduling and other applications.
- E. Binary Alarms:
 - 1. Each binary point shall be set to alarm based on operator-specified state.
 - 2. Include capability to automatically and manually disable alarming.
- F. Analog Alarms:
 - 1. Each analog object shall have both high and low alarm limits.
 - 2. Alarming shall be able to be automatically and manually disabled.
- G. Alarm Reporting:
 - 1. Operator shall be able to determine action to be taken in event of an alarm.
 - 2. Alarms shall be routed to appropriate operator workstations or mobile devices based on time and other conditions.
 - 3. Alarm shall be able to start programs, print, be logged in event log, generate custom messages, and display graphics.
- H. Remote Communication:
 - 1. System shall have ability to dial out in the event of an alarm.
- I. Maintenance Management: System shall monitor equipment status and generate maintenance messages based on operator-designated run-time, starts, and calendar date limits.
- J. Sequencing: Include application software based on sequences of operation indicated to properly sequence chillers, boilers, and other applicable HVAC equipment.
- K. Control Loops:
 - 1. Support any of the following control loops, as applicable to control required:
 - a. Two-position (on/off, open/close, slow/fast) control.

- b. Proportional control.
 - c. Proportional plus integral (PI) control.
 - d. Proportional plus integral plus derivative (PID) control.
 - 1) Include PID algorithms with direct or reverse action and anti-windup.
 - 2) Algorithm shall calculate a time-varying analog value used to position an output or stage a series of outputs.
 - 3) Controlled variable, set point, and PID gains shall be operator-selectable.
 - e. Adaptive (automatic tuning).
- L. Staggered Start: Application shall prevent all controlled equipment from simultaneously restarting after a power outage. Order which equipment (or groups of equipment) is started, along with the time delay between starts, shall be operator-selectable.
- M. Energy Calculations:
 - 1. Include software to allow instantaneous power or flow rates to be accumulated and converted to energy usage data.
 - 2. Include an algorithm that calculates a sliding-window average (rolling average). Algorithm shall be flexible to allow window intervals to be operator specified (such as 15, 30, or 60 minutes).
 - 3. Include an algorithm that calculates a fixed-window average. A digital input signal shall define start of window period (such as signal from utility meter) to synchronize fixed-window average with that used by utility.
- N. Anti-Short Cycling:
 - 1. BO points shall be protected from short cycling.
 - 2. Feature shall allow minimum on-time and off-time to be selected.
- O. On and Off Control with Differential:
 - 1. Include an algorithm that allows a BO to be cycled based on a controlled variable and set point.
 - 2. Algorithm shall be direct- or reverse-acting and incorporate an adjustable differential.
- P. Run-Time Totalization:
 - 1. Include software to totalize run-times for all BI and BO points.
 - 2. A high run-time alarm shall be assigned, if required, by operator.

2.18 ENCLOSURES

- A. General Enclosure Requirements:
 - 1. House each controller and associated control accessories in a single enclosure. Enclosure shall serve as central tie-in point for control devices such as switches, transmitters, transducers, power supplies and transformers.
 - 2. Do not house more than one controller in a single enclosure.

3. Include enclosure door with key locking mechanism. Key locks alike for all enclosures and include one pair of keys per enclosure.
4. Include wall-mounted enclosures with brackets suitable for mounting enclosures to wall or freestanding support stand as indicated.
5. Supply each enclosure with a complete set of as-built schematics, and wiring diagrams and product literature located in a pocket on inside of door.

B. Internal Arrangement:

1. Internal layout of enclosure shall group and protect electric and electronic components associated with a controller, but not an integral part of controller.
2. Arrange layout to group similar products together.
3. Include a barrier between line-voltage and low-voltage electrical and electronic products.
4. Factory or shop install products, cabling and wiring complying with requirements and standards indicated.
5. Terminate field cable and wire using heavy-duty terminal blocks.
6. Include spare terminals, equal to not less than 10 percent of used terminals.
7. Include spade lugs for stranded cable and wire.
8. Install a maximum of two wires on each side of a terminal.
9. Include enclosure field power supply with a toggle-type switch located at entrance inside enclosure to disconnect power.
10. Mount products within enclosure on removable internal panel(s).
11. Include products mounted in enclosures with engraved, laminated phenolic nameplates (black letters on a white background). The nameplates shall have at least 1/4-inch-high lettering.
12. Route cable and wire located inside enclosure within a raceway with a continuous removable cover.
13. Label each end of cable and wire in enclosure following an approved identification system that extends from field I/O connection and all intermediate connections throughout length to controller connection.
14. Size enclosure internal panel to include at least 25 percent spare area on face of panel.

2.19 RELAYS

A. General-Purpose Relays:

1. Relays shall be heavy duty and rated for at least 10 A at 250-V ac and 60 Hz.
2. Relays shall be either double pole double throw (DPDT) or three-pole double throw, depending on the control application.
3. Use a plug-in-style relay with an eight-pin octal plug for DPDT relays and an 11-pin octal plug for three-pole double-throw relays.
4. Construct the contacts of either silver cadmium oxide or gold.
5. Enclose the relay in a clear transparent polycarbonate dust-tight cover.
6. Relays shall have LED indication and a manual reset and push-to-test button.
7. Performance:
 - a. Mechanical Life: At least 10 million cycles.
 - b. Electrical Life: At least 100,000 cycles at rated load.
 - c. Pickup Time: 15 ms or less.
 - d. Dropout Time: 10 ms or less.
 - e. Pull-in Voltage: 85 percent of rated voltage.

- f. Dropout Voltage: 50 percent of nominal rated voltage.
 - g. Power Consumption: 2 VA.
 - h. Ambient Operating Temperatures: Minus 40 to 115 deg F.
 - 8. Equip relays with coil transient suppression to limit transients to non-damaging levels.
 - 9. Plug each relay into an industry-standard, 35-mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.
 - 10. Relay socket shall have screw terminals. Mold into the socket the coincident screw terminal numbers and associated octal pin numbers.
- B. Multifunction Time-Delay Relays:
- 1. Relays shall be continuous duty and rated for at least 10 A at 240-V ac and 60 Hz.
 - 2. Relays shall be DPDT relay with up to eight programmable functions to provide on/off delay, interval and recycle timing functions.
 - 3. Use a plug-in-style relay with either an 8- or 11-pin octal plug.
 - 4. Construct the contacts of either silver cadmium oxide or gold.
 - 5. Enclose the relay in a dust-tight cover.
 - 6. Include knob and dial scale for setting delay time.
 - 7. Performance:
 - a. Mechanical Life: At least 10 million cycles.
 - b. Electrical Life: At least 100,000 cycles at rated load.
 - c. Timing Ranges: Multiple ranges from 0.1 seconds to 100 minutes.
 - d. Repeatability: Within 2 percent.
 - e. Recycle Time: 45 ms.
 - f. Minimum Pulse Width Control: 50 ms.
 - g. Power Consumption: 5 VA or less at 120-V ac.
 - h. Ambient Operating Temperatures: Minus 40 to 115 deg F.
 - 8. Equip relays with coil transient suppression to limit transients to non-damaging levels.
 - 9. Plug each relay into an industry-standard, 35-mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.
 - 10. Relay socket shall have screw terminals. Mold into the socket the coincident screw terminal numbers and associated octal pin numbers.
- C. Latching Relays:
- 1. Relays shall be continuous duty and rated for at least 10 A at 250-V ac and 60 Hz.
 - 2. Relays shall be either DPDT or three-pole double throw, depending on the control application.
 - 3. Use a plug-in-style relay with a multibladed plug.
 - 4. Construct the contacts of either silver cadmium oxide or gold.
 - 5. Enclose the relay in a clear transparent polycarbonate dust-tight cover.
 - 6. Performance:
 - a. Mechanical Life: At least 10 million cycles.
 - b. Electrical Life: At least 100,000 cycles at rated load.
 - c. Pickup Time: 15 ms or less.
 - d. Dropout Time: 10 ms or less.
 - e. Pull-in Voltage: 85 percent of rated voltage.
 - f. Dropout Voltage: 50 percent of nominal rated voltage.

- g. Power Consumption: 2 VA.
 - h. Ambient Operating Temperatures: Minus 40 to 115 deg F.
 - 7. Equip relays with coil transient suppression to limit transients to non-damaging levels.
 - 8. Plug each relay into an industry-standard, 35-mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.
 - 9. Relay socket shall have screw terminals. Mold into the socket the coincident screw terminal numbers and associated octal pin numbers.
- D. Current Sensing Relay:
 - 1. Monitors ac current.
 - 2. Independent adjustable controls for pickup and dropout current.
 - 3. Energized when supply voltage is present and current is above pickup setting.
 - 4. De-energizes when monitored current is below dropout current.
 - 5. Dropout current is adjustable from 50 to 95 percent of pickup current.
 - 6. Include a current transformer, if required for application.
 - 7. House current sensing relay and current transformer in its own enclosure. Use NEMA 250, Type 12 enclosure for indoors and NEMA 250, Type 4 for outdoors.
- E. Combination On-Off Status Sensor and On-Off Relay:
 - 1. Description:
 - a. On-off control and status indication in a single device.
 - b. LED status indication of activated relay and current trigger.
 - c. Closed-Open-Auto override switch located on the load side of the relay.
 - 2. Performance:
 - a. Ambient Temperature: Minus 30 to 140 deg F.
 - b. Voltage Rating: Single-phase loads rated for 300-V ac. Three-phase loads rated for 600-V ac.
 - 3. Status Indication:
 - a. Current Sensor: Integral sensing for single-phase loads up to 20 A and external solid or split sensing ring for three-phase loads up to 150 A.
 - b. Current Sensor Range: As required by application.
 - c. Current Set Point: [Fixed] [Adjustable] [Fixed or adjustable as required by application].
 - d. Current Sensor Output:
 - 1) Solid-state, single-pole double-throw contact rated for 30-V ac and dc and for 0.4 A.
 - 2) Solid-state, single-pole double-throw contact rated for 120-V ac and 1.0 A.
 - 3) Analog, zero- to 5- or 10-V dc.
 - 4) Analog, 4 to 20 mA, loop powered.
 - 4. Relay: Single-pole double-throw, continuous-duty coil; rated for 10-million mechanical cycles.
 - 5. Enclosure: NEMA 250, Type 1 enclosure.

2.20 CONTROL WIRE AND CABLE

A. Single Twisted Shielded Instrumentation Cable 24 V and Less:

1. Wire size shall be a minimum No. 18 AWG.
2. Conductors shall be a twisted, 7/24 soft annealed copper stranding with a 2- to 2.5-inch lay.
3. Conductor insulation shall have a nominal 15-mil thickness, constructed from flame-retardant PVC.
4. Shielding shall be 100 percent type, 1.35-mil aluminum/polymer tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
5. Outer jacket insulation shall have a 300-V, 105-deg C rating and shall be Type PLTC cable.
6. For twisted pair, conductor colors shall be black and white. For twisted triad, conductor colors shall be black, red and white.
7. Furnish wire on spools.

B. Communication Cable: Comply with DDC system manufacturer requirements for network being installed.

1. Cable shall be balanced twisted pair.
 - a. Cable shall be plenum rated.
 - b. Cable shall have a unique color that is different from other cables used on Project.

2.21 RACEWAYS

A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for electrical power raceways and boxes.

2.22 ACCESSORIES

A. Damper Blade Limit Switches:

1. Sense positive open and/or closed position of the damper blades.
2. NEMA 250, Type 13, oil-tight construction.
3. Arrange for the mounting application.
4. Additional waterproof enclosure when required by its environment.
5. Arrange to prevent "over-center" operation.

2.23 IDENTIFICATION

A. Control Equipment, Instruments, and Control Devices:

1. Self-adhesive label bearing unique identification.
 - a. Include instruments with unique identification identified by equipment being controlled or monitored, followed by point identification.

2. Letter size shall be as follows:
 - a. DDC Controllers: Minimum of 0.5 inch high.
 - b. Enclosures: Minimum of 0.5 inch high.
 - c. Electrical Power Devices: Minimum of 0.25 inch high.
 - d. Accessories: Minimum of 0.25 inch high.
 - e. Instruments: Minimum of 0.25 inch high.
 - f. Control Damper and Valve Actuators: Minimum of 0.25 inch high.
3. Legend shall consist of white lettering on black background.
4. Laminated acrylic or melamine plastic sign shall be engraved phenolic consisting of three layers of rigid laminate. Top and bottom layers are color-coded black with contrasting white center exposed by engraving through outer layer and shall be fastened with drive pins.
5. Instruments, control devices and actuators with Project-specific identification tags having unique identification numbers following requirements indicated and provided by original manufacturer do not require additional identification.

B. Raceway and Boxes:

1. Provide labeling.
2. Paint cover plates on junction boxes and conduit same color as the tape banding for conduits. After painting, label cover plate "HVAC Controls," using an engraved phenolic tag.
3. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for electrical power raceways and boxes

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. Verify compatibility with and suitability of substrates.
 2. Examine roughing-in for products to verify actual locations of connections before installation.
 - a. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.
 - b. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.
 3. Examine walls, floors, roofs, and ceilings for suitable conditions where product will be installed.
 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install products to satisfy more stringent of all requirements indicated.
- B. Install products level, plumb, parallel, and perpendicular with building construction.
- C. Support products, wiring, and raceways, comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for electrical power raceways and boxes and comply with requirements in Section 260519 "Low-voltage electrical power conductors and cables" for electrical wiring .
- D. If codes and referenced standards are more stringent than requirements indicated, comply with requirements in codes and referenced standards.
- E. Fabricate openings and install sleeves in ceilings, floors, roof, and walls required by installation of products. Before proceeding with drilling, punching, and cutting, check for concealed work to avoid damage. Patch, flash, grout, seal, and refinish openings to match adjacent condition.
- F. Firestop penetrations made in Fire-Rated or Smoke-Rated assemblies.
- G. Seal penetrations made in acoustically rated assemblies.
- H. Fastening Hardware:
 - 1. Stillson wrenches, pliers, and other tools that damage surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening fasteners.
 - 2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
 - 3. Lubricate threads of bolts, nuts and screws with graphite and oil before assembly.
- I. If product locations are not indicated, install products in locations that are accessible and that will permit service and maintenance from floor, equipment platforms, or catwalks without removal of permanently installed furniture and equipment.

3.3 CONTROLLER INSTALLATION

- A. Install controllers in enclosures to comply with indicated requirements.
- B. Install controller with latest version of applicable software and configure to execute requirements indicated.
- C. Test and adjust controllers to verify operation of connected I/O to achieve performance indicated requirements while executing sequences of operation.
- D. Installation of Network Controllers:
 - 1. Quantity and location of network controllers shall be determined by DDC system manufacturer to satisfy requirements indicated.
 - 2. Install controllers in a protected location that is easily accessible by operators.
 - 3. Top of controller shall be within 72 inches of finished floor.

E. Installation of Programmable Application Controllers:

1. Quantity and location of programmable application controllers shall be determined by DDC system manufacturer to satisfy requirements indicated.
2. Install controllers in a protected location that is easily accessible by operators.
3. Top of controller shall be within 72 inches of finished floor.

3.4 ENCLOSURES INSTALLATION

A. Install the following items in enclosures, to comply with indicated requirements:

1. Network Controllers.
2. Electrical power devices.

B. Attach wall-mounted enclosures to wall using the following types of steel struts:

1. For NEMA 250, Type 1 Enclosures: Use corrosion-resistant-coated steel strut and hardware.
2. For NEMA 250, Type 4 Enclosures and Enclosures Located Outdoors: Use stainless-steel strut and hardware.
3. Install plastic caps on exposed cut edges of strut.

C. Align top of adjacent enclosures of like size.

D. Install continuous and fully accessible wireways to connect conduit, wire, and cable to multiple adjacent enclosures. Wireway used for application shall have protection equal to NEMA 250 rating of connected enclosures.

3.5 ELECTRIC POWER CONNECTIONS

A. Connect electrical power to DDC system products requiring electrical power connections.

B. Design of electrical power to products not indicated with electric power is delegated to DDC system provider and installing trade. Work shall comply with NFPA 70 and other requirements indicated.

C. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical power conductors and cables.

D. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for electrical power raceways and boxes.

3.6 NETWORK NAMING AND NUMBERING

A. Coordinate with Owner and provide unique naming and addressing for networks and devices.

B. ASHRAE 135 Networks

1. MAC Address:

- a. Every network device shall have an assigned and documented MAC address unique to its network.
 - b. Ethernet Networks: Document MAC address assigned at its creation.
 - c. ARCNET or MS/TP networks: Assign from 00 to 64.
2. Network Numbering:
 - a. Assign unique numbers to each new network.
 - b. Provide ability for changing network number through device switches or operator interface.
 - c. DDC system, with all possible connected LANs, can contain up to 65,534 unique networks.
3. Device Object Identifier Property Number:
 - a. Assign unique device object identifier property numbers or device instances for each device network.
 - b. Provide for future modification of device instance number by device switches or operator interface.
4. Device Object Name Property Text:
 - a. Device object name property field shall support 32 minimum printable characters.
 - b. Assign unique device "Object Name" property names with plain-English descriptive names for each device.
 - 1) Example 1: Device object name for device controlling boiler plant at Building 1000 would be "HW System B1000."
 - 2) Example 2: Device object name for a VAV terminal unit controller could be "VAV unit 102".
5. Object Name Property Text for Other Than Device Objects:
 - a. Object name property field shall support 32 minimum printable characters.
 - b. Assign object name properties with plain-English names descriptive of application.
 - 1) Example 1: "Zone 1 Temperature."
 - 2) Example 2 "Fan Start and Stop."
6. Object Identifier Property Number for Other Than Device Objects:
 - a. If not indicated, object identifier property numbers may be assigned at Installer's discretion but must be approved by Owner in advance, be documented and be unique for like object types within device.

3.7 CONTROL WIRE, CABLE AND RACEWAYS INSTALLATION

- A. Comply with NECA 1.
 1. Terminate wiring in a junction box.

- a. Clamp cable over jacket in junction box.
 - b. Individual conductors in the stripped section of the cable shall be slack between the clamping point and terminal block.
2. Terminate field wiring and cable not directly connected to instruments and control devices having integral wiring terminals using terminal blocks.
 3. Install signal transmission components according to IEEE C2, REA Form 511a, NFPA 70, and as indicated.
 4. Use shielded cable to transmitters.
 5. Use shielded cable to temperature sensors.
 6. Perform continuity and meager testing on wire and cable after installation.

B. Conduit Installation:

1. Comply with Section "260533 "Raceways and Boxes for Electrical Systems" for control-voltage conductors.

3.8 WIRING CRITERIA

- A. All Line Voltage and Control wiring must be run in EMT. Properly sealed Rigid Metallic Conduit must be used in any explosion proof applications.
- B. Do not run binary control circuit wiring in the same conduit as power wiring over 100 volts. Where analog signal wiring requires conduit, do not run in the same conduit with AC power circuits or control circuits operating at more than 100 volts.
- C. Provide circuit and wiring protection required by NFPA 70.
- D. Input/output identification: Permanently label each field-installed wire at each end with descriptive text using a commercial wire marking system that fully encircles the wire, cable, or tube. Locate the markers within 2 inches of each termination. Match the names and I/O number to the project's point list. Similarly label all power wiring serving control devices, including the word "power" in the label. Label all terminal blocks with alpha/numeric labels. All wiring and the wiring methods must be in accordance with UL 508A.
- E. For controller power, provide new 120 VAC circuits, with ground.
- F. Provide each circuit with a dedicated breaker, and run wiring in its own conduit, separate from any control wiring. Connect the controller's ground wire to the electrical panel ground; conduit grounds are not acceptable.
- G. Surge Protection: Install surge protection according to manufacturer's instructions. Multiple controllers fed from a common power supply may be protected by a common surge protector, properly sized for the total connected devices.
- H. Grounding: Ground controllers and cabinets to a good earth ground as specified in Division 26. Comply with requirements in Section 20526 "Grounding and bonding for electrical systems".
- I. Conduit grounding is not acceptable; all grounding must have a direct path to the building earth ground. Ground sensor drain wire shields at the controller end.
- J. The Contractor must be responsible for correcting all associated ground loop problems.

- K. Run wiring in panel enclosures in covered wire track.

3.9 ACCEPTANCE TESTING

- A. Upon completion of the installation, this contractor shall load all system software and start-up the system. This contractor shall perform all necessary calibration, testing and debugging and perform all required operational checks to ensure that the system is functioning in full accordance with these specifications as well as the sequence of operation.
- B. This contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.
- C. Controls testing shall also include operation verification of emergency shutdown sequence and emergency and normal power sequence.
- D. System Acceptance: Satisfactory completion is when this contractor and the Division 26 contractor have performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner. Final system acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.10 OPERATOR INSTRUCTION, TRAINING

- A. At such time that acceptable performance of the BAS hardware and software has been established, this contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.
- B. This contractor shall provide 20 hours of instruction to the owner's designated personnel on the operation of the BAS and describe its intended use with respect to the programmed functions specified. Operator orientation of the systems shall include, but not be limited to; the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation.
- C. The training shall be in three sessions as follows:
 - 1. Initial Training: One day session (8 hours) after system is started up and at least one week before first acceptance test. Manual shall have been submitted at least two weeks prior to training so that the owners' personnel can start to familiarize themselves with the system before classroom instruction begins.
 - 2. Warranty Follow Up: 12 hours total, in no less than 4-hour increments, to be scheduled at the request of the owner during the one-year warranty period. These sessions shall cover topics as requested by the owner such as; how to add additional points, create and gather data for trends, graphic screen generation or modification of control routines.
- D. Video of Training Sessions:

1. Provide a digital video and audio recording of each training session. Create a separate recording file for each session.
2. Stamp each recording file with training session number, session name and date.
3. Provide Owner with two copies of digital files on DVDs or flash drives for later reference and for use in future training.
4. Owner retains right to make additional copies for intended training purposes without having to pay royalties.

3.11 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
 1. Operational Test. After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment, and retest.
 3. Calibration test electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
- B. Engage a factory-authorized service representative to perform startup service.
- C. Replace damaged or malfunctioning controls and equipment.
 1. Start, test, and adjust control systems.
 2. Demonstrate compliance with requirements, including calibration and testing, and control sequences.
 3. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.
- D. Verify DDC as follows:
 1. Verify software including automatic restart, control sequences, scheduling, reset controls, and occupied/unoccupied cycles.
 2. Verify local control units including self-diagnostics.

3.12 DDC SYSTEM I/O ADJUSTMENT, CALIBRATION AND TESTING

- A. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.
- B. Provide a written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.
- C. For each analog instrument, make a three-point test of calibration for both linearity and accuracy.

- D. Equipment and procedures used for calibration shall comply with instrument manufacturer's written instructions.
- E. Provide diagnostic and test equipment for calibration and adjustment.
- F. Field instruments and equipment used to test and calibrate installed instruments shall have accuracy at least twice the instrument accuracy being calibrated. An installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.
- G. Calibrate each instrument according to instrument instruction manual supplied by manufacturer.
- H. If after calibration indicated performance cannot be achieved, replace out-of-tolerance instruments.
- I. Comply with field testing requirements and procedures indicated by ASHRAE's Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements, and to supplement requirements indicated.
- J. Analog Signals:
 - 1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
 - 2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
 - 3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistant source.
- K. Digital Signals:
 - 1. Check digital signals using a jumper wire.
 - 2. Check digital signals using an ohmmeter to test for contact making or breaking.
- L. Control Dampers:
 - 1. Stroke and adjust control dampers following manufacturer's recommended procedure, from 100 percent open to 100 percent closed and back to 100 percent open.
 - 2. Stroke control dampers with pilot positioners. Adjust damper and positioner following manufacturer's recommended procedure, so damper is 100 percent closed, 50 percent closed and 100 percent open at proper air pressure.
 - 3. Check and document open and close cycle times for applications with a cycle time less than 30 seconds.
 - 4. For control dampers equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.
- M. Control Valves:
 - 1. Stroke and adjust control valves following manufacturer's recommended procedure, from 100 percent open to 100 percent closed and back to 100 percent open.
 - 2. Stroke control valves with pilot positioners. Adjust valve and positioner following manufacturer's recommended procedure, so valve is 100 percent closed, 50 percent closed and 100 percent open at proper air pressures.

3. Check and document open and close cycle times for applications with a cycle time less than 30 seconds.
4. For control valves equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

N. Meters: Check sensors at zero, 50, and 100 percent of Project design values.

O. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.

P. Switches: Calibrate switches to make or break contact at set points indicated.

Q. Transmitters:

1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.
2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistant source.

3.13 DDC SYSTEM CONTROLLER CHECKOUT

A. Verify power supply.

1. Verify voltage, phase and hertz.
2. Verify that protection from power surges is installed and functioning.
3. Verify that ground fault protection is installed.

B. Verify that wire and cabling is properly secured to terminals and labeled with unique identification.

C. Verify that spare I/O capacity is provided.

3.14 DDC SYSTEM VALIDATION TESTS

A. Perform validation tests before requesting final review of system. Before beginning testing, first submit Pretest Checklist and Test Plan.

B. After approval of Test Plan, execute all tests and procedures indicated in plan.

C. After testing is complete, submit completed test checklist.

D. Pretest Checklist: Submit the following list with items checked off once verified:

1. Detailed explanation for any items that are not completed or verified.
2. Required DDC system components, wiring, and accessories are installed.
3. Installed DDC system architecture matches approved Drawings.
4. Control electric power circuits operate at proper voltage and are free from faults.
5. Required surge protection is installed.
6. DDC system network communications function properly, including uploading and downloading programming changes.
7. Each controller's programming is backed up.
8. Equipment, products, wiring cable and conduits are properly labeled.

9. All I/O points are programmed into controllers.
10. Dampers and actuators zero and span adjustments are set properly.
11. Each control damper and actuator goes to failed position on loss of power.
12. Valves and actuators zero and span adjustments are set properly.
13. Each control valve and actuator goes to failed position on loss of power.
14. Meter, sensor and transmitter readings are accurate and calibrated.
15. Control loops are tuned for smooth and stable operation.
16. View trend data where applicable.
17. Each controller works properly in standalone mode.
18. Safety controls and devices function properly.
19. Electrical interlocks function properly.
20. Record Drawings are completed.

E. Test Plan:

1. Prepare and submit a validation test plan including test procedures for performance validation tests.
2. Test plan shall address all specified functions of DDC system and sequences of operation.
3. Explain detailed actions and expected results to demonstrate compliance with requirements indicated.
4. Explain method for simulating necessary conditions of operation used to demonstrate performance.
5. Include a test checklist to be used to check and initial that each test has been successfully completed.
6. Submit test plan documentation 20 business days before start of tests.

F. Validation Test:

1. Verify operating performance of each I/O point in DDC system.
 - a. Verify analog I/O points at operating value.
 - b. Make adjustments to out-of-tolerance I/O points.
 - 1) Identify I/O points for future reference.
 - 2) Simulate abnormal conditions to demonstrate proper function of safety devices.
 - 3) Replace instruments and controllers that cannot maintain performance indicated after adjustments.
2. Simulate conditions to demonstrate proper sequence of control.
3. Readjust settings to design values and observe ability of DDC system to establish desired conditions.
4. After 24 Hours following Initial Validation Test:
 - a. Re-check I/O points that required corrections during initial test.
 - b. Identify I/O points that still require additional correction and make corrections necessary to achieve desired results.
5. After 24 Hours of Second Validation Test:

- a. Re-check I/O points that required corrections during second test.
 - b. Continue validation testing until I/O point is normal on two consecutive tests.
6. Completely check out, calibrate, and test all connected hardware and software to ensure that DDC system performs according to requirements indicated.
7. After validation testing is complete, prepare and submit a report indicating all I/O points that required correction and how many validation re-tests it took to pass. Identify adjustments made for each test and indicate instruments that were replaced.

3.15 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.16 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two year(s).
- B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two year(s) from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
 1. Upgrade Notice: At least 30 days to allow Owner to schedule and access system and to upgrade computer equipment if necessary.

END OF SECTION 230923

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Copper building wire rated 600 V or less.
 - 2. Metal-clad cable, Type MC, rated 600 V or less.
 - 3. Connectors, splices, and terminations rated 600 V and less.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Alpha Wire Company.
 - 2. American Bare Conductor.
 - 3. Belden Inc.
 - 4. Southwire Company.
- C. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. RoHS compliant.
 - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

- E. Conductor Insulation:

- 1. Type THHN and Type THWN-2: Comply with UL 83.

2.2 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- 1. AFC Cable Systems; a part of Atkore International.
 - 2. Alpha Wire Company.
 - 3. American Bare Conductor.
 - 4. Belden Inc.
 - 5. Encore Wire Corporation.
 - 6. General Cable Technologies Corporation.
 - 7. Okonite Company (The).
 - 8. Service Wire Co.
 - 9. Southwire Company.
 - 10. WESCO.

- C. Standards:

- 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. Comply with UL 1569.
 - 3. RoHS compliant.
 - 4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

- D. Circuits:

- 1. Single circuit.

- E. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

- F. Ground Conductor: Insulated.

- G. Conductor Insulation:

- 1. Type TFN/THHN/THWN-2: Comply with UL 83.
 - 2. Type XHHW-2: Comply with UL 44.

- H. Armor: Steel, interlocked.

- I. Jacket: PVC applied over armor.

2.3 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. 3M Electrical Products.
 - 2. AFC Cable Systems; a part of Atkore International.
 - 3. Gardner Bender.
 - 4. Hubbell Power Systems, Inc.
 - 5. Ideal Industries, Inc.
 - 6. ILSCO.
 - 7. NSi Industries LLC.
 - 8. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 9. Service Wire Co.
 - 10. TE Connectivity Ltd.
 - 11. Thomas & Betts Corporation; A Member of the ABB Group.
- C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
 - 1. Material: Copper.
 - 2. Type: Two hole with standard barrels.
 - 3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- B. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Metal-clad cable, Type MC.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 IDENTIFICATION

- A. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Perform each of the following visual and electrical tests:

- a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
- b. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - 3) Thermographic survey.
- c. Inspect compression-applied connectors for correct cable match and indentation.
- d. Inspect for correct identification.
- e. Inspect cable jacket and condition.
- f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
- g. Continuity test on each conductor and cable.
- h. Uniform resistance of parallel conductors.

B. Cables will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Advanced Lightning Technology, Ltd.
 - 2. Burndy; Part of Hubbell Electrical Systems.
 - 3. Thomas & Betts Corporation; A Member of the ABB Group.

2.3 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B3.
 - 2. Stranded Conductors: ASTM B8.
 - 3. Tinned Conductors: ASTM B33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- C. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Grounding Conductors: Green-colored insulation with continuous yellow stripe.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Receptacle circuits.
 - 3. Flexible raceway runs.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

3.4 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
- B. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Conduit and cable support devices.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- B. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- C. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Hilti, Inc.
 - 2) ITW Ramset/Red Head; Illinois Tool Works, Inc.

- 3) [MKT Fastening, LLC.](#)
 - 4) [Simpson Strong-Tie Co., Inc.](#)
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. [Manufacturers:](#) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) [B-line, an Eaton business.](#)
 - 2) [Empire Tool and Manufacturing Co., Inc.](#)
 - 3) [Hilti, Inc.](#)
 - 4) [ITW Ramset/Red Head; Illinois Tool Works, Inc.](#)
 - 5) [MKT Fastening, LLC.](#)
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, [Grade A325 \(Grade A325M\).](#)
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
 1. NECA 1.
 2. NECA 101
 3. NECA 102.
 4. NECA 105.
 5. NECA 111.
- B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, according to NFPA 70.
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 3. To Existing Concrete: Expansion anchor fasteners.
 - 4. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
 - 5. To Steel: Spring-tension clamps.
 - 6. To Light Steel: Sheet metal screws.
 - 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits and fittings.
 - 2. Boxes, enclosures, and cabinets.

1.3 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. Metal Conduit:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. AFC Cable Systems; a part of Atkore International.
 - b. Allied Tube & Conduit; a part of Atkore International.
 - c. Anamet Electrical, Inc.
 - d. Calconduit.
 - e. Electri-Flex Company.
 - f. FSR Inc.
 - 2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 3. EMT: Comply with ANSI C80.3 and UL 797.
- B. Metal Fittings:

1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AFC Cable Systems; a part of Atkore International.
 - b. Allied Tube & Conduit; a part of Atkore International.
 - c. Anamet Electrical, Inc.
 - d. Calconduit.
 - e. Electri-Flex Company.
 - f. FSR Inc.
 - g. Korkap.
 - h. NEC, Inc.
 - i. NewBasis.
 - j. Opti-Com Manufacturing Network, Inc (OMNI).
 - k. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - l. Patriot Aluminum Products, LLC.
 - m. Perma-Cote.
 - n. Picoma Industries, Inc.
2. Comply with NEMA FB 1 and UL 514B.
3. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Fittings, General: Listed and labeled for type of conduit, location, and use.
5. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
6. Fittings for EMT:
 - a. Material: Steel or die cast.
 - b. Type: compression.

2.2 BOXES, ENCLOSURES, AND CABINETS

- A. **Manufacturers:** Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. Adalet.
2. Crouse-Hinds, an Eaton business.
3. EGS/Appleton Electric.
4. Erickson Electrical Equipment Company.
5. FSR Inc.
6. Hoffman; a brand of nVent.
7. Hubbell Incorporated.
8. Hubbell Incorporated; Wiring Device-Kellems.
9. Kraloy.
10. Milbank Manufacturing Co.
11. MonoSystems, Inc.
12. Oldcastle Enclosure Solutions.
13. O-Z/Gedney; a brand of Emerson Industrial Automation.

14. Plasti-Bond.

- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).
- F. Gangable boxes are prohibited.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Indoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: EMT.
 - 2. Exposed, Not Subject to Severe Physical Damage: EMT
 - 3. Concealed in Ceilings and Interior Walls and Partitions: EMT or MC Cable.
 - 4. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- B. Minimum Raceway Size: 1/2-inch (16-mm) trade size.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - 2. EMT: Use compression fittings. Comply with NEMA FB 2.10.
- D. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

3.2 INSTALLATION

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits.

Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

- C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.
- D. Do not fasten conduits onto the bottom side of a metal deck roof.
- E. Keep raceways at least **6 inches (150 mm)** away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- F. Complete raceway installation before starting conductor installation.
- G. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within **12 inches (300 mm)** of changes in direction.
- H. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- I. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- J. Support conduit within **12 inches (300 mm)** of enclosures to which attached.
- K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- L. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- M. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where required by NFPA 70.
- N. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- P. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

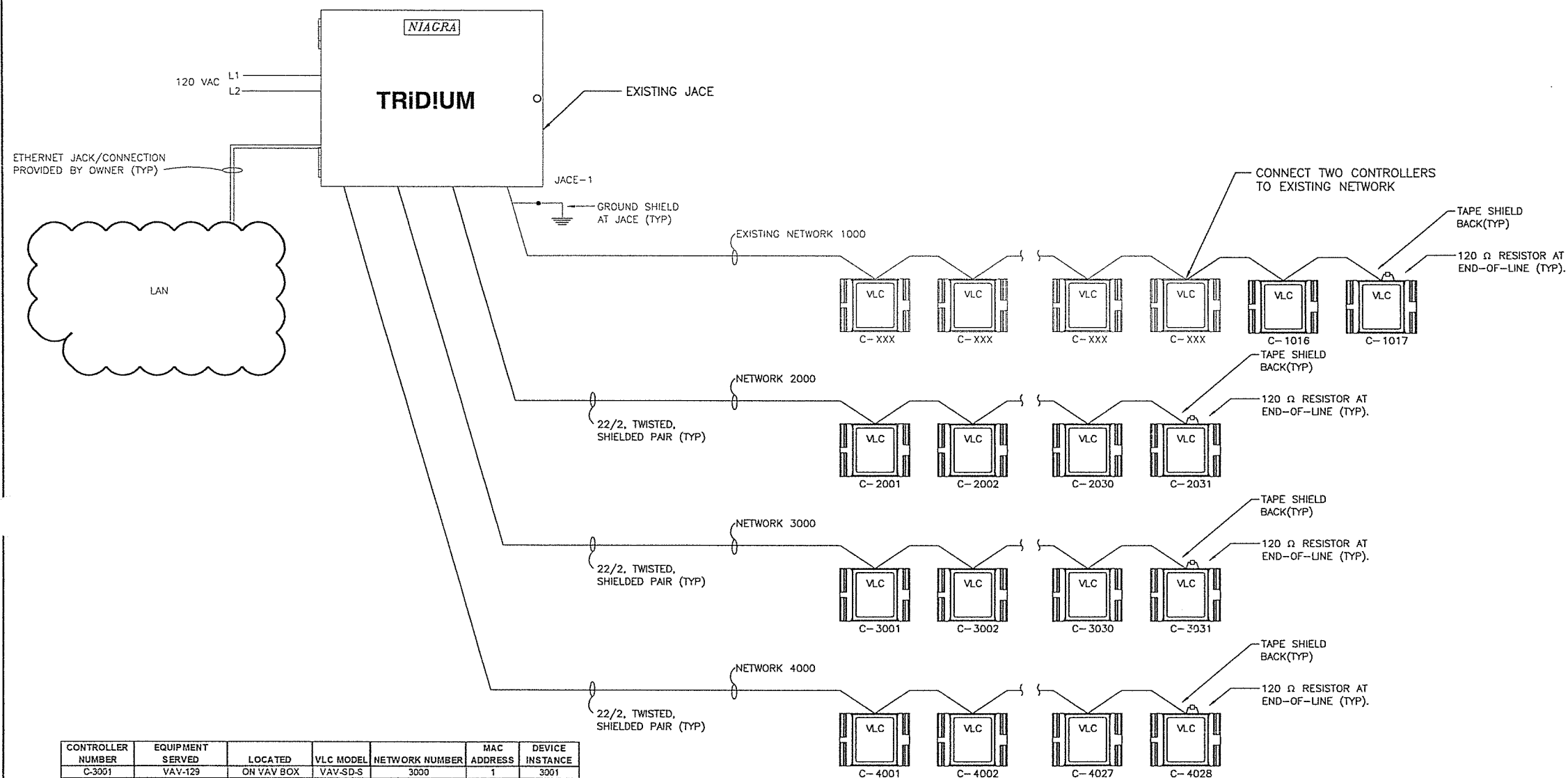
- Q. Locate boxes so that cover or plate will not span different building finishes.
- R. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

END OF SECTION 260533

GREAT BAY COMMUNITY COLLEGE
AS BUILDS



CONTROLLER NUMBER	EQUIPMENT SERVED	LOCATED	VLC MODEL	NETWORK NUMBER	MAC ADDRESS	DEVICE INSTANCE
C-3001	VAV-129	ON VAV BOX	VAV-SD-S	3000	1	3001
C-3002	VAV-130	ON VAV BOX	VAV-SD-S	3000	2	3002
C-3003	VAV-131	ON VAV BOX	VAV-SD-S	3000	3	3003
C-3004	VAV-132	ON VAV BOX	VAV-SD-S	3000	4	3004
C-3005	VAV-133	ON VAV BOX	VAV-SD-S	3000	5	3005
C-3006	VAV-134	ON VAV BOX	VAV-SD-S	3000	6	3006
C-3007	VAV-135	ON VAV BOX	VAV-SD-S	3000	7	3007
C-3008	VAV-136	ON VAV BOX	VAV-SD-S	3000	8	3008
C-3009	VAV-137	ON VAV BOX	VAV-SD-S	3000	9	3009
C-3010	VAV-138	ON VAV BOX	VAV-SD-S	3000	10	3010
C-3011	VAV-139	ON VAV BOX	VAV-SD-S	3000	11	3011
C-3012	VAV-140	ON VAV BOX	VAV-SD-S	3000	12	3012
C-3013	VAV-141	ON VAV BOX	VAV-SD-S	3000	13	3013
C-3014	VAV-142	ON VAV BOX	VAV-SD-S	3000	14	3014
C-3015	VAV-143	ON VAV BOX	VAV-SD-S	3000	15	3015
C-3016	VAV-144	ON VAV BOX	VAV-SD-S	3000	16	3016
C-3017	VAV-145	ON VAV BOX	VAV-SD-S	3000	17	3017
C-3018	VAV-146	ON VAV BOX	VAV-SD-S	3000	18	3018
C-3019	VAV-147	ON VAV BOX	VAV-SD-S	3000	19	3019
C-3020	VAV-148	ON VAV BOX	VAV-SD-S	3000	20	3020
C-3021	VAV-149	ON VAV BOX	VAV-SD-S	3000	21	3021
C-3022	VAV-150	ON VAV BOX	VAV-SD-S	3000	22	3022
C-3023	VAV-151	ON VAV BOX	VAV-SD-S	3000	23	3023
C-3024	VAV-152	ON VAV BOX	VAV-SD-S	3000	24	3024
C-3025	VAV-153	ON VAV BOX	VAV-SD-S	3000	25	3025
C-3026	VAV-154	ON VAV BOX	VAV-SD-S	3000	26	3026
C-3027	VAV-155	ON VAV BOX	VAV-SD-S	3000	27	3027
C-3028	VAV-156	ON VAV BOX	VAV-SD-S	3000	28	3028
C-3029	VAV-157	ON VAV BOX	VAV-SD-S	3000	29	3029
C-3030	HUM-1	-	VAV-SD2A	3000	30	3030
C-3031	EF-18	-	VAV-SD	3000	31	3031

CONTROLLER NUMBER	EQUIPMENT SERVED	LOCATED	VLC MODEL	NETWORK NUMBER	MAC ADDRESS	DEVICE INSTANCE
C-4001	VAV-158	ON VAV BOX	VAV-SD-S	4000	1	4001
C-4002	VAV-159	ON VAV BOX	VAV-SD-S	4000	2	4002
C-4003	VAV-160	ON VAV BOX	VAV-SD-S	4000	3	4003
C-4004	VAV-161	ON VAV BOX	VAV-SD-S	4000	4	4004
C-4005	VAV-163	ON VAV BOX	VAV-SD-S	4000	5	4005
C-4006	VAV-164	ON VAV BOX	VAV-SD-S	4000	6	4006
C-4007	VAV-165	ON VAV BOX	VAV-SD-S	4000	7	4007
C-4008	VAV-166	ON VAV BOX	VAV-SD-S	4000	8	4008
C-4009	VAV-167	ON VAV BOX	VAV-SD-S	4000	9	4009
C-4010	VAV-168	ON VAV BOX	VAV-SD-S	4000	10	4010
C-4011	VAV-169	ON VAV BOX	VAV-SD-S	4000	11	4011
C-4012	VAV-170	ON VAV BOX	VAV-SD-S	4000	12	4012
C-4013	VAV-171	ON VAV BOX	VAV-SD-S	4000	13	4013
C-4014	VAV-176	ON VAV BOX	VAV-SD-S	4000	14	4014
C-4015	VAV-177	ON VAV BOX	VAV-SD-S	4000	15	4015
C-4016	VAV-178	ON VAV BOX	VAV-SD-S	4000	16	4016
C-4017	VAV-179	ON VAV BOX	VAV-SD-S	4000	17	4017
C-4018	VAV-180	ON VAV BOX	VAV-SD-S	4000	18	4018
C-4019	VAV-181	ON VAV BOX	VAV-SD-S	4000	19	4019
C-4020	UHA	-	VAV-SD	4000	20	4020
C-4021	AHU-5	-	VLC-1188	4000	21	4021
C-4022	AHU-5	-	VLC-550	4000	22	4022
C-4023	AHU-5 S.A. VFD	-	AAB VFD	4000	23	4023
C-4024	AHU-5 R.A. VFD	-	AAB VFD	4000	24	4024
C-4025	EF-11/12	-	VAV-SD	4000	25	4025
C-4026	EF-13/14	-	VAV-SD	4000	26	4026
C-4027	EF-5-10	-	VLC-853	4000	27	4027
C-4028	RTU-1	-	-	4000	28	4028
C-4029	RTU-1 S.A. VFD	-	AAB VFD	4000	29	4029
C-4030	RTU-1 E.A. VFD	-	AAB VFD	4000	30	4030

DRAWING INDEX

- 1ST FLOOR SYSTEM ARCHITECTURE
- REMAINING SYSTEM ARCHITECTURE
- B-4 TO EXISTING PLANT
- CH-2 & CT-1
- HEAT/COOL CONTROLLERS
- 1ST FLOOR VAV BOXES
- REMAINING VAV BOXES
- AHU-2 THRU AHU-5
- AHU CONTROLLERS
- RTU-1
- HUM-1
- EF-5 THRU EF-10
- EF-11 THRU EF-14/EF-16 & EF-17
- EF-15 / EF-18 / EF-20
- EF-19 REFRIGERATION EXHAUST 13A. EF-25 & EF-26
- UH / UH-A / CUH
- DUCTLESS AC / ELEVATOR VENT SHAFT
- DC-1 COMPUTER ROOM AC
- MAINTENANCE BUILDING
- CO/EF-A/UH-1
- HVAC-1/UH-2~3/EF-B

MATERIAL LIST			
ITEM	QTY	MODEL #	DESCRIPTION
-	1	IA-ENT-1	ENTERPRISE SERVER SOFTWARE
-	3	IA-ENT-N	ADDITIONAL ENTERPRISE SOFTWARE LICENSE
-	3	IA-DRV-4MST-P	BACKNET MS/TP DRIVER

CONTROLLER NUMBER	EQUIPMENT SERVED	LOCATED	VLC MODEL	NETWORK NUMBER	MAC ADDRESS	DEVICE INSTANCE
C-MC01	HW/CHW SYSTEM	MECH ROOM	VLC-1188	1000	1	1001
C-MC02	HW/CHW SYSTEM	MECH ROOM	VLC-1188	1000	2	1002
C-MC03	HW/CHW SYSTEM	MECH ROOM	VLC-16180	1000	3	1003
C-MC04	HW/CHW SYSTEM	MECH ROOM	VLC-550	1000	4	1004
C-AH11	AHU-1	-	VLC-1188	1000	5	1005
C-AH12	AHU-1	-	VLC-550	1000	6	1006
C-AH21	AHU-2	-	VLC-1188	1000	7	1007
C-AH22	AHU-2	-	VLC-550	1000	8	1008
C-V01	VAV-13	ON VAV BOX	VAV-SD	1000	9	1009
C-V02	VAV-EXSTNG	ON VAV BOX	VAV-SD	1000	10	1010
C-V03	VAV-EXSTNG	ON VAV BOX	VAV-SD	1000	11	1011
C-EF01	EF-1	-	VAV-SD	1000	12	1012
C-EF02	EF-2/UH-2	-	VAV-SD	1000	13	1013
C-EF04	EF-4	-	VLC-550	1000	14	1014
CONTROLLERS ADDED DURING PHASE II						
C-1015	HW/CHW SYSTEM	MECH ROOM	VLC1188	1000	15	1015
C-1016	HW/CHW SYSTEM	MECH ROOM	VLC-660R	1000	16	1016
C-1017	DC-1	DATA ROOM	VAV-SD	1000	17	1017

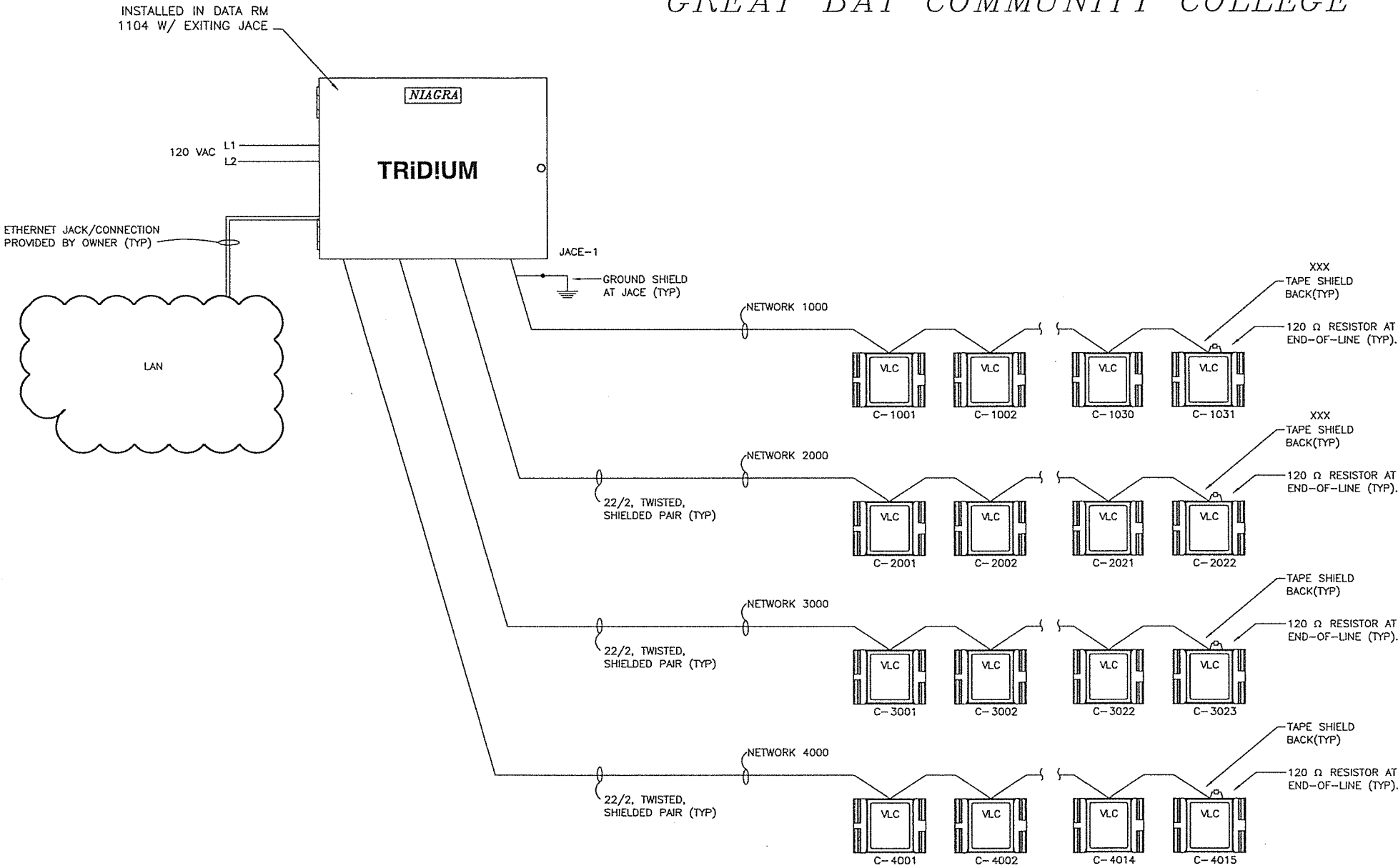
CONTROLLER NUMBER	EQUIPMENT SERVED	LOCATED	VLC MODEL	NETWORK NUMBER	MAC ADDRESS	DEVICE INSTANCE
C-2001	VAV-101	ON VAV BOX	VAV-SD-S	2000	1	2001
C-2002	VAV-102	ON VAV BOX	VAV-SD-S	2000	2	2002
C-2003	VAV-103	ON VAV BOX	VAV-SD-S	2000	3	2003
C-2004	VAV-104	ON VAV BOX	VAV-SD-S	2000	4	2004
C-2005	VAV-105	ON VAV BOX	VAV-SD-S	2000	5	2005
C-2006	VAV-106	ON VAV BOX	VAV-SD-S	2000	6	2006
C-2007	VAV-107	ON VAV BOX	VAV-SD-S	2000	7	2007
C-2008	VAV-108	ON VAV BOX	VAV-SD-S	2000	8	2008
C-2009	VAV-109	ON VAV BOX	VAV-SD-S	2000	9	2009
C-2010	VAV-110	ON VAV BOX	VAV-SD-S	2000	10	2010
C-2011	VAV-111	ON VAV BOX	VAV-SD-S	2000	11	2011
C-2012	VAV-112	ON VAV BOX	VAV-SD-S	2000	12	2012
C-2013	VAV-113	ON VAV BOX	VAV-SD-S	2000	13	2013
C-2014	VAV-114	ON VAV BOX	VAV-SD-S	2000	14	2014
C-2015	VAV-115	ON VAV BOX	VAV-SD-S	2000	15	2015
C-2016	VAV-116	ON VAV BOX	VAV-SD-S	2000	16	2016
C-2017	VAV-117	ON VAV BOX	VAV-SD-S	2000	17	2017
C-2018	VAV-118	ON VAV BOX	VAV-SD-S	2000	18	2018
C-2019	VAV-119	ON VAV BOX	VAV-SD-S	2000	19	2019
C-2020	VAV-120	ON VAV BOX	VAV-SD-S	2000	20	2020
C-2021	VAV-121	ON VAV BOX	VAV-SD-S	2000	21	2021
C-2022	VAV-122	ON VAV BOX	VAV-SD-S	2000	22	2022
C-2023	VAV-123	ON VAV BOX	VAV-SD-S	2000	23	2023
C-2024	VAV-124	ON VAV BOX	VAV-SD-S	2000	24	2024
C-2025	VAV-125	ON VAV BOX	VAV-SD-S	2000	25	2025
C-2026	VAV-126	ON VAV BOX	VAV-SD-S	2000	26	2026
C-2027	VAV-127	ON VAV BOX	VAV-SD-S	2000	27	2027
C-2028	VAV-128	ON VAV BOX	VAV-SD-S	2000	28	2028
C-2029	VAV-172	ON VAV BOX	VAV-SD-S	2000	29	2029
C-2030	VAV-173	ON VAV BOX	VAV-SD-S	2000	30	2030
C-2031	UH-A	-	VAV-SD	2000	31	2031

For Reference Only

1ST FLOOR SYSTEM ARCHITECTURE DRAWING

		CONTROL TECHNOLOGIES, INC.	
		70 Zachary Drive Manchester, New Hampshire 03109 (603)626-6070 FAX: (603)626-0352	
-REVISIONS-		JOB NAME	
DATE	CHANGE	LOCATION	
12/10/09	AS BUILT	PEASE TRADEPORT	
		ARCHITECT	
		DENNIS MIRE	
		ENGINEER	
		FITZMEYER & TOCCI	
		CONTRACTOR	
		ECKHARDT & JOHNSON	
		DRAWN BY	
		CPC	
		CHECKED BY	
		CPC	
		DATE	
		10/21/08	
		DRAWING NO.	
		N08123	
		1 OF 18	

GREAT BAY COMMUNITY COLLEGE



CONTROLLER NUMBER	EQUIPMENT SERVED	LOCATED	VLC MODEL	NETWORK NUMBER	MAC ADDRESS	DEVICE INSTANCE
C-3001	VAV-401	ON VAV BOX	VAV-SD-S	3000	1	3001
C-3002	VAV-402	ON VAV BOX	VAV-SD-S	3000	2	3002
C-3003	VAV-403	ON VAV BOX	VAV-SD-S	3000	3	3003
C-3004	VAV-404	ON VAV BOX	VAV-SD-S	3000	4	3004
C-3005	VAV-405	ON VAV BOX	VAV-SD-S	3000	5	3005
C-3006	VAV-406	ON VAV BOX	VAV-SD-S	3000	6	3006
C-3007	VAV-407	ON VAV BOX	VAV-SD-S	3000	7	3007
C-3008	VAV-408	ON VAV BOX	VAV-SD-S	3000	8	3008
C-3009	VAV-409	ON VAV BOX	VAV-SD-S	3000	9	3009
C-3010	VAV-410	ON VAV BOX	VAV-SD-S	3000	10	3010
C-3011	VAV-411	ON VAV BOX	VAV-SD-S	3000	11	3011
C-3012	VAV-412	ON VAV BOX	VAV-SD-S	3000	12	3012
C-3013	VAV-413	ON VAV BOX	VAV-SD-S	3000	13	3013
C-3014	VAV-414	ON VAV BOX	VAV-SD-S	3000	14	3014
C-3015	VAV-415	ON VAV BOX	VAV-SD-S	3000	15	3015
C-3016	VAV-416	ON VAV BOX	VAV-SD-S	3000	16	3016
C-3017	VAV-417	ON VAV BOX	VAV-SD-S	3000	17	3017
C-3018	VAV-418	ON VAV BOX	VAV-SD-S	3000	18	3018
C-3019	VAV-419	ON VAV BOX	VAV-SD-S	3000	19	3019

CONTROLLER NUMBER	EQUIPMENT SERVED	LOCATED	VLC MODEL	NETWORK NUMBER	MAC ADDRESS	DEVICE INSTANCE
C-4001	AHU-2	-	VLC-1188	4000	1	4001
C-4002	AHU-2	-	VLC-550	4000	2	4002
C-4003	AHU-2 S.A. VFD	-	AAB VFD	4000	3	4003
C-4004	AHU-2 R.A. VFD	-	AAB VFD	4000	4	4004
C-4005	AHU-3	-	VLC-1188	4000	5	4005
C-4006	AHU-3	-	VLC-550	4000	6	4006
C-4007	AHU-3 S.A. VFD	-	AAB VFD	4000	7	4007
C-4008	AHU-3 R.A. VFD	-	AAB VFD	4000	8	4008
C-4009	AHU-4	-	VLC-1188	4000	9	4009
C-4010	AHU-4	-	VLC-550	4000	10	4010
C-4011	AHU-4 S.A. VFD	-	AAB VFD	4000	11	4011
C-4012	AHU-4 R.A. VFD	-	AAB VFD	4000	12	4012
C-4016	EF-12/14	-	VAV-SD	4000	13	4013

MATERIAL LIST			
ITEM	QTY	MODEL #	DESCRIPTION
JACE	1	JACE-545	NETWORK CONTROLLER
-	1	IA-ENT-1	ENTERPRISE SERVER SOFTWARE
-	3	IA-ENT-N	ADDITIONAL ENTERPRISE SOFTWARE LICENSE
-	4	IA-DRV-MST-P	BACNET MS/TP DRIVER

SECOND FLOOR						
CONTROLLER NUMBER	EQUIPMENT SERVED	LOCATED	VLC MODEL	NETWORK NUMBER	MAC ADDRESS	DEVICE INSTANCE
C-1001	VAV-200	ON VAV BOX	VAV-SD-S	1000	1	1001
C-1002	VAV-201	ON VAV BOX	VAV-SD-S	1000	2	1002
C-1003	VAV-202	ON VAV BOX	VAV-SD-S	1000	3	1003
C-1004	VAV-203	ON VAV BOX	VAV-SD-S	1000	4	1004
C-1005	VAV-204	ON VAV BOX	VAV-SD-S	1000	5	1005
C-1006	VAV-205	ON VAV BOX	VAV-SD-S	1000	6	1006
C-1007	VAV-206	ON VAV BOX	VAV-SD-S	1000	7	1007
C-1008	VAV-207	ON VAV BOX	VAV-SD-S	1000	8	1008
C-1009	VAV-208	ON VAV BOX	VAV-SD-S	1000	9	1009
C-1010	VAV-209	ON VAV BOX	VAV-SD-S	1000	10	1010
C-1011	VAV-210	ON VAV BOX	VAV-SD-S	1000	11	1011
C-1012	VAV-211	ON VAV BOX	VAV-SD-S	1000	12	1012
C-1013	VAV-212	ON VAV BOX	VAV-SD-S	1000	13	1013
C-1014	VAV-213	ON VAV BOX	VAV-SD-S	1000	14	1014
C-1015	VAV-214	ON VAV BOX	VAV-SD-S	1000	15	1015
C-1016	VAV-215	ON VAV BOX	VAV-SD-S	1000	16	1016
C-1017	VAV-216	ON VAV BOX	VAV-SD-S	1000	17	1017
C-1018	VAV-217	ON VAV BOX	VAV-SD-S	1000	18	1018
C-1019	VAV-218	ON VAV BOX	VAV-SD-S	1000	19	1019
C-1020	VAV-219	ON VAV BOX	VAV-SD-S	1000	20	1020
C-1021	VAV-220	ON VAV BOX	VAV-SD-S	1000	21	1021
C-1022	VAV-221	ON VAV BOX	VAV-SD-S	1000	22	1022
C-1023	VAV-222	ON VAV BOX	VAV-SD-S	1000	23	1023
C-1024	VAV-223	ON VAV BOX	VAV-SD-S	1000	24	1024
C-1025	VAV-224	ON VAV BOX	VAV-SD-S	1000	25	1025
C-1026	VAV-225	ON VAV BOX	VAV-SD-S	1000	26	1026
C-1027	VAV-226	ON VAV BOX	VAV-SD-S	1000	27	1027

C-1029	VAV-228	ON VAV BOX	VAV-SD-S	1000	29	1029
C-1030	VAV-229	ON VAV BOX	VAV-SD-S	1000	30	1030
C-1031	VAV-230	ON VAV BOX	VAV-SD-S	1000	31	1031
CONTROLLER NUMBER	EQUIPMENT SERVED	LOCATED	VLC MODEL	NETWORK NUMBER	MAC ADDRESS	DEVICE INSTANCE
C-2001	VAV-301	ON VAV BOX	VAV-SD-S	2000	1	2001
C-2002	VAV-302	ON VAV BOX	VAV-SD-S	2000	2	2002
C-2003	VAV-303	ON VAV BOX	VAV-SD-S	2000	3	2003
C-2004	VAV-304	ON VAV BOX	VAV-SD-S	2000	4	2004
C-2005	VAV-305	ON VAV BOX	VAV-SD-S	2000	5	2005
C-2006	VAV-306	ON VAV BOX	VAV-SD-S	2000	6	2006
C-2007	VAV-307	ON VAV BOX	VAV-SD-S	2000	7	2007
C-2008	VAV-308	ON VAV BOX	VAV-SD-S	2000	8	2008
C-2009	VAV-309	ON VAV BOX	VAV-SD-S	2000	9	2009
C-2010	VAV-310	ON VAV BOX	VAV-SD-S	2000	10	2010
C-2011	VAV-311	ON VAV BOX	VAV-SD-S	2000	11	2011
C-2012	VAV-312	ON VAV BOX	VAV-SD-S	2000	12	2012
C-2013	VAV-313	ON VAV BOX	VAV-SD-S	2000	13	2013
C-2014	VAV-314	ON VAV BOX	VAV-SD-S	2000	14	2014
C-2015	VAV-315	ON VAV BOX	VAV-SD-S	2000	15	2015
C-2016	VAV-316	ON VAV BOX	VAV-SD-S	2000	16	2016
C-2017	VAV-317	ON VAV BOX	VAV-SD-S	2000	17	2017
C-2018	VAV-318	ON VAV BOX	VAV-SD-S	2000	18	2018

For Reference Only

2ND-4TH FLOOR SYSTEM ARCHITECTURE DRAWING

CONTROL TECHNOLOGIES, INC.

70 Zachary Drive

Manchester, New Hampshire 03109

(603)626-6070 FAX: (603)626-0352

REVISIONS

DATE	CHANGE
12/10/09	AS BUILT

JOB NAME

LOCATION

ARCHITECT

ENGINEER

CONTRACTOR

DRAWN BY

CHECKED BY

DATE

GREAT BAY COMMUNITY COLLEGE

PEASE TRADEPORT

DENNIS MIRES

FITZMEYER & TOCCI

ECKHARDT & JOHNSON

CPC

CPC

10/21/08

DRAWING NO.

08123

1A OF 18

Great Bay Technical College
Sequence of Operations As Builds

N08123

1.0 GENERAL

- A. All sequences below will be incorporated and coordinated with existing Phase I control work.
- B. All setpoints and time delays mentioned in the following sequences will be adjustable by the operator without any hardware or software revisions.
- C. All sequences of operations will be performed by direct digital control (DDC) panels. Software in the DDC panels will determine occupied and unoccupied mode of operation. Names for all points and variables will be coordinated with Owner and/or Engineer.
- D. Fail-safe positions are positions that devices will go to when de-energized: no – normally open, nc = normally closed. All heating coils (preheat, heating and reheat) will have two way control valve arrangement with the normally open position (stay open on power failure) to the coil.
- E. Whenever a piece of HVAC equipment is off per the control system or main power is disconnected, the control devices for the unit will go to their fail-safe position.
- F. Supply and return smoke isolation dampers (nc) for air handling will close whenever associated unit is off. Provide end switches to verify position of dampers before unit starts.
- G. All heating coils (preheat, heating and reheat) will have two way control valve arrangement and will fail in the open position (stay open on power failure) to the coil.
- H. All cooling coils will have two way control valve arrangement and will fail in the closed position (stay closed on power failure) to the coil.
- I. Whenever a piece of HVAC equipment is off per the control system or main power is disconnected, the control devices for the unit will go to their fail-safe position.
- J. Supply and return smoke isolation dampers (nc) for air handling units will closed whenever associated unit is off. Provide end switches to verify position of dampers before unit starts.

2.0 SAFETIES

- A. The following safeties, each with its own software manual reset, will shut down unit and the control system will initiate respective alarm. All safeties will be hardwired into fan motor starter circuits with auxiliary contact to register alarm and provide software override capability at DDC system central panel. Manual reset will be accomplished by entering a command at the DDC workstation rather than going to a piece of equipment involved.
- B. Supply smoke detector (SD) and return smoke detectors for air handlers are activated. Smoke detectors will be furnished and wired to the fire alarm system under work of Division 16; ATC Contractor will mount detectors and wire to control system. All air handling units are to have smoke detectors.
- C. For air handlers, discharge static pressure high limit (SPH) indicates more than 5" w.g. when the unit status is on (with a 5 minute delay). This will prevent over pressurizing ductwork if supply fan is on with supply smoke damper. While it is the intention to provide normally open VAV boxes for zones served by air handler number 2, if normally closed boxes are installed on the job, then this contractor will install static pressure high limit in this air handler as well.

- D. For air handlers return static pressure low limit (SPL) indicates less than - 2 ½" negative status pressure when the unit status is on (with a 5 minute delay). This will prevent duct collapse if return fan is on with return smoke damper being closed.
- E. Freezestat falls to 38°F. Software manual reset of freezestat will be required all air handlers will have freezestats. Length of freezestat capillary will be minimum of 20'. Capillary will cover the entire face area of the coil. Use more than one freezestat if required to fully cover coil face area.
- F. The control system will initiate an alarm, describing the alarm if any of the following conditions are met (all setpoints and time periods below will be adjustable by user from the DDC system's central console). Whenever a unit is shut down because of one of the safeties, the control system will retain in memory the reading and setpoint of each device to help the operator in isolating the reason for the problem. All control sensors will have a high and low software alarm limit to indicate temperature problems or a faulty sensor.
- G. Supply, relief or exhaust fans are commanded to run and any time after a 15 second delay the control senses no running status via the fans current transformer relays (ct).
- H. Filter differential pressure switch, across filter section, senses greater than 1.5" w.g. for 15 minutes.
- I. Discharge air temperature sensor goes 5°F below the minimum cooling discharge air temperature setpoint for 10 minutes when fan is on.
- J. Any alarm from the chiller control panel is initiated.
- K. The chilled water supply or return temperature goes 5°F below or above its setpoint for 5 minutes.
- L. The chiller is commanded to run and any time after a 15 second delay, the control system senses no running status via the chiller control panel.
- M. Any pump is commanded to run and any time after a 15 second delay the control system senses no running status via the pumps current transformer relays (ct).
- N. Any space temperature is more than 5°F from setpoint as sensed by the terminal boxes DDC box controller for 5 minutes.
- O. For spaces which are not cooled, the temperature rises above 85°F for 5 minutes as sensed by the space temperature sensor.
- P. Any duct high limit humidstat goes above 85% or space humidstat varies more than 10% from setpoint for more than 5 minutes.
- Q. Temperature of hot water discharge at boiler or return to boiler varies more than 5°F from setpoint for more than 5 minutes.
- R. Differential pressure at separator goes to 3 feet above design pressure differential.
- S. Flow is sensed via flow switch in overflow line from remote cooling tower sump for more than 10 minutes.

3.0 FIRE ALARM INTERLOCKS

- A. Air Handler Smoke Control: Smoke detector, located in supply and return air signals alarm, stops fan, and closes smoke dampers when products of combustion are detected in airstream.

4.0 AIR-HANDLING UNIT CONTROL SEQUENCES

- A. Supply-Fan Control: System starts fan to run continuously during occupied periods. Modulate variable-speed fan drive to maintain supply duct static pressure.
 - 1. Signal alarm if fan fails to start as commanded.
 - 2. Static-pressure controller located in fan discharge stops fan and signals alarm when static pressure rises above excessive-static-pressure setpoint.

3. Set variable-speed drive to minimum speed when fans are stopped.
- B. Upon command for start, associated smoke dampers will open and will be proven open by end switch prior to start of fans.
- C. Fans will ramp slowly up to speed on fan start.
- D. Return-Air Fan Control: System starts fan to run continuously during occupied periods. System modulates return-air fan variable-speed fan drive to maintain differential setpoint.
- E. Freeze Protection: Heating coil interlaced freezestat, located before supply fan, signals alarm, stops fan, and closes outside-air dampers when temperature falls below 37°F.
- F. Smoke Control: Smoke detector, located in return and supply air, signals alarm, stops fans, and closes smoke dampers when products of combustion are detected in air stream.
- G. Mixed-Air Control: During occupied periods, when fan is running, system modulates outside-air, return-air and relief-air dampers to maintain discharge supply air temperature.
 1. During occupied periods, when fan is running, open outside-air dampers to minimum position.
 2. During heating sequence, set outside-air dampers to minimum position.
 3. When outside-air temperature exceeds return-air temperature, set outside-air dampers to minimum position.
 4. When outside-air enthalpy exceeds return-air enthalpy, set outside-air dampers to minimum position.
 5. During unoccupied periods, position outside-air and relief-air dampers closed and return-air dampers open.
- H. Filters: During occupied periods, when fan is running, differential air-pressure transmitter signals alarm when low- and high-pressure conditions exist.
- I. Hydronic Preheat Coil: During occupied periods when fan is running, system modulates control valve to maintain supply-air temperature. Coil interlaced freezestat thermostat on discharge side of preheat coil stops fan when any part of coil face temperature falls below 38°F.
- J. Night Heating: The air handlers and associated VAV boxes will maintain a night setback temperature of 60°F (adj.). Outside air dampers will be fully closed and return air dampers fully open during unoccupied mode. Areas with fin-tube radiation will be provided with night time heating via the fin-tube; if the space falls below setpoint, the associated air handler will energize and the VAV boxes reheat coil valves will fully open, if pumps and heat exchanger systems are off, the will be commanded to start, systems will run until setpoint is reached.
- K. Night Cooling: The air handlers will maintain a night setback cooling temperature of 80°F (adj.). If any space goes above the setpoint, the associated air handler will be energized, chilled water pump, if off, will be energized. Once space is satisfied, unit will go back to unoccupied mode. Outdoor air dampers will be fully closed and return dampers fully opened throughout this sequence.
- L. Morning Warm-up: During morning warm-up, the outside air dampers will be fully closed and the return air dampers fully open. The air handler preheat coil and VAV box reheat coils will provide morning warm-up. During unoccupied periods, when fan is on, enable normal control.
- M. Hydronic Cooling Coil: During occupied periods, when fan is running, system modulates control valve to maintain supply air temperature.
 1. System resets supply-air temperature in response to greatest cooling demand and outside air temperature.
 2. During unoccupied periods, when fan is off, return valve to closed position.
- N. Condensate Pan High Limit: Provide high limit float switch to alarm at DDC and shut down associated air cooled condensing unit when air handler condensate pan is near overflow condition.

- O. Coordination of Air-Handling Unit Sequences: Ensure that mixed-air, heating-coil and cooling-coil controls have common inputs and do not overlap in function.
- P. Operator Station Display: Indicate the following on operator workstation display terminal:
 - 1. System graphic
 - 2. System on-off indication
 - 3. System occupied/unoccupied mode
 - 4. System fan on-off indication
 - 5. Return fan on-off indication
 - 6. Outside-air temperature indication
 - 7. Outside-air enthalpy
 - 8. Relative humidity indication
 - 9. Preheat-coil air-temperature indication
 - 10. Preheat-coil air-temperature setpoint
 - 11. Preheat-coil control-valve position
 - 12. Mixed-air-temperature indication
 - 13. Mixed-air-temperature setpoint
 - 14. Mixed-air damper position
 - 15. Filter air-pressure-drop indication
 - 16. Filter low-air-pressure setpoint
 - 17. Filter high-air-pressure setpoint
 - 18. Condensate pan high limit indication
 - 19. Supply-fan-discharge air-temperature indication
 - 20. Supply-fan-discharge air-temperature setpoint
 - 21. Cooling-coil control-valve position
 - 22. Supply air temperature indication
 - 23. Supply air temperature setpoint
 - 24. Supply-fan-discharge static-pressure indication
 - 25. Supply-fan-discharge static-pressure setpoint
 - 26. Supply-fan speed
 - 27. Return-air-temperature indication
 - 28. Return-air-enthalpy indication
 - 29. Economizer mode indication
 - 30. Return-air static-pressure indication
 - 31. Return fan speed

5.0 VARIABLE AIR VOLUME ROOFTOP UNIT SEQUENCE BY YORK

- A. Units will be provided with manufacturer installed DDC controls.
- B. the ATC Contractor will field install all components requiring field installation. All items required for a complete operating system not provided by the manufacturer will be by this Contractor. The temperature control contractor will fully coordinate all control components, sequences and requirements with the manufacturer before submitting shop drawings.
- C. Static Pressure and Volumetric Control:
 - 1. Upon start-up, the supply and return fans will start with their VFDs at lowest speed (to avoid ductwork over-pressurization). Fans will not start until supply and return smoke dampers are proven open by limit switches. The outdoor air damper will open to minimum position. After a 30-second (adj.) delay, the static pressure control sequence (outlined below) will control the VFD of the supply fan – the volumetric control sequences (outlined below) will control the

return fan VFD. The 30-second delay is to let VAV boxes settle out and prevent control instability on startup.

2. Supply fan VFD will be modulated to maintain static pressure at static pressure sensor (SP) located 2/3 the way down supply duct. As system requirements for air volume increase and system static pressure decreases, the VFD will increase fan speed. As system requirements for air volume decrease as sensed by an increase in static pressure at controlling (SP), the VFDs will decrease fan speed. Provide adequate differential around setpoint to prevent excessively rapid changes in air volume. Initial static pressure setpoints will be set at 1" and will be adjustable in software.
 3. The control system will measure outdoor air, supply and return fan air volumes through supply and return flow-measuring stations (FMS). During occupied cycle, the control system will modulate return fan variable frequency drive so that the cfm differential with supply air is equal to the minimum outdoor air quantity listed on the schedules. Outdoor air volumetric control station will be an independent control loop and will measure the outdoor air. If the measured outdoor air quantity falls below the minimum quantity listed in the air handler schedule, then the outdoor air damper will be modulated open to maintain minimum outdoor air setpoint. The purpose of this control loop is to provide the required ventilation air when the supply and return air fans modulate down. Outdoor air flow measuring station will be capable of producing accurate repeatable control outputs at airflow velocities as low as 200 FPM. Pitot tube type stations will not be acceptable.
- D. Occupied Mode:
1. The roof top units will run continuously under static pressure and volumetric control through the cycle.
 2. If the outdoor air enthalpy is lower than the enthalpy of the return air and the outdoor air dry bulb temperature is higher than the supply air discharge temperature (53°F), then the outdoor air and relief air dampers will be fully open, the return damper will be fully closed, and the cooling coil valve will modulate as required to maintain supply discharge air setpoint.
 3. If the outside air enthalpy is lower than the return air enthalpy and the outdoor air dry bulb temperature is lower than the supply air discharge temperature of 55°F, then the DX cooling will be controlled off and the mixed air temperature sensor will modulate the outdoor air, return air and relief air dampers as required to maintain a discharge setpoint of 55°F. If, with the outdoor air damper at minimum position the discharge air temperature falls below 55°F, then the gas fired heat exchanger will be modulated to maintain a discharge temperature of 55°F.
 4. If the outside air enthalpy is higher than the return air enthalpy, then the return damper will be fully open, the relief damper and the outdoor air damper will be at minimum position (unless overridden by the flow measuring station). The DX cooling coil will modulate as required to maintain discharge temperature setpoints.
 5. On smoke condition, the smoke detectors in the supply fan discharge and return air duct will stop the unit's fan(s) and close the outside air damper.
- E. Unoccupied Cycle:
1. Roof top unit will be off and will remain off throughout the cycle under normal conditions. Outdoor air damper and relief air damper will be closed during cycle; return damper will be fully open. DX cooling coil will be locked out.
 2. During unoccupied heating, the associated roof top unit and VAV boxes will perform the required heating via system cycling. Monitor space sensors and bring on the associated roof top unit if space temperature falls below 45°F. Coils in VAV boxes will provide emergency heating – see their sequences. Roof top units will be under static pressure and volumetric control throughout this cycle.

3. Operator Station Display – Indicate the following on operator workstation display terminal:
 - a. System graphic
 - b. System on-off indication
 - c. System occupied/unoccupied mode
 - d. System supply fan on-off indication
 - e. System return fan on-off indication
 - f. Outside-air-temperature indication
 - g. Outdoor relative humidity indication
 - h. Mixed-air-temperature indication
 - i. Mixed-air-temperature setpoint
 - j. Mixed-air damper position
 - k. Supply fan speed set point
 - l. Supply fan speed indication
 - m. Return fan speed setpoint
 - n. Return fan speed indication
 - o. Outside air flow rate (cfm)
 - p. Return air flow rate (cfm)
 - q. Supply air flow rate (cfm)
 - r. Filter air-pressure-drop indication
 - s. Filter low-air-pressure setpoint
 - t. Filter high-air-pressure setpoint
 - u. Fan-discharge air-temperature indication
 - v. Fan-discharge air-temperature setpoint
 - w. DX cooling stage(s) status
 - x. Gas furnace percent capacity and status
- F. Safeties/Alarms
 1. The following safeties, each with its own software manual reset, will shut down unit and the control system will initiate respective alarm. All safeties will be hardwired into fan motor starter circuits with auxiliary contact to register alarm and provide software override capability at FMS central panel. Manual reset will be accomplished by entering a command at the DDC workstation rather than going to a piece of equipment involved.
 - a. Supply smoke detector (SD) and return smoke detectors for air handlers are activated. Smoke detectors will be furnished and wired to the fire alarm system under the work of Division 26, ATC Contractor will mount detectors and wire to control system. All air handling units are to have smoke detectors.
 - b. Air handlers supply/return fan discharge static pressure high limit (SPH) indicates more than 4 ½" w.g. when the unit status is on (with a 5 minute delay). This will prevent overpressurizing ductwork if supply fan is on with supply smoke damper. While it is the intention to provide normally open VAV boxes for zones served by air handler number 2, if normally closed boxes are installed on the job, then this contractor will install static pressure high limit in this air handler as well.
 - c. Air handlers supply/return fan inlet static pressure low limit (SPL) indicates less than -2 ½" negative static pressure when the unit status is on (with a 5 minute delay). This will prevent duct collapse if return fan is on with return smoke damper being closed.
 - d. Freezestat falls to 38°F. Software manual reset of freezestat will be required. All air handlers will have freezestats. Length of freezestat capillary will be minimum of 20'. Capillary will cover the entire face area of the coil. Use more than one freezestat if required to fully cover coil face area.

- G. The control system will initiate and alarm, describing the alarm if any of the following conditions are met (all setpoints and time periods below will be adjustable by user from the FMS' central console. Whenever a unit is shut down because of one of the safeties, the control system will retrain in memory the reading and setpoint of each device to help the operator in isolating the reason for the problem. All control systems sensors will have a high and low software alarm limit to indicate temperature problems or a faulty sensor.
1. Supply, relief or exhaust fans are commanded to run and anytime after a 15-second delay the control senses no running status via the fans current transformer relays (ct).
 2. Filter differential pressure switch, across filter section, senses greater than 1.5" w.g. for 15 minutes.
 3. Discharge air temperature sensor goes 5 degrees below the minimum cooling discharge air temperature setpoint for 10 minutes when fan status is on.

6.0 VAV AIR TERMINAL UNIT SEQUENCES

- A. Room sensor modulates VAV damper and coil control valve. Room sensor reports temperature.
- B. Rooms with fin-tube radiation heating: The fin-tube radiation control valve will be controlled by the associated VAV box room sensor to ensure that heating is not called for when in cooling mode.
- C. Operator Workstation - Display the following data:
1. Room/area served
 2. Room occupied/unoccupied
 3. Room temperature
 4. Room temperature setpoint, occupied
 5. Room temperature setpoint, occupied standby
 6. Room temperature setpoint, unoccupied
 7. Air-damper position as percent open
 8. Control-valve position as percent open
 9. Terminal box discharge air temperature

7.0 CHILLER PLANT CONTROLS

- A. Operator Workstation - Display the following data:
Add data requirements in coordination with chiller manufacturers. Provide all required system points (and associated sensors and equipment) to display the following (at a minimum)
1. Outside air temperature
 2. Chillers' on/off status
 3. Entering chilled-water temperature
 4. Entering chilled-water temperature setpoint
 5. Leaving chilled-water temperature
 6. Chilled water control valve position
 7. Chilled-water flow rate through each chiller (primary loop)
 8. Chilled-water flow rate to each secondary loop
 9. Chilled-water pressure drop through chiller
 10. Operating status of primary chilled-water pump
 11. Operating status of secondary chilled water pumps (including drive speed)
 12. Power draw of primary chilled water pumps
 13. Power draw of secondary chilled water pumps

- B. Chillers will not start until flow is proved by water flow switch wired to chiller control panel. Flow switch will be furnished and wired by this contractor.
- C. Chilled water pumps will be interlocked with chiller and will not be energized unless chiller is energized. Standby pump(s) will run upon failure of any of the above.
- D. Secondary chilled water distribution pumps will be modulated via differential pressure sensing across the supply/return mains to adjust secondary loop flow in response to loop loading. A minimum loop flow will be maintained via differential bypass piping or end of loop bypass valves.
- E. This contractor will install any temperature controls supply by chiller manufacturer including, but not limited to, discharge and return chilled water temperature sensors, flow switches, alarm points, etc.
- F. This contractor will wire from a common alarm contact in the chiller control panel to the DDC system to alarm if any chiller alarms are activated.
- G. Condenser water bypass valve shall maintain minimum condenser water temperature during low ambient conditions.

8.0 SECONDARY HOT WATER PUMP SEQUENCES

- A. Start lead pump if the temperature is below 60°F or if there is any call for heat at any air handler control valves or if there is a call for heat at any of the DDC monitoring sensors.
- B. Pumps will have variable frequency drive to maintain differential pressure in system.
- C. On the failure of one pump, the stand-by pump will be started automatically.
- D. An end-of-loop bypass valve will be provided to ensure that the system always has required minimum flow.
- E. Pumps will have lead lag operation to equalize run time of each pump.
- F. Operator Workstation - Display the following data:
 - 1. System graphic
 - 2. Outside temperature
 - 3. Secondary heating-water supply temperature
 - 4. Secondary heating-water supply temperature setpoint
 - 5. Operating status of primary circulating pumps
 - 6. Differential pressure indication
 - 7. Differential pressure setpoint
 - 8. Pump speed setpoint
 - 9. Pump speed indication

9.0 BOILER PLANT CONTROLS

- A. Provide outdoor reset schedule and associated controls such that boiler water temperature is 180°F when outdoor air is 0°F, and boiler water temperature is 140°F at 60°F.
- B. This contractor will install any controls provided by the boiler manufacturer.
- C. Enable boiler plant if the temperature is below 60°F or if there is any call for heat at any air handler control valves or if there is a call for heat at any of the DDC monitoring sensors (VAV boxes).
- D. Boiler primary pumps will be constant volume and interlocked with boiler enable circuits.
- E. Interface with existing carbon monoxide monitor and provide local alarm and alarm at DDC system. Provide two adjustable levels of alarm – Warning and High Limit. Interlock with boiler and domestic hot water heater to shut down on high limit alarm.
- F. Combustion Air Controls:

1. Provide automatic control dampers for combustion air inlets to each boiler. When the boiler operates, the ACD will open. Otherwise, the dampers will be closed. Interlock dampers with boilers; boilers will not fire if dampers are not proven open by end-switches.
- G. Operator Workstation - Display the following data:
 1. System Graphic
 2. Outside temperature
 3. Boilers' status
 4. Boiler outlet water temperature
 5. Primary loop heating-water supply temperature
 6. Primary loop heating-water supply temperature setpoint
 7. Primary loop heating-water return temperature
 8. Expansion tank pressure indication
 9. Operating status of primary circulating pumps
 10. Pump failure indication
 11. Intake and exhaust damper position for each boiler

10.0 EXHAUST FAN SEQUENCES

- A. All fans will be controlled by the DDC system. See the schedules for fan numbers and the areas which they serve.
- B. Refrigerant exhaust fan will be interlocked to chiller room refrigerant detector, room air intake damper (existing), and all boiler burners.
- C. Electrical room fans will be under DDC thermostatic control based on a signal from room thermostat. Initial setpoint will be 78°F (adj.); interlock with intake air dampers.
- D. All other exhaust fans will be started and stopped by a time based schedule in the DDC panel.
- E. Provide motorized control dampers interlocked to all exhaust fans. Dampers will open when fans are energized.
- F. Operator Workstation - Display the following data:
 1. Room/area or system served
 2. Operating status of fan
 3. Fan speed (fans controlled by VFDs)
 4. Fan failure indication
 5. All alarms from refrigerant exhaust/detection system

11.0 HEATING TERMINAL UNIT OPERATING SEQUENCE

- A. All terminal equipment will be controlled by the DDC system.
- B. Cabinet Unit Heater, Hydronic: Room sensor/thermostat cycles fan.
 1. Pipe-mounted thermostat stops fan when return heating-water space temperature falls below setpoint.
- C. Cabinet Unit Heater, Electric: Room sensor/thermostat cycles fan and sequences stages of heating.
- D. Unit Heater, Hydronic: Room sensor/thermostat cycles fan.
 1. Pipe-mounted thermostat stops fan when return heating-water space temperature falls below setpoint.
- E. Operator Workstation: Display the following data:
 1. Room/area served
 2. Room temperature
 3. Room temperature setpoint, occupied

4. Room temperature setpoint, occupied standby
5. Room temperature setpoint, unoccupied

12.0 COMPUTER ROOM ENVIRONMENTAL CONTROL UNIT SEQUENCES

- A. This contractor will install any controls provided by the equipment manufacturer to be field installed. Provide all interlocking controls between the dry coolers, pump packages, and environmental units as required.
- B. Provide alarms back to the main EMS of the following:
 1. Environmental unit failure
 2. Humidifier failure
 3. High or low humidity
 4. High temperature alarm
 5. Leak detection below floor
- C. Provide independent room temperature and humidity sensor within data room spaces for monitoring/alarming of the spaces via FMS system.
- D. Operator Workstation – Display the following data:
 1. Room/area served
 2. Room temperature
 3. Room humidity
 4. Computer room unit status
 5. Computer room unit general alarm
- E. Safeties/Alarms
 1. The control system will initiate an alarm, describing the alarm if any of the following conditions are met (all setpoints and time periods below will be adjustable by user from the FMS' central console). Whenever a unit is shut down because of one of the safeties, the control system will retain in memory the reading and setpoint of each device to help the operator in isolating the reason for the problem. All control system sensors will have a high and low software alarm limit to indicate temperature problems or a faulty sensor.
 - a. Any alarm for system control panel.
 - b. Any alarm for leak detection system.

13.0 DUCTLESS SPLIT SYSTEM OPERATING SEQUENCE

- A. The ATC Contractor will provide the interlock wiring between units and the remote condensing units.
- B. Independent DDC system space sensors will monitor the room temperature and provide for alarm on building automation system upon high temperature condition.
- C. Mount factory provided thermostat within room.
- D. Operator Workstation – Display the following data:
 1. Room/area served
 2. Room temperature

14.0 ELEVATOR MACHINE ROOM

- A. General
 1. Provide thermostatic control of elevator machine room fan.

2. Fan will interlock with fire alarm system smoke detector in space. On signal from the fire alarm system, the fan will operate.

15.0 ELEVATOR SHAFT

A. General

1. Provide damper, damper actuators and end switches on elevator shaft louver/damper systems.
2. Dampers will interlock with fire alarm system and shaft thermostat. Damper will be powered closed. On signal from the fire alarm system, the damper will open. Damper will fail open under own power.
3. Damper will also open when shaft temperature is above 78°F (adj.) as sensed by shaft thermostat.

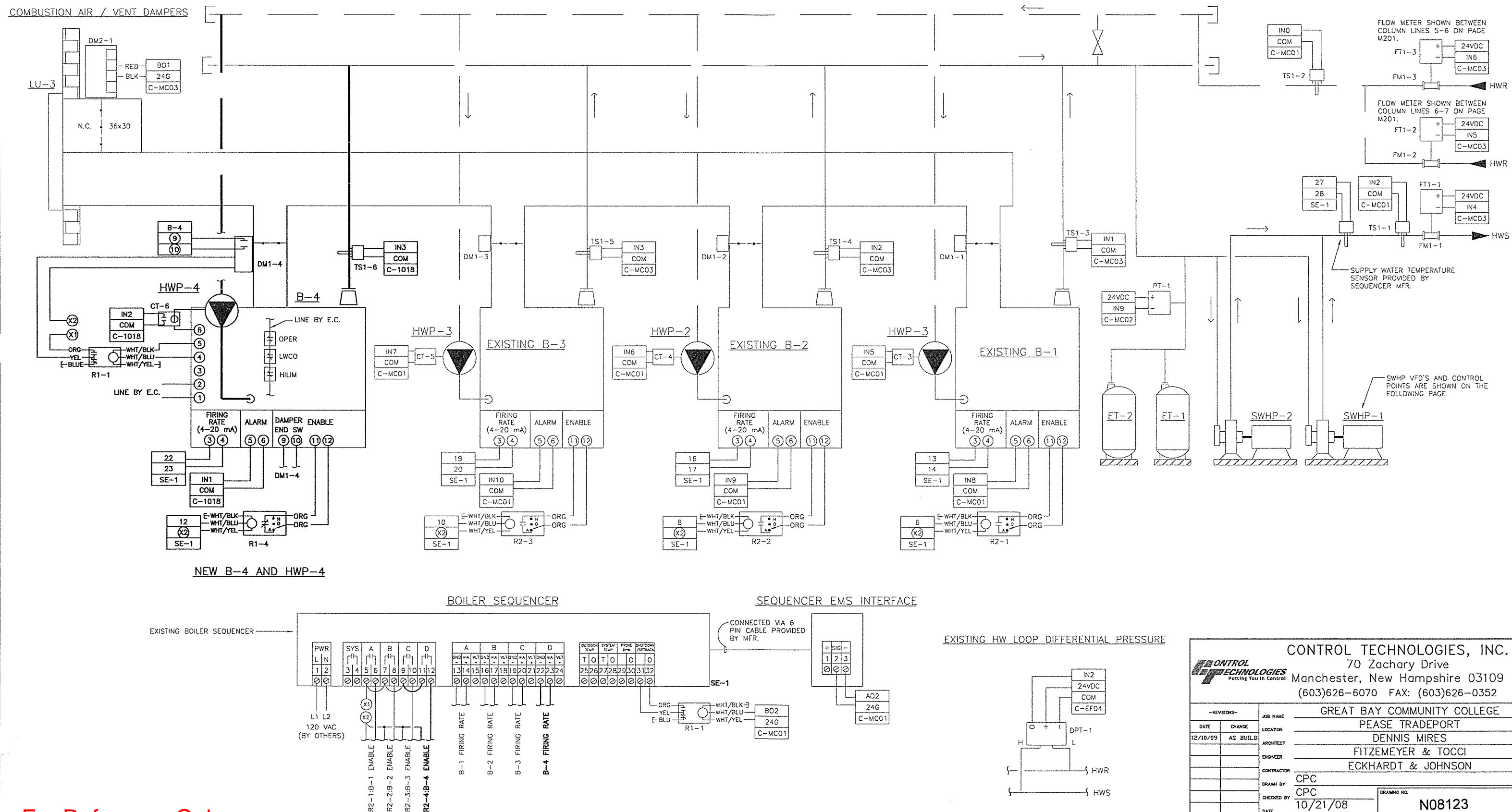
16.0 DUCT HUMIDIFIER CONTROLS

- A. During occupied periods, when supply air flow is proven, the space humidistat modulates control valve to maintain humidity.
- B. Unit will operate per it's packaged controls with the DDC system sending the percentage on signal and receiving an alarm point.
- C. Operator Workstation – Display the following data:
 1. Room/area served
 2. Room occupied/unoccupied
 3. Room temperature
 4. Duct high humidity limit setpoint
 5. Room humidity setpoint, occupied
 6. Room humidity setpoint, unoccupied
 7. Humidifier percent output

Great Bay Technical College- Maintenance Building Sequence of Operations

1. Exhaust Fans EF-A and EF-B
 - a. Exhaust fan will operate when activated by either the manual 4 hour timer or by the CO detector. The CO detector will activate the fan for a minimum of 5 minutes (adj) when CO level rises to 35 PPM (adj) for a period of not less than 1 minute (adj). Upon fan activation the outdoor air intake dampers will open.
2. Unit Heaters UH-1 ~ UH-3
 - a. The unit heaters will operate on a manual adjusted thermostat.
3. HVAC-1
 - a. HVAC-1 will either heat or cool to maintain the occupied/unoccupied setpoints programmed into the thermostat. The outdoor air damper will be open during the occupied time.

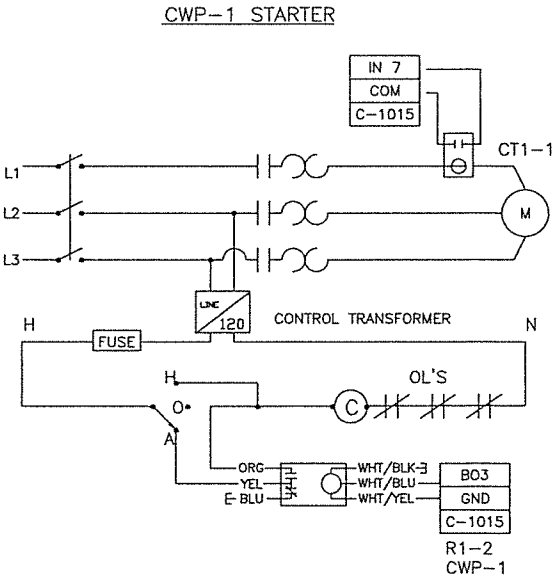
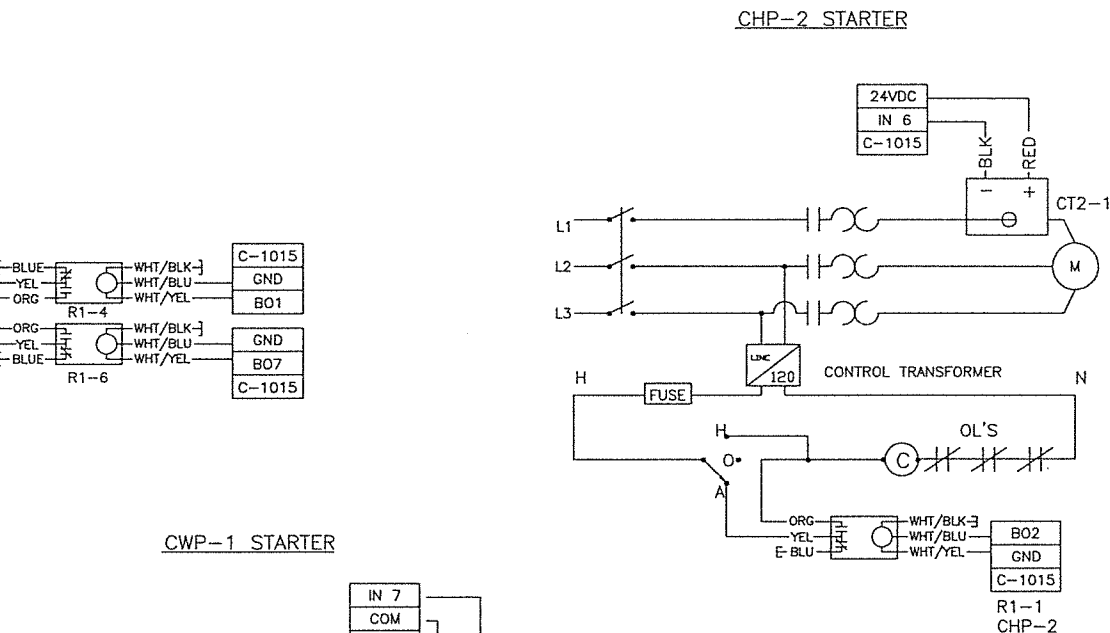
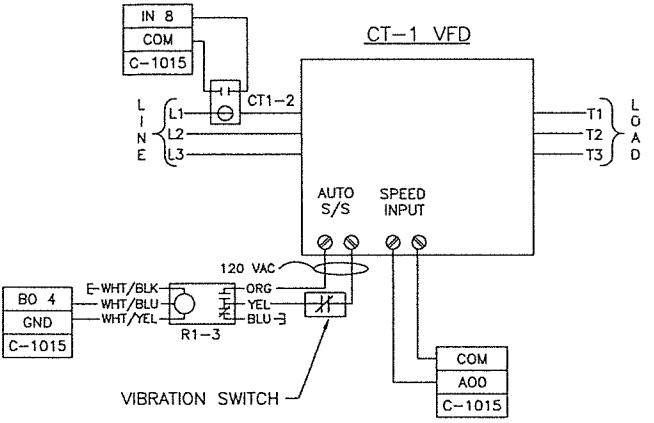
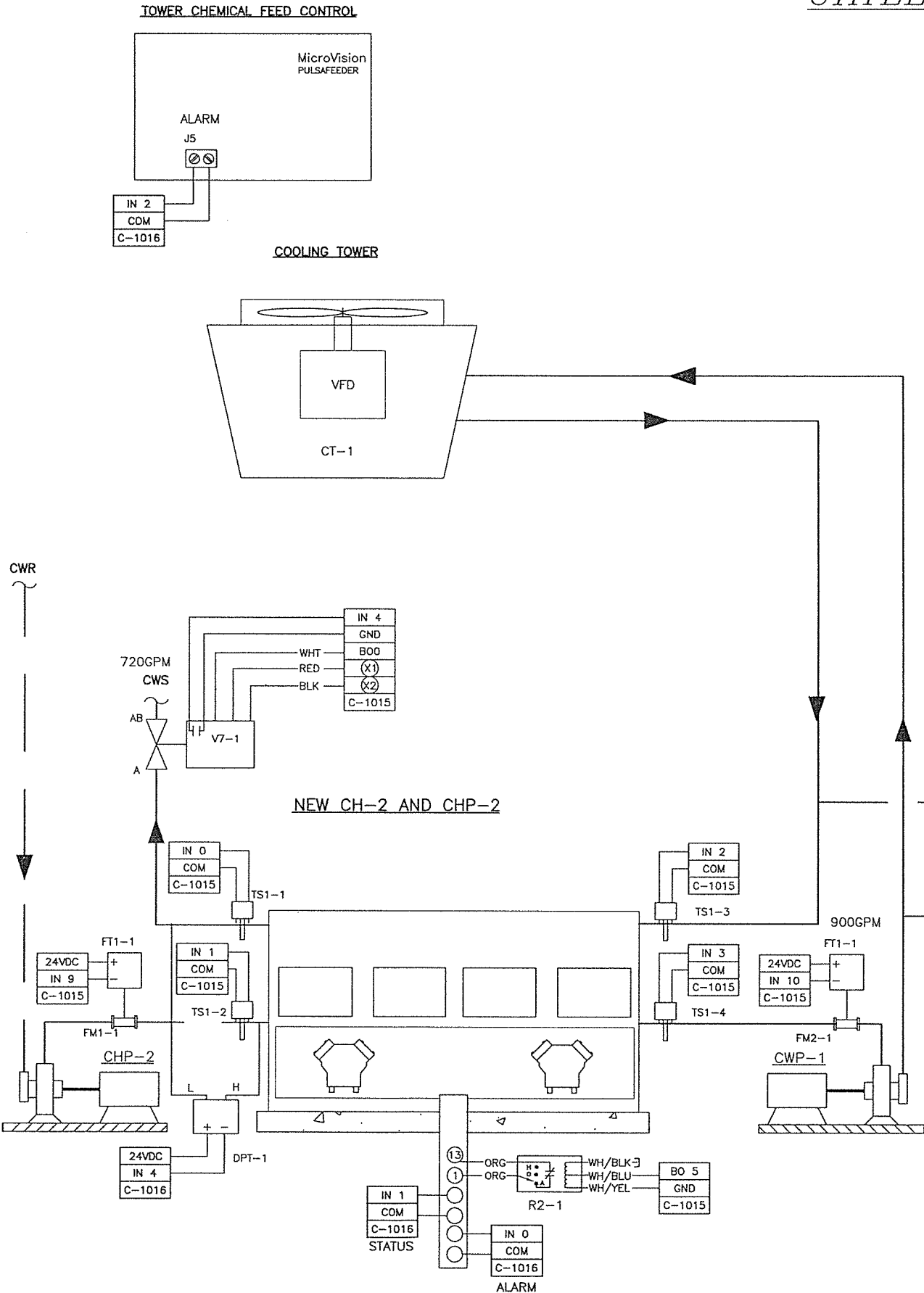
MATERIAL LIST			
ITEM	QTY	MODEL #	DESCRIPTION
-	1	TS-3104-CI-00-AA	4" STAINLESS STEEL WELL
CT	1	RIBXKTA	ENCLOSURE ADJUSTABLE CURRENT SWITCH
DM1	1	MA40-7043-501	35 IN-LB. 24V. 2 POS. SR ACTUATOR W/END SW
R1	1	RBUIC	10 AMP, SPDT(1), 24VAC/DC/120VAC COIL(1) RELAY IN A BOX
R2	1	RIB2401SB-NC	20 AMP, SPDT-NC(1), HOA SWITCH, 24VAC/DC/120 VAC COIL(1) RELAY IN A BOX
TS1	1	TS-2104-GH-10-AA	4" IMMERSION TEMP SENSOR




For Reference Only

CHILLED WATER SYSTEM

MATERIAL LIST			
ITEM	QTY	MODEL #	DESCRIPTION
-	4	TS-3104-CI-00-AA	4" STAINLESS STEEL WELL
CT1	1	RIBXXTF	ENCLOSED FIXED 1/4 AMP CURRENT SWITCH
CT2	1	RIBXX420-50	0-50 AMP CURRENT TRANSDUCER
DPT	1	PR-2824-2-A-1-2-B	0-30PSI, 4-20mA, 2 WIRE 24VDC WET DIFFERENTIAL PRESSURE TRANSDUCER
FM1	1	VW-F-6	6" VENTURI FLOW METER
FM2	1	VW-F-8	8" VENTURI FLOW METER
FT1	2	M230-005PD-C-3VLV	DIFFERENTIAL PRESSURE TRANSMITTER, 0-5 PSI, 0.25% FS, ACCURACY, 4-20mA
R1	5	RIBU1C	10 AMP, SPDT(1), 24VAC/DC/120VAC COIL(1) RELAY IN A BOX
R2	1	RIB24015B-NC	20 AMP, SPDT-NC(1), HOA SWITCH, 24VAC/DC/120 VAC COIL(1) RELAY IN A BOX
TS1	4	TS-2104-GH-10-AA	4" IMMERSION TEMP SENSOR



For Reference Only



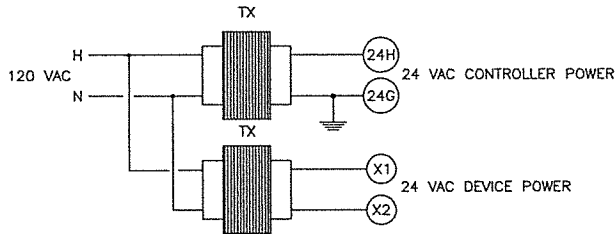
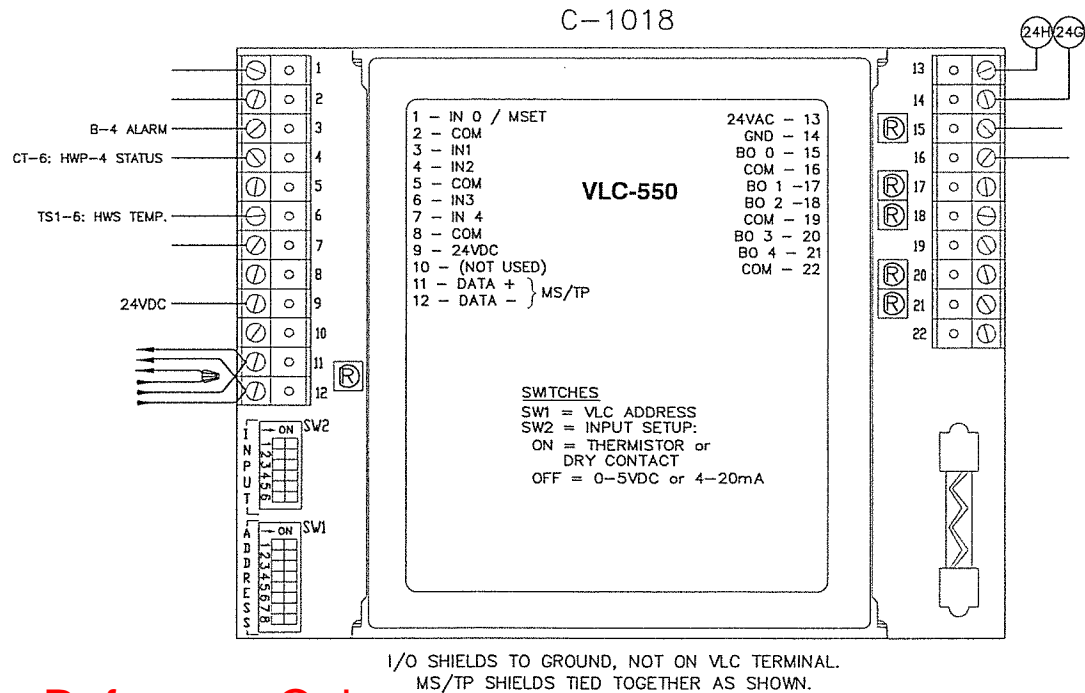
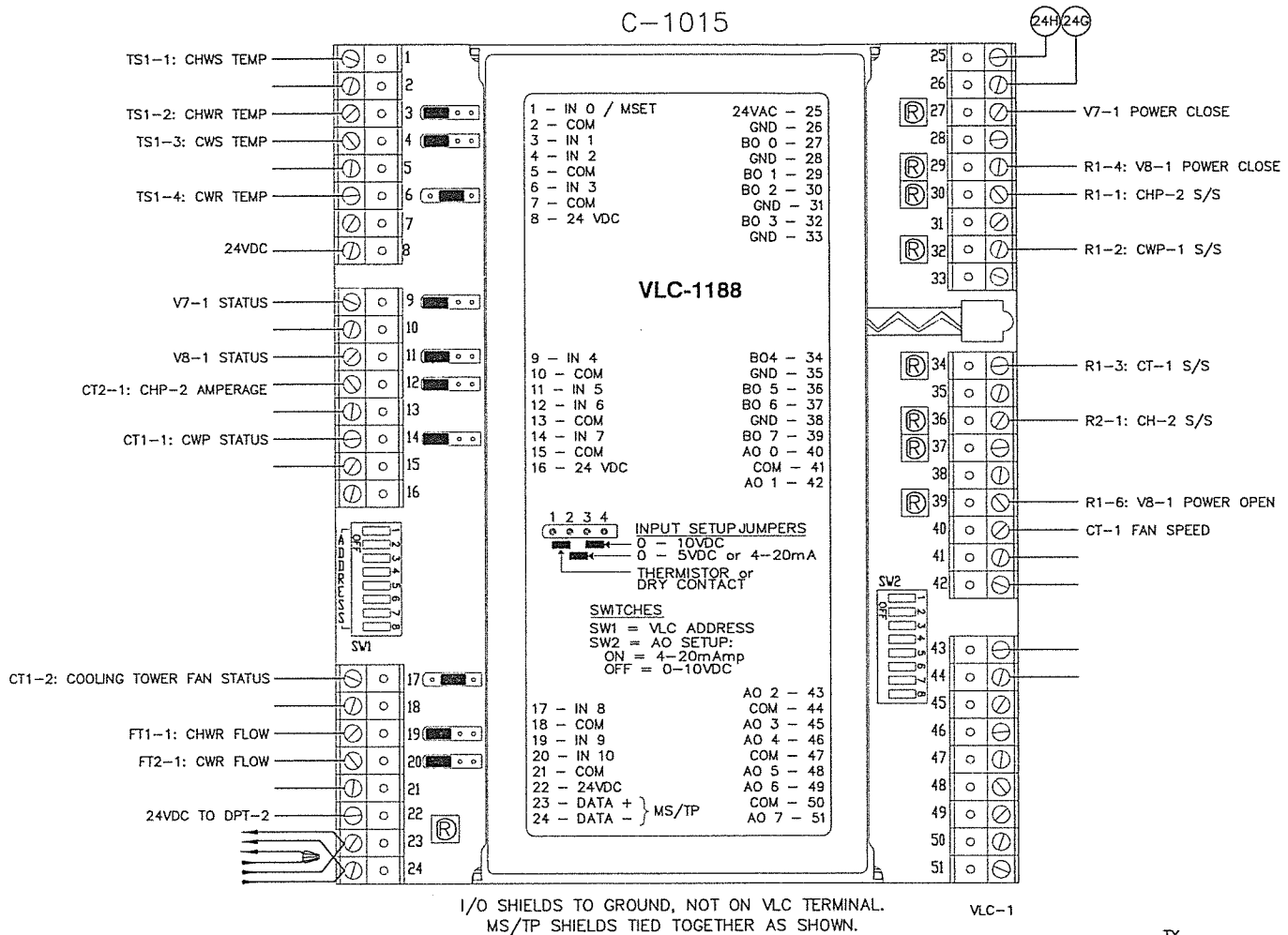
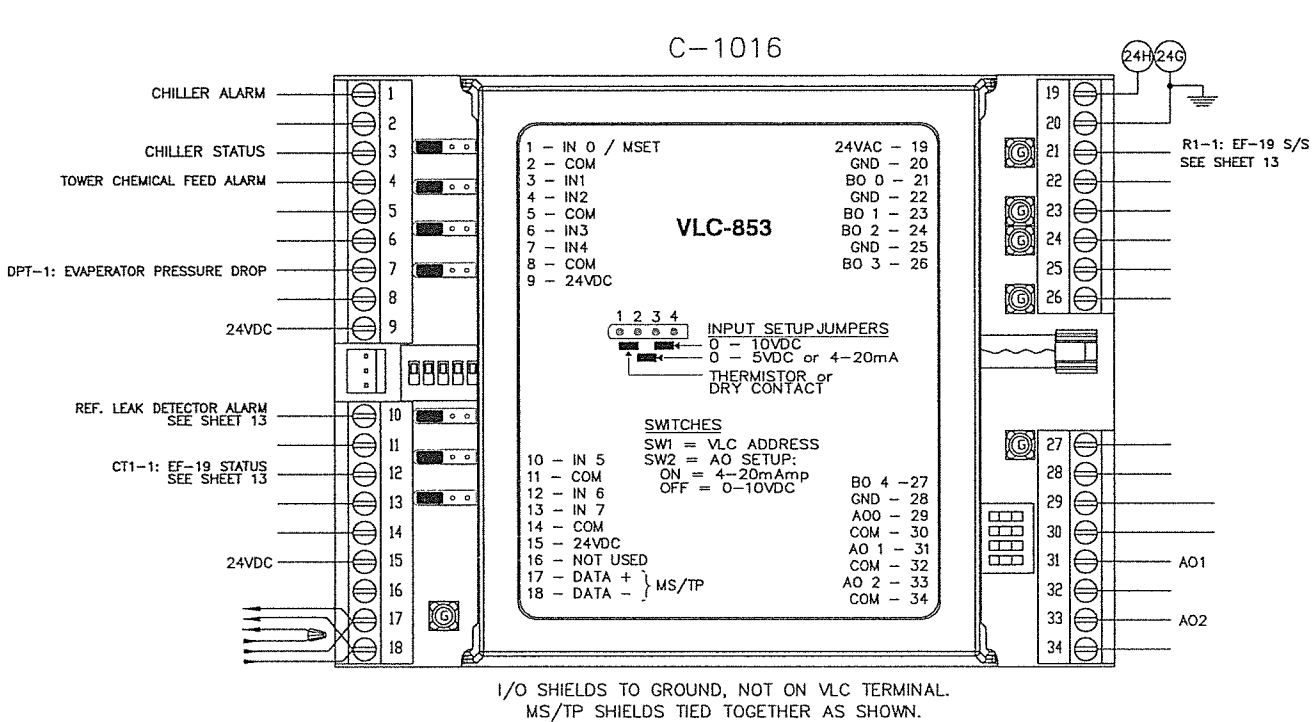
CONTROL TECHNOLOGIES, INC.
70 Zachary Drive
Manchester, New Hampshire 03109
(603)626-6070 FAX: (603)626-0352

-REVISIONS-		JOB NAME	
DATE	CHANGE	LOCATION	AS BUILD
12/10/09	AS BUILD	ARCHITECT	DENNIS MIRE
		ENGINEER	FITZMEYER & TOCCI
		CONTRACTOR	ECKHARDT & JOHNSON
		DRAWN BY	CPC
		CHECKED BY	CPC
		DATE	10/21/08

DRAWING NO.	V08123
	3 OF 18

HEATING / COOLING WATER PLANT CONTROLLERS

MATERIAL LIST			
ITEM#	QTY	MODEL #	DESCRIPTION
1188	1	VLC-1188	DDC CONTROLLER: 11 UI, 8 BO, 8 AO
853	1	VLC-853	DDC CONTROLLER: 8 UI, 5 BO, 2 AO
TX	3	T-208	88 VA TRANSFORMER
ENC	2	AE-280	ENCLOSURE



For Reference Only

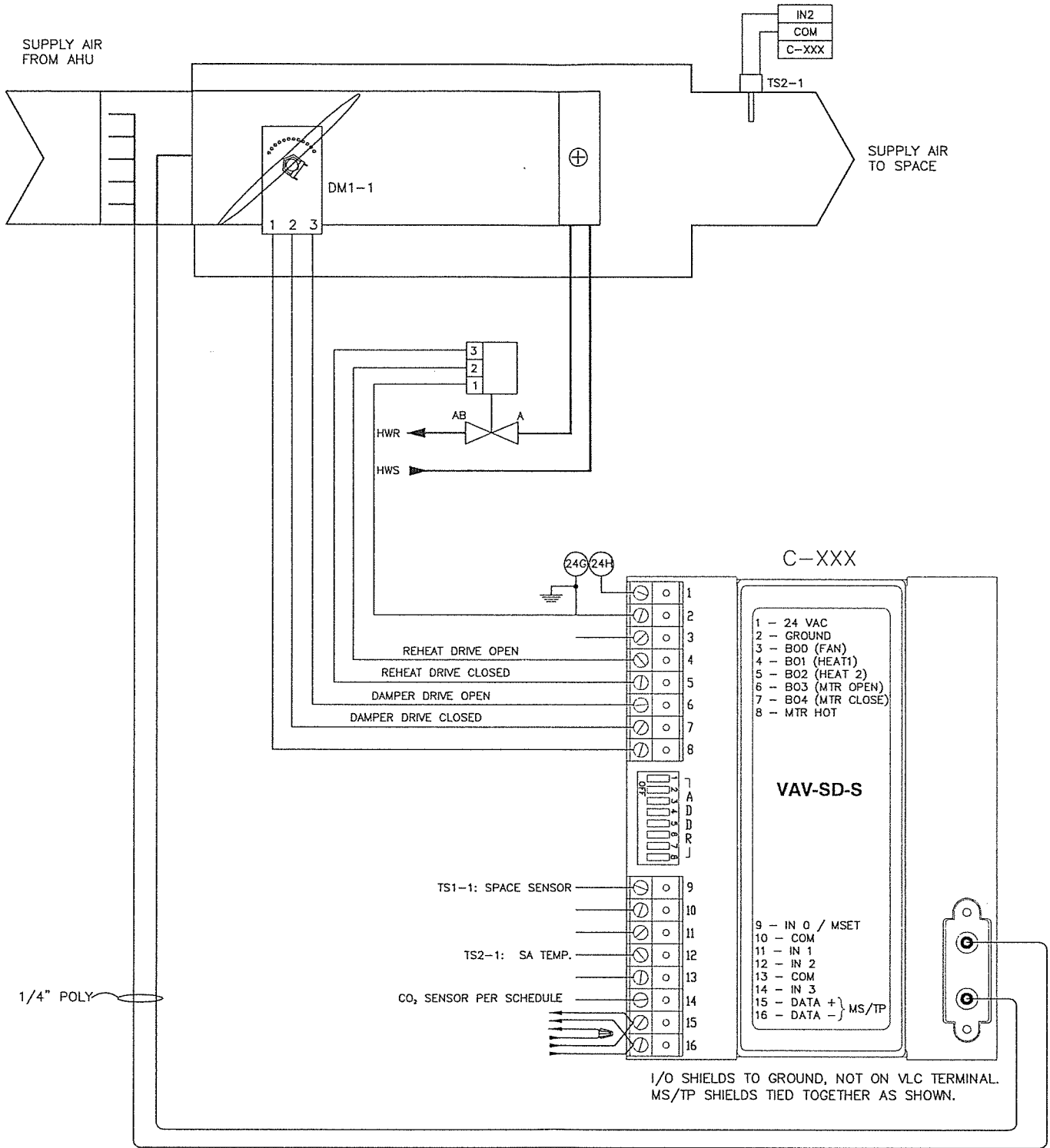
CONTROL TECHNOLOGIES, INC. 70 Zachary Drive Manchester, New Hampshire 03109 (603)626-6070 FAX: (603)626-0352	
GREAT BAY COMMUNITY COLLEGE	
PEASE TRADEPORT	
DENNIS MIRES	
FITZMEYER & TOCCI	
ECKHARDT & JOHNSON	
CONTRACTOR	
CPC	
DRAWN BY	
CPC	
CHECKED BY	
10/21/08	
DATE	
N08123	
1 OF 18	

NAME	BELIMO VALVE #	MAX CFM	MIN CFM	CO ₂ MIN CFM	BOO	IN 1	IN 3
VAV-101	B212B	1335	1335	267			CO ₂
VAV-102	B212B	1740	1740	348			CO ₂
VAV-103	B212B	1740	1740	348			CO ₂
VAV-104	B212B	1740	1740	348			
VAV-105	B212B	1740	1740	348			CO ₂
-106	B212B	1740	1740	348			CO ₂
-107	B211B	1740	1740	340			CO ₂
VAV-108	B207B	250	200	50		HWS FLOW METER	
VAV-109	B212B	1740	1740	348			
VAV-110	B210B	1200	800	240			CO ₂
VAV-111	B212B	1740	1740	348			
VAV-112	B210B	1200	800	240			CO ₂
VAV-113	B210B	1000	630	200			
VAV-114	B210B	375	375	75			
VAV-115	B210B	800	800	160	CUH-C S/S	RM 1024 SPACE TEMP	
VAV-116	B211B	1600	825	320	CUH-C S/S	RM 1025 SPACE TEMP	
VAV-117	B210B	1255	500	251	CUH-A S/S	RM 1023 SPACE TEMP	
VAV-118	B210B	800	800	160	CUH-C S/S	RM 1024 SPACE TEMP	
VAV-119	B210B	665	455	133			
VAV-120	B213B	2925	2250	585			CO ₂
VAV-121	B213B	2925	2250	585			CO ₂
VAV-122	B207B	250	150	50			
VAV-123	B212B	1950	1500	390			CO ₂
VAV-124	B212B	2600	1935	520			
VAV-125	B210B	715	490	143			
VAV-126	B210B	940	680	188			
VAV-127	B208B	320	270	64			
VAV-128	B209B	450	250	90			
VAV-129	B207B	300	150	60			
VAV-130	B211B	1000	1000	200			
VAV-131	B210B	750	750	150			
VAV-132	B210B	800	450	160			
VAV-133	B211B	1785	870	357			
VAV-134	B210B	1300	470	260			
VAV-135	B210B	750	750	150			
VAV-136	B210B	800	500	160			
VAV-137	B210B	800	500	160	CUH-A S/S	RM 1118 SPACE TEMP	
VAV-138	B210B	1200	800	240			
VAV-139	B210B	400	400	80			
VAV-140	B210B	1000	750	200	EF-25/26 S/S	EF-25 STATUS	EF-26 STATUS
-141	B210B	1850	670	370			
-142	B213B	2500	2500	500			
VAV-143	B212B	2800	1660	560	CUH-B S/S	RM 1001 SPACE TEMP	
VAV-144	B207B	250	150	50			
VAV-145	B210B	540	540	108			
VAV-146	B210B	400	400	80			
VAV-147	B208B	1000	275	200			
VAV-148	DELETED						
VAV-149	B210B	540	335	108	UH S/S	RM 1067 SPACE TEMP	
VAV-150	B209B	2000	250	400	CUH-A S/S	RM 1102 SPACE TEMP	
VAV-151	B212B	2030	2000	400			
VAV-152	B212B	2050	2000	400			
VAV-153	B210B	540	540	108			
VAV-154	B211B	875	875	175			
VAV-155	B212B	1600	1600	320			CO ₂
VAV-156	B212B	1400	1400	280			CO ₂
VAV-157	B207B	350	200	70	CUH-A S/S	RM 1057 SPACE TEMP	
VAV-158	B212B	1400	1400	280			CO ₂
VAV-159	B208B	400	260	80			
VAV-160	B211B	1200	1200	240			
VAV-161	B207B	135	60	27	UH S/S	RM 1101 SPACE TEMP	
VAV-162	DELETED						
VAV-163	B211B	1500	1200	300			
VAV-164	B210B	800	535	160			
VAV-165	B208B	450	230	90			
VAV-166	B210B	1125	520	225			
VAV-167	B207B	300	150	60			
VAV-168	B212B	1740	1740	348			CO ₂
VAV-169	B210B	555	380	111			
VAV-170	B212B	2585	1735	517			
VAV-171	B212B	3000	1670	600			
VAV-172	B210B	500	500	100			
VAV-173	B210B	500	500	100	EF-15 S/S	EF-15 STATUS	
VAV-174	B210B	500	500	100			
VAV-175	B210B	750	750	N/A		RM 1087 SPACE TEMP	
-176	B210B	350	350	N/A	EF-20 S/S	EF-20 STATUS	
-177	B211B	1150	1150	230			CO ₂
VAV-178	B207B	350	80	N/A			
VAV-179	B210B	750	475	150			CO ₂
VAV-180	B210B	750	475	150			CO ₂
VAV-181	B212B	1580	200	N/A			

NOTE:
1: SEE SHEET 14 FOR CUH/UH DETAIL
2: VAV-143 SHALL CONTROL 2 CUH'S

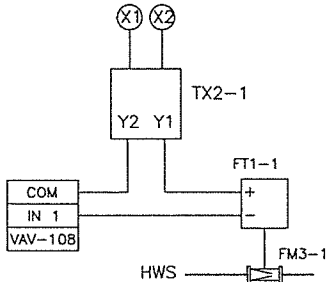
VAV BOXES

TYPICAL OF 79

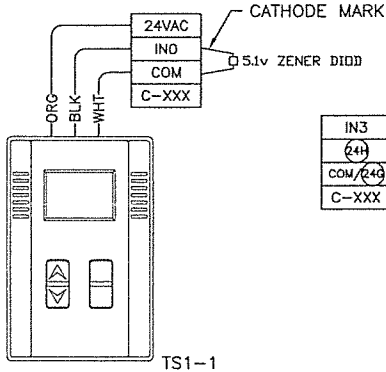


MATERIAL LIST			
ITEM	QTY	MODEL #	DESCRIPTION
CO2	18	IAQFT-SM-A	CO2 MONITOR, WALL MOUNT
DM1	79	LHB24-3-T	45 IN-LB, 24V, FLOATING NON-SPRING RETURN ACTUATOR W/TERM
FM3	1	VGE-3	3" VENTURI FLOW METER GROOVED ENDS
FT1	1	M203-00SPD-C-3VLV	DIFFERENTIAL PRESSURE TRANSMITTER, 0.5 PSI, 0.25% FS, ACCURACY, 4-20mA
TS1	79	MS-2000-BT	SPACE SENSOR W/ SP AND OVERRIDE
TS2	79	TS-2008-GD-10-AA	8" DUCT TEMP SENSOR
TX	79	T-208	96 VA TRANSFORMER
TX2	1	DCP-1.5-W	24VAC TO 24VDC POWER SUPPLY
VLC	79	VAV-SD-S	DDC CONTROLLER: 4 UI, 6 BO UL 864
ZD	79	1N4733	5.1V, 1WV ZENER DIODE

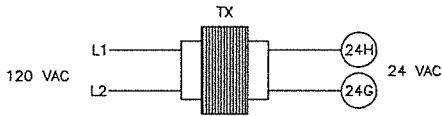
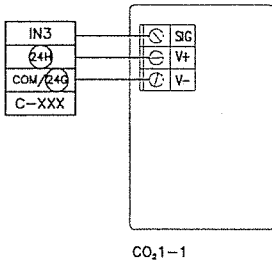
1ST FLOOR FLOW METER



SPACE TEMPERATURE SENSOR



SPACE CO₂ SENSOR TYPICAL FOR 18



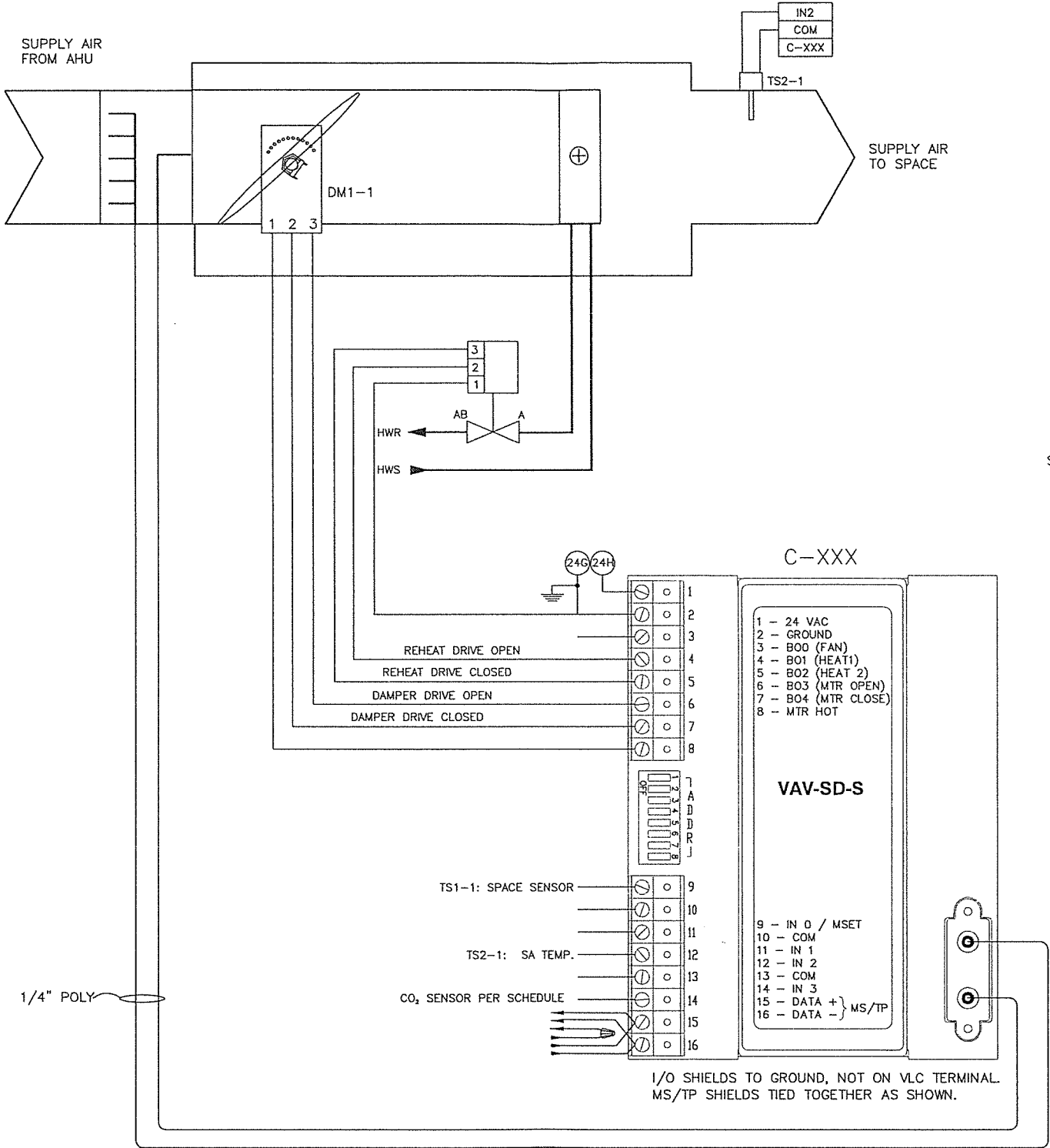
CONTROL TECHNOLOGIES, INC. 70 Zachary Drive Manchester, New Hampshire 03109 (603)626-6070 FAX: (603)626-0352			
CONTROL TECHNOLOGIES Putting You in Control			
-REVISIONS-		JOB NAME	
DATE	CHANGE	LOCATION	
02/10/09	AS BUILT	PEASE TRADEPORT	
		ARCHITECT	
		DENNIS MIRES	
		ENGINEER	
		FITZEMEYER & TOCCI	
		CONTRACTOR	
		ECKHARDT & JOHNSON	
		DRAWN BY	
		CPC	
		CHECKED BY	
		CPC	
		DATE	
		10/21/08	
		DRAWING NO.	
		N08123	
		3 OF 18	

For Reference Only

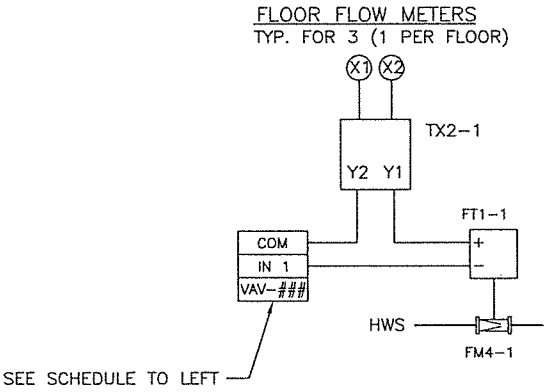
NAME	BELIMO VALVE #	MAX CFM	MIN CFM	CO ₂ MIN CFM	B00	IN 1	IN 3
VAV-200	B212B	1740	1560	348			CO ₂
VAV-201	B210B	540	440	108			
VAV-202	B211B	1080	960	216			CO ₂
VAV-203	B212B	1590	1560	318			CO ₂
VAV-204	B210B	1740	1560	348			CO ₂
VAV-205	B210B	800	800	160			CO ₂
VAV-206	B211B	1350	1200	270			CO ₂
VAV-207	B208B	320	240	64			
VAV-208	B212B	1600	1560	320			CO ₂
VAV-209	B207B	210	180	42			
VAV-210	B207B	210	180	42			
VAV-211	B211B	1000	900	200			
VAV-212	B210B	1240	780	248			CO ₂
VAV-213	B207B	550	60	110		HWS FLOW METER	
VAV-214	B210B	1460	780	292			CO ₂
VAV-215	B207B	550	160	110		RM 2024 SPACE TEMP	
VAV-216	B210B	500	420	100			
VAV-217	B212B	1560	1560	312			CO ₂
VAV-218	B207B	330	120	66			
VAV-219	B207B	490	120	96			
VAV-220	B210B	850	720	170			CO ₂
VAV-221	B210B	1000	720	200			CO ₂
VAV-222	B210B	1050	720	210			CO ₂
VAV-223	B210B	540	480	108			
VAV-224	B207B	200	180	40			
VAV-225	B210B	540	480	106			
VAV-226	B210B	440	420	88			
VAV-227	B207B	740	180	148			
VAV-228	B208B	660	240	132			
VAV-229	B210B	800	720	160			
VAV-230	B212B	1600	1560	320			CO ₂
VAV-231	B210B	750	750	150			
VAV-301	B213B	2200	2200	440			CO ₂
VAV-302	B212B	1500	1500	300			CO ₂
VAV-303	B312B	1500	1500	300			CO ₂
VAV-304	B210B	300	300	60			
VAV-305	B212B	1500	1500	300			CO ₂
VAV-306	B211B	1000	1000	200		HWS FLOW METER	
VAV-307	B210B	400	400	80			
VAV-308	B210B	300	300	60			
VAV-309	B210B	500	500	100			
VAV-310	B210B	300	300	60			
VAV-311	B210B	300	300	60			
VAV-312	B212B	1700	1700	340			CO ₂
VAV-313	B211B	1000	1000	200		RM 3033 SPACE TEMP	
VAV-314	B210B	400	400	80			
VAV-315	B210B	300	300	60			
VAV-316	B210B	400	400	80			
VAV-317	B210B	540	540	108			CO ₂
VAV-318	B212B	1300	1300	260			CO ₂
VAV-319	B212B	1300	1300	260			CO ₂
VAV-320	B212B	1300	1300	260			CO ₂
VAV-321	B212B	1300	1300	260			CO ₂
VAV-322	B212B	1300	1300	260			CO ₂
VAV-401	B212B	1640	1620	328			
VAV-402	B211B	1240	1200	248			CO ₂
VAV-403	B311B	1240	1200	248			CO ₂
VAV-404	B211B	1240	1200	248			CO ₂
VAV-405	B211B	1240	1200	248		HWS FLOW METER	CO ₂
VAV-406	B211B	1300	1200	260			CO ₂
VAV-407	B211B	1300	1200	260			CO ₂
VAV-408	B212B	2870	1750	574			CO ₂
VAV-409	B211B	1400	1200	280			CO ₂
VAV-410	B207B	235	135	N/A			
VAV-411	B211B	1090	1000	N/A			
VAV-412	B210B	500	320	N/A			
VAV-413	B207B	670	135	134			CO ₂
VAV-414	B208B	485	270	N/A			
VAV-415	B210B	375	375	N/A			
VAV-416	B211B	1000	1000	N/A		RM 4020 SPACE TEMP	
VAV-417	B212B	1660	1560	372			CO ₂
VAV-418	B211B	1050	1020	210			CO ₂
VAV-419	B211B	1450	1200	290			CO ₂
VAV-420	B211B	1300	1200	260			CO ₂
VAV-421	B211B	1300	1200	260			CO ₂
VAV-422	B212B	1950	1560	390			CO ₂
VAV-423	B212B	1950	1560	390			CO ₂

VAV BOXES

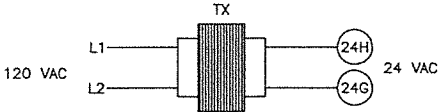
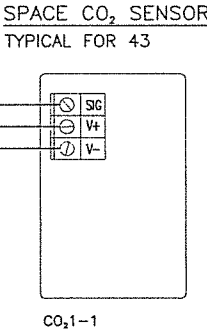
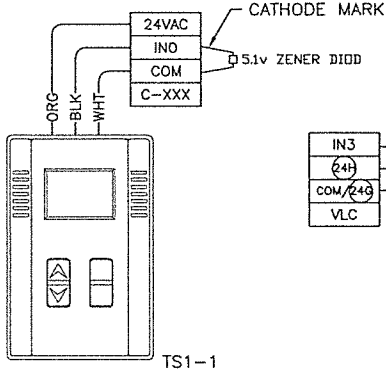
TYPICAL OF 77



MATERIAL LIST			
ITEM	QTY	MODEL #	DESCRIPTION
CO2	43	IAQPT-EM-A	CO2 MONITOR, WALL MOUNT
DM1	77	LM24-S-T	48 IN-LB, 24V, FLOATING NON-SPRING RETURN ACTUATOR W/ TERM
FM4	3	VGE-2-E	2-1/2" VENTURI FLOW METER GROOVED ENDS
FT1	3	MD3-005PD-Q-SVLY	DIFFERENTIAL PRESSURE TRANSMITTER, 0-6 PSI, 0.25% FS, ACCURACY, 4-20 mA
TS1	77	MS-200D-BT	SPACE SENSOR W/ SP AND OVERRIDE
TS2	77	TS-200S-SD-13-AA	8" DUCT TEMP SENSOR
TX	77	T-208	95 VA TRANSFORMER
TX2	2	DCP-1-E-W	24VAC TO 24VDC POWER SUPPLY
VLC	77	VAV-SD-S	DDC CONTROLLER, 4 UL E, 50 UL 564
ZD	78	1N4733	5.1V, 1W ZENER DIODE



SPACE TEMPERATURE SENSOR

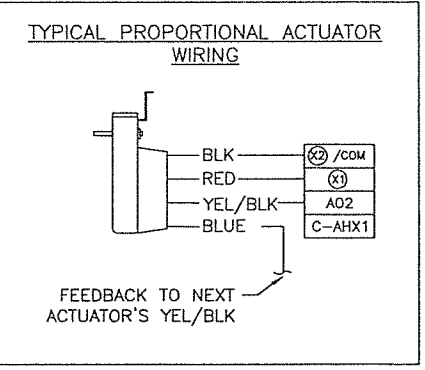
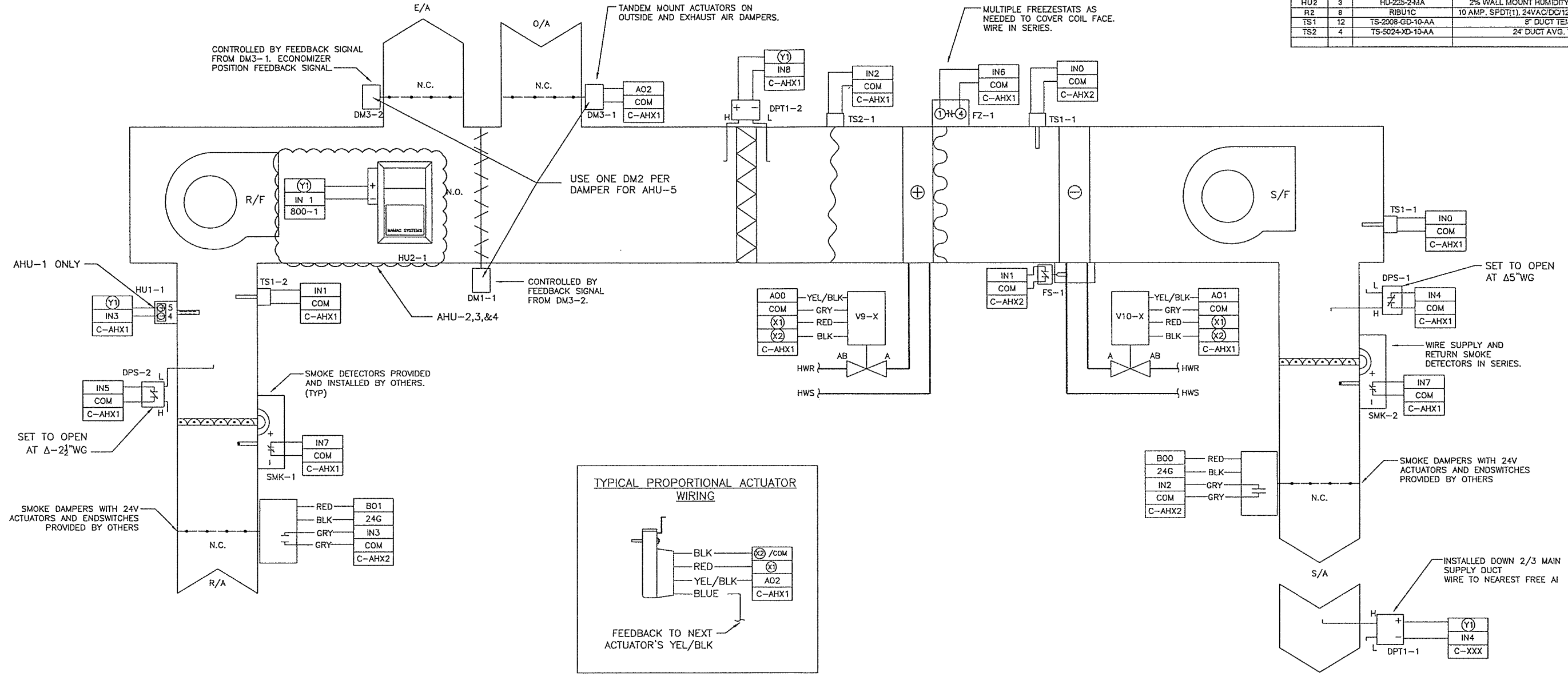


For Reference Only

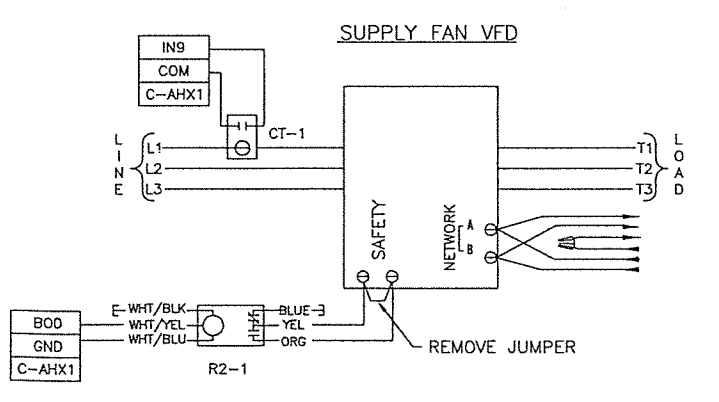
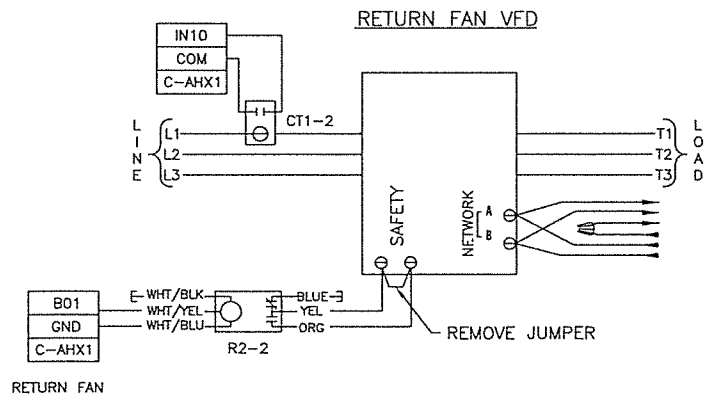
CONTROL TECHNOLOGIES, INC.			
70 Zachary Drive			
Manchester, New Hampshire 03109			
(603)626-6070 FAX: (603)626-0352			
-REVISIONS-		JOB NAME	
DATE	CHANGE	LOCATION	
12/10/09	AS BUILT	GREAT BAY COMMUNITY COLLEGE	
		PEASE TRADEPORT	
		DENNIS MIRES	
		FITZMEYER & TOCCI	
		ECKHARDT & JOHNSON	
		CONTRACTOR	
		CPC	
		DRAWN BY	
		CPC	
		CHECKED BY	
		10/21/08	
		DATE	
		DRAWING NO.	
		N08123	
		5A OF 18	

AHU-2

TYPICAL FOR 4



MATERIAL LIST			
ITEM	QTY	MODEL #	DESCRIPTION
CT	8	REXKA	ENCLOSED ADJUSTABLE CURRENT SWITCH
DM1	3	MS41-7153	133 IN-LB. 24V. PROP. SR ACTUATOR
DM2	3	MS40-7043	35 IN-LB. 24V. PROP. SR ACTUATOR
DM3	6	MS40-7173	150 IN-LB. 24V. PROP. SR ACTUATOR
DPS	8	AFS-222-112	DIFFERENTIAL PRESSURE SWITCH
DPT	8	8800-05P0	DFF. PRESSURE TRANSMITTER (0-5") 4-20mA
FS	4	2P874	FLOAT CONTROL SAFETY SWITCH
FZ	4	TC-E231	AUTO RESET SPDT FREEZE STAT
HU1	1	HU-224-2-MA	2% DUCT MOUNT HUMIDITY SENSOR 4-20 mA OUTPUT
HU2	3	HU-225-2-MA	2% WALL MOUNT HUMIDITY SENSOR 4-20 mA OUTPUT
R2	8	RIBU1C	10 AMP. SPDT(1), 24VAC/DC/120VAC COIL(1) RELAY IN A BOX
TS1	12	TS-2008-GD-10-AA	8" DUCT TEMP SENSOR
TS2	4	TS-5024-XD-15-AA	24" DUCT AVG. TEMP SENSOR



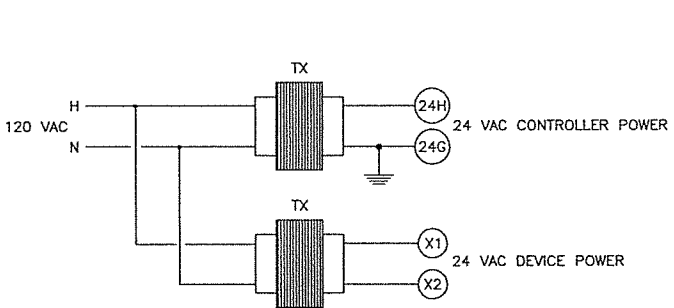
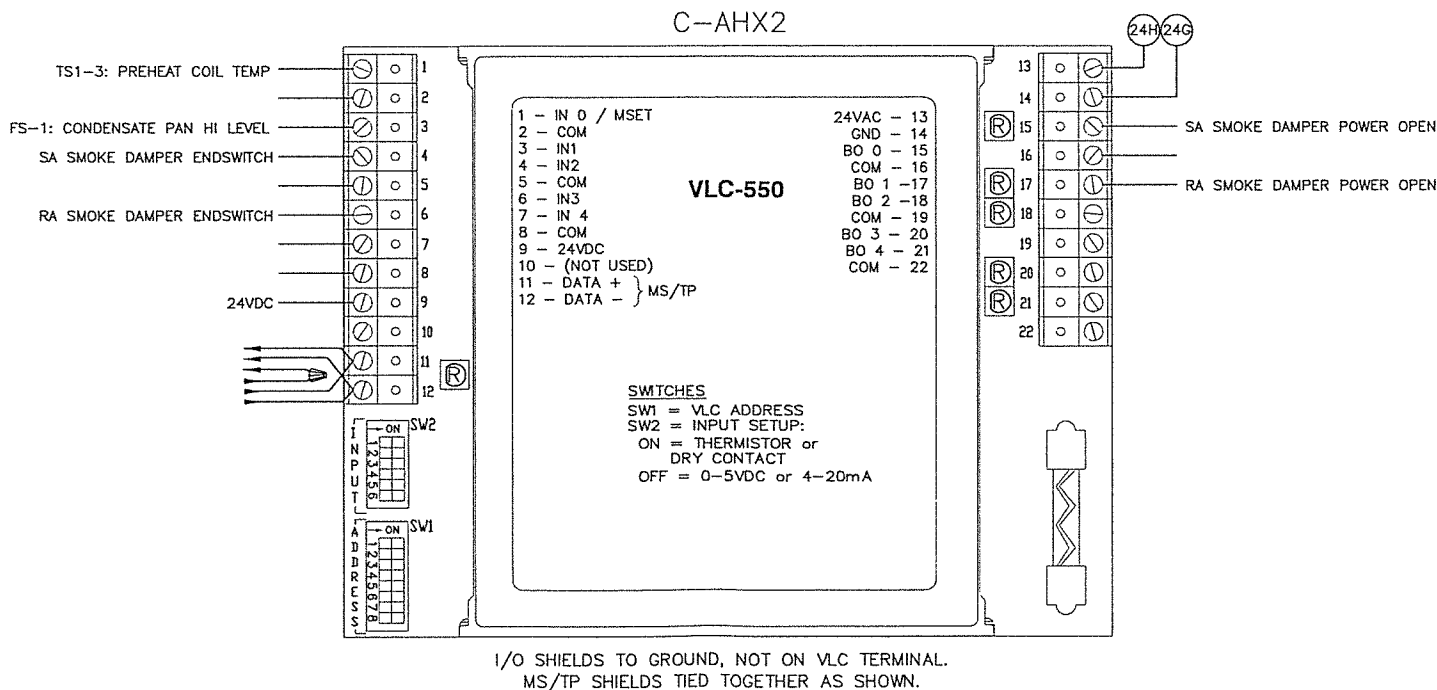
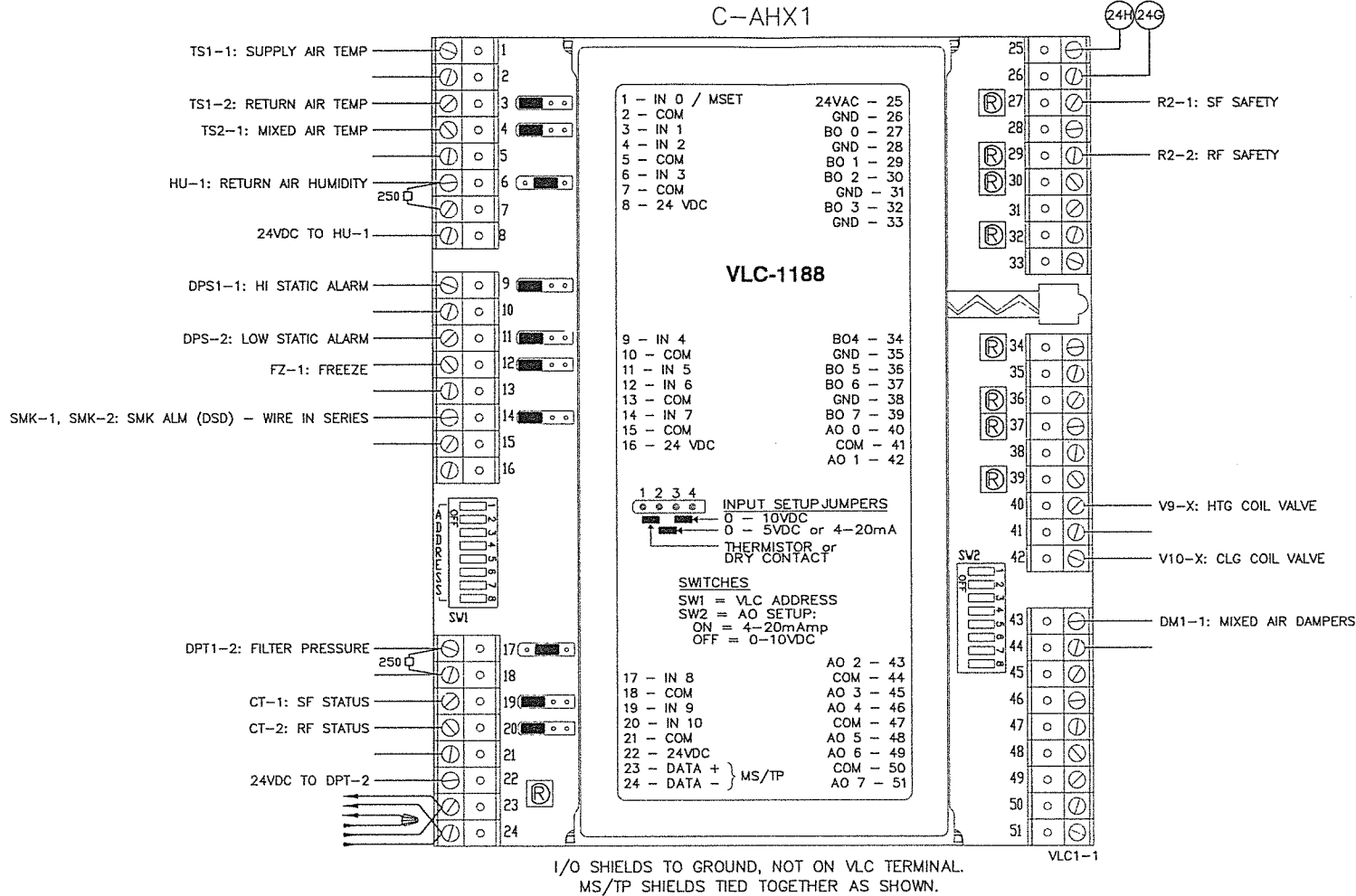
		CONTROL TECHNOLOGIES, INC. 70 Zachary Drive Manchester, New Hampshire 03109 (603)626-6070 FAX: (603)626-0352	
		GREAT BAY COMMUNITY COLLEGE PEASE TRADEPORT DENNIS MIRES FITZMEYER & TOCCI ECKHARDT & JOHNSON	
DATE	CHANGE	JOB NAME	LOCATION
10/10/09	00000000	GREAT BAY COMMUNITY COLLEGE	PEASE TRADEPORT
		ARCHITECT	DENNIS MIRES
		ENGINEER	FITZMEYER & TOCCI
		CONTRACTOR	ECKHARDT & JOHNSON
		DRAWN BY	CPC
		CHECKED BY	CPC
		DATE	10/21/08
		DRAWING NO.	N08123
			3 OF 18

For Reference Only

AHU CONTROLLERS

TYP. FOR 4

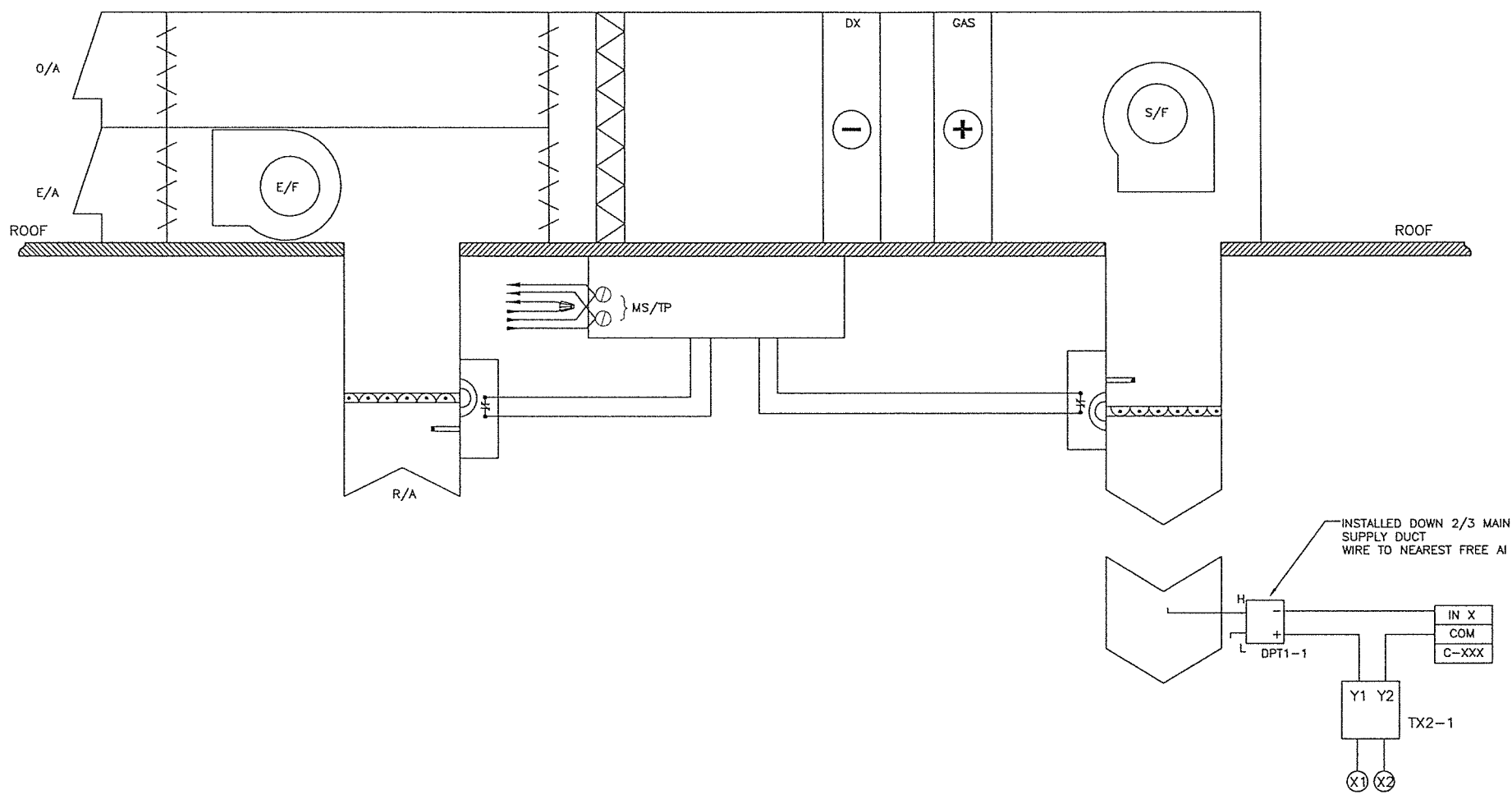
MATERIAL LIST			
ITEM	QTY	MODEL #	DESCRIPTION
VLC1	4	VLC-1188	DDC CONTROLLER: 11 UI, 8 BO, 8 AO
VLC2	4	VLC-550	DDC CONTROLLER: 5 UI, 5 BO
TX	12	T-208	95 VA TRANSFORMER
ENC	8	AE-690	ENCLOSURE




CONTROL TECHNOLOGIES, INC.			
70 Zachary Drive Manchester, New Hampshire 03109 (603)626-6070 FAX: (603)626-0352			
GREAT BAY COMMUNITY COLLEGE			
PEASE TRADEPORT			
DENNIS MIRES			
FITZMEYER & TOCCI			
ECKHARDT & JOHNSON			
CPC			
CPC			
10/21/08			
DATE			
N08123			
7 OF 18			

MATERIAL LIST			
ITEM	QTY	MODEL #	DESCRIPTION
DPT	1	883D-05P0	DIFF. PRESSURE TRANSMITTER (0-5") 4-20mA
TX	1	DCP-1.5-W	24VAC TO 24VDC POWER SUPPLY

RTU-1: FACTORY INSTALLED CONTROLS

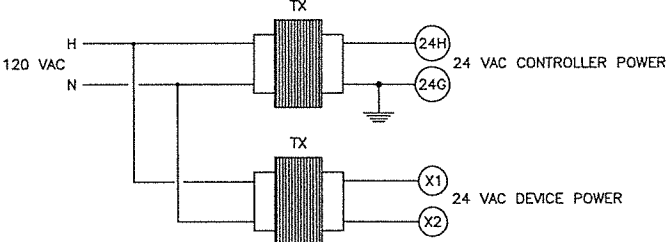
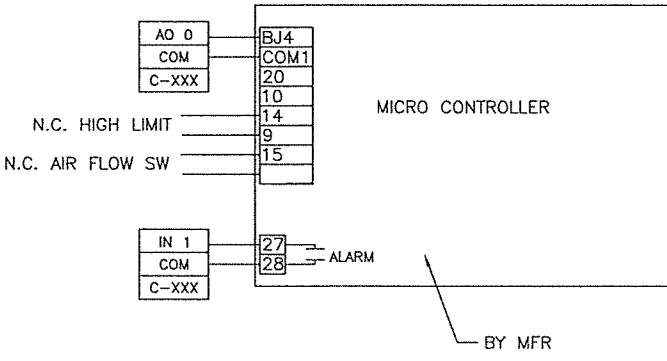
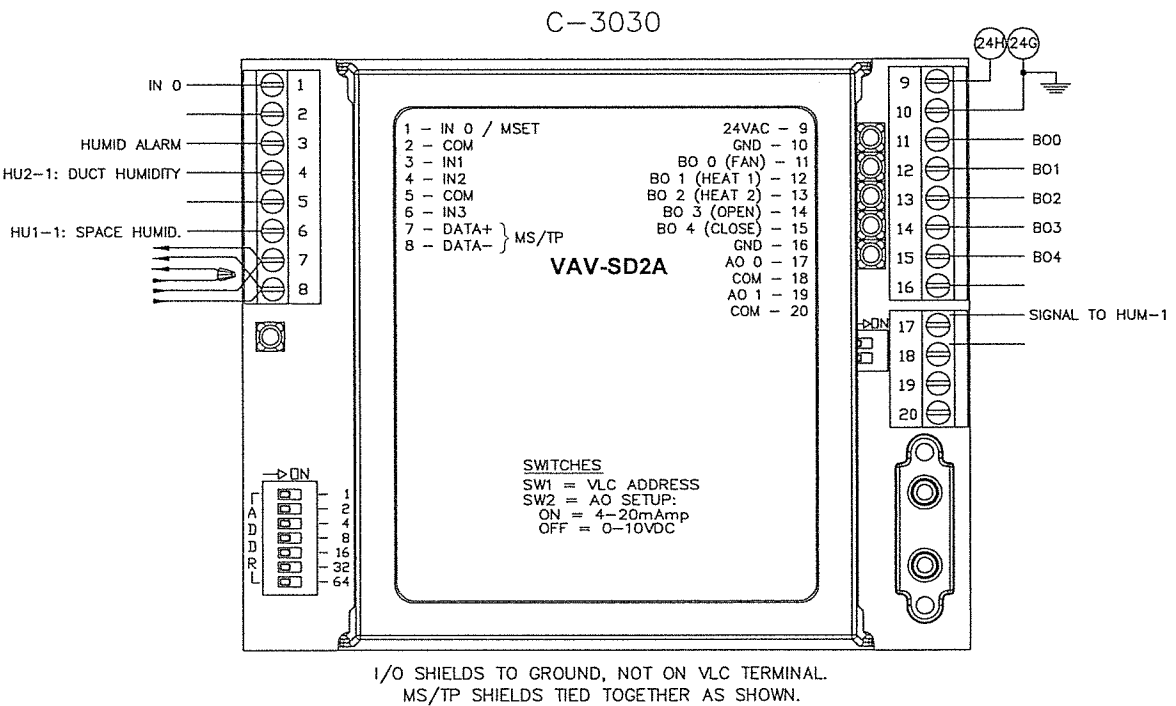
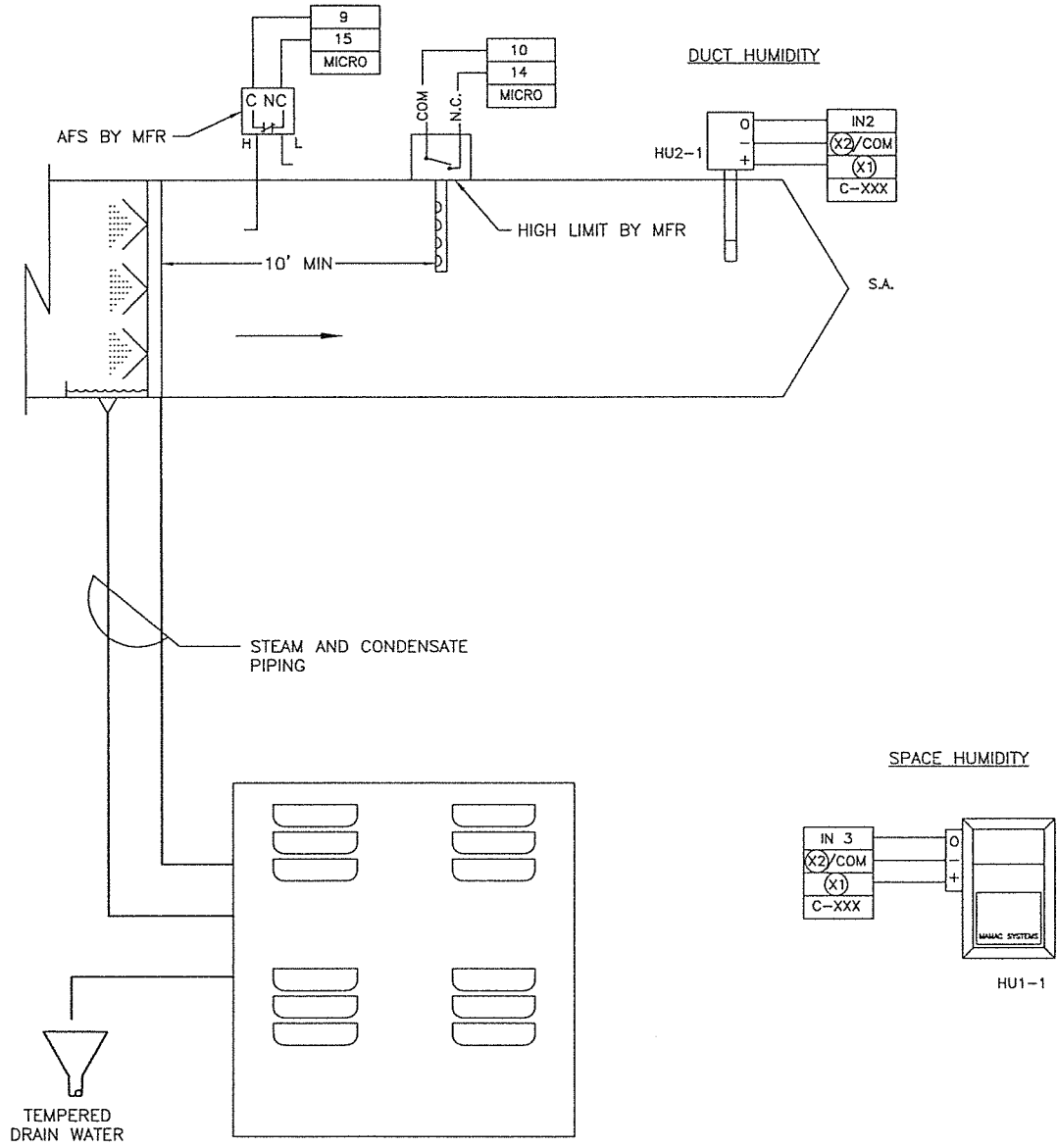


For Reference Only

		CONTROL TECHNOLOGIES, INC. 70 Zachary Drive Manchester, New Hampshire 03109 (603)626-6070 FAX: (603)626-0352	
		GREAT BAY COMMUNITY COLLEGE PEASE TRADEPORT DENNIS MIRES FITZMEYER & TOCCI ECKHARDT & JOHNSON	
-REVISIONS- DATE CHANGE 12/10/09 AS BUILT		JOB NAME LOCATION ARCHITECT ENGINEER CONTRACTOR DRAWN BY CHECKED BY DATE	10/21/08 N08123 8 OF 18

MATERIAL LIST			
ITEM	QTY	MODEL #	DESCRIPTION
HU1	1	HU-225-2A/DC	2% WALL MOUNT HUMIDITY SENSOR 0-10 VDC OUTPUT
HU2	1	HU-224-2A/DC	2% DUCT MOUNT HUMIDITY SENSOR 0-10 VDC OUTPUT
VAV	1	VAV-SD2A	DDC CONTROLLER, 4 UI, 8 BO, 2 AO
TX	2	T-208	96 VA TRANSFORMER

HUM-1: LIBRARY HUMDIFIER



For Reference Only

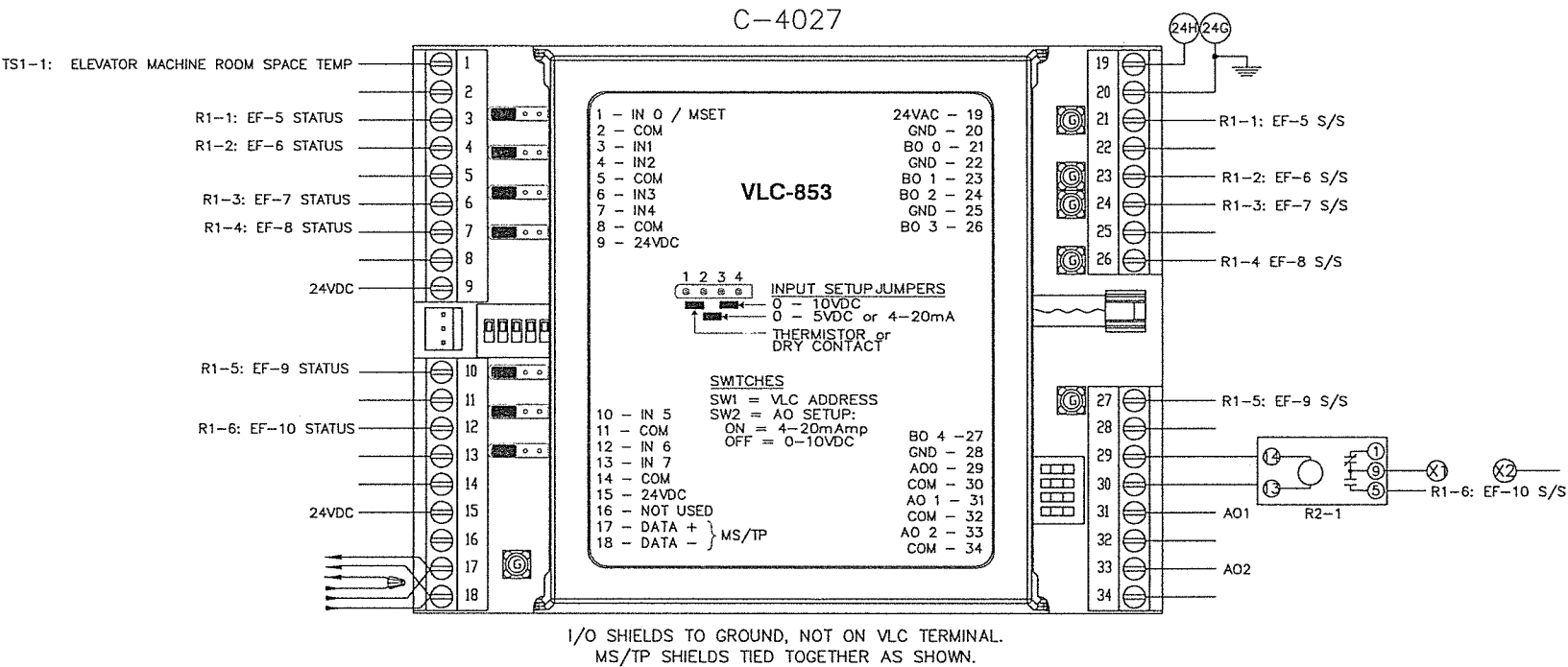
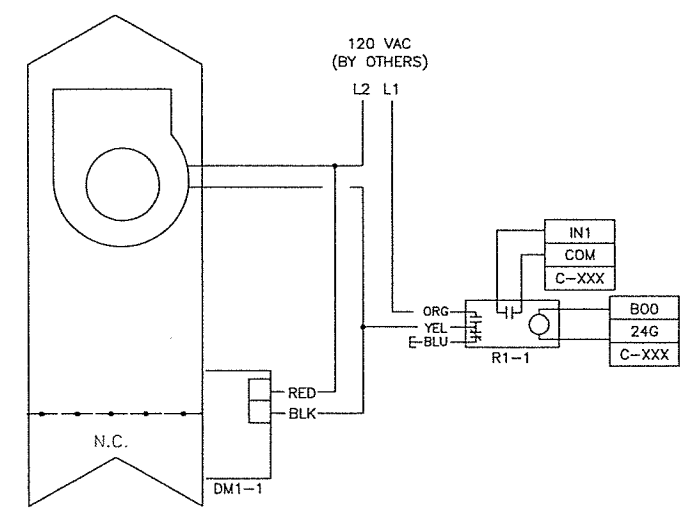
CONTROL TECHNOLOGIES, INC. 70 Zachary Drive Manchester, New Hampshire 03109 (603)626-6070 FAX: (603)626-0352			
-REVISIONS- DATE CHANGE 12/10/09 AS BUILD		JOB NAME GREAT BAY COMMUNITY COLLEGE LOCATION PEASE TRADEPORT ARCHITECT DENNIS MIREs ENGINEER FITZMEYER & TOCCI CONTRACTOR ECKHARDT & JOHNSON DRAWN BY CPC CHECKED BY CPC DATE 10/21/08	
		DRAWING NO. N08123 9 OF 18	

MATERIAL LIST			
ITEM	QTY	MODEL #	DESCRIPTION
853	1	VLC-853	DDC CONTROLLER: 8 UI, 5 BO, 3 AO
-	1	SH1B-05	SINGLE POLE RELAY SOCKET
R1	6	RIBX24BA	20 AMP, SPDT(1), ADJ CURRENT SWITCH, 24VAC/DC COIL(1) RELAY IN A BOX
R2	1	RH1B-U-DC12V	10 AMP, SPDT(1), 12VDC COIL(1) DEC RELAY
TS1	1	TS-1101-WA-10-AA	STAINLESS STEEL WALLPLATE SENSOR
TX	1	T-208	96 VA TRANSFORMER

EF-5 THRU EF-10 EXHAUST

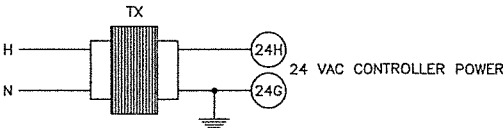
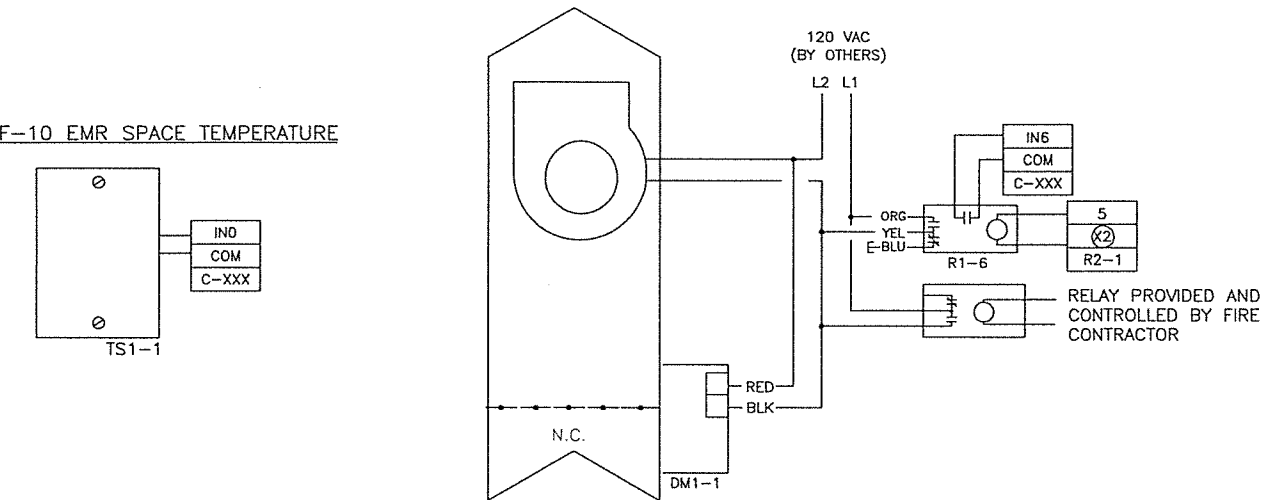
EF-5

TYPICAL FOR EF-6 THRU EF-9



EF-10 EMR

EF-10 EMR SPACE TEMPERATURE

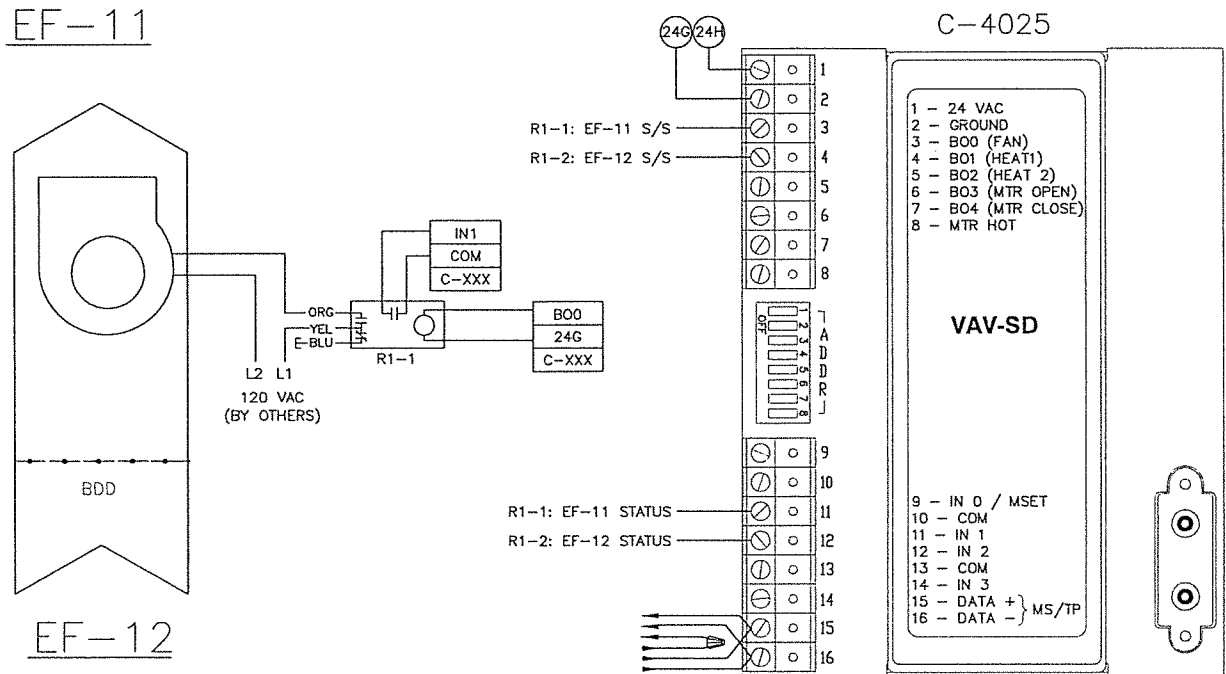


<div> <div> <div>CONTROL</div> <div>TECHNOLOGIES</div> <div>Putting You in Control</div> </div> <div> <div>CONTROL TECHNOLOGIES, INC.</div> <div>70 Zachary Drive</div> <div>Manchester, New Hampshire 03109</div> <div>(603)626-6070 FAX: (603)626-0352</div> </div> </div>			
<div> <div>DATE</div> <div>12/10/09</div> </div>		<div> <div>JOB NAME</div> <div>GREAT BAY COMMUNITY COLLEGE</div> </div>	
<div> <div>CHANGE</div> <div>AS BUILT</div> </div>		<div> <div>LOCATION</div> <div>PEASE TRADEPORT</div> </div>	
<div> <div>ARCHITECT</div> <div>FITZMEYER & TOCCI</div> </div>		<div> <div>ENGINEER</div> <div>ECKHARDT & JOHNSON</div> </div>	
<div> <div>CONTRACTOR</div> <div>CPC</div> </div>		<div> <div>DESIGN BY</div> <div>CPC</div> </div>	
<div> <div>CHECKED BY</div> <div>10/21/08</div> </div>		<div> <div>DRAWING NO.</div> <div>N08123</div> </div>	
<div> <div>DATE</div> <div>10/21/08</div> </div>		<div> <div>10 OF 18</div> </div>	

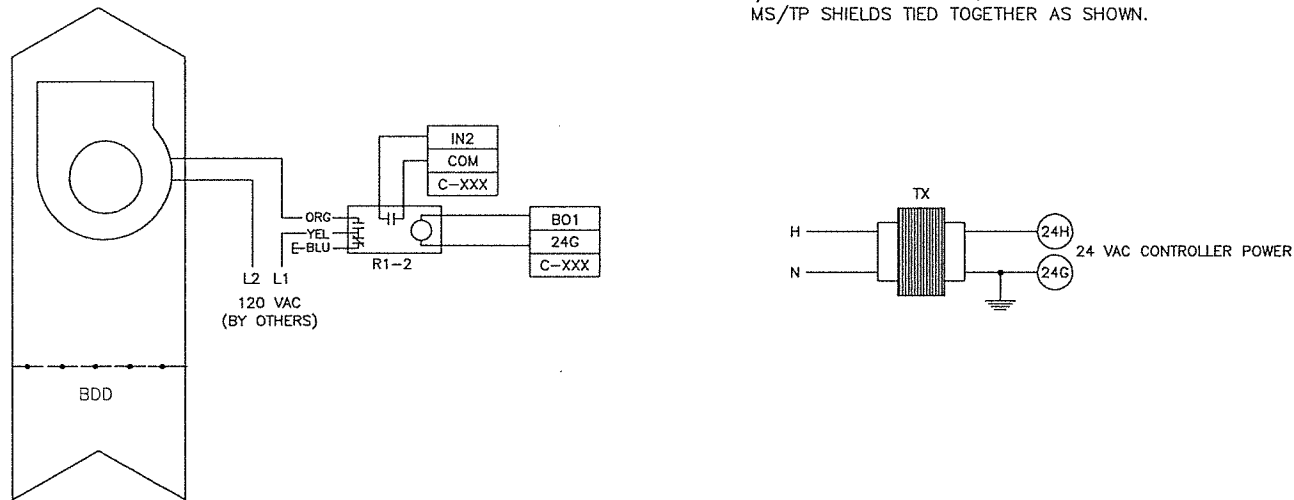
MATERIAL LIST			
ITEM	QTY	MODEL #	DESCRIPTION
R1	6	RIEX24EF	20 AMP, SPDT(1), FUSED CURRENT SWITCH, 24VAC/50 COIL(1) RELAY IN A BOX
TX	3	T-208	56 VA TRANSFORMER
VAV	3	VAV-SD	DDC CONTROLLER, 4 UI, 2 EO

EF-11 & EF-12 INLINE BATH EXHAUST

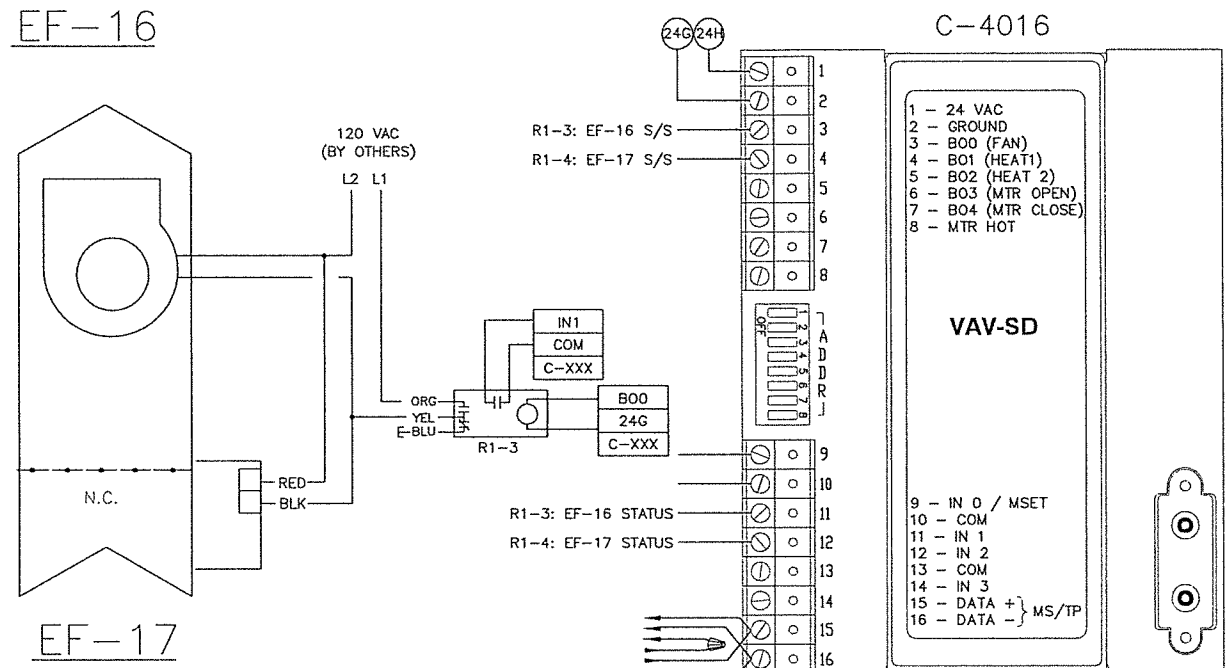
TYPICAL FOR (EF-13 & EF-14)



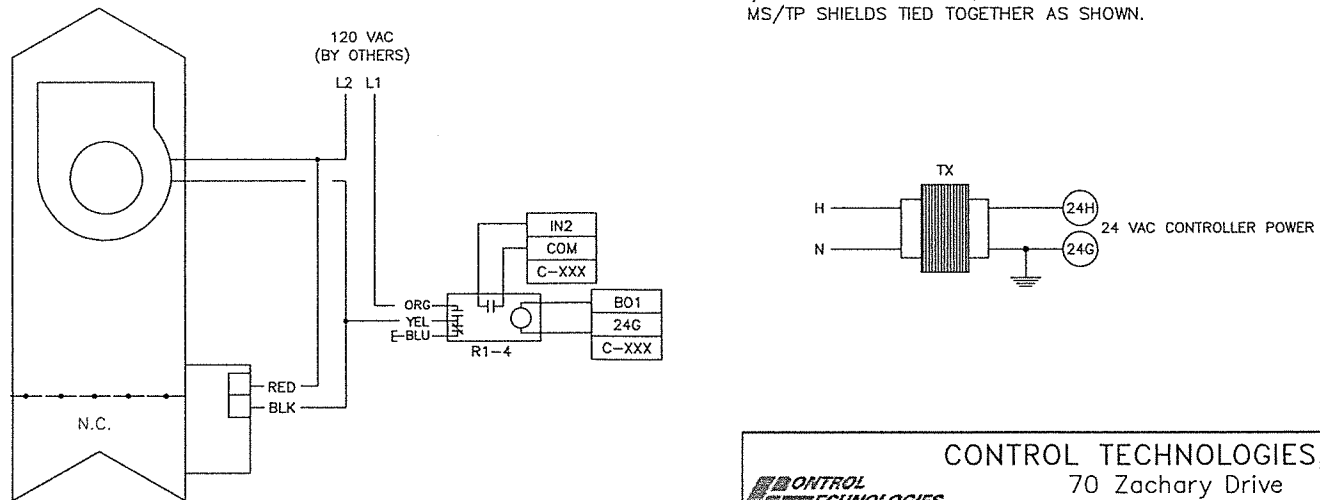
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MS/TP SHIELDS TIED TOGETHER AS SHOWN.



EF-16 & EF-17 ROOF BATH EXHAUST



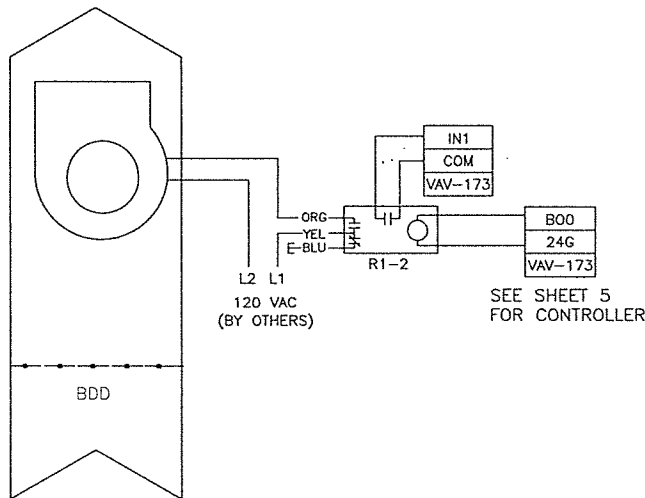
I/O SHIELDS TO GROUND, NOT ON VLC TERMINAL.
MS/TP SHIELDS TIED TOGETHER AS SHOWN.



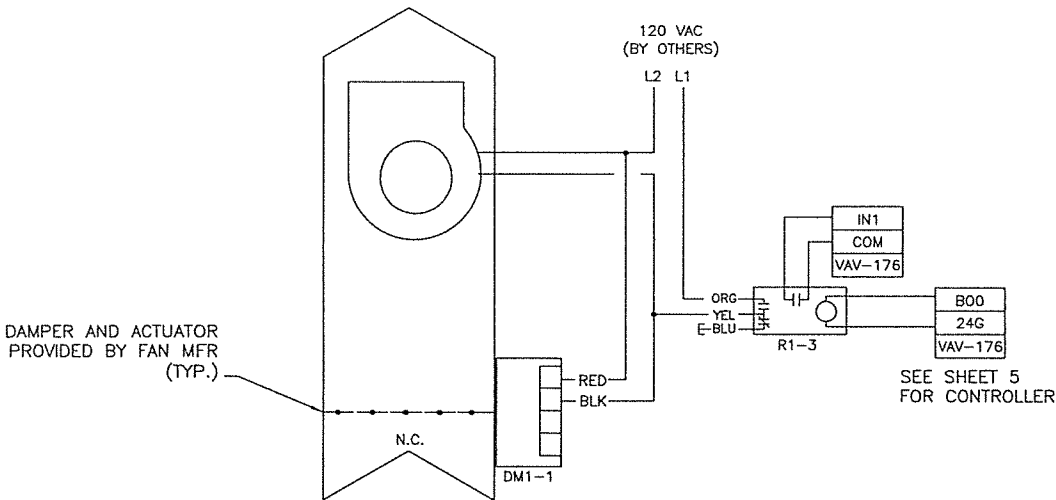
CONTROL TECHNOLOGIES, INC. 70 Zachary Drive Manchester, New Hampshire 03109 (603)626-6070 FAX: (603)626-0352			
CONTROL TECHNOLOGIES Putting You In Control		GREAT BAY COMMUNITY COLLEGE PEASE TRADEPORT DENNIS MIREs FITZMEYER & TOCCI ECKHARDT & JOHNSON	
-REVISIONS- DATE 12/10/09 CHANGE AS BUILT ARCHITECT ENGINEER CONTRACTOR DRAWN BY CPC CHECKED BY CPC DATE 10/21/08	JOB NAME LOCATION ARCHITECT ENGINEER CONTRACTOR DRAWN BY CPC CHECKED BY CPC DATE 10/21/08	DRAWING NO. N08123 11 OF 18	

MATERIAL LIST				
ITEM	QTY	MODEL #	DESCRIPTION	
R1	3	RBX24BF	20 AMP, SPDT(1), FIXED CURRENT SWITCH, 24VAC/DC COIL(1) RELAY IN A BOX	
TS1	1	TS-1101-WA-10-AA	STAINLESS STEEL WALLPLATE SENSOR	
TX	1	T-208	96 VA TRANSFORMER	
VAV	1	VAV-SD	DDC CONTROLLER: 4 UI, 5 BO	

EF-15

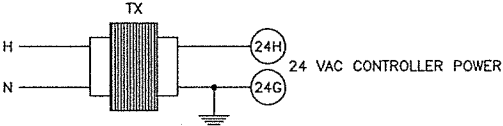
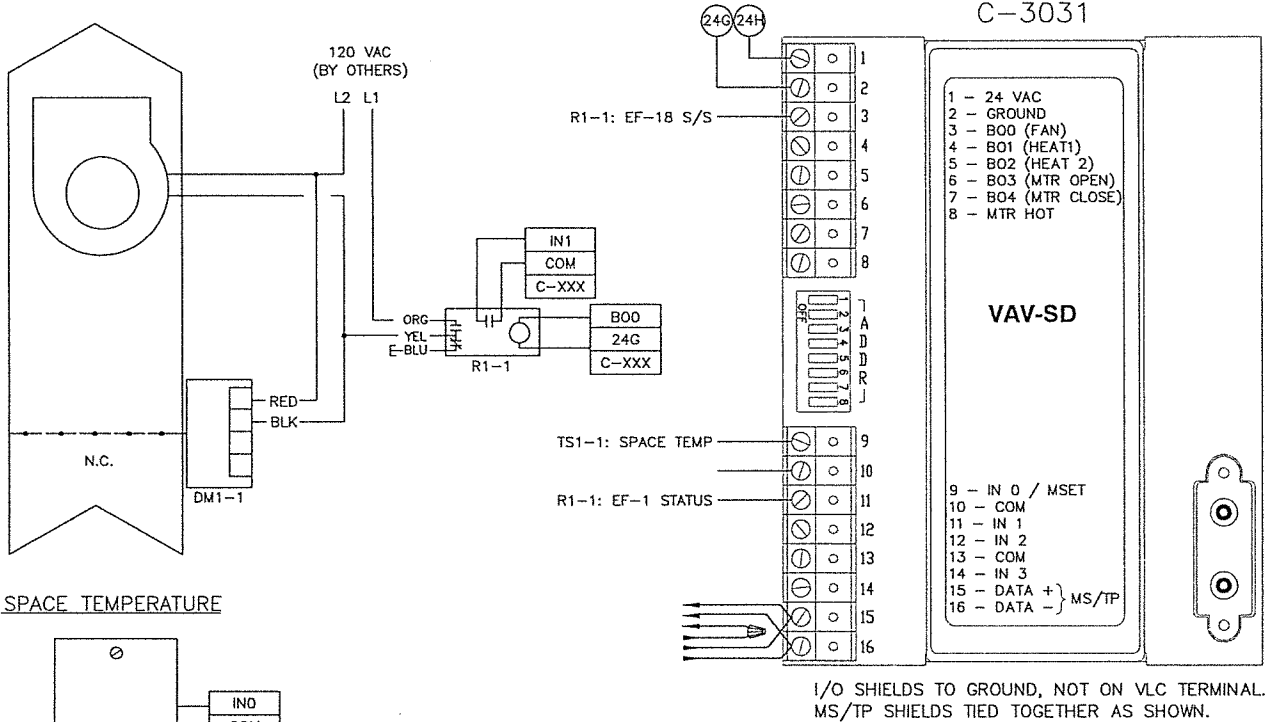


EF-20



ELECTRIC ROOM

EF-18



CONTROL

TECHNOLOGIES

Putting You In Control

CONTROL TECHNOLOGIES, INC.

70 Zachary Drive

Manchester, New Hampshire 03109

(603)626-6070 FAX: (603)626-0352

REVISIONS

DATE	CHANGE
12/10/09	AS BUILT

JOB NAME

LOCATION

ARCHITECT

ENGINEER

CONTRACTOR

DRAWN BY

CHECKED BY

DATE

GREAT BAY COMMUNITY COLLEGE

PEASE TRADEPORT

DENNIS MIRES

FITZMEYER & TOCCI

ECKHARDT & JOHNSON

CPC

CPC

10/21/08

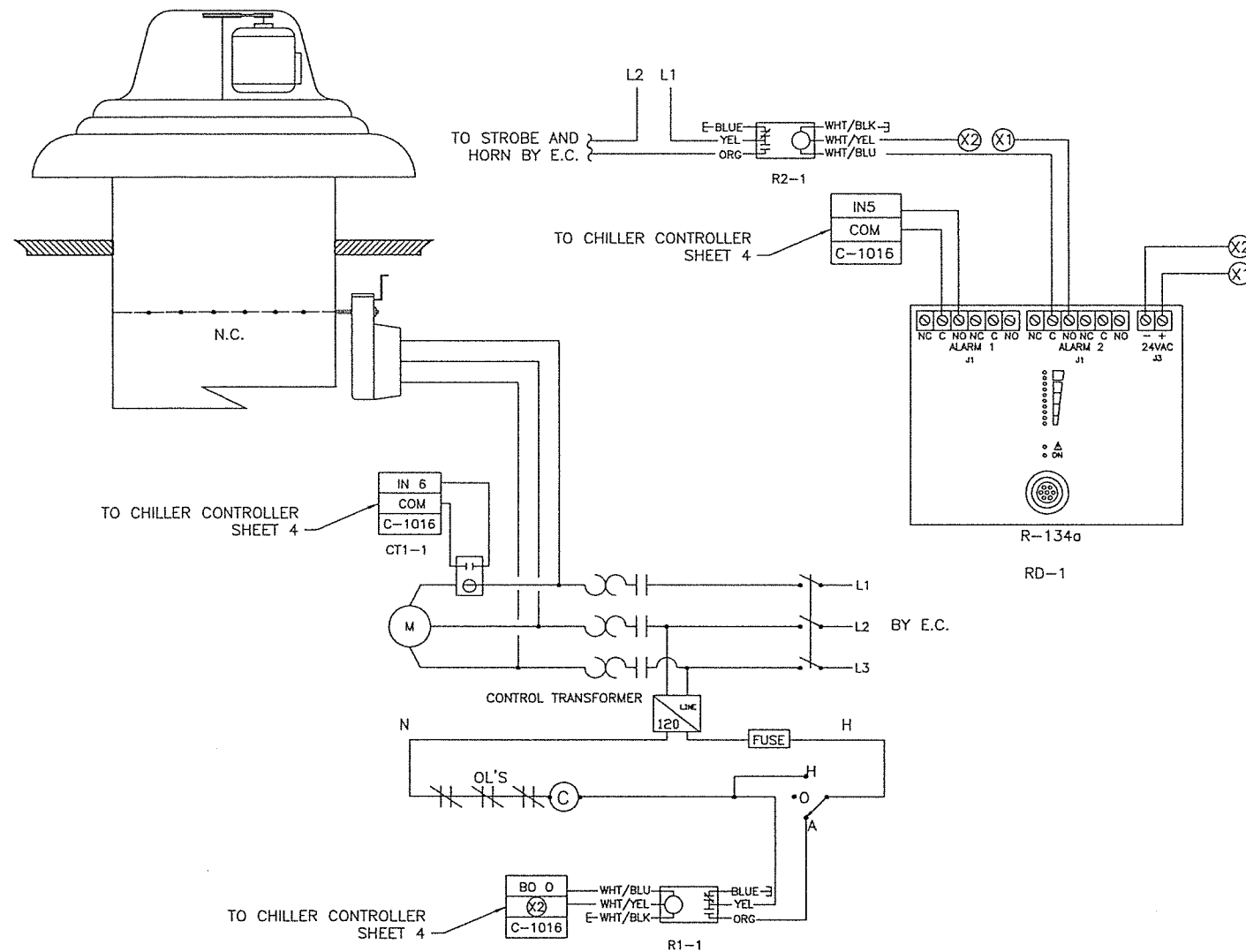
DRAWING NO.

N08123

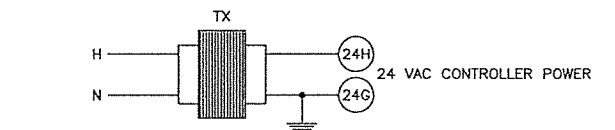
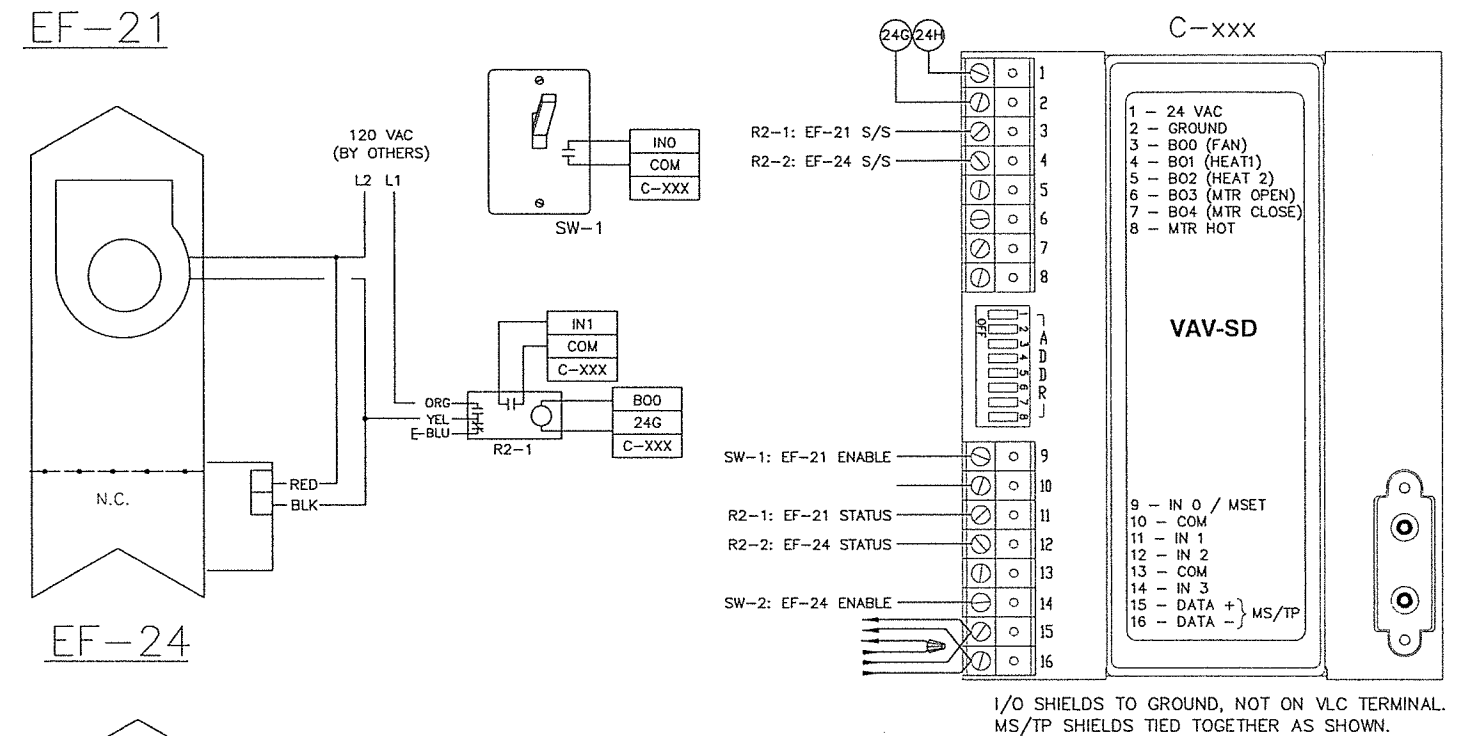
12 OF 18

EF-19 & REFRIGERATION DETECTION

MATERIAL LIST			
ITEM	QTY	MODEL #	DESCRIPTION
CT	1	RIBXKTA	ENCLOSED ADJUSTABLE CURRENT SWITCH W/TERM.
R2	1	RIB2401B	20 AMP, SPDT(1), 24VAC/DC/120VAC COIL (1) RELAY IN A BOX
R1	1	RIBU1C	10 AMP, SPDT(1), 24VAC/DC/120VAC COIL(1) RELAY IN A BOX
RD	1	VA201MQ2R134A	STAND ALONE R-134A MONITOR, 0-1000 PPM
R2	2	RIBX24BA	20 AMP, SPDT(1), ADJ CURRENT SWITCH, 24VAC/DC COIL(1) RELAY IN A BOX
SW	2		SPST TOGGLE SW W/ COVER PLATE
SD	1	VAV-SD	DDC CONTROLLER: 4 UI 5 BO



EF-21 & EF-24 ROOF EXHAUST

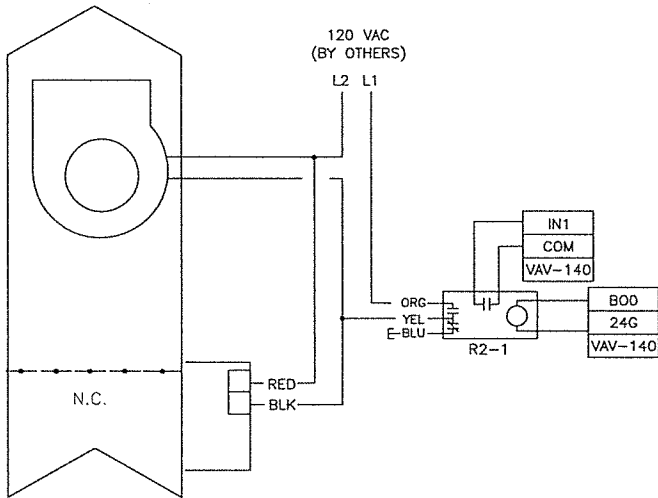


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GREAT BAY COMMUNITY COLLEGE			
PEASE TRADEPORT			
DENNIS MIRE			
FITZMEYER & TOCCI			
ECKHARDT & JOHNSON			
CPC			
CPC			
10/21/08			
N08123			
13 OF 18			

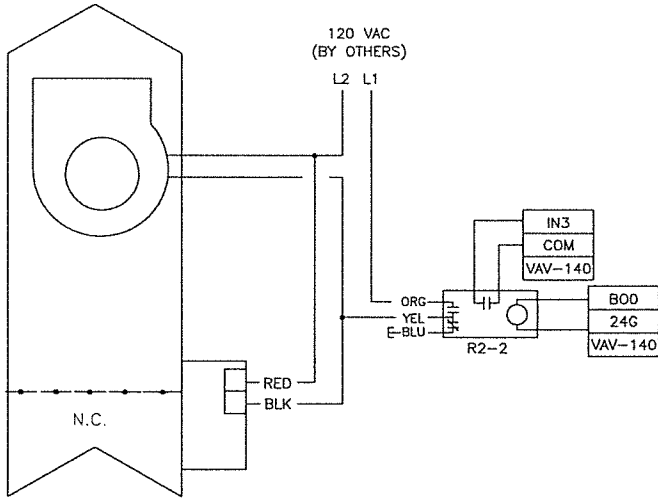
MATERIAL LIST			
ITEM	QTY	MODEL #	DESCRIPTION
R3	2	RISX24BA	20 AMP. SPDT(1), ADJ CURRENT SWITCH, 24VAC/DC COL(1) RELAY N A BOX


EF-25 & EF-26

EF-25



EF-26

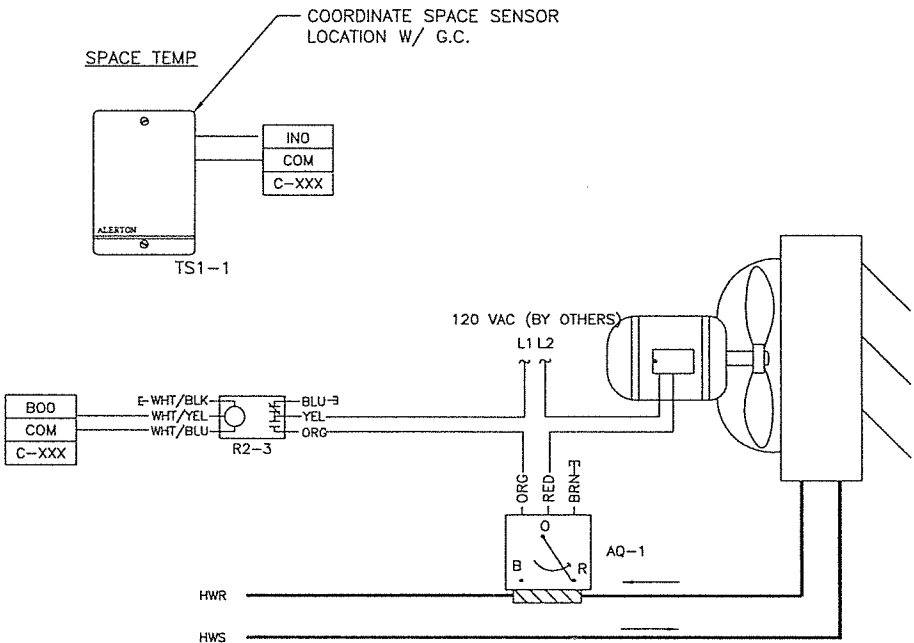
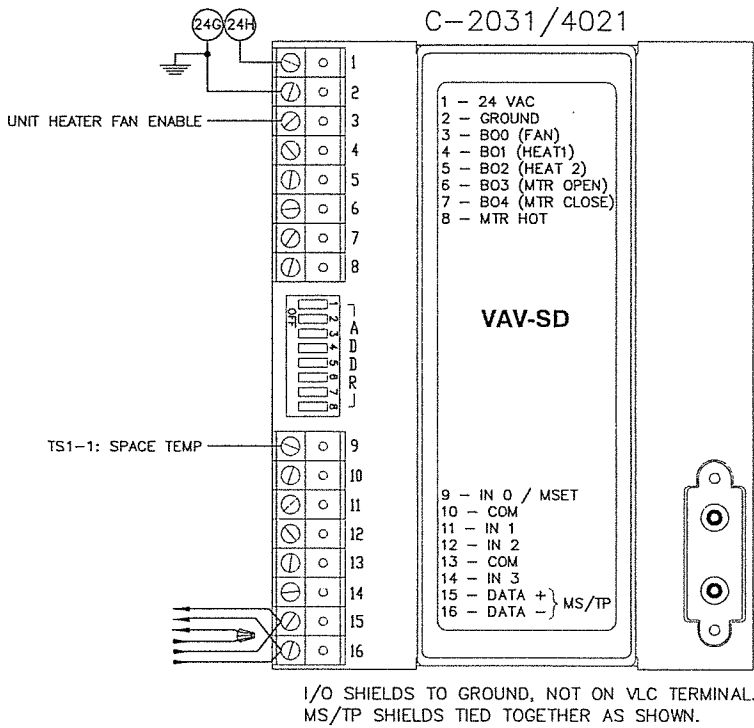


 CONTROL TECHNOLOGIES, INC. 70 Zachary Drive Manchester, New Hampshire 03109 (603)626-6070 FAX: (603)626-0352		JOB NAME		GREAT BAY COMMUNITY COLLEGE
		LOCATION		PEASE TRADEPORT
DATE		CHANGE	ARCHITECT	DENNIS MIRES
12/10/09		AS BUILT	ENGINEER	FITZMEYER & TOCCI
			CONTRACTOR	ECKHARDT & JOHNSON
			DRAWN BY	CPC
			CHECKED BY	CPC
			DATE	10/21/08
				DRAWING NO. N08123 13A OF 18

MATERIAL LIST			
ITEM	QTY	MODEL #	DESCRIPTION
TS1	4	TS-1101-WA-10-AA	STAINLESS STEEL WALLPLATE SENSOR
VAV	2	VAV-SD	DDC CONTROLLER: 4 UI, 5 BO
AQ	14	TC-2974	STRAP-ON AQUASTAT
R2	14	RB2401B	20 AMP, SPDT(1), 24VAC/DC/120VAC COIL (1), RELAY IN A BOX
TS2	10	TS-2006-GD-10-AA	8" DUCT TEMP SENSOR

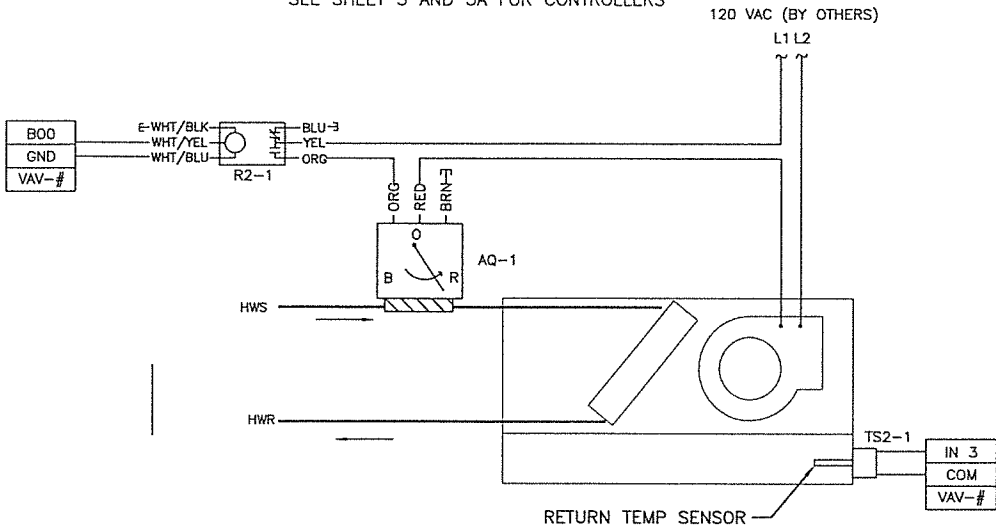
UH-A

TYPICAL FOR 2
SPRINKLER ROOMS 1040a & 1094



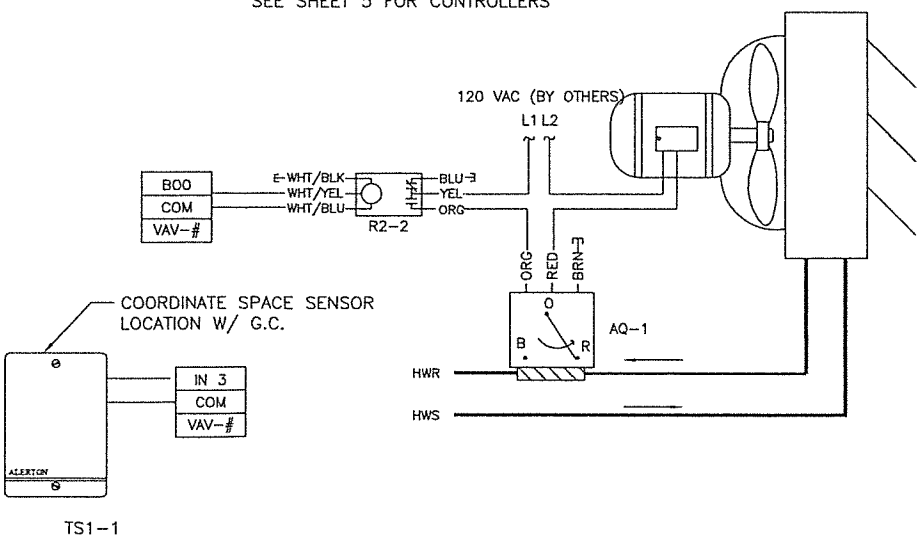
CUH

TYPICAL FOR 10
SEE SHEET 5 AND 5A FOR CONTROLLERS



UH

TYPICAL FOR 2
SEE SHEET 5 FOR CONTROLLERS

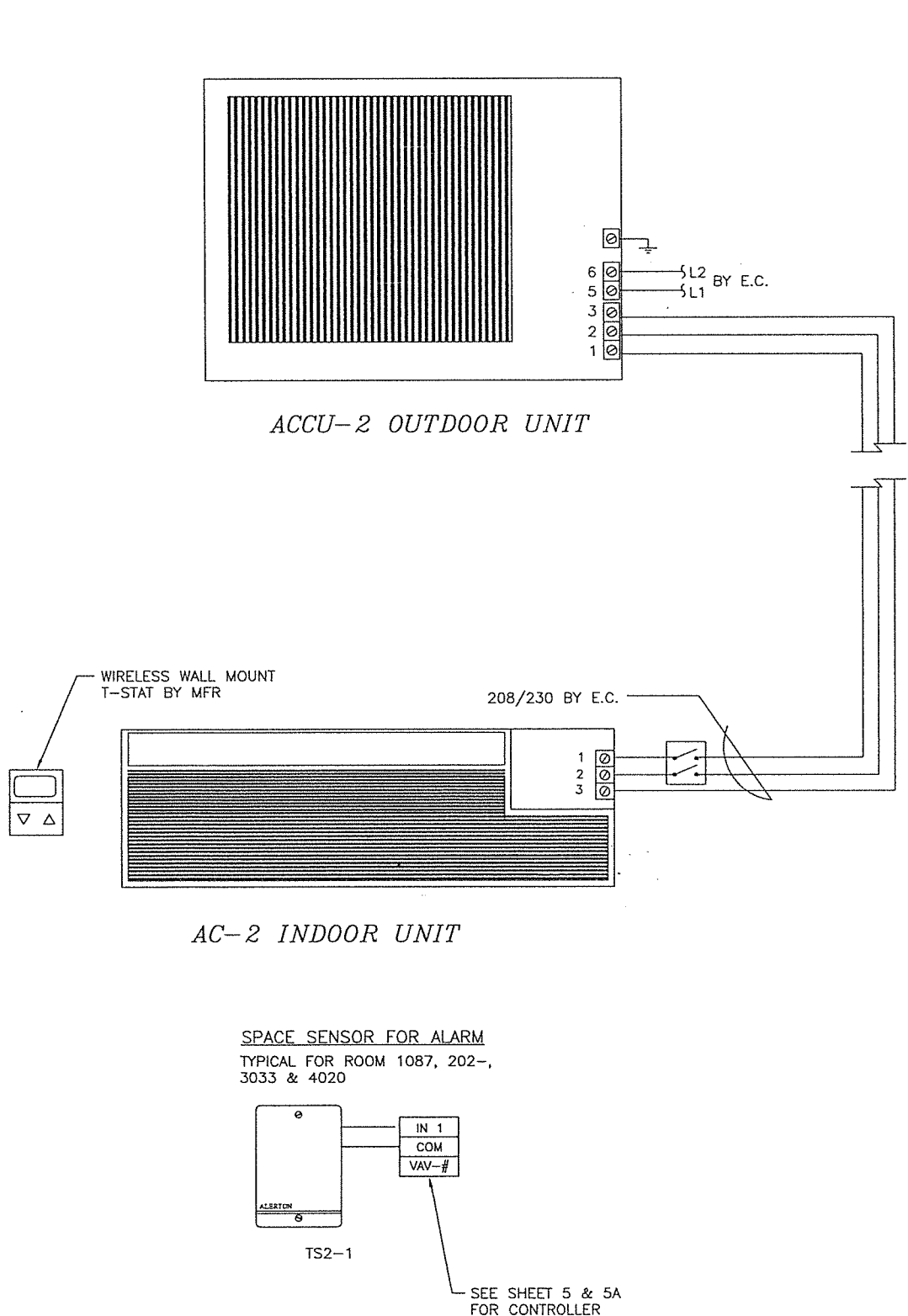


For Reference Only

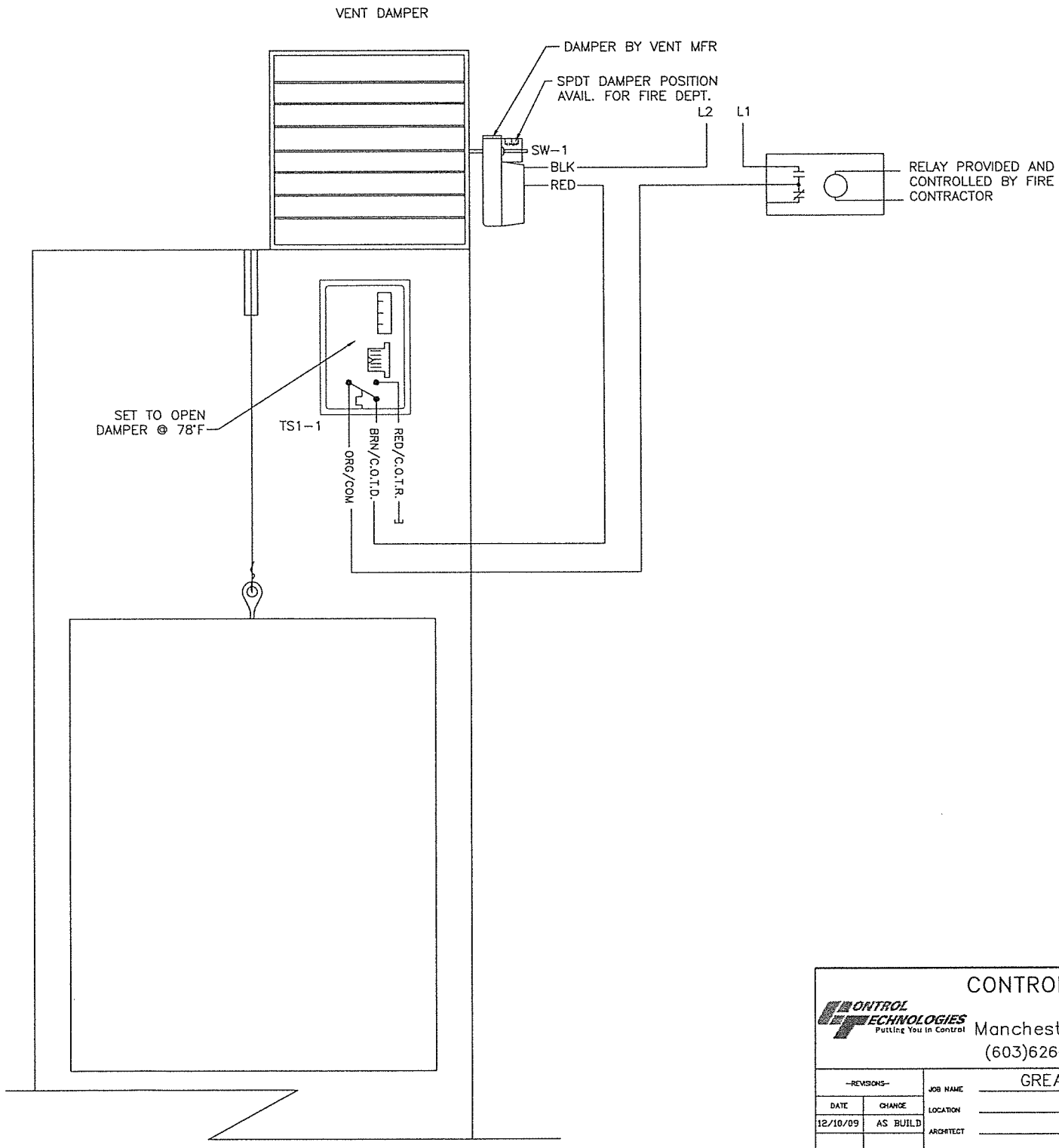
CONTROL TECHNOLOGIES, INC. 70 Zachary Drive Manchester, New Hampshire 03109 (603)626-6070 FAX: (603)626-0352			JOB NAME GREAT BAY COMMUNITY COLLEGE	
			LOCATION PEASE TRADEPORT	
DATE 12/10/09			CHANGE AS BUILT	
ARCHITECT DENNIS MIRE			ENGINEER FITZMEYER & TOCCI	
CONTRACTOR ECKHARDT & JOHNSON			DRAWN BY CPC	
CHECKED BY CPC			DATE 10/21/08	
DRAWING NO. N08123			14 OF 18	

DUCTLESS SPLIT AC SYSTEM

TYPICAL FOR 4



ELEVATOR SHAFT VENT



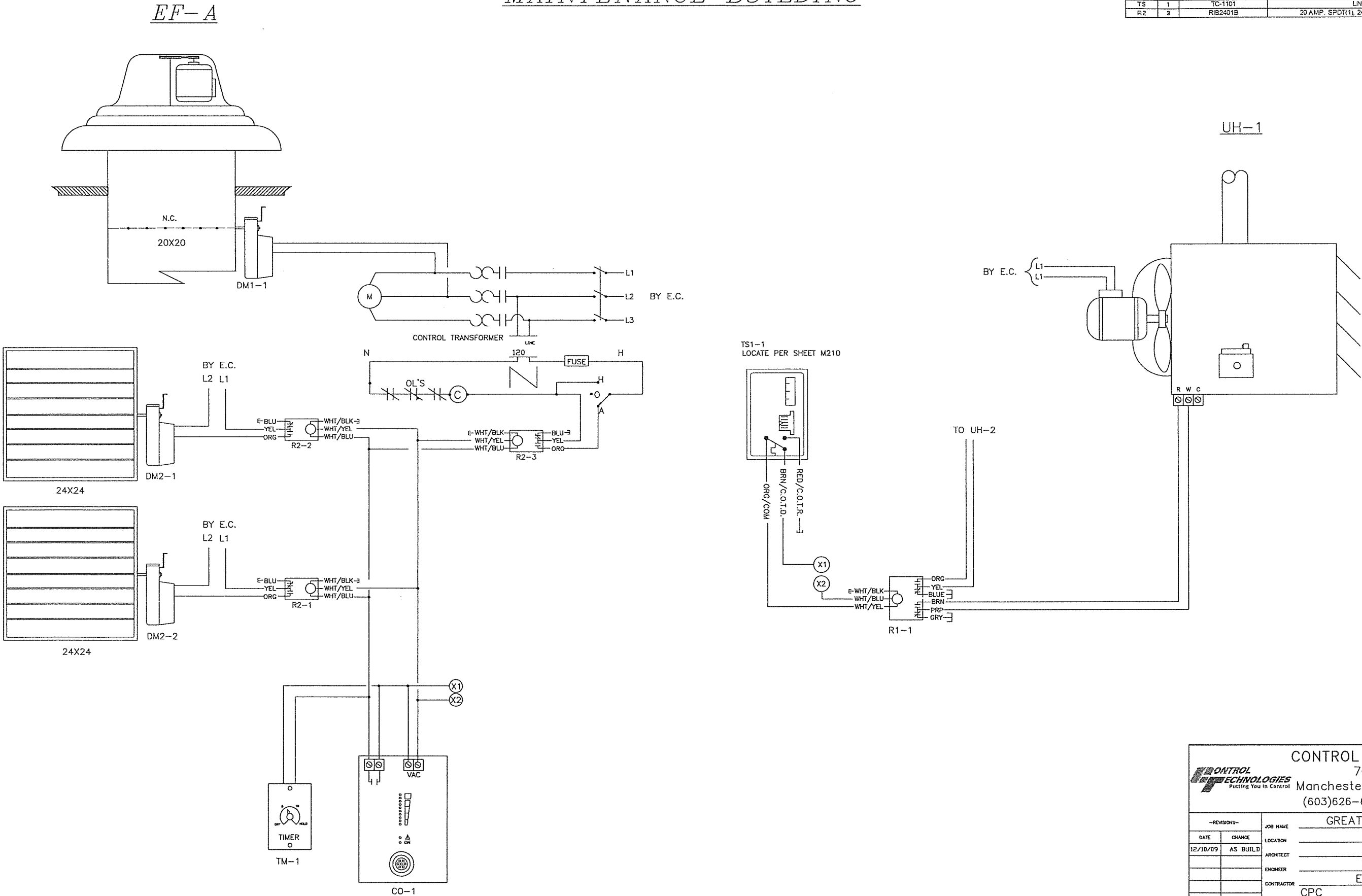
MATERIAL LIST			
ITEM	QTY	MODEL #	DESCRIPTION
SW	1	TS-475	DAMPER POSITION SWITCH, 1/2" SHAFT MOUNT, SPDT, NON-MERCURY
TS1	1	TC-1101	LINE VOLTAGE THERMOSTAT
TS2	4	TS-1101-WA-10-4A	STAINLESS STEEL WALLPLATE SENSOR

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PEASE TRADEPORT	
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CPC	
CPC	
10/21/08	
N08123	
15 OF 18	

For Reference Only

MAINTENANCE BUILDING

MATERIAL LIST			
ITEM	QTY	MODEL #	DESCRIPTION
CO	1	VA201MQ2	CO MONITOR WITH INDICATOR LIGHTS, HORN, AND RELAY OUT
DM1	1	MA40-7043-S01	35 IN-LB, 24V, 2 POS. SR ACTUATOR W/ END SW
DM2	2	MA40-7043	35 IN-LB, 24V, 2 POS. SR ACTUATOR
R1	1	RIB2401D	10 AMP. DPDT(1), 24VAC/DC/120VAC COIL(1) RELAY IN A BOX
TM	1	C8304NONC	0-4 HR TIMER W/O HOLD
TS	1	TC-1101	LINE VOLTAGE THERMOSTAT
R2	3	RIB2401B	20 AMP. SPDT(1), 24VAC/DC/120VAC COIL (1), RELAY IN A BOX



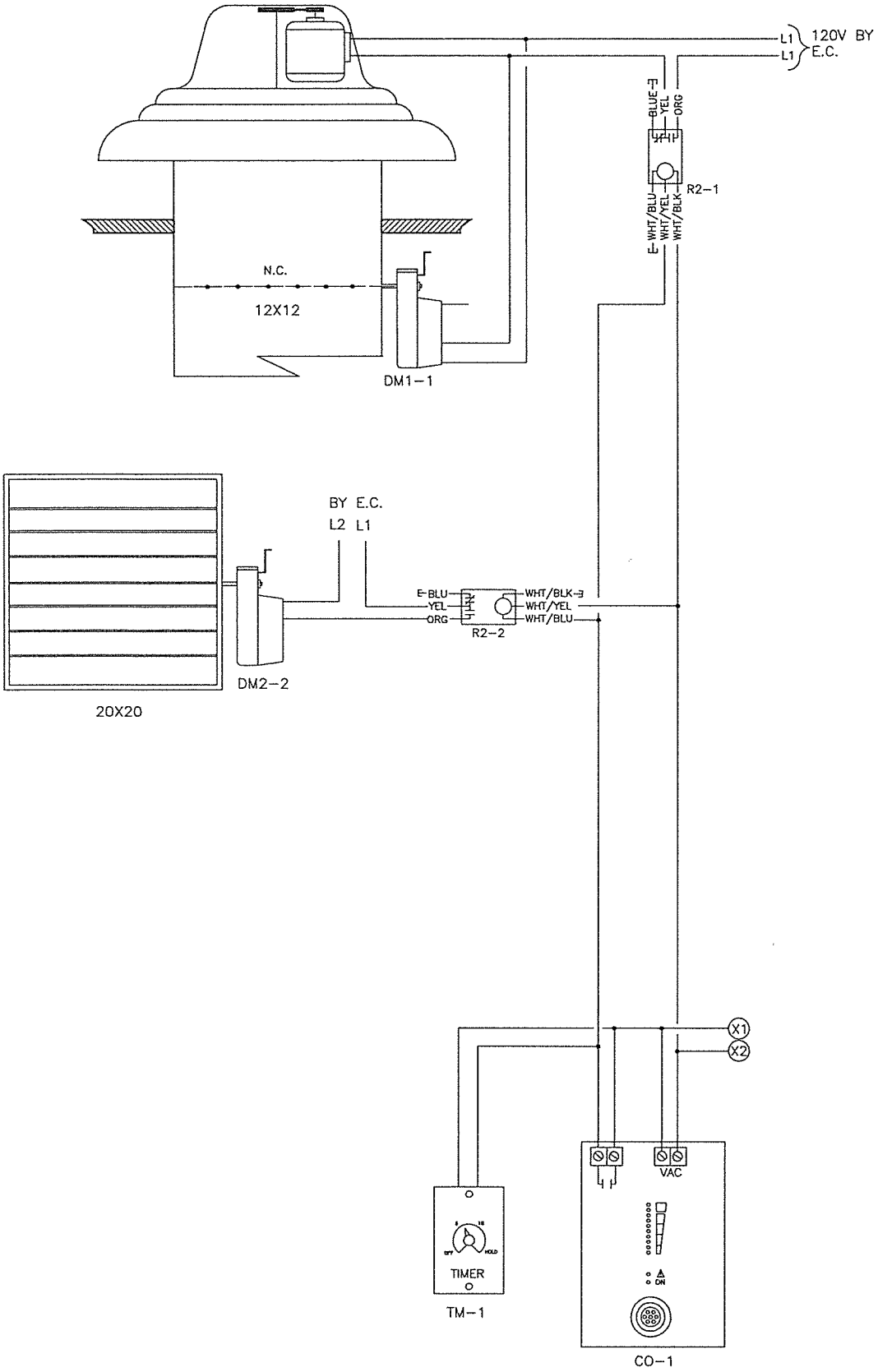
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CPC	
CPC	
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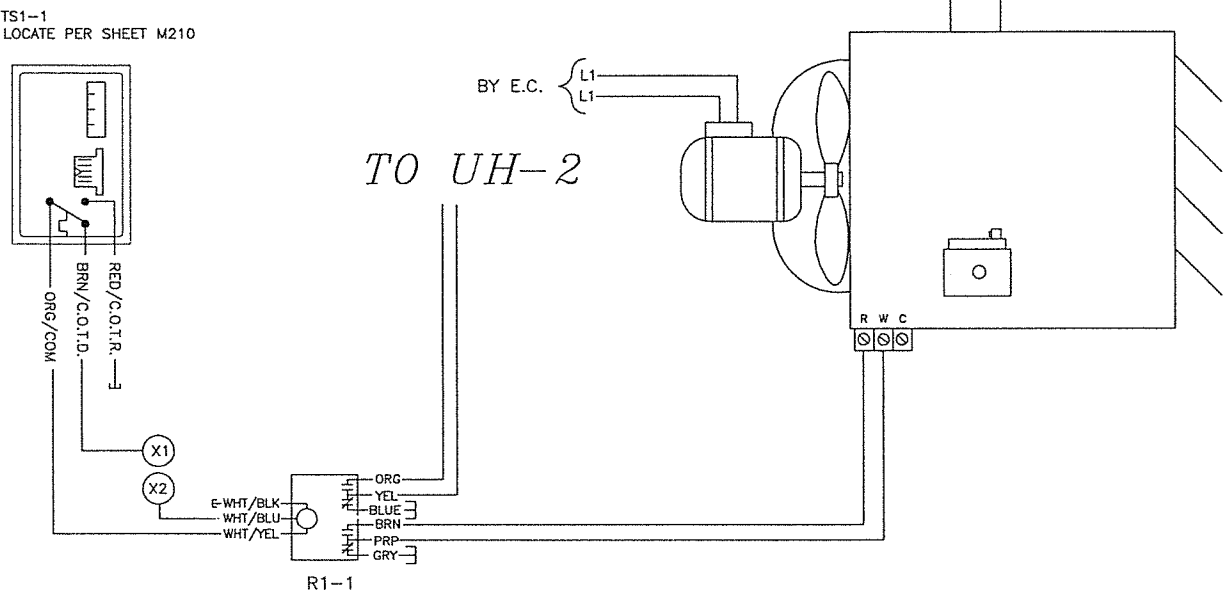
EF-B

MAINTENANCE BUILDING

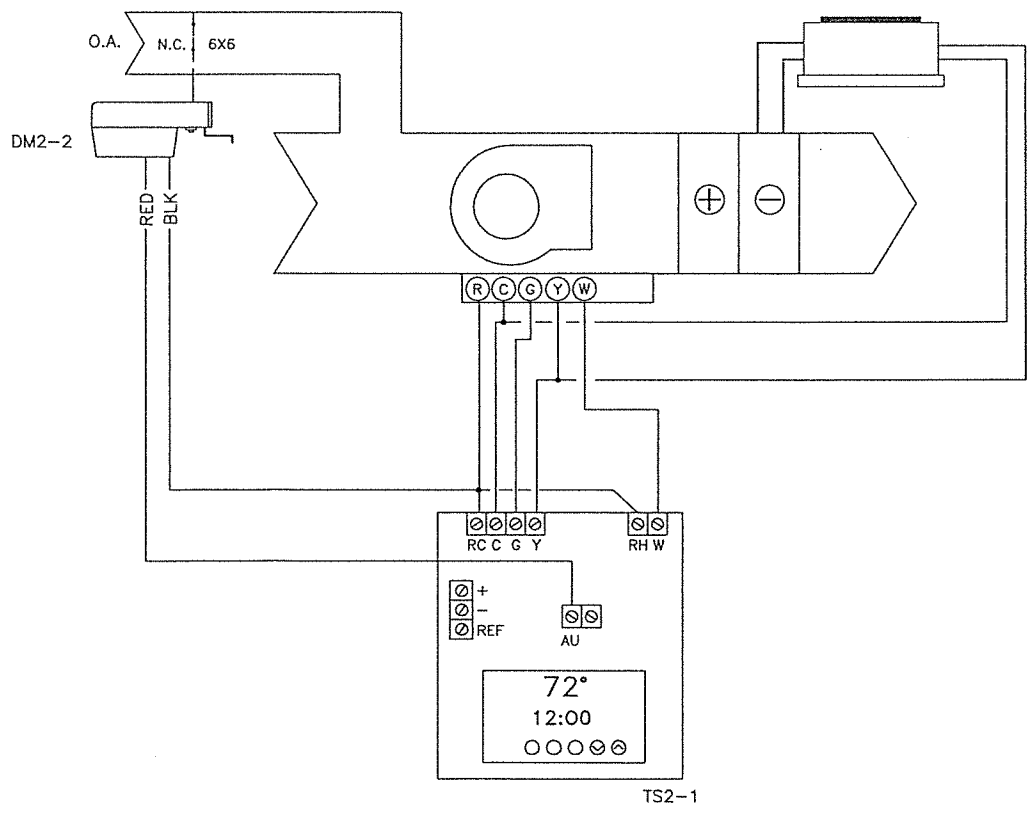
MATERIAL LIST			
ITEM	QTY	MODEL #	DESCRIPTION
CO	1	VA201MQ2	CO MONITOR WITH INDICATOR LIGHTS, HORN, AND RELAY OUT
DM1	1	MA40-7043-501	35 IN-LB. 24V. 2 POS. SR ACTUATOR W/ END SW
DM2	2	MA40-7043	35 IN-LB. 24V. 2 POS. SR ACTUATOR
R1	1	RIB2401D	10 AMP. DPDT(1), 24VAC/DC/120VAC COIL(1) RELAY IN A BOX
TM	1	C8304NONC	0-4 HR TIMER W/O HOLD
TS	1	TC-1101	LINE VOLTAGE THERMOSTAT
TS2	1	VT7552A	1H/1C PROGRAMMABLE AUX OUT COMMUNICATING THERMOSTAT
R2	2	RIB2401B	20 AMP. SPDT(1), 24VAC/DC/120VAC COIL (1), RELAY IN A BOX



UH-3



HVAC-1



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PORTSMOUTH, NH



111 ZACHARY ROAD
MANCHESTER, NH 03109
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FAX: (603) 626-0352

SHEET INDEX


SHEET 01: SYSTEM NETWORK ARCHITECTURE
SHEET 02: SEQUENCE OF OPERATIONS(1)
SHEET 03: SEQUENCE OF OPERATIONS(2)
SHEET 04: SEQUENCE OF OPERATIONS(3)
SHEET 05: EF/CUH/UH/FTR/HC-1&2
SHEET 06: HC-1&2 CONTROLLERS
SHEET 07: EF-1 CONTROLLER
SHEET 08: HVAC-1
SHEET 09: P-1&2
SHEET 10: VRF SYSTEM
SHEET 11: AC-1
SHEET 12: SCHEDULES
SHEET 13: WIRING DETAILS

AUTOMATIC TEMPERATURE CONTROLS SUBMITTAL


ARCHITECT: JSA
ENGINEER: YEATON ASSOCIATES
CONTRACTOR: GSPH

N14182 Rev 0


SYMBOLS




Coil, hydronic




Damper, with motor




Fan, axial




Fan, centrifugal




Fan, plenum




Filter, duct




Light, pilot




Pump, in-line




Pump, base mounted




Relay




Sensor, temperature, averaging, duct




Switch, temperature, low limit, duct




Sensor, temperature, rigid probe




Sensor, temperature immersion with well




Sensor, temperature, space




Sensor, gas, space




Sensor, occupancy, space




Station, airflow, duct




Detector, gas




Station, humidity, duct




Station, duct, dewpoint




Station, duct, smoke




Switch, level




Switch, pressure




Switch, flow




Switch, temperature




Switch, limit




Switch, push-button




Overload, thermal




Switch, mushroom head push-button




Switch, current




Transmitter, current, 4-20mA




Switch, hand, illuminated




Switch, pressure




Transmitter, pressure, 4-20 mA




Transmitter, pressure, steam, 4-20 mA




Transformer




Valve, two-way, with actuator



Valve, three-way, with actuator



Variable frequency drive



Motor start

ABBREVIATIONS			
ADJ	Adjustable	OVRD	Override
AFS	Air Flow Switch	P	Pump
AHU	Air Handling Unit	PLC	Programmable Logic Controller
AI	Analog Input	PWR	Power
ALM	Alarm	RA	Return Air
AO	Analog Output	RH	Relative Humidity
BLR	Boiler	RM	Room
C	Coil	RTU	Roof Top Unit
CAF	Combustion Air Fan	SD	Smoke Detector
CFM	Cubic Feet Per Minute	SF	Supply Fan
CHW	Chilled Water	SHLD	Shield
CLG	Cooling	SLK	S-Link
CMD	Command	SMK	Smoke
CO	Carbon Monoxide	SP	Setpoint
CO2	Carbon Dioxide	STAT	Status
COM	Common	TB	Terminal Block
CP	Control Panel	TEMP	Temperature
CUH	Cabinet Unit Heater	TO	Triac Output
CW	Cold Water	TP	Twisted Pair
D	Damper	TSP	Twisted Shielded Pair
DDC	Direct Digital Control	TSTAT	Thermostat
DHW	Domestic Hot Water	UI	Universal Input
DI	Digital Input	UO	Universal Output
DO	Digital Output	VLV	Valve
DPC	Digital Point Card	VAC	Voltage Alternating Current
DPS	Differential Pressure Switch	VAV	Variable Air Volume
DPT	Differential Pressure Transmitter	VDC	Volts Direct Current
DX	Direct Expansion	VFD	Variable Frequency Drive
EA	Exhaust Air	VOC	Volatile Organic Compound
EF	Exhaust Fan	WH	Water Heater
ERU	Energy Recovery Unit	W	Watts
ES	End Switch		
EVAP	Evaporator		
FBK	Feedback (Analog)		
FCU	Fan Coil Unit		
FLA	Full Load Amps		
FLT	Fault		
FTR	Finned Tube Radiation		
GND	Ground		
HOA	Hand/Off/Auto		
HP	Horsepower		
HRU	Heat Recovery Unit		
HW	Hot Water		
HX	Heat Exchanger		
IM	Install Material		
INTLK	Interlock		
JB	Junction Box		
KW	Kilowatt		
L	Line		
LA	Leaving Air		
LON	Lonworks		
M	Motor		
MA	Mixed Air		
MS	Motor Starter		
N	Neutral		
NC	Normally Closed		
NO	Normally Open		
OA	Outside Air		
OCC	Occupancy		

DDC ACRONYMS	
AC	Area Controller
AM	Actuator Motor
AN	Auxiliary Notifications
AS	Auxiliary Switches
CL	Controller
CS	Current Switch
CT	Current Transmitter
GS	Global Server
DT	Duct Transmitter
ET	Electro-pneumatic Transducer
FS	Flow Switch
FT	Flow Transmitter
GT	Gas Transmitter
HS	Humidity Switch
LS	Level Switch
LT	Liquid Transmitter
NS	Network Switch
OS	Occupancy Switch
OT	Outdoor Transmitter
PL	DDC Panel
PS	Pressure Switch
PT	Pressure Transmitter
RE	Relay
RT	Room Transmitter
TS	Temp Switch
TX	Transformer

LINETYPE & COLOR DESCRIPTION

--- ASD --- ASD --- ASD ---

ASD

--- BAC --- BAC --- BAC ---

BACNET

--- ETHIP --- ETHIP ---

Ethernet

--- N2 --- N2 --- N2 ---

JCI N2

--- LON --- LON --- LON ---

LON

--- MRTU --- MRTU ---

Modbus RTU

--- MTCP --- MTCP ---

Modbus TCP

Cable

Wire

Connected

Enclosure

COLOR ABBREVIATIONS

RED

Red

PUR

Purple

ORG

Orange

BRN

Brown

YEL

Yellow

BLK

Black

GRN

Green

WHT

White

BLU

Blue

GRY

Gray

NOTATIONS

#

Note

#

Revision, see title block

2

07

ID Sheet No. } Continuance

USAGE	WIRE TYPE	COLOR	PART NO.
Ethernet	CAT6	Blue Jkt	556609-S
ASD Bus	24/2 TSP	Orange Jkt	042002-S
MSTP Bus	24/2 TSP	Purple Jkt	042005-S
LON Bus	22/2 TP	Blue Jkt	105500-S
Remote I/O	24/2 TSP	Gray Jkt	042001-S
AI	18/2 TSP	Blue Stp	002322-S
AO	18/2 TSP	Red Stp	002321-S
DI	18/2 TP	Yellow Stp	002363-S
DO	18/2 TP	White Jkt	002360-S
24V Power	18/2 TP	Green Stp	002366-S

WIRE ID

XX NN

Sequential wire ID
Drawing sheet number
where wire originates

Example

Wire "0517" is the 17th wire designated
on sheet 05 of the drawing.

CABLE ID

CAB-AAAA-X

Used for multiple
cables to same device
Device to which
cable is associated
Cable

Example

Cable "CAB-V01-2" is the second cable
associated with valve V01.

Note

Cable ID is always associated with the
field device.

DEVICE TERMINATION LEGEND

AI

COM

I/O POINT TYPE

HWS

TEMP

I/O POINT DESCRIPTION

C

XXX

CONTROLLER ID

CONTROL TECHNOLOGIES

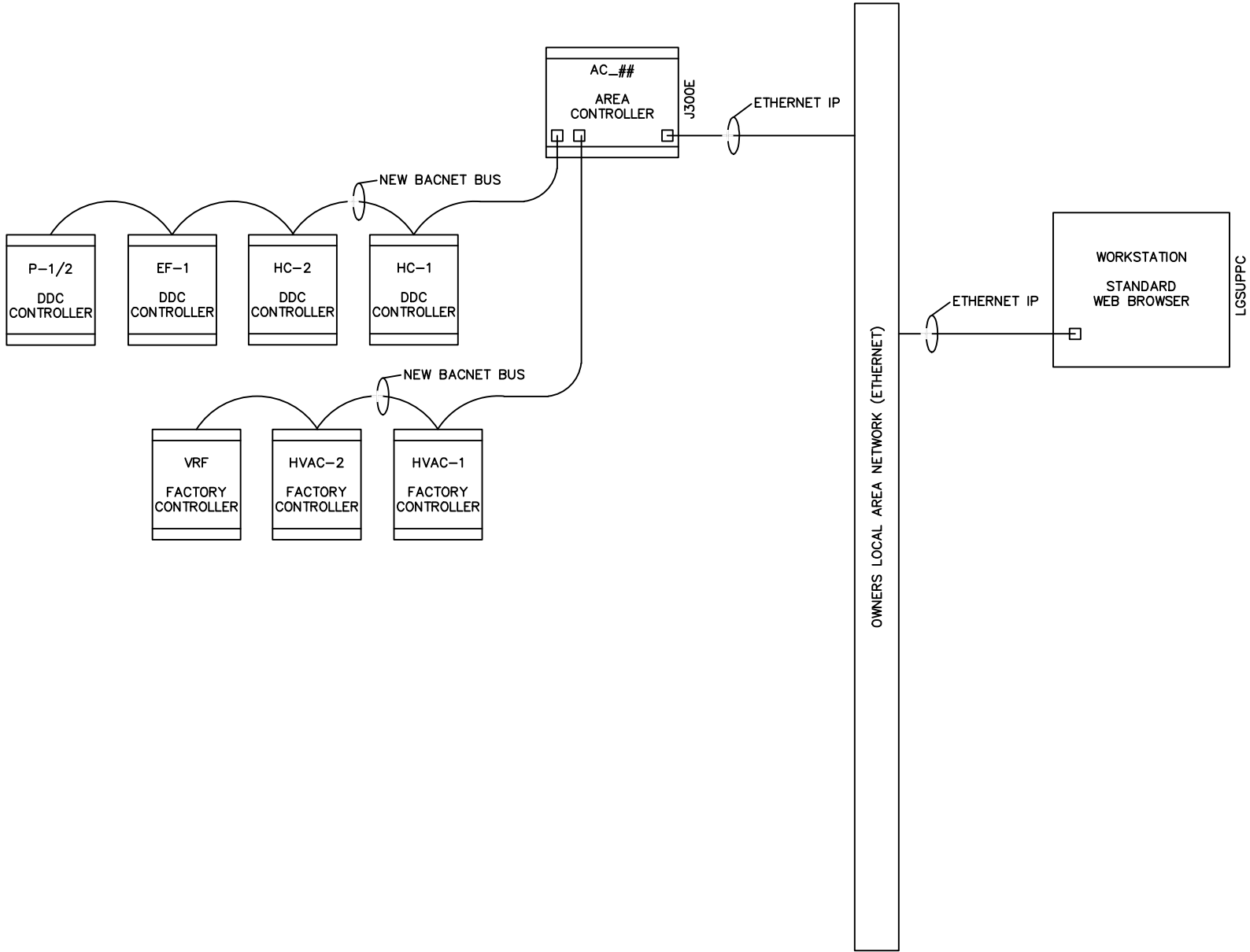
DEFINING BUILDING PERFORMANCE

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MANCHESTER, NH 03109
PHONE: (603) 626-6070
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SYSTEM NETWORK ARCHITECTURE

BILL OF MATERIALS, NETWORK				
TAG	QTY	PART NO	DESCRIPTION	MANUFACTURER
JPWR	1	NPB-PWR	JACE POWER SUPPLY, 24VAC/DC	VYKON
J485X2	1	NPB-2X-485	JACE COMM CARD, (2) RS-485 PORTS	VYKON
J300E	1	J-300E	AREA CONTROLLER	VYKON
JDMSTP	1	DR-MSTP-AX	JACE BACNET MSTP LICENSE	VYKON
JSAX3	1	S-AX-3	JACE SERVER SOFTWARE, UP TO 3 JACES	VYKON
LGSUPPC	1	LGSUPPC	LARGE SUPERVISOR PC	DELL



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ARCHITECT: JSA YEATON ASSOCIATES

ENGINEER: GSPH

CONTRACTOR: (603) 529-3322

DESIGNED BY: MJK

DATE: 2/5/15

REVIEW BY: EL SW PR SA PM APPR

GBCC

STUDENT SUCCESS CENTER

PORTSMOUTH, NH

N14182

01 OF 13

NETWORK

	6	5	4	3	2	1
SEQUENCE OF OPERATIONS						
A.	Global Valve Control:					
	<ol style="list-style-type: none"> To facilitate hot water system balancing, a global command through the EMS shall be programmed to open all hot water ACV's installed under this contract. 					
B.	Occupancy Control:					
	<ol style="list-style-type: none"> Program occupancy schedules through the EMS for all time indexed equipment and components described hereinafter. 					
C.	Cabinet Heater/Unit Heater Control:					
	<ol style="list-style-type: none"> Furnish unit with two-way, two-position, low voltage electric ACV and DDC space temperature sensor. ACV shall open/close as required to maintain occupied/unoccupied temperature set points. When the temperature sensor is satisfied, fan shall stop and ACV shall close. Whenever the outside air temperature is less than 40°F (adj.), the two-way ACV shall remain open, and the unit fan only shall respond to the temperature sensor. Graphics List: <ul style="list-style-type: none"> Operating status - On/Off Space temperature Space temperature set point ACV commanded position - Open/Closed Outside air temperature Alarm 					
D.	Radiation Control:					
	<ol style="list-style-type: none"> Radiation shown to be controlled independently by an ACV shall have a two-way, two-position, low voltage ACV and DDC space temperature sensor. ACV shall open/close as required to maintain occupied/unoccupied temperature set points. Unoccupied temperature set points shall be adjustable through the EMS only. Graphics List: <ul style="list-style-type: none"> Space temperature Space temperature set point (per occupancy mode) Occupancy schedule ACV commanded position - Open/Closed 					
E.	Smoke Detectors:					
	<ol style="list-style-type: none"> Air handling equipment scheduled on drawings shall have a duct mounted smoke detector(s) furnished by the Electrical Contractor and installed by the Mechanical Contractor in the supply air ductwork and return air ductwork (where applicable). The ATC Contractor shall furnish and install low voltage wiring between smoke detector and air handling unit to automatically stop the supply and return fan (where applicable) upon sensing of smoke in the supply and/or return (where applicable) air stream. Smoke detector status and alarms shall be presented through the EMS. 					
F.	EF-1 Control:					
	<ol style="list-style-type: none"> Fan shall operate on a rise in temperature above the associated space temperature sensor set point. Graphics List: <ul style="list-style-type: none"> Operating status - ON/OFF Failure alarm 					
G.	Domestic Hot Water Plant Control:					
	<ol style="list-style-type: none"> Through the EMS, domestic hot water recirculation pump RP-1 shall be set up for operation based on a time schedule or hot water temperature. Provide analog current sensor (or equivalent means) to detect pump failure and loss of water flow. Should the pump be enabled to run and failure detected, an alarm shall be indicated through the EMS. Graphics List: <ul style="list-style-type: none"> Pump operating status - On/Off Hot water flow status (Proof of Flow) Recirculated hot water temperature Alarms 					
H.	HVAC - 1 Control:					
	<ol style="list-style-type: none"> HVAC - 1 is a packaged rooftop unit with supply fan, exhaust fan, DX cooling coil, hot water heating coil with 3-way DDC ACV (furnished with the RTU) and energy recovery wheel with outside airflow measuring station (TRAQ dampers). The unit will be provided with BACnet integration capability appropriate for interface with the established Alerton EMS. CTI shall verify seamless integration and equipment responsibilities in advance of bid with the unit manufacturer. Unit Shutdown: HVAC - 1 shall normally operate per its programmed occupancy schedule; however, start/stop of the unit shall also be possible manually through the EMS. When unit is disabled, control dampers within the unit shall go to fail-safe positions per manufacturer provided control strategies. Unit Start-up: Start-up of HVAC - 1 shall be accomplished manually through the EMS. Restart of unit upon safety shutdown may occur manually or automatically through the EMS. When unit is enabled to operate the following shall occur per manufacturer provided control strategies: <ol style="list-style-type: none"> Optimal Start: Fifteen minutes (adj.) prior to the start of the scheduled occupied cycle, the supply fan shall start and run continuously in the occupied mode to return the space temperature to the occupied set point, except that the outside air damper shall be 100% closed unless economizer is available for free cooling. (Minimum O.A. set point shall be released to zero CFM.) Occupied Mode: At the completion of the Optimal Start period, the scheduled occupied period shall commence. HVAC - 1 shall operate in occupied mode. In occupied mode, the supply fan shall run continuously and the outside air damper (with airflow measuring station) shall modulate open and return air damper shall modulate closed until the measured outside air quantity equals 10% (adj.) of the supply air quantity (or greater if in economizer mode) subject to “CO₂ Override” logic described below. <ol style="list-style-type: none"> When required, the exhaust fan shall start at minimum speed and gradually ramp up to controlled speed as specified below. In the absence of, or upon the loss of, airflow measurement from the outside air airflow station, the O.A./R.A. dampers shall position to a default minimum position of 25%/75% open (adj.) as determined in cooperation with the Testing & Balancing Contractor, and an alarm shall be indicated through the EMS. (This strategy does not apply if in economizer mode.) CO₂ Override: This contractor shall furnish and install a CO₂ sensor in the return air duct of HVAC - 1. The outside air and return air dampers shall modulate open/closed beyond the minimum as required to maintain the CO₂ level of the return air below 1000 ppm (adj.). PID control logic shall be used. Low-limit logic shall limit the outside air quantity to prevent the mixed air temperature from dropping below 38 °F (adj.) regardless of CO₂ level. Note that HVAC - 1 shall continue to operate in CO₂ Override mode until the CO₂ sensor is satisfied regardless of space occupancy status (to purge space of CO₂ prior to the next occupied period). 					

6	5	4	3	2	1
SEQUENCE OF OPERATIONS					
J. Hot Water Pump Control (P-1 & P-2):					
1. Pump P-1 or P-2 shall automatically start based on a specific outside air temperature or on a call for heating by any terminal in the system, as programmed based on owner preference. P-1 & P-2 shall be enabled based on command and the lead pump shall operate. The lag pump shall automatically operate whenever the lead pump has been enabled for operation and a flow sensor furnished by this contractor in the HWS piping senses no flow.					
2. Pump speed shall vary as required to satisfy a differential pressure relationship of 5 psi (adj.). Locate the differential pressure sensor in the HWS and HWR lines where coordinated with the engineer.					
3. Pumps P-1 and P-2 shall be automatically alternated every 200 hours (adjustable through the EMS).					
4. Graphics list: <ul style="list-style-type: none"> ▪ Pump lead or lag designation ▪ Pump operating status - On/Off ▪ Hot water flow status (proof of flow) ▪ Pump VFD information ▪ Differential pressure setpoint ▪ Differential pressure ▪ Accumulated run hours for each pump ▪ Variable alternation schedule ▪ Alarms 					
K. Refrigerant Heat Pump Systems Control:					
1. Refer to Specification Section 23 81 29. The ATC Contractor shall address EMS BACnet interface and provide graphic screens for each application.					
L. AC-1/ACCU-1 Control:					
1. Install factory furnished controls provided with the split system in accordance with the manufacturer's published instructions.					
M. Duct Heating Coils (HC-1 & 2) Control:					
1. The ducted heating coils shall be controlled by a modulating DDC 2-way ACV. ACV shall modulate as required to satisfy the space temperature command.					
2. Graphics List: <ul style="list-style-type: none"> ▪ Entering air temperature ▪ Leaving air temperature ▪ ACV position - % Open 					

6	5	4	3	2	1
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<p style="text-align: center;">GBCC</p> <p style="text-align: center;">STUDENT SUCCESS CENTER</p> <p style="text-align: center;">PORTSMOUTH, NH</p>	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%; border-right: 1px solid black; padding: 5px; text-align: center;">N14182</td> <td style="width: 15%; border-right: 1px solid black; padding: 5px;"></td> <td style="width: 70%; padding: 5px; text-align: center;">SEQUENCE</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 5px; text-align: center;">04 OF 13</td> <td style="border-right: 1px solid black; padding: 5px;"></td> <td style="padding: 5px;"></td> </tr> </table>	N14182		SEQUENCE	04 OF 13		
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<p>ARCHITECT: JSA</p> <p>ENGINEER: YEATON ASSOCIATES</p> <p>CONTRACTOR: C3PH</p>	<p>DESIGNED BY: MJK</p> <p>DATE: 2/5/15</p>	<p>REVIEW</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%; border-right: 1px solid black; padding: 5px;">BY:</td> <td style="width: 15%; border-right: 1px solid black; padding: 5px;">EL</td> <td style="width: 15%; border-right: 1px solid black; padding: 5px;">SW</td> <td style="width: 15%; border-right: 1px solid black; padding: 5px;">PR</td> <td style="width: 15%; border-right: 1px solid black; padding: 5px;">SA</td> <td style="width: 15%; border-right: 1px solid black; padding: 5px;">PM</td> <td style="width: 15%; padding: 5px;">APPR</td> </tr> </table>	BY:	EL	SW	PR	SA	PM	APPR
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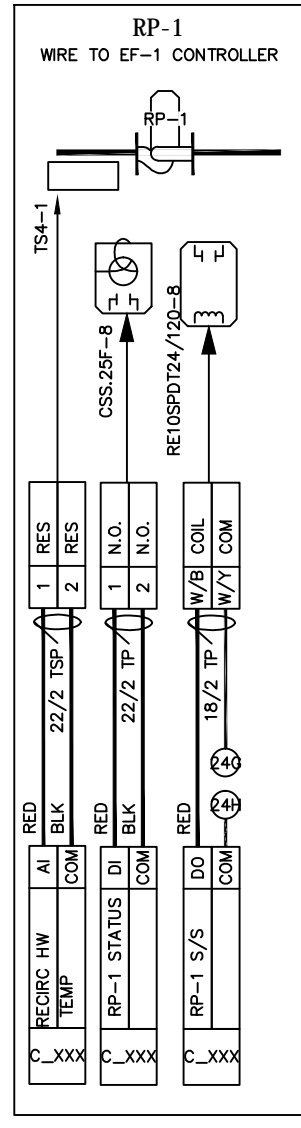
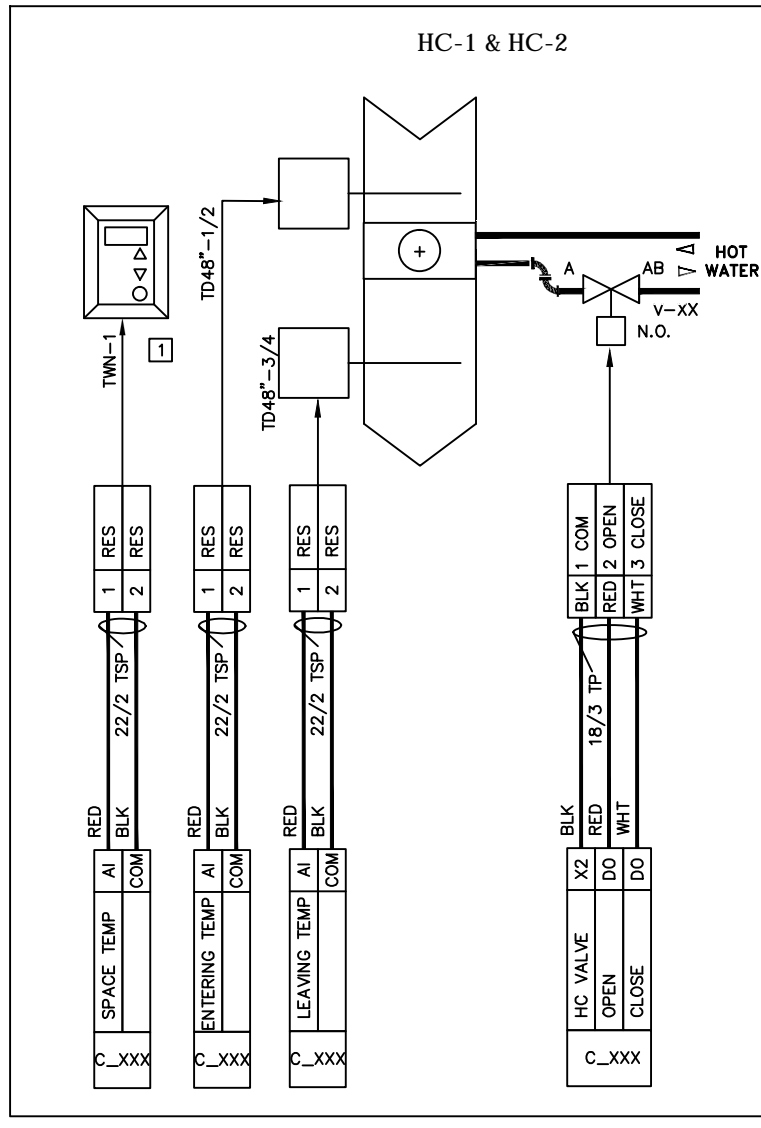
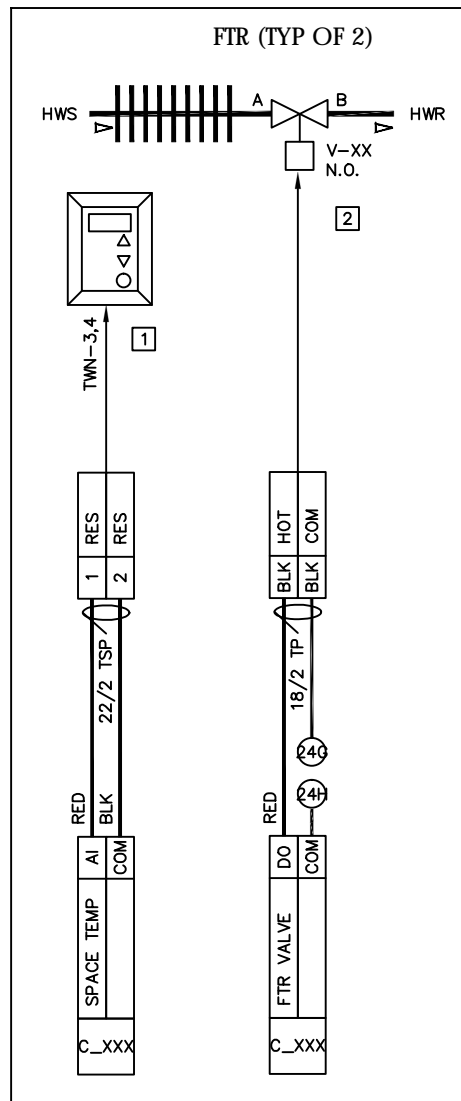
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BY:	EL				

- 2.1. FOR VALVE DATA SEE VALVE SCHEDULE
- 2.2. VALVE IN HORIZONTAL PIPE RUN WITH THE ACTUATOR ABOVE PIPE AT AN ANGLE OF NO MORE THAN 45 DEGREES FROM VERTICAL
- 2.3. VALVE PLUMBED TO A/B/AB PORT DESIGNATIONS

EQUIPMENT	SERVES	CONTROLLER
UH-1	RM 1225	EF-1
UH-2	RM 1224	EF-1
CH-1	RM 1201	HC-2
CH-2	RM 1214	HC-1
CH-3	RM 1217	HC-1
CH-4	RM 1213	HC-1

EQUIPMENT	SERVES	CONTROLLER
FTR	RM 1205	HC-2
FTR	RM 1207	HC-2



BILL OF MATERIALS, EF/CUH/UH/FTR/RP				
TAG	QTY	PART NO	DESCRIPTION	MANUFACTURER
TWN	4	MS-2000-BT	WALL TEMP/OCC/SP	ALERTON
TW4SP	9	A/CP-SP	SSP 10K-2 TEMP	ACI
CSS.25F	8	RIBXKTF	.25-150A SOLID FIXED CURRENT SWITCH	FDI
RE10SPDT24/120	8	V100	ENCLOSED 10A SPDT,24/120V COIL	VERIS
TD48"	4	A/CP-D-8-PB	DUCT 8" 10K-2 TEMP	ACI
AO35S24	1	LF24 US	35 IN-LB, 2-POS, 24V, SR ACTUATOR	BEUMIO
CAB01188	2	VLC-1188	CONTROLLER, MS/TP	ALERTON
TX120/24/50	5	TR50VA005	TRANSFORMER, 120/24VAC, 50VA	FDI
SUPA1212-4	3	SCE-12N12MIP	SUB-PANEL, 12x12	SAGINAW
ENC121206	3	SCE-12N1206LP	ENCLOSURE, NEMA 1, 12x12x6	SAGINAW

CONTROL
TECHNOLOGIES
DEFINING BUILDING PERFORMANCE

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ARCHITECT: JSA
 ENGINEER: YEATON ASSOCIATES
 CONTRACTOR: GSPH
 (603) 529-3322
 DESIGNED BY: MJK DATE: 2/5/15

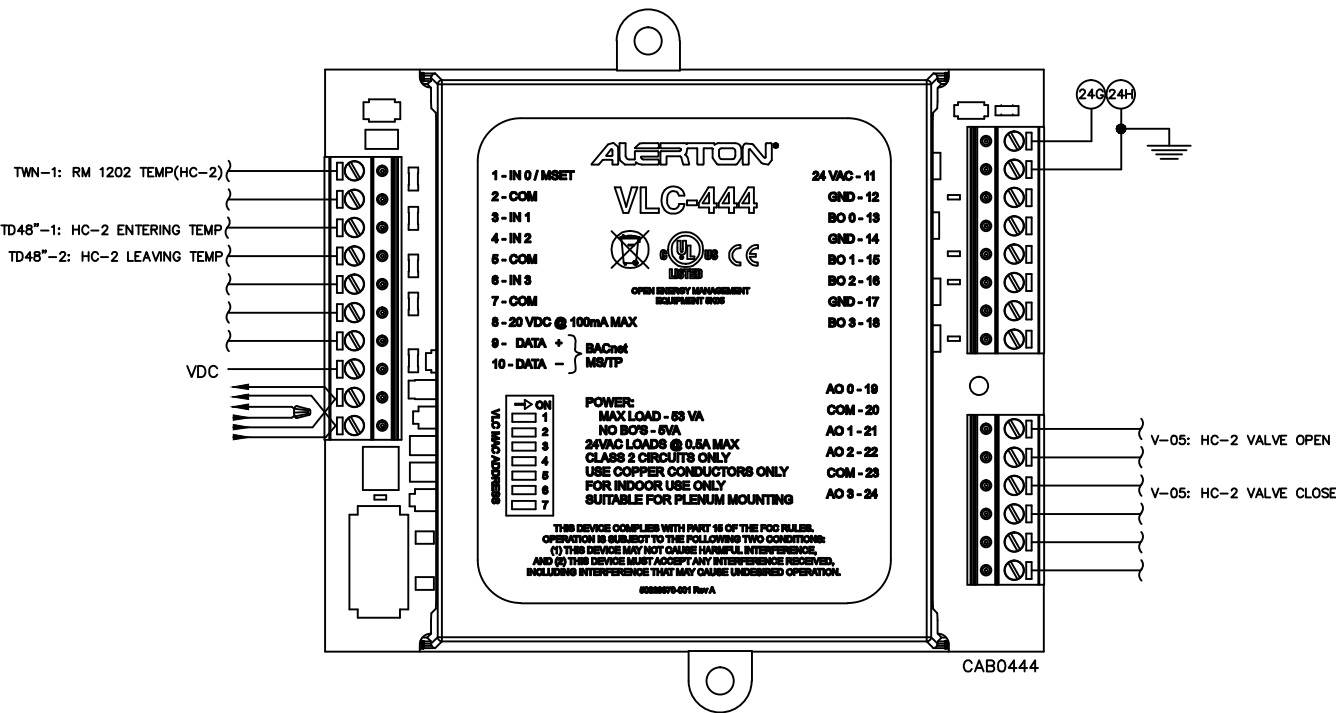
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PORTSMOUTH, NH

N14182 | EF/FTR/CUH/UH
05 OF 13

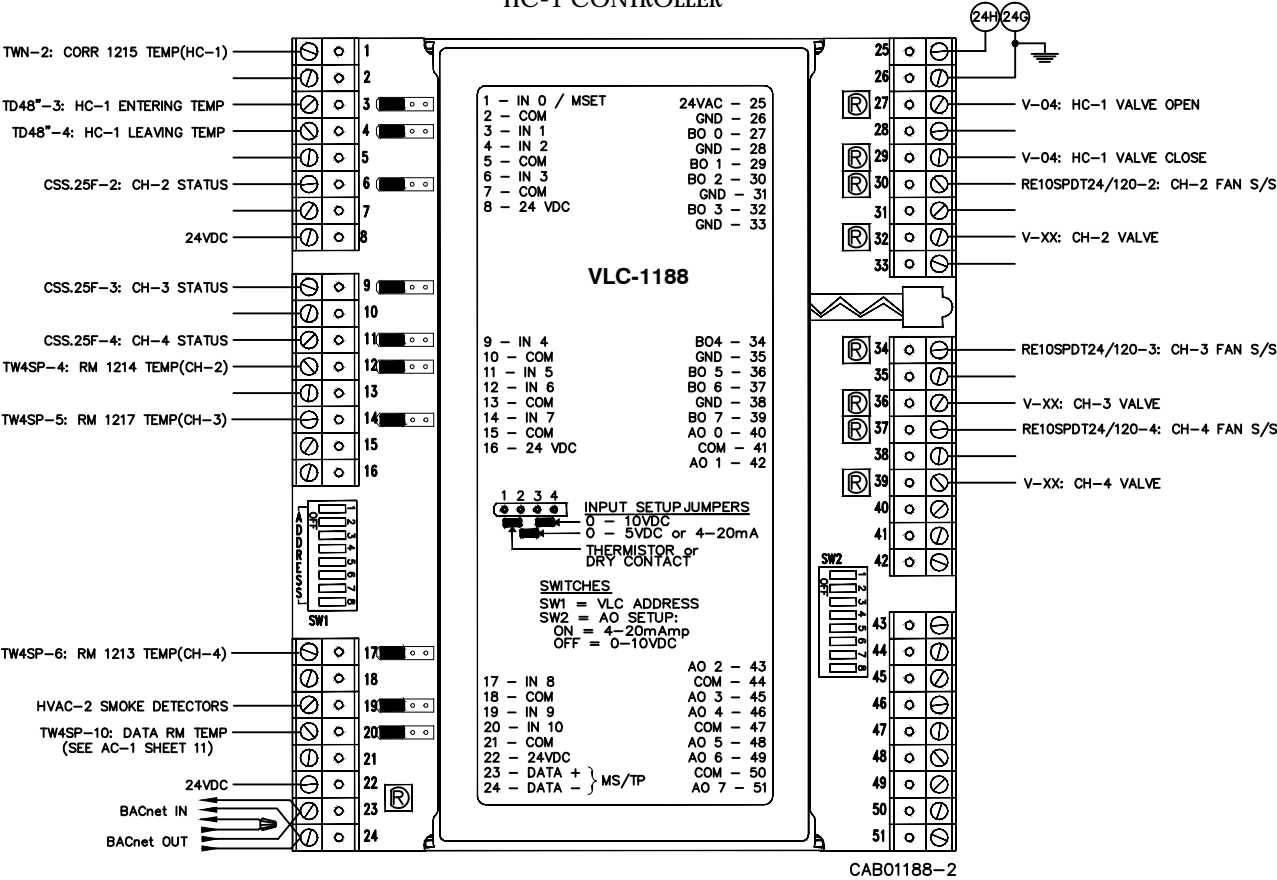
HC-1&2 CONTROLLERS

HC-2 CONTROLLER

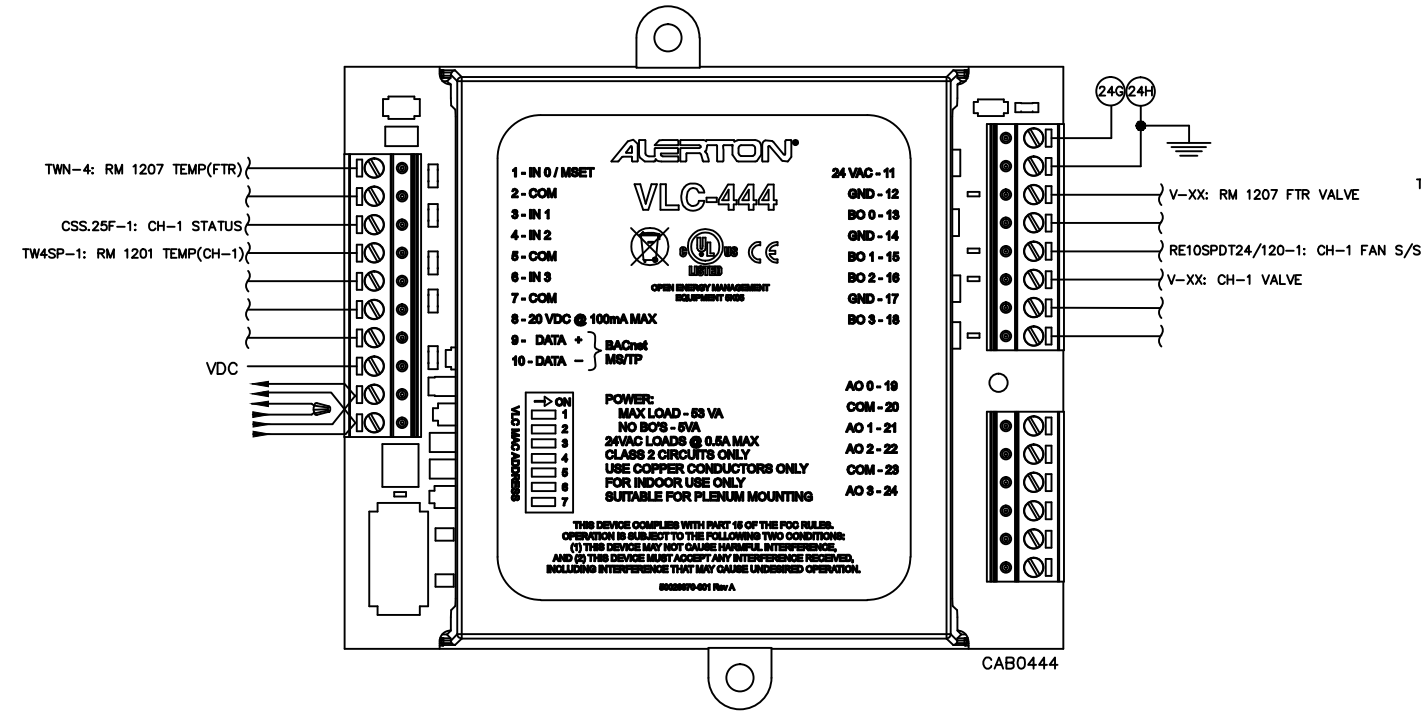


I/O SHIELDS TO GROUND, NOT ON VLC TERMINAL.
MS/TP SHIELDS TIED TOGETHER AS SHOWN.

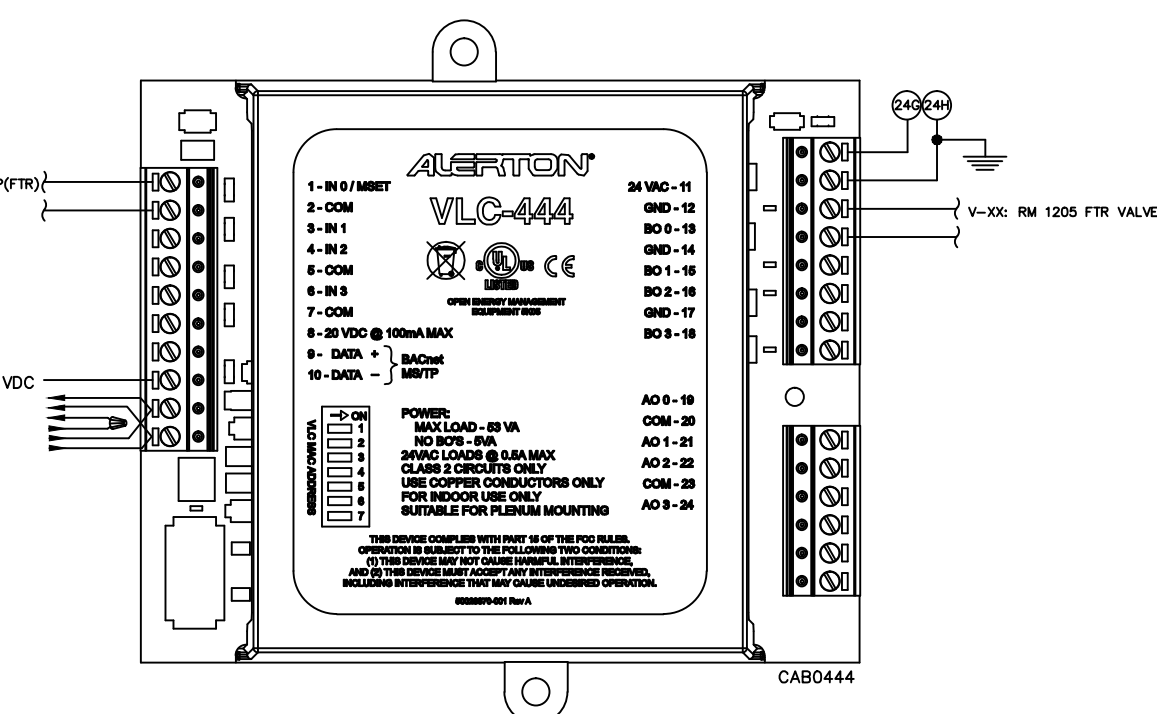
HC-1 CONTROLLER



I/O SHIELDS TO GROUND, NOT ON VLC TERMINAL.
MS/TP SHIELDS TIED TOGETHER AS SHOWN.



I/O SHIELDS TO GROUND, NOT ON VLC TERMINAL.
MS/TP SHIELDS TIED TOGETHER AS SHOWN.



DATE: _____

REVISION: _____

ARCHITECT: JSA YEATON ASSOCIATES

ENGINEER: GSPH

CONTRACTOR: (603) 529-3322

DESIGNED BY: MJK

DATE: 2/5/15

REVIEW BY: _____

EL SW PR SA PM APPR

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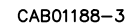
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06 OF 13

HC-1&2 CONTROLLERS

EF-1 CONTROLLER



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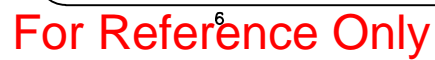
DATE: 2/5/15

REVIEW BY:	EL	SW	PR	SA	PM	APPR

N14182 07 OF 13	GBCC STUDENT SUCCESS CENTER PORTSMOUTH, NH	EF-1 CONTROLLER
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NOTES:

1. ALL DEVICES PROVIDED BY OTHERS
 - 1.1. INSTALL/WIRE AS REQUIRED
 - 1.2. FIELD VERIFY CONNECTIONS
2. WIRE SMOKE DETECTORS IN PARALLEL TO CONTROLLERS
 - 2.1. HVAC-1 SMOKE TO EF-1 CONTROLLER
 - 2.2. HVAC-2 SMOKE TO HC-1 CONTROLLER



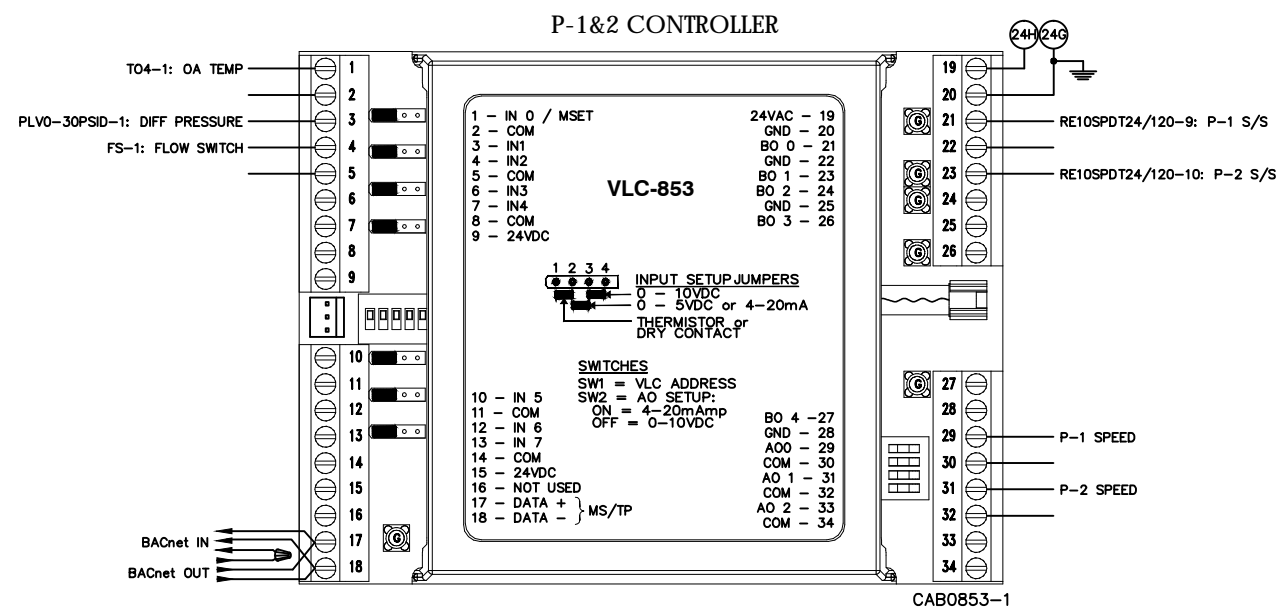
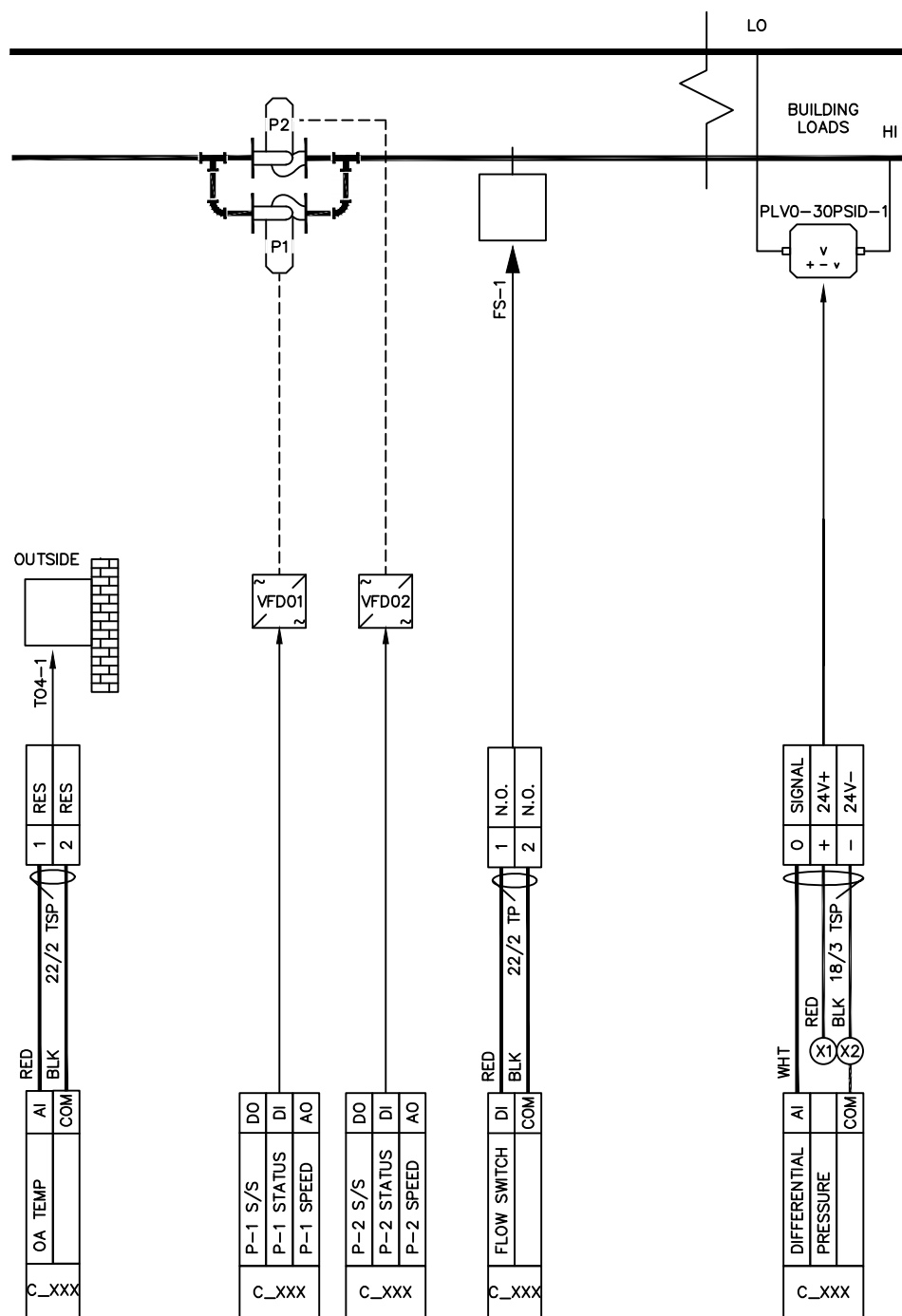
P-1 & 2

NOTES:

- ## 1. COORDINATE DIFFERENTIAL PRESSURE SENSOR LOCATION WITH ENGINEER

BILL OF MATERIALS, P-1/2

TAG	QTY	PART NO	DESCRIPTION	MANUFACTURER
TO4	1	A/CP-O-EH	OUTDOOR 10K-2 TEMP	ACI
PLV0-30PSID	1	PR-282-2-2-B-1-2-B	0-30 PSID WET SNSOR (0-5 VDC), 24 VAC	MAMAC
FS	1	FS1-6	PADDLE FLOW SWITCH	KELE
CAB0853	1	VLC-853	CONTROLLER, MS/TP	ALERTON
TX120/24/50	1	TR50VA005	TRANSFORMER, 120/24VAC, 50VA	FDI
SUPA1212-4	1	SCE-12N12MP	SUB-PANEL, 12x12	SAGINAW
ENC121206	1	SCE-12N1206LP	ENCLOSURE, NEMA 1, 12x12x6	SAGINAW



CONTROL TECHNOLOGIES
DEFINING BUILDING PERFORMANCE

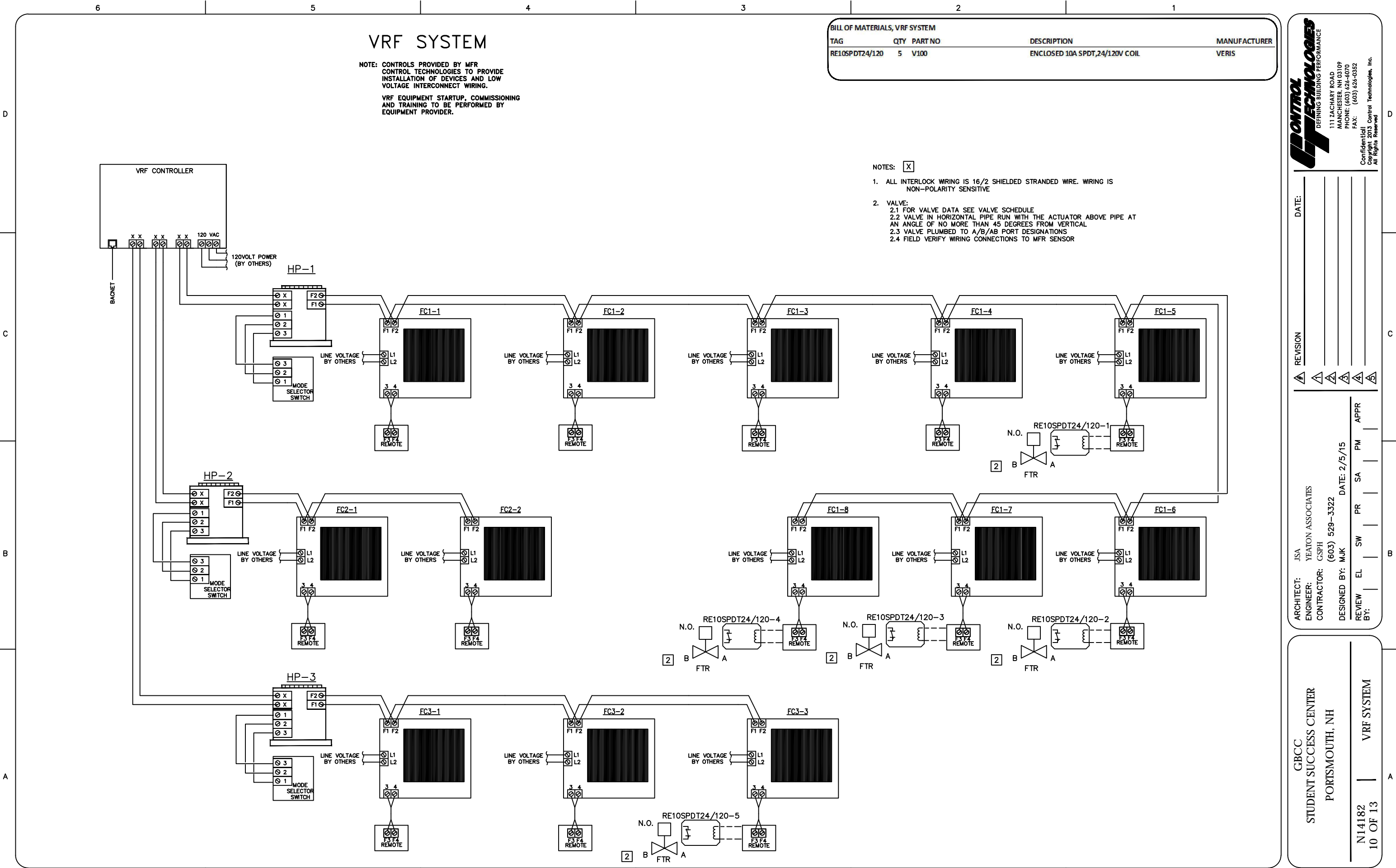
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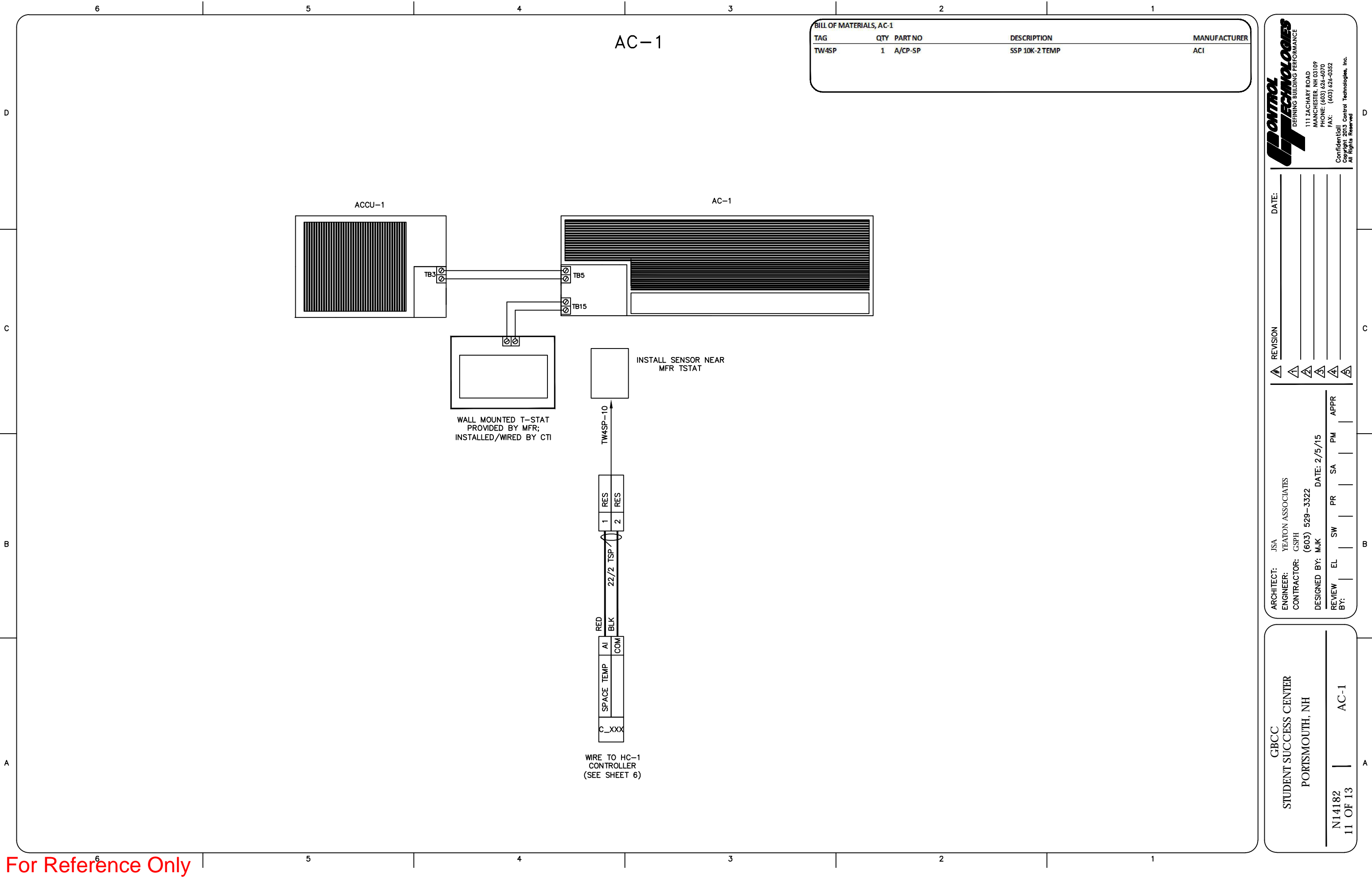
REVISION	DATE:
1	
2	
3	
4	
5	

ARCHITECT:	JSA								
ENGINEER:	YEATON ASSOCIATES								
CONTRACTOR:	GSPH								
	(603) 529-3322								
DESIGNED BY:	MJK								
	DATE: 2/5/15								
REVIEW BY:	EL	SW	PR	SA	PM	APPR			

GBCC
STUDENT SUCCESS CENTER
PORTSMOUTH, NH

N14182
09 OF 13
P-1 & 2





MISCELLANEOUS

VALVE SCHEDULE – N14182, GBCC–STUDENT SUCCESS CENTER

ITEM	TAG	SERVICE		QTY	PART NO	MFR	TYPE	VALVE SIZE	PIPE SIZE	CONN TYPE	DESIGN CV	ACTUAL CV	FLOW	PRESS DROP	RATED TEMP	CLOSEOFF	FAILS	ACTION	SUPPLY
		UNIT	MEDIA																
001	V–01	FTR	HW	6	VT2313G13A020	TAC	2–WAY	3/4	3/4	NPT	0.58	3.5	1. GPM	0.1 PSI	200. F	25. PSI	N.C.	2–POS	24 VAC
002	V–02	CH1~4	HW	4	VT2313G13A020	TAC	2–WAY	3/4	3/4	NPT	0.81	3.5	1.4 GPM	0.2 PSI	200. F	25. PSI	N.C.	2–POS	24 VAC
003	V–03	UH1&2	HW	2	VT2313G13A020	TAC	2–WAY	3/4	3/4	NPT	2.02	3.5	3.5 GPM	1. PSI	200. F	25. PSI	N.C.	2–POS	24 VAC
004	V–04	HC–1	HW	1	B212B+TR24–3–T US	BELIMO	2–WAY	1/2	1/2	NPT	2.96	3.0	5.1 GPM	2.9 PSI	212. F	200. PSI	N.O.	FLOAT	
005	V–05	HC–2	HW	1	B214B+TR24–3–T US	BELIMO	2–WAY	1/2	1/2	NPT	5.21	7.4	9. GPM	1.5 PSI	212. F	200. PSI	N.O.	FLOAT	

DAMPER SCHEDULE – N14182, GBCC–STUDENT SUCCESS CENTER

ITEM	TAG	SERVICE		QTY	PART NO	TYPE	WIDTH	HEIGHT	CONN TYPE	TORQUE REQ	ACTUATOR			
		UNIT	MEDIA								TORQUE	FAILS	ACTION	SUPPLY
001	D–1	EF–1	OA	1	CD60	PARALLEL	12. IN	12. IN	SLEEVE	7. INLB	35. INLB	N.C.	2–POS	24 VAC

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PORTSMOUTH, NH

N14182
12 OF 13

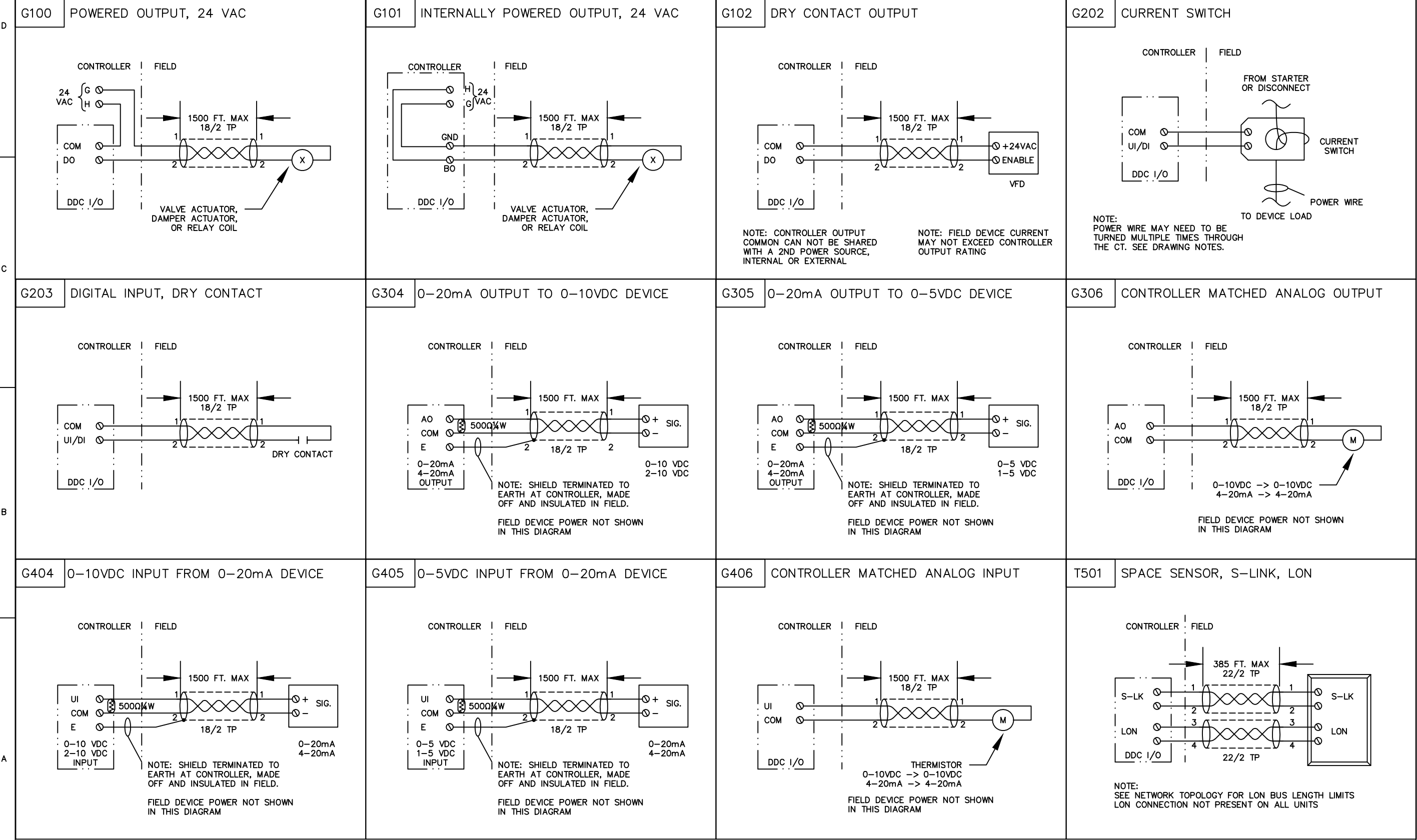
MISCELLANEOUS

ARCHITECT: JSA
ENGINEER: YEATON ASSOCIATES
CONTRACTOR: GSPH
DESIGNED BY: MJK
REVIEW BY: EL
DATE: 2/5/15
(603) 529–3322
DATE: 2/5/15
PR
SA
PM
APPR

Control Technologies
DEFINING BUILDING PERFORMANCE
111 ZACHARY ROAD
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PHONE: (603) 624-4070
FAX: (603) 624-0352
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WIRING DETAILS



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PHONE: (603) 624-4070
FAX: (603) 624-0352

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DATE: _____

REVISION: _____

ARCHITECT: JSA YEATON ASSOCIATES
ENGINEER: GSPH
CONTRACTOR: (603) 529-3322
DESIGNED BY: MJK DATE: 2/5/15

REVIEW BY: _____
EL SW PR SA PM APPR

GBCC
STUDENT SUCCESS CENTER
PORTSMOUTH, NH

N14182
13 OF 13

WIRING DETAILS

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ABBREVIATIONS

A	AMP
AFF	ABOVE FINISHED FLOOR
AD	ACCESS DOOR
AHU	AIR–HANDLING UNIT
AP	ACCESS PANEL
BAS	BUILDING AUTOMATION SYSTEM
CUH	CABINET UNIT HEATER
DB	DRY BULB
DDC	DIRECT DIGITAL CONTROL
DEG, °	DEGREE
DP, DPS	DIFFERENTIAL–PRESSURE SENSOR
(E), EXIST	EXISTING
EAT	ENTERING AIR TEMPERATURE
EC	ELECTRONICALLY COMMUTATED
EF	EXHAUST FAN
ETR	EXISTING TO REMAIN
F	FAN, FAHRENHEIT
FLA	FULL LOAD AMPS
FPM	FEET PER MINUTE
FT	FEET
FTR	FINNED TUBE RADIATOR
GPM	GALLONS PER MINUTE
HP	HEAT PUMP, HORSEPOWER
HR	HOUR
HZ	HERTZ
IN, IN.	INCHES
IP	INTERNET PROTOCOL
IT	INFORMATION TECHNOLOGY
KW	KILOWATT
JACE	JAVA APPLICATION CONTROL ENGINE
LAN	LOCAL AREA NETWORK
MAX	MAXIMUM
MCA	MAXIMUM CIRCUIT AMPACITY
MCP	MAIN CONTROL PANEL
MIN	MINIMUM
MOPD	MAXIMUM OVER–CURRENT PROTECTION DEVICE
MS/TP	MASTER SLAVE TOKEN PASSING
NPT	NATIONAL PIPE THREAD
NTS	NOT TO SCALE
OA	OUTSIDE AIR
PH	PHASE
PS	PRESSURE SWITCH
PSI	POUNDS PER SQUARE INCH
PT	PRESSURE TRANSMITTER
RG	REFRIGERANT GAS
RH	RELATIVE HUMIDITY
SP	STATIC PRESSURE
SS	STAINLESS STEEL
T	TEMPERATURE SENSOR, THERMOSTAT
TYP	TYPICAL
UH	UNIT HEATER
V	VOLTS
VAC	VOLTS ALTERNATING CURRENT
VFD	VARIABLE FREQUENCY DRIVE
W/	WITH
WB	WET BULB
WC	WATER COLUMN
WG	WATER GAUGE

APPLICABLE CODES AND STANDARDS

- NEW HAMPSHIRE STATE FIRE CODE SAF–C 6000
- NATIONAL ELECTRICAL CODE (NEC) (2014) WITH NH AMENDMENTS
- INTERNATIONAL MECHANICAL CODE (2009) WITH NH AMENDMENTS
- INTERNATIONAL ENERGY CONSERVATION CODE (2009) WITH NH AMENDMENTS

MECHANICAL GENERAL NOTES

- GENERAL NOTES, SYMBOLS LIST AND DETAILS ARE APPLICABLE TO DRAWINGS MARKED M–#.
- DRAWINGS ARE DIAGRAMMATIC; DETERMINE LOCATIONS OF SYSTEMS AND COMPONENTS IN FIELD.
- WORK SHALL BE COORDINATED WITH TRADES INVOLVED.
- PROVIDE ADEQUATE CLEARANCE FOR ACCESS TO HARDWARE.

MECHANICAL LINE TYPE LEGEND

—————	EXISTING ITEMS TO REMAIN
-----	ITEMS TO BE REMOVED
—————	ITEMS TO BE PROVIDED
— — — —	CONTROL WIRING

ELECTRICAL GENERAL NOTES:

- PERFORM WORK IN ACCORDANCE WITH NFPA–70, NATIONAL ELECTRICAL CODE (NEC) 2017.
- UNLESS OTHERWISE NOTED, WIRING SHALL BE 2#12 AWG CONDUCTORS AND #12 GND. HOME RUNS FED FROM 20A–1P CIRCUITS IN EXCESS OF 100 FEET SHALL BE #10 AWG.
- INTERIOR DISTRIBUTION AND BRANCH WIRING SHALL BE 600V, COPPER WITH THHN/THWN INSULATION. EXTERIOR DISTRIBUTION AND BRANCH WIRING SHALL BE 600V, COPPER WITH XHHW INSULATION.
- INTERIOR CONDUIT SHALL BE TYPE EMT AND EXTERIOR CONDUIT SHALL BE RIGID GALVANIZED STEEL.

ELECTRICAL ABBREVIATIONS:

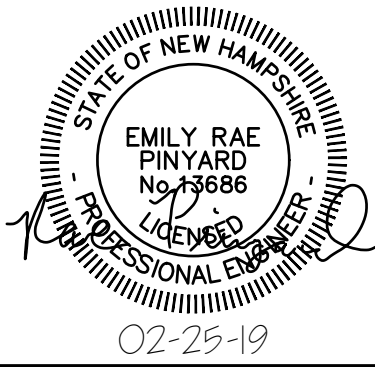
AMP/A	AMPERE
CKT	CIRCUIT
GND	GROUND
KVA	KILOVOLT–AMPERE
NO	NUMBER
NTS	NOT TO SCALE
V	VOLT
VA	VOLT–AMPERE


POWER:

■	PANELBOARD, NORMAL POWER
↪	HOME RUN

ELECTRICAL LINE TYPES:

—————	EXISTING
—————	NEW





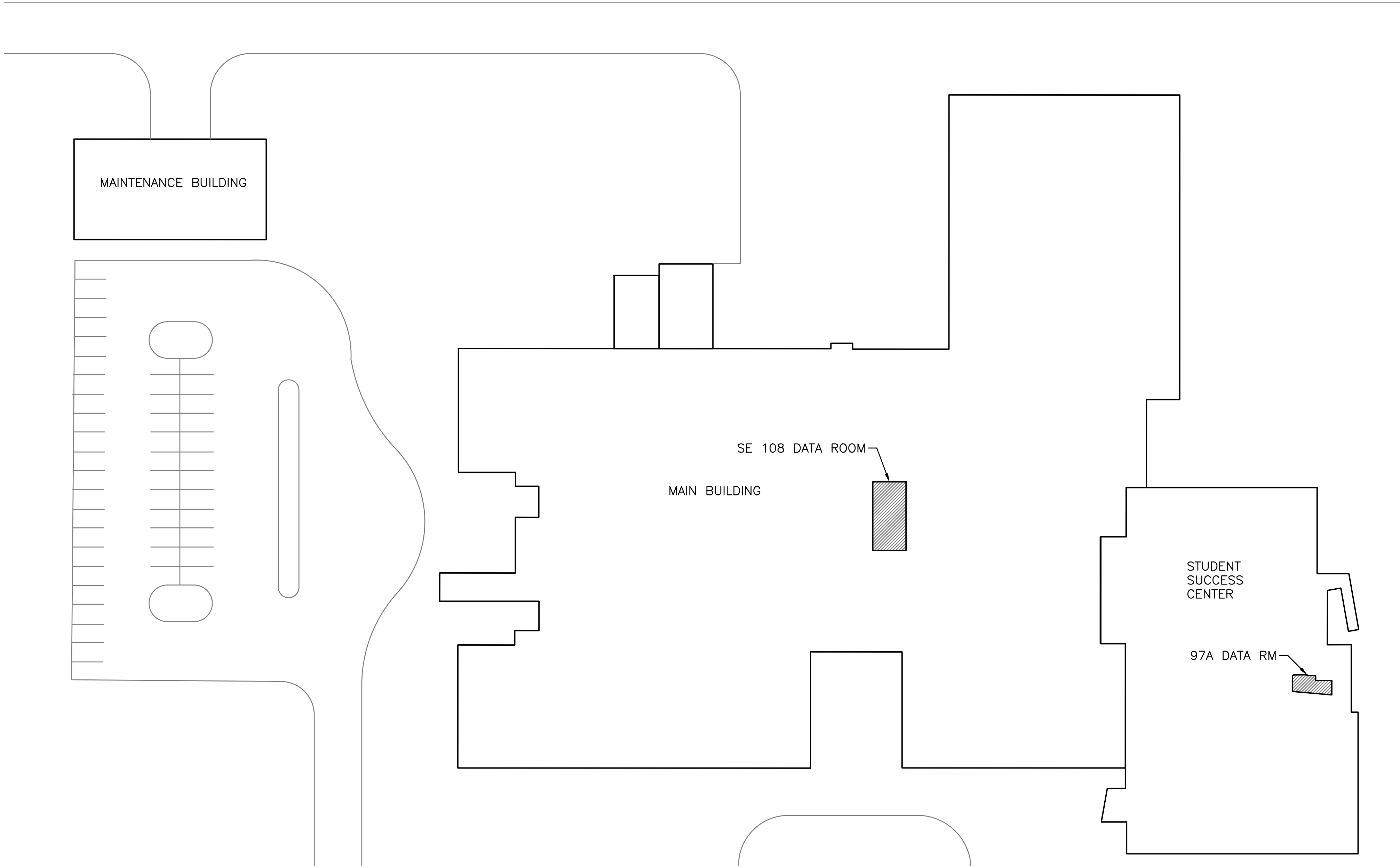
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04101
207.553.7753

GREAT BAY COMMUNITY COLLEGE PORTSMOUTH, NH				
GREAT BAY COMMUNITY COLLEGE REPLACE BUILDING AUTOMATION SYSTEM				
0 ISSUED FOR BID		PML	ERP	02/25/19
REV	DESCRIPTION	DWN	APP	DATE
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DRAWING NO.

M-001

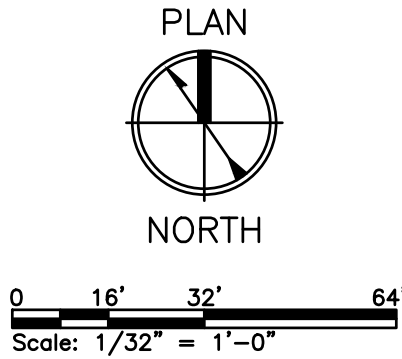
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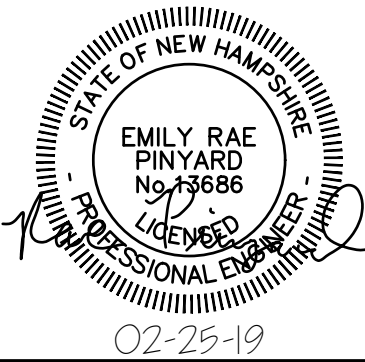
- NOTES:
- SEE DRAWING M-100 FOR NOTES, ABBREVIATIONS, AND LEGEND.
 - REMOVE EXISTING AND PROVIDE NEW DDC NETWORK CONTROLLERS AT THE MAIN BUILDING.
 - CHANGEOVER FROM EXISTING BAS TO NEW BAS SHALL OCCUR WITHIN A SINGLE WEEK-LONG TIMEFRAME, DURING NORMAL BUSINESS HOURS. HVAC EQUIPMENT SHALL REMAIN OPERATIONAL DURING THIS OUTAGE VIA EXISTING FIELD CONTROLLERS, BUT THERE WILL BE NO ABILITY TO REMOTELY ADJUST AND MONITOR CONTROL POINTS DURING THIS OUTAGE.
 - THE MAINTENANCE BUILDING CURRENTLY HAS STANDALONE HVAC ELECTRIC/ELECTRONIC CONTROLS. PROVIDE NEW DDC CONTROLLER FOR EXISTING HVAC EQUIPMENT AND CONNECT TO NEW BAS. REFER TO M-501 FOR A LIST OF HVAC SYSTEMS IN THIS BUILDING.
 - INTEGRATE NEW NETWORK CONTROLLERS INTO THE OWNER'S CLOUD-BASED NIAGARA N4 SERVER.
 - COORDINATE WITH THE OWNER ON ALL NETWORK CONNECTIONS, IP ADDRESSES REQUIRED, PANEL LOCATIONS, REQUIRED GRAPHICS AND ALARMS.
 - ROUTER CONNECTIONS AND ETHERNET CABLING SHALL BE PROVIDED BY OWNER.
 - PROVIDE MODIFICATIONS TO FIELD CONTROLLER AND FIELD DEVICE MODIFICATIONS FOR THE MAIN BUILDING, AS DESCRIBED ON THE BUILDING FLOOR PLANS AND SHEET M-501 (NOT IN CONTRACT, BY OTHERS).

LEGEND:

 EXISTING NETWORK CONTROLLER LOCATIONS



SITE PLAN
SCALE 1/32" = 1'-0"



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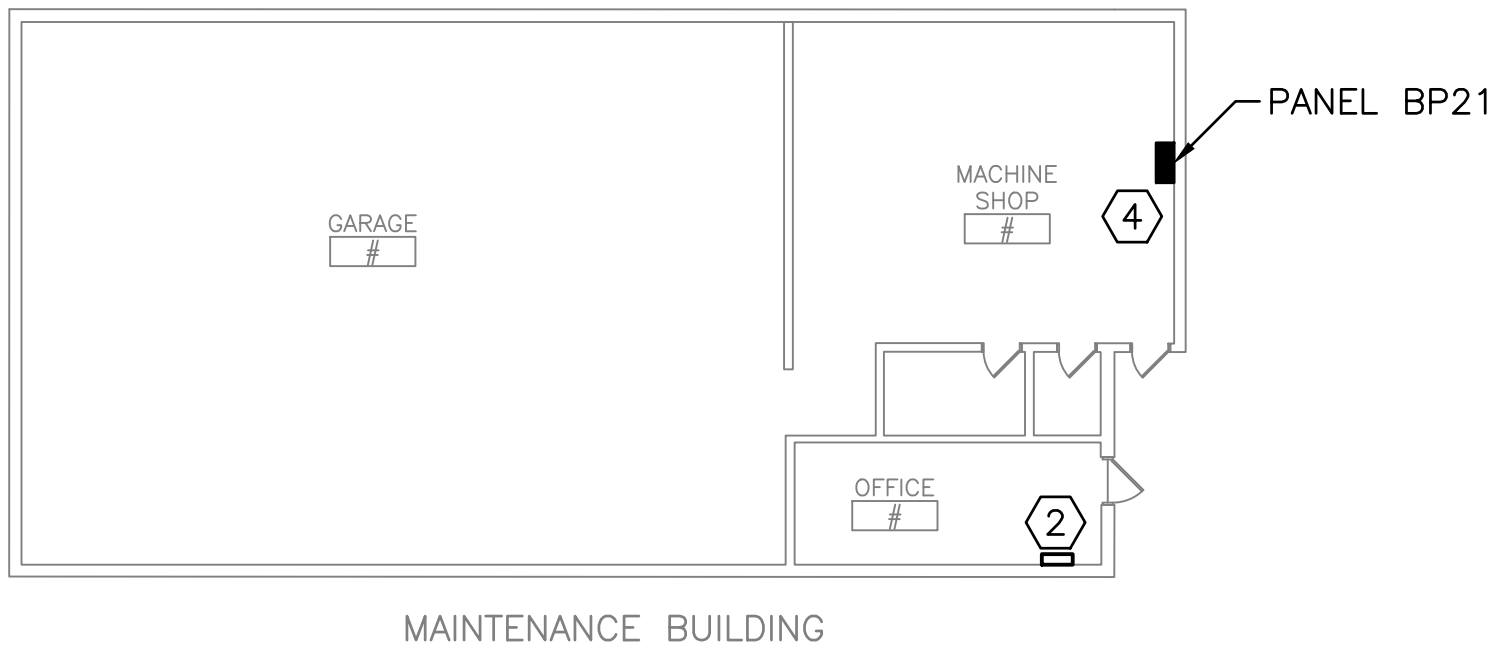
PROJECT NO.
372.003.001
SHEET
2 OF 5

DRAWING NO.
MS-101

GREAT BAY COMMUNITY COLLEGE
PORTSMOUTH, NH

GREAT BAY COMMUNITY COLLEGE
REPLACE BUILDING AUTOMATION SYSTEM

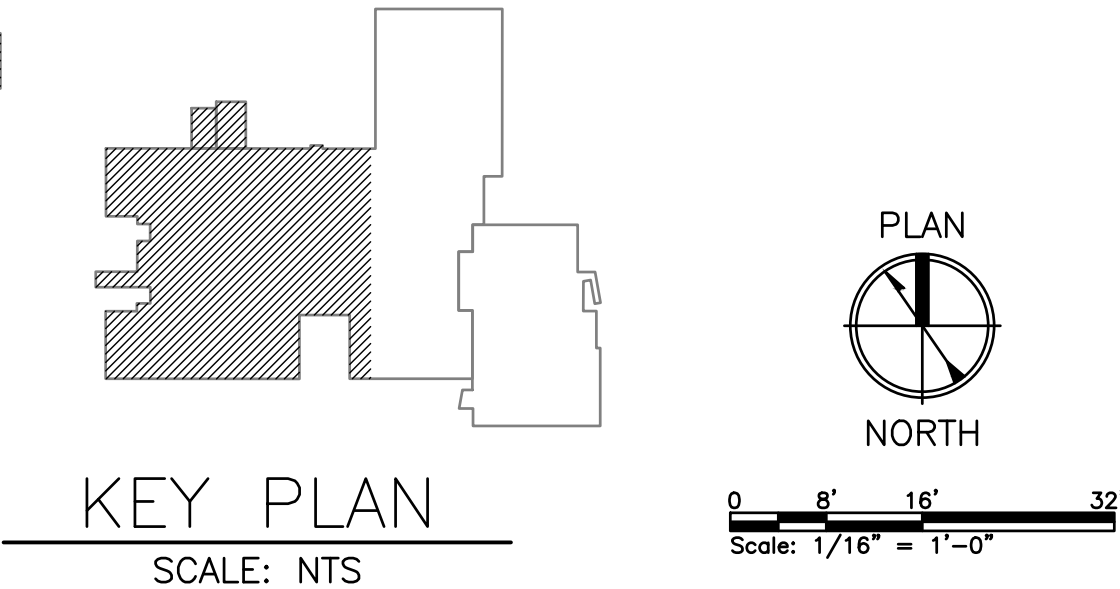
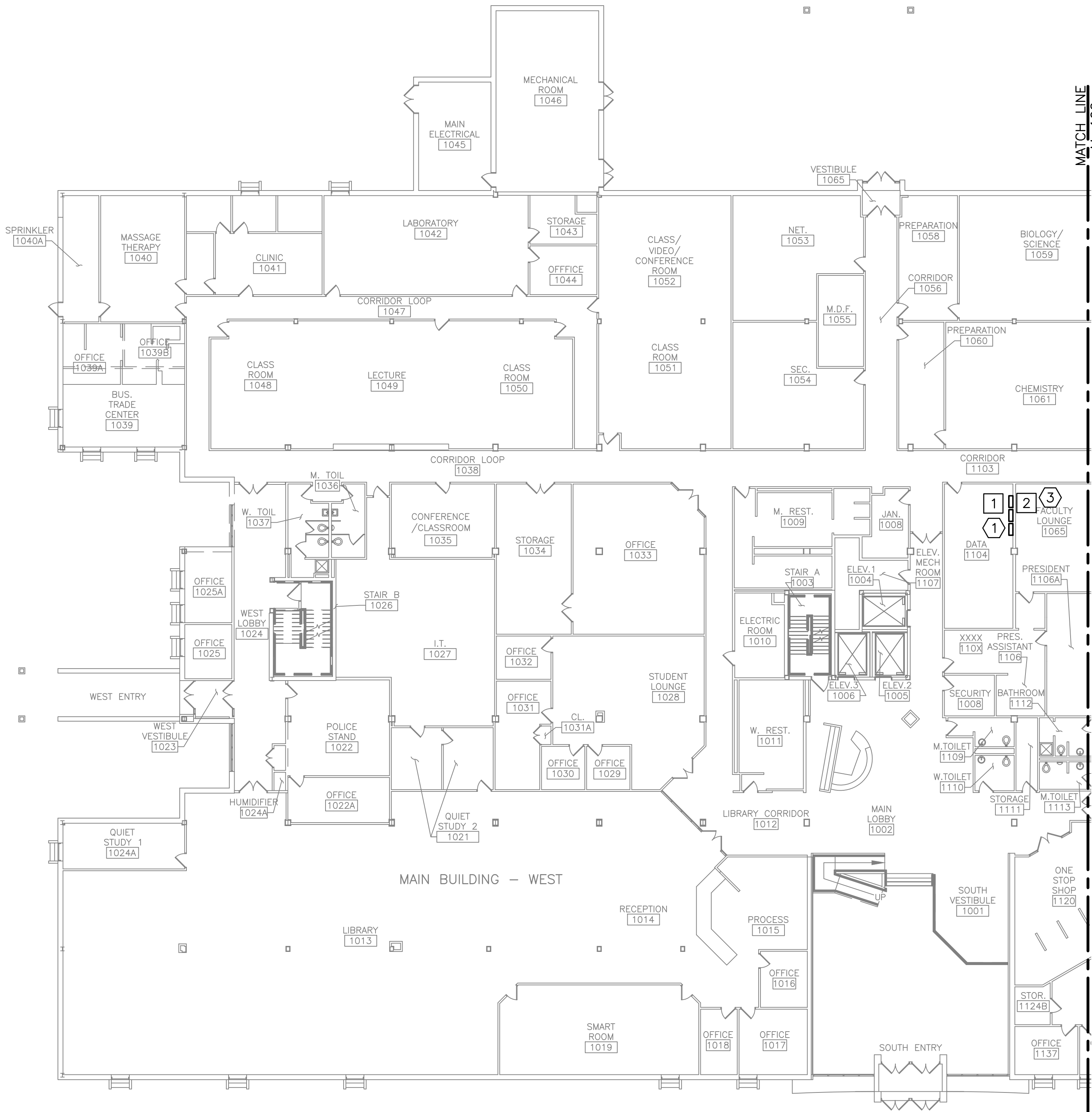
MECHANICAL SITE PLAN



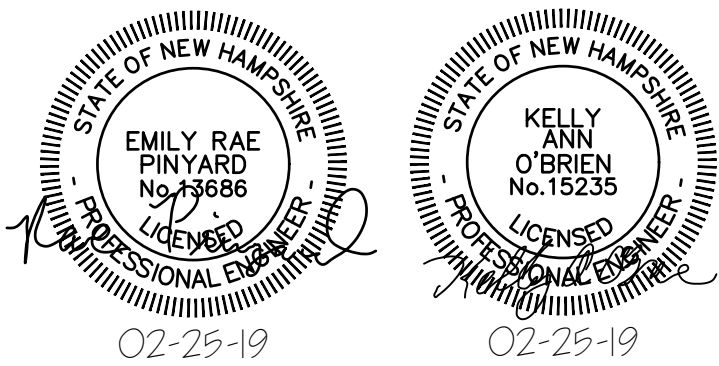
- NOTES:
- SEE DRAWING M-001 FOR NOTES, ABBREVIATIONS, AND LEGENDS.
 - COORDINATE WITH OWNER ON ROOM NUMBERS IN MAINTENANCE BUILDING.

- DEMOLITION KEYED NOTES:
- REMOVE JACE-1, JACE-2, AND JACE-3 AND ASSOCIATED POWER SUPPLIES. DISCONNECT BACNET/MSTP WIRING.
 - DISCONNECT 120V CIRCUIT FROM JACE-1, JACE-2, AND JACE-3. WIRING TO REMAIN FOR RE-USE. PROTECT DURING CONSTRUCTION.

- KEYED NOTES:
- PROVIDE JACE-1, JACE-2, AND JACE-3 NETWORK CONTROL PANELS IN SAME LOCATIONS AS EXISTING.
 - PROVIDE DDC CONTROLLER IN OFFICE FOR EXISTING MAINTENANCE BUILDING HVAC SYSTEMS.
 - CONNECT EXISTING CIRCUIT TO JACE-1, JACE-2, AND JACE-3. RE-USE EXISTING WIRING AND CIRCUIT.
 - CONNECT DDC CONTROLLER TO EXISTING 120V, 20 AMP SPARE BREAKER IN PANEL BP21-3-21.



PLAN WEST
SCALE: 1/16" = 1'-0"

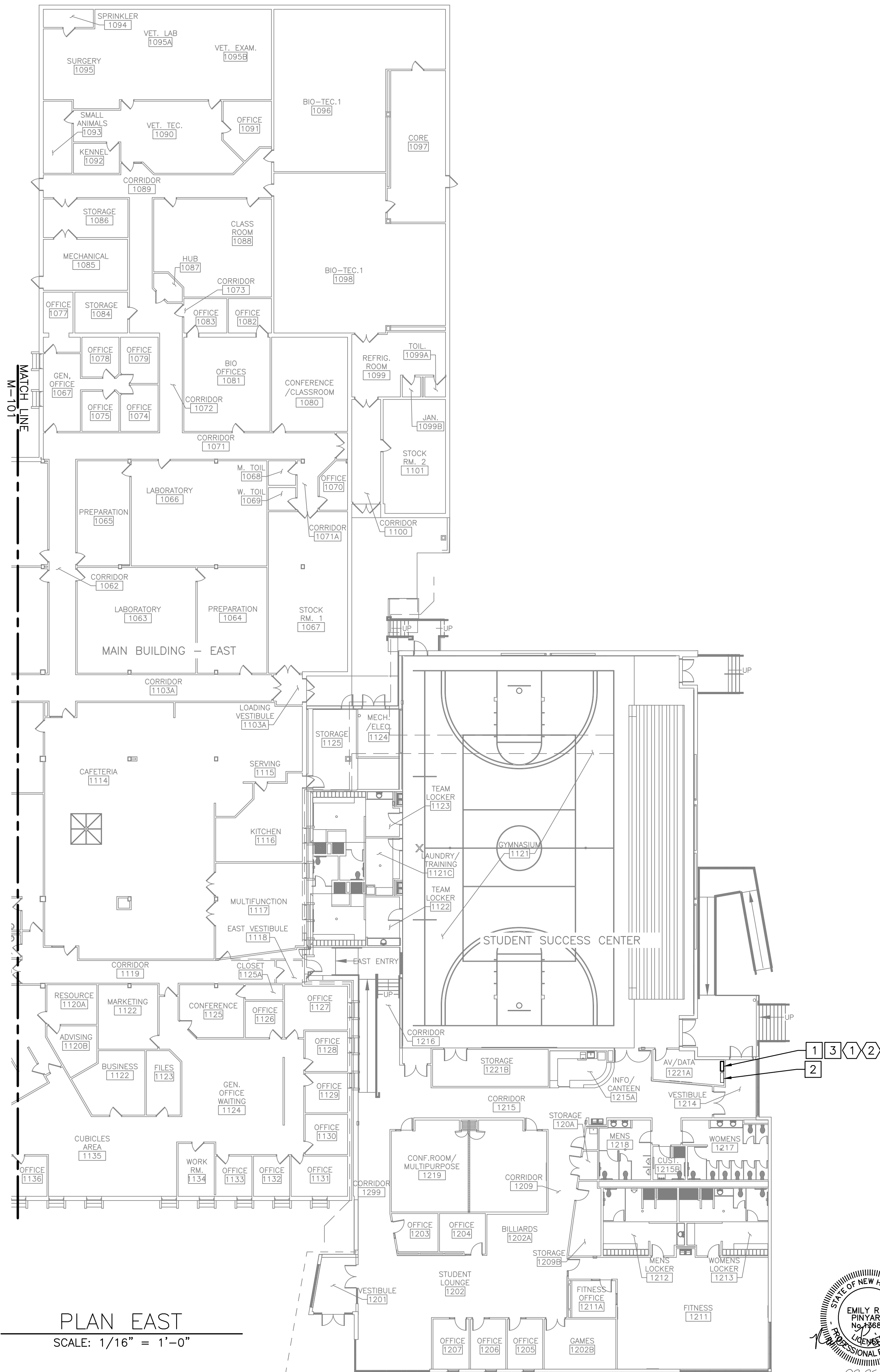


COBY COMPANY LLC
engineering & design

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Portland, ME 04101
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				GREAT BAY COMMUNITY COLLEGE PORTSMOUTH, NH			
				GREAT BAY COMMUNITY COLLEGE REPLACE BUILDING AUTOMATION SYSTEM			
				FIRST FLOOR MECHANICAL PLAN			
0	ISSUED FOR BID	PML	ERP	02/25/19			
REV	DESCRIPTION	DWN	APP	DATE			
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				DATE: 01/18/2019	372.003.001		
DES BY: ERP				SHEET			
DWN BY: PML				3 OF 5			
CKD BY: DHB							

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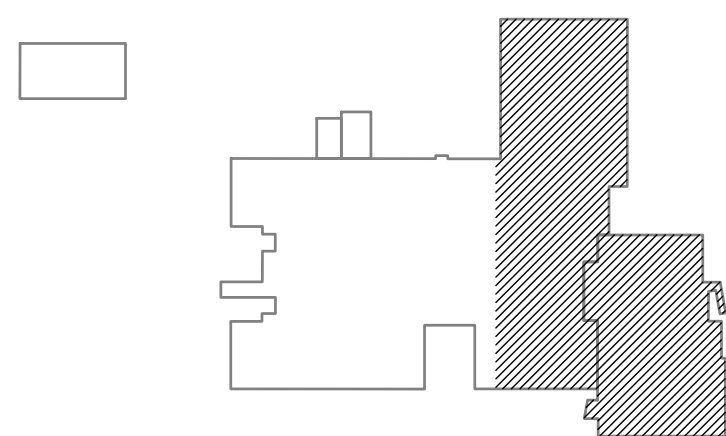
- SEE DRAWING M-001 FOR NOTES, ABBREVIATIONS, AND LEGENDS.

DEMOLITION KEYED NOTES:

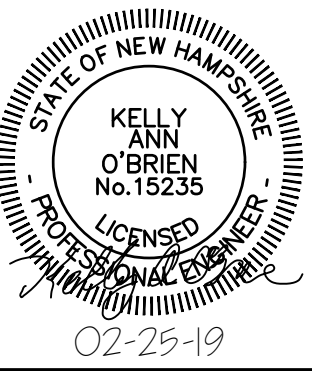
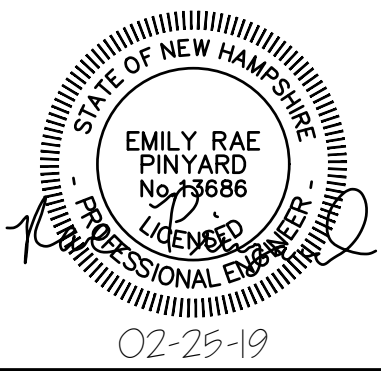
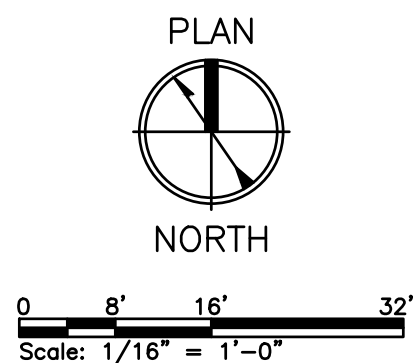
- REMOVE JACE-4 AND ASSOCIATED POWER SUPPLY. DISCONNECT BACNET MS/TP WIRING.
- EXISTING TRANE TRACER VRF CONTROL PANEL TO REMAIN.
- DISCONNECT 120V CIRCUIT FROM JACE-4. WIRING TO REMAIN FOR RE-USE. PROTECT DURING CONSTRUCTION.

KEYED NOTES:

- PROVIDE JACE-4 NETWORK CONTROL PANEL IN SAME LOCATION AS EXISTING. PROVIDE SECURE, LOCKABLE CABINET TO HOUSE JACE-4.
- CONNECT JACE-4 TO EXISTING CIRCUIT. RE-USE EXISTING WIRING AND CIRCUIT.



KEY PLAN
SCALE: NTS



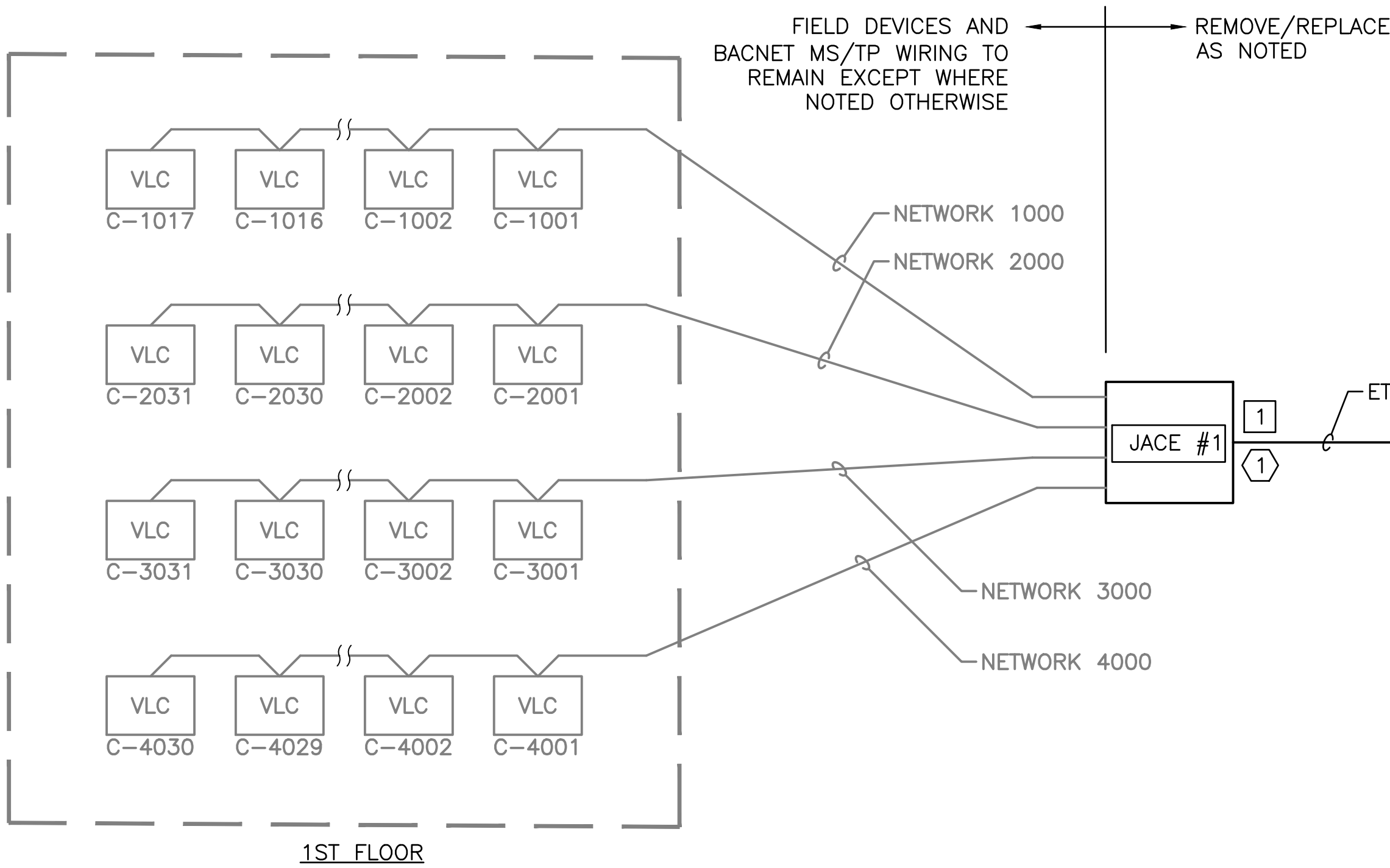
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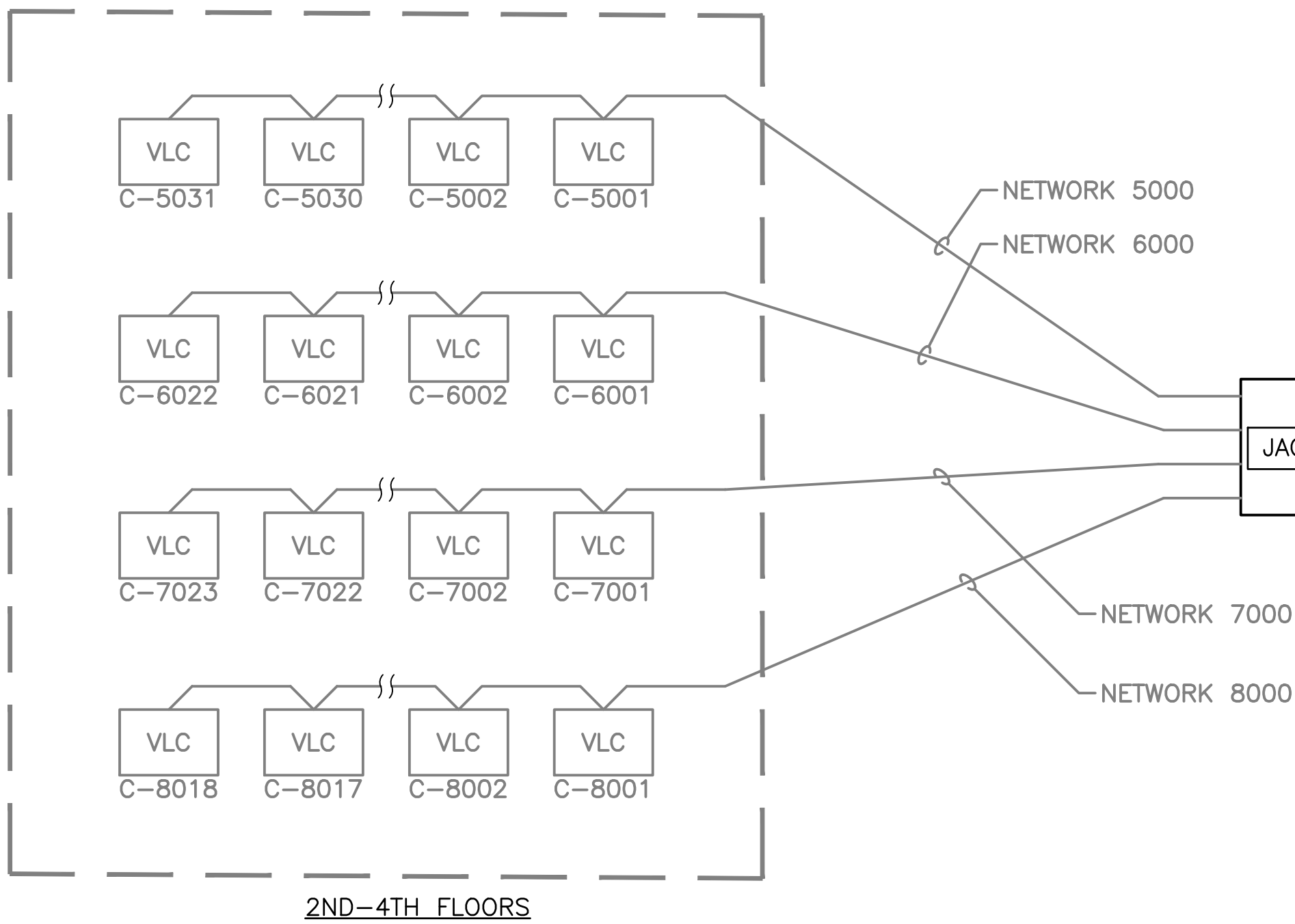
GREAT BAY COMMUNITY COLLEGE PORTSMOUTH, NH		GREAT BAY COMMUNITY COLLEGE REPLACE BUILDING AUTOMATION SYSTEM	
PROJECT NO. 372.003.001		DRAWING NO. M-102	
SHEET 4 OF 5			

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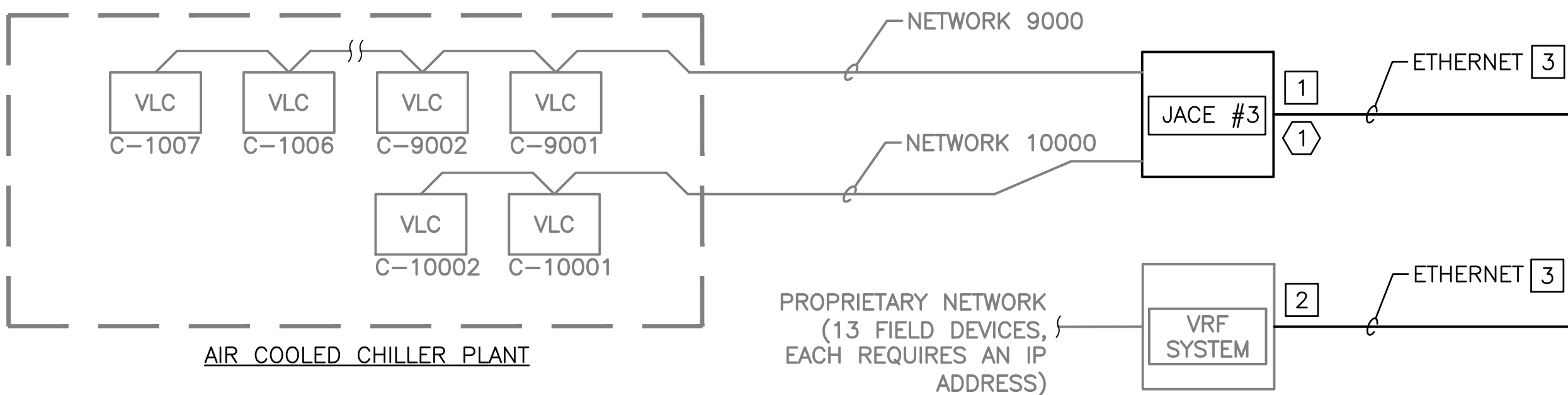
EXISTING JACE-1
HAS APPROX 109
FIELD CONTROLLERS
AS SHOWN



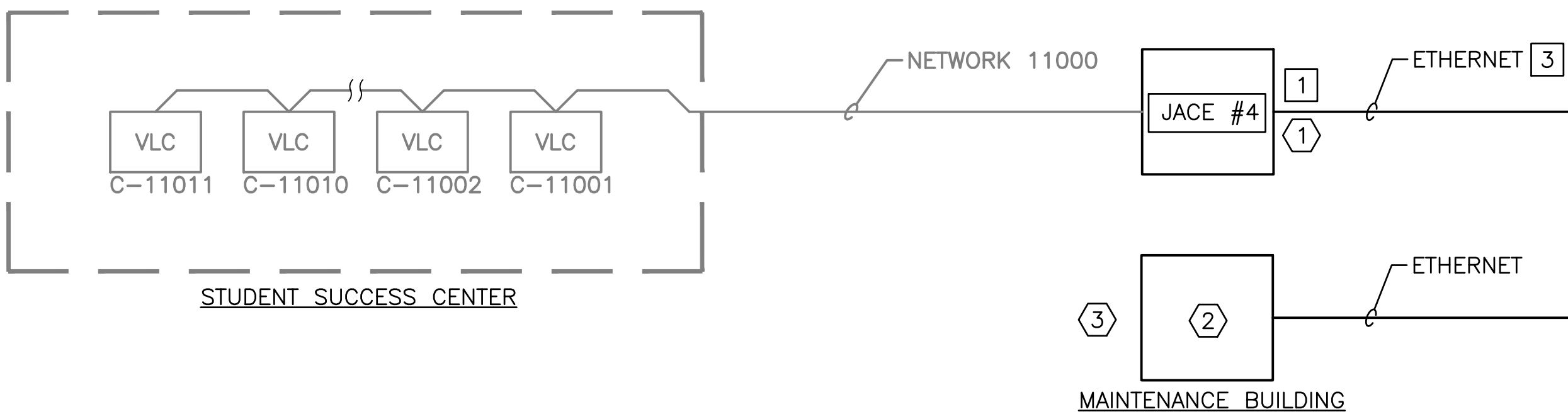
EXISTING JACE-2
HAS APPROX 94
FIELD CONTROLLERS
AS SHOWN



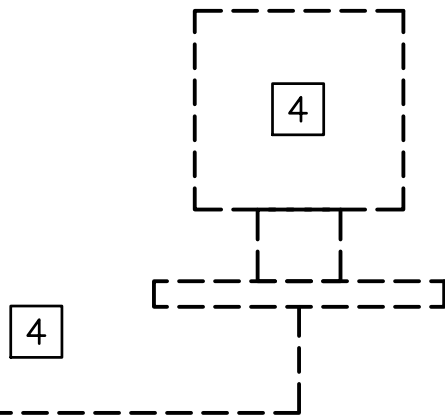
EXISTING JACE-3
HAS APPROX 9
FIELD CONTROLLERS
AS SHOWN



EXISTING JACE-4
HAS APPROX 11
FIELD CONTROLLERS
AS SHOWN



OPERATOR WORKSTATION



NOTES:

- SEE DRAWING M-001 FOR NOTES, ABBREVIATIONS, AND LEGENDS.
- REFER TO DDC SPECIFICATION SECTION 230923.
- MAIN BUILDING FIELD CONTROLLERS (EXISTING TO REMAIN) ARE MANUFACTURED BY ALERTON AND UTILIZE BACNET MS/TP PROTOCOL. MODIFICATIONS TO POINTS AND SEQUENCES OF OPERATION EXISTING ON THESE FIELD CONTROLLERS ARE NOT PART OF THIS CONTRACT AS A MANUFACTURER-SPECIFIC PROGRAMMING TOOL IS REQUIRED.
- TRANE TRACER VRF PANEL USES A PROPRIETARY PROTOCOL FOR FIELD DEVICES. MODIFICATIONS TO POINTS AND SEQUENCES ON THESE CONTROLLERS IS NOT PART OF THIS CONTRACT.
- ETHERNET WIRING AND NETWORK SWITCHES TO BE PROVIDED BY OWNER.
- COORDINATE WITH OWNER ON ALL IP ADDRESSES REQUIRED FOR THIS PROJECT.

DEMOLITION KEYED NOTES:

- REMOVE JACE AND DISCONNECT BACNET MS/TP WIRING.
- TRANE VRF CONTROL PANEL TO REMAIN. TIE INTO NEW BAS. OWNER TO PROVIDE NEW LAN CONNECTION AS NEEDED.
- DISCONNECT EXISTING DDC CONTROLLERS FROM LAN AND CONNECT NEW DDC CONTROLLERS (BY OWNER).
- REMOVE EXISTING BAS OPERATOR WORKSTATION AND LAN CONNECTION (BY OWNER).

KEYED NOTES:

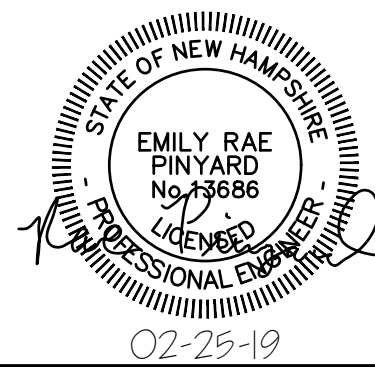
- PROVIDE JACE AND BACNET MS/TP NETWORK CONNECTIONS.
- PROVIDE DDC CONTROLLER WITH BACNET IP PROTOCOL IN THE MAINTENANCE BUILDING TO PERMIT BAS CONNECTION WITHOUT A NETWORK CONTROL PANEL (JACE).
- MAINTENANCE BUILDING HVAC SYSTEMS INCLUDE A GAS-FIRED FURNACE WITH SPLIT DX COOLING, TWO GARAGE EXHAUST FANS TIED TO A CO DETECTOR, A RESTROOM EXHAUST FAN, AND THREE GAS-FIRED UNIT HEATERS. THE EXISTING LOCAL CONTROLS SHALL REMAIN. PROVIDE DEVICES TO MONITOR THE STATUS OF HVAC-RELATED MOTORS (QTY: 9, TO BE FIELD VERIFIED), SPACE TEMPERATURE IN THE GARAGE, MACHINE SHOP, AND OFFICE, AND CO DETECTOR STATUS. PROVIDE TEMPERATURE SENSORS AND NEW CO DETECTOR AS NEEDED TO ENABLE SUPERVISION BY THE BAS.

FIELD DEVICE MODIFICATIONS (NOT IN CONTRACT, BY OTHERS):

- THE SCOPE DESCRIBED BELOW IS NOT PART OF THIS CONTRACT AND WILL BE PERFORMED BY A CONTRACTOR THAT IS CAPABLE OF MODIFYING ALERTON CONTROLLERS AS PART OF A SEPARATE CONTRACT.
- THE COMPLETION OF THIS PROJECT SHALL RESULT IN AN INTEGRATED, FULLY FUNCTIONAL BUILDING AUTOMATION SYSTEM FOR THE GBCC CAMPUS, OPERATING FROM A SINGLE PLATFORM.
- CONTROLS CONTRACTOR SHALL FIELD TEST EVERY DDC I/O POINT TO VERIFY FUNCTIONALITY OF DEVICES AND SEQUENCES OF OPERATION AND IDENTIFY ANY DEFICIENCIES. ALLOWANCES FOR ANTICIPATED FIELD DEVICE MODIFICATIONS ARE DESCRIBED BELOW. ALL NEW DEVICES SHALL BE IN-KIND REPLACEMENTS OF EXISTING DEVICES, UNLESS THE EXISTING DEVICES DO NOT PERMIT BAS CONNECTION. IN THAT EVENT, THE CONTRACTOR SHALL PROVIDE AN APPROPRIATE DEVICE AND SUBMIT A CUTSHEET TO THE OWNER AND ENGINEER FOR APPROVAL AS PART THE CONTROLS SUBMITTAL. CONTRACTOR SHALL KEEP RECORD OF ACTUAL QUANTITIES UTILIZED AND PROVIDE A CREDIT TO THE OWNER FOR ANY DEVICES THAT WERE NOT REQUIRED:
 - REPLACE CHILLED WATER VENTURI FLOW METERS (ONE 6", ONE 8")
 - REPLACE HOT WATER VENTURI FLOW METERS (ONE 2-1/2", TWO 3")
 - REPLACE CONTROL VALVE ACTUATORS (ALLOWANCE - 10)
 - REPLACE DAMPER ACTUATORS AND LIMIT SWITCHES (ALLOWANCE - 5)
 - REPLACE RELATIVE HUMIDITY SENSORS (QUANTITY - 7)
 - REPLACE OUTDOOR AIR TEMPERATURE AND RELATIVE HUMIDITY SENSORS
 - REPLACE MISCELLANEOUS SENSORS AND DEVICES (QUANTITY - 15)
 - REPLACE BOILER ROOM CO DETECTOR
 - REPLACE REFRIGERANT LEAK DETECTOR AND CONNECT TO BAS (EXISTING DETECTOR IS NOT CONNECTED). COORDINATE WITH TYPE OF REFRIGERANT USED IN THE INDOOR WATER-COOLED CHILLER.
 - CONNECT FIVE EXHAUST FANS IN MAIN BUILDING TO BAS (EF-13, 14, 19, 22, 23) THAT ARE NOT CURRENTLY CONNECTED. PROVIDE CAPABILITY TO CONTROL AND MONITOR FAN STATUS.
 - VERIFY AND CORRECT SEQUENCE OF OPERATIONS AS NEEDED FOR THE FOLLOWING EQUIPMENT TO ENSURE PROPER OPERATION. REFER TO AS-BUILT DRAWINGS ON-SITE FOR INTENDED SEQUENCES OF OPERATIONS.
 - AHU-2, 5 (MAIN BUILDING)
 - HVAC-1, 2 (STUDENT SUCCESS CENTER)
 - VAV BOXES (MAIN BUILDING, ALLOWANCE - 10)
 - EXHAUST FAN EF-27 (MAIN BUILDING)



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REV	DESCRIPTION	PML DWN	ERP APP	02/25/19 DATE
0	ISSUED FOR BID			

GREAT BAY COMMUNITY COLLEGE PORTSMOUTH, NH			
GREAT BAY COMMUNITY COLLEGE REPLACE BUILDING AUTOMATION SYSTEM			
NETWORK ARCHITECTURE DIAGRAM			
PROJECT NO. 372.003.001	DRAWING NO. M-501	SHEET 5 OF 5	