STATE OF NEW HAMPSHIRE
DEPARTMENT OF MILITARY AFFAIRS AND VETERANS SERVICES

BUSINESS ADMINISTRATION
STATE MILITARY RESERVATION
4 PEMBROKE ROAD
CONCORD, NEW HAMPSHIRE 03301-5652

David J. Mikolaities, Major General
The Adjutant General

Nicole Desilets-Bixler
Deputy Adjutant General

Phone: 603-225-1360
TDD Access: 1-800-735-2964

October 9, 2026

Her Excellency Governor Kelly A. Ayotte
and the Honorable Executive Council
State House
Concord, New Hampshire 03301

REQUESTED ACTION

1. Authorize the Department of Military Affairs and Veterans Services to enter into a contract with Turnstone Corporation (VC#169530), Milford, New Hampshire, in the amount of $837,630.00 for the State Military Reservation Building 1 Alterations Project in Concord, New Hampshire upon Governor and Executive Council approval through May 31, 2027. **75% Federal Funds and 25% State Funds.**

2. Further, authorize a contingency in the amount of $60,000.00 for unanticipated expenses bringing the contract total to $897,630.00 effective upon Governor and Council approval through May 31, 2027. **75% Federal Funds and 25% State Funds.**

Funds are available in the following account for Fiscal Year 2027, with the authority to adjust encumbrances between fiscal years within the price limitation through the Budget Office, if needed and justified.

	FY 2027
030-012-44950000-034-500161-Statewide Building Improvement	$897,630.00

EXPLANATION

This project addresses deficiencies identified during a retro-commissioning study of the HVAC systems in Building 1 at the State Military Reservation. The project includes upgrading the obsolete and failing building management system (BMS), repairing or replacing failed HVAC components and sensors, and replacing two nonfunctional rooftop energy recovery units. These improvements are necessary to restore reliable heating and cooling, improve energy efficiency, and reduce ongoing maintenance costs and the risk of future system failures.

The Department of Military Affairs and Veteran Services solicited for these construction services by placing a Request for Bid (RFB) on the State of New Hampshire Bureau of Purchase and Property website on July 30, 2026. Two (2) vendors submitted qualified bids. Turnstone Corporation was the lowest cost and were awarded this contract contingent upon Governor and Council approval.

Funds to support the required Army National Guard Facilities Renovation are provided by the Federal Government and administered under an existing Federal-State Agreement. Under the Agreement, the State of New Hampshire - Department of Military Affairs and Veterans Services provides these services and the Federal Government reimburses the State for the costs related to the services at the rate of 75%. In the event that Federal Funds are not available for this contract, General Funds will not be used.

The Department of Military Affairs and Veterans services has determined that the vendor is in good standing with the Secretary of State's Office, has secured the required levels of insurance, and has provided evidence of authority to execute and be bound by the contract.

This contract has been approved for form, substance, and execution by the New Hampshire Department of Justice.

Respectfully submitted,

David J. Mikolaities
Major General, NH National Guard
The Adjutant General

RFB-DMAVS-2027-03

Name of RFB: NHARNG – State Military Reservation – Building 1 Alterations

Number of Responses to RFB: Two (2)

Contractor	Bid Amount	ALT #1	ALT #2	ALT #3	ALT #4	Rank
Turnstone Corporation	$411,700.00	$216,230.00	$217,050.00	$217,050.00	$51,830.00	A
KJ Fisher & Sons LLC	$735,982.00	$93,981.00	$108,556.00	$108,556.00	52,131.00	B

Contract Awarded to: Turnstone Corporation

9/14/24

STATE OF NEW HAMPSHIRE
DEPARTMENT OF MILITARY AFFAIRS AND VETERANS SERVICES
BID FORM

BID POSTING
Date: 07/30/2026
Time: 3:00 PM EST
Subject: RFB-DMAVS-2027-03

BID CLOSING
Date: 09/02/2026
Time: 12:00 PM EST

Location Address: State Military Reservation, 1 Minuteman Way, Concord, NH 03301

CONTRACT PRICE
Numerical Bid $ 351,000.00

Verbal Bid Three Hundred Fifty One Thousand Dollars

Allowance for Unforeseen Conditions and Owner Initiated Changes $ *60,000.00*
Sixty Thousand Dollars

TOTAL BID AMOUNT
Numerical Bid $ 411,700.00

Verbal Bid Four Hundred Eleven Thousand Seven Hundred Dollars

ALTERNATES 1, 2, & 3
BASE BID: EXISTING ERV-1, ERV-2, & ERV-3 AND THEIR CONTROLS WILL REMAIN IN PLACE.

ALTERNATE 1: ADD COST TO REPLACE ERV-1 AND ITS CONTROLS IN THE SAME LOCATION.
Numerical Bid $ 216,230.00

Verbal Bid Two Hundred Sixteen Thousand Two Hundred Thirty Dollars

ALTERNATE 2: ADD COST TO REPLACE ERV-2 AND ITS CONTROLS IN THE SAME LOCATION.
Numerical Bid $ 217,050.00

Verbal Bid Two Hundred Seventeen Thousand Fifty Dollars

ALTERNATE 3: ADD COST TO REPLACE ERV-3 AND ITS CONTROLS IN THE SAME LOCATION.
Numerical Bid $ 217,050.00

Verbal Bid Two Hundred Seventeen Thousand Fifty Dollars

Initials
Date 9/2/26

ALTERNATE 4
BASE BID: THE EXISTING CONTROLS FOR EXISTING TERMINAL DEVICES (CUH's, UH's, FTR's, HP-1 THROUGH HP-4, , HEAT EXCHANGERS, AND PUMPS LOCATED IN BUILDING 1 ROOM 167) NOT INCLUDED IN THE PRIMARY SCOPE, WILL REMAIN IN PLACE. THE NEW NETWORK WILL BE WIRED TO MAINTAIN EXISTING CONTROLS.

ALTERNATE 4: ADD COST TO REPLACE THE CONTROLS FOR THE EXISTING TERMINAL DEVICES (CUH's, UH's, FTR's, HP-1 THROUGH HP-4, HEAT EXCHANGERS AND PUMPS LOCATED IN BUILDING 1 ROOM 167) NOT INCLUDED IN THE PRIMARY SCOPE AND WIRE TO THE NEW NETWORK.

Numerical Bid $ 51,830.00

Verbal Bid Fifty One Thousand Eight Hundred Thirty Dollars

VENDOR CONTACT INFORMATION:
Please provide contact information below for a person knowledgeable of and who can answer questions regarding this bid response.

Jeff Comeau	603-249-9300	603-249-9300
Contact Person	Local Telephone Number	Toll Free Telephone Number

JComeau@TurnstoneCorp.com	www.turnstonecorp.com
E-mail Address	Company Website

Vendor Company Name: Turnstone Corporation

Vendor Address: 17 Armory Road, Milford, NH 03055

Initials

Date 9/2/26

Notice: This agreement and all of its attachments shall become public upon submission to Governor and Executive Council for approval. Any information that is private, confidential or proprietary must be clearly identified to the agency and agreed to in writing prior to signing the contract.

AGREEMENT

The State of New Hampshire and the Contractor hereby mutually agree as follows:

GENERAL PROVISIONS

1. IDENTIFICATION.

1.1 State Agency Name Department of Military Affairs and Veteran Services		1.2 State Agency Address 1 Minuteman Way, Concord, NH 03301	
1.3 Contractor Name Turnstone Corporation (VC#:169530)		1.4 Contractor Address 17 Armory Road Milford, NH 03055	
1.5 Contractor Phone Number (603)249-9300	1.6 Account Unit and Class 010-012-44950000-34-500161	1.7 Completion Date 5/31/2027	1.8 Price Limitation Not to Exceed $897,630.00
1.9 Contracting Officer for State Agency Quinton Hawkins		1.10 State Agency Telephone Number (603) 225-1358	
1.11 Contractor Signature Date: September 14, 2026		1.12 Name and Title of Contractor Signatory Stacy J. Clark, President	
1.13 State Agency Signature Date: 10/19/26		1.14 Name and Title of State Agency Signatory Quinton Hawkins Admin Bureau	
1.15 Approval by the N.H. Department of Administration, Division of Personnel *(if applicable)* By:		Director, On:	
1.16 Approval by the Attorney General (Form, Substance and Execution) *(if applicable)* By: J.D. Lavallee		On: 10/20/2026	
1.17 Approval by the Governor and Executive Council *(if applicable)* G&C Item number:		G&C Meeting Date:	

Contractor Initials SJC
Date 9/14/26

2. SERVICES TO BE PERFORMED. The State of New Hampshire, acting through the agency identified in block 1.1 ("State"), engages contractor identified in block 1.3 ("Contractor") to perform, and the Contractor shall perform, the work or sale of goods, or both, identified and more particularly described in the attached EXHIBIT B which is incorporated herein by reference ("Services").

3. EFFECTIVE DATE/COMPLETION OF SERVICES.

3.1 Notwithstanding any provision of this Agreement to the contrary, and subject to the approval of the Governor and Executive Council of the State of New Hampshire, if applicable, this Agreement, and all obligations of the parties hereunder, shall become effective on the date the Governor and Executive Council approve this Agreement, unless no such approval is required, in which case the Agreement shall become effective on the date the Agreement is signed by the State Agency as shown in block 1.13 ("Effective Date").

3.2 If the Contractor commences the Services prior to the Effective Date, all Services performed by the Contractor prior to the Effective Date shall be performed at the sole risk of the Contractor, and in the event that this Agreement does not become effective, the State shall have no liability to the Contractor, including without limitation, any obligation to pay the Contractor for any costs incurred or Services performed.

3.3 Contractor must complete all Services by the Completion Date specified in block 1.7.

4. CONDITIONAL NATURE OF AGREEMENT.

Notwithstanding any provision of this Agreement to the contrary, all obligations of the State hereunder, including, without limitation, the continuance of payments hereunder, are contingent upon the availability and continued appropriation of funds. In no event shall the State be liable for any payments hereunder in excess of such available appropriated funds. In the event of a reduction or termination of appropriated funds by any state or federal legislative or executive action that reduces, eliminates or otherwise modifies the appropriation or availability of funding for this Agreement and the Scope for Services provided in EXHIBIT B, in whole or in part, the State shall have the right to withhold payment until such funds become available, if ever, and shall have the right to reduce or terminate the Services under this Agreement immediately upon giving the Contractor notice of such reduction or termination. The State shall not be required to transfer funds from any other account or source to the Account identified in block 1.6 in the event funds in that Account are reduced or unavailable.

5. CONTRACT PRICE/PRICE LIMITATION/ PAYMENT.

5.1 The contract price, method of payment, and terms of payment are identified and more particularly described in EXHIBIT C which is incorporated herein by reference.

5.2 Notwithstanding any provision in this Agreement to the contrary, and notwithstanding unexpected circumstances, in no event shall the total of all payments authorized, or actually made hereunder, exceed the Price Limitation set forth in block 1.8. The payment by the State of the contract price shall be the only and the complete reimbursement to the Contractor for all expenses, of whatever nature incurred by the Contractor in the performance hereof, and shall be the only and the complete compensation to the Contractor for the Services.

5.3 The State reserves the right to offset from any amounts otherwise payable to the Contractor under this Agreement those liquidated amounts required or permitted by N.H. RSA 80:7 through RSA 80:7-c or any other provision of law.

5.4 The State's liability under this Agreement shall be limited to monetary damages not to exceed the total fees paid. The Contractor agrees that it has an adequate remedy at law for any breach of this Agreement by the State and hereby waives any right to specific performance or other equitable remedies against the State.

6. COMPLIANCE BY CONTRACTOR WITH LAWS AND REGULATIONS/EQUAL EMPLOYMENT OPPORTUNITY.

6.1 In connection with the performance of the Services, the Contractor shall comply with all applicable statutes, laws, regulations, and orders of federal, state, county or municipal authorities which impose any obligation or duty upon the Contractor, including, but not limited to, civil rights and equal employment opportunity laws and the Governor's order on Respect and Civility in the Workplace, Executive order 2020-01. In addition, if this Agreement is funded in any part by monies of the United States, the Contractor shall comply with all federal executive orders, rules, regulations and statutes, and with any rules, regulations and guidelines as the State or the United States issue to implement these regulations. The Contractor shall also comply with all applicable intellectual property laws.

6.2 During the term of this Agreement, the Contractor shall not discriminate against employees or applicants for employment because of age, sex, sexual orientation, race, color, marital status, physical or mental disability, religious creed, national origin, gender identity, or gender expression, and will take affirmative action to prevent such discrimination, unless exempt by state or federal law. The Contractor shall ensure any subcontractors comply with these nondiscrimination requirements.

6.3 No payments or transfers of value by Contractor or its representatives in connection with this Agreement have or shall be made which have the purpose or effect of public or commercial bribery, or acceptance of or acquiescence in extortion, kickbacks, or other unlawful or improper means of obtaining business.

6.4. The Contractor agrees to permit the State or United States access to any of the Contractor's books, records and accounts for the purpose of ascertaining compliance with this Agreement and all rules, regulations and orders pertaining to the covenants, terms and conditions of this Agreement.

7. PERSONNEL.

7.1 The Contractor shall at its own expense provide all personnel necessary to perform the Services. The Contractor warrants that all personnel engaged in the Services shall be qualified to perform the Services, and shall be properly licensed and otherwise authorized to do so under all applicable laws.

7.2 The Contracting Officer specified in block 1.9, or any successor, shall be the State's point of contact pertaining to this Agreement.

Contractor Initials
Date

8. EVENT OF DEFAULT/REMEDIES.

8.1 Any one or more of the following acts or omissions of the Contractor shall constitute an event of default hereunder ("Event of Default"):

8.1.1 failure to perform the Services satisfactorily or on schedule;

8.1.2 failure to submit any report required hereunder; and/or

8.1.3 failure to perform any other covenant, term or condition of this Agreement.

8.2 Upon the occurrence of any Event of Default, the State may take any one, or more, or all, of the following actions:

8.2.1 give the Contractor a written notice specifying the Event of Default and requiring it to be remedied within, in the absence of a greater or lesser specification of time, thirty (30) calendar days from the date of the notice; and if the Event of Default is not timely cured, terminate this Agreement, effective two (2) calendar days after giving the Contractor notice of termination;

8.2.2 give the Contractor a written notice specifying the Event of Default and suspending all payments to be made under this Agreement and ordering that the portion of the contract price which would otherwise accrue to the Contractor during the period from the date of such notice until such time as the State determines that the Contractor has cured the Event of Default shall never be paid to the Contractor;

8.2.3 give the Contractor a written notice specifying the Event of Default and set off against any other obligations the State may owe to the Contractor any damages the State suffers by reason of any Event of Default; and/or

8.2.4 give the Contractor a written notice specifying the Event of Default, treat the Agreement as breached, terminate the Agreement and pursue any of its remedies at law or in equity, or both.

9. TERMINATION.

9.1 Notwithstanding paragraph 8, the State may, at its sole discretion, terminate the Agreement for any reason, in whole or in part, by thirty (30) calendar days written notice to the Contractor that the State is exercising its option to terminate the Agreement.

9.2 In the event of an early termination of this Agreement for any reason other than the completion of the Services, the Contractor shall, at the State's discretion, deliver to the Contracting Officer, not later than fifteen (15) calendar days after the date of termination, a report ("Termination Report") describing in detail all Services performed, and the contract price earned, to and including the date of termination. In addition, at the State's discretion, the Contractor shall, within fifteen (15) calendar days of notice of early termination, develop and submit to the State a transition plan for Services under the Agreement.

10. PROPERTY OWNERSHIP/DISCLOSURE.

10.1 As used in this Agreement, the word "Property" shall mean all data, information and things developed or obtained during the performance of, or acquired or developed by reason of, this Agreement, including, but not limited to, all studies, reports, files, formulae, surveys, maps, charts, sound recordings, video recordings, pictorial reproductions, drawings, analyses, graphic representations, computer programs, computer printouts, notes, letters, memoranda, papers, and documents, all whether finished or unfinished.

10.2 All data and any Property which has been received from the State, or purchased with funds provided for that purpose under this Agreement, shall be the property of the State, and shall be returned to the State upon demand or upon termination of this Agreement for any reason.

10.3 Disclosure of data, information and other records shall be governed by N.H. RSA chapter 91-A and/or other applicable law. Disclosure requires prior written approval of the State.

11. CONTRACTOR'S RELATION TO THE STATE. In the performance of this Agreement the Contractor is in all respects an independent contractor, and is neither an agent nor an employee of the State. Neither the Contractor nor any of its officers, employees, agents or members shall have authority to bind the State or receive any benefits, workers' compensation or other emoluments provided by the State to its employees.

12. ASSIGNMENT/DELEGATION/SUBCONTRACTS.

12.1 Contractor shall provide the State written notice at least fifteen (15) calendar days before any proposed assignment, delegation, or other transfer of any interest in this Agreement. No such assignment, delegation, or other transfer shall be effective without the written consent of the State.

12.2 For purposes of paragraph 12, a Change of Control shall constitute assignment. "Change of Control" means (a) merger, consolidation, or a transaction or series of related transactions in which a third party, together with its affiliates, becomes the direct or indirect owner of fifty percent (50%) or more of the voting shares or similar equity interests, or combined voting power of the Contractor, or (b) the sale of all or substantially all of the assets of the Contractor.

12.3 None of the Services shall be subcontracted by the Contractor without prior written notice and consent of the State.

12.4 The State is entitled to copies of all subcontracts and assignment agreements and shall not be bound by any provisions contained in a subcontract or an assignment agreement to which it is not a party.

13. INDEMNIFICATION. The Contractor shall indemnify, defend, and hold harmless the State, its officers, and employees from and against all actions, claims, damages, demands, judgments, fines, liabilities, losses, and other expenses, including, without limitation, reasonable attorneys' fees, arising out of or relating to this Agreement directly or indirectly arising from death, personal injury, property damage, intellectual property infringement, or other claims asserted against the State, its officers, or employees caused by the acts or omissions of negligence, reckless or willful misconduct, or fraud by the Contractor, its employees, agents, or subcontractors. The State shall not be liable for any costs incurred by the Contractor arising under this paragraph 13. Notwithstanding the foregoing, nothing herein contained shall be deemed to constitute a waiver of the State's sovereign immunity, which immunity is hereby reserved to the State. This covenant in paragraph 13 shall survive the termination of this Agreement.

Contractor Initials

Date 9/14/20

14. INSURANCE.

14.1 The Contractor shall, at its sole expense, obtain and continuously maintain in force, and shall require any subcontractor or assignee to obtain and maintain in force, the following insurance:

14.1.1 commercial general liability insurance against all claims of bodily injury, death or property damage, in amounts of not less than $1,000,000 per occurrence and $2,000,000 aggregate or excess; and

14.1.2 special cause of loss coverage form covering all Property subject to subparagraph 10.2 herein, in an amount not less than 80% of the whole replacement value of the Property.

14.2 The policies described in subparagraph 14.1 herein shall be on policy forms and endorsements approved for use in the State of New Hampshire by the N.H. Department of Insurance, and issued by insurers licensed in the State of New Hampshire.

14.3 The Contractor shall furnish to the Contracting Officer identified in block 1.9, or any successor, a certificate(s) of insurance for all insurance required under this Agreement. At the request of the Contracting Officer, or any successor, the Contractor shall provide certificate(s) of insurance for all renewal(s) of insurance required under this Agreement. The certificate(s) of insurance and any renewals thereof shall be attached and are incorporated herein by reference.

15. WORKERS' COMPENSATION.

15.1 By signing this agreement, the Contractor agrees, certifies and warrants that the Contractor is in compliance with or exempt from, the requirements of N.H. RSA chapter 281-A *("Workers' Compensation")*.

15.2 To the extent the Contractor is subject to the requirements of N.H. RSA chapter 281-A, Contractor shall maintain, and require any subcontractor or assignee to secure and maintain, payment of Workers' Compensation in connection with activities which the person proposes to undertake pursuant to this Agreement. The Contractor shall furnish the Contracting Officer identified in block 1.9, or any successor, proof of Workers' Compensation in the manner described in N.H. RSA chapter 281-A and any applicable renewal(s) thereof, which shall be attached and are incorporated herein by reference. The State shall not be responsible for payment of any Workers' Compensation premiums or for any other claim or benefit for Contractor, or any subcontractor or employee of Contractor, which might arise under applicable State of New Hampshire Workers' Compensation laws in connection with the performance of the Services under this Agreement.

16. WAIVER OF BREACH. A State's failure to enforce its rights with respect to any single or continuing breach of this Agreement shall not act as a waiver of the right of the State to later enforce any such rights or to enforce any other or any subsequent breach.

17. NOTICE. Any notice by a party hereto to the other party shall be deemed to have been duly delivered or given at the time of mailing by certified mail, postage prepaid, in a United States Post Office addressed to the parties at the addresses given in blocks 1.2 and 1.4, herein.

18. AMENDMENT. This Agreement may be amended, waived or discharged only by an instrument in writing signed by the parties hereto and only after approval of such amendment, waiver or discharge by the Governor and Executive Council of the State of New Hampshire unless no such approval is required under the circumstances pursuant to State law, rule or policy.

19. CHOICE OF LAW AND FORUM.

19.1 This Agreement shall be governed, interpreted and construed in accordance with the laws of the State of New Hampshire except where the Federal supremacy clause requires otherwise. The wording used in this Agreement is the wording chosen by the parties to express their mutual intent, and no rule of construction shall be applied against or in favor of any party.

19.2 Any actions arising out of this Agreement, including the breach or alleged breach thereof, may not be submitted to binding arbitration, but must, instead, be brought and maintained in the Merrimack County Superior Court of New Hampshire which shall have exclusive jurisdiction thereof.

20. CONFLICTING TERMS. In the event of a conflict between the terms of this P-37 form (as modified in EXHIBIT A) and any other portion of this Agreement including any attachments thereto, the terms of the P-37 (as modified in EXHIBIT A) shall control.

21. THIRD PARTIES. This Agreement is being entered into for the sole benefit of the parties hereto, and nothing herein, express or implied, is intended to or will confer any legal or equitable right, benefit, or remedy of any nature upon any other person.

22. HEADINGS. The headings throughout the Agreement are for reference purposes only, and the words contained therein shall in no way be held to explain, modify, amplify or aid in the interpretation, construction or meaning of the provisions of this Agreement.

23. SPECIAL PROVISIONS. Additional or modifying provisions set forth in the attached EXHIBIT A are incorporated herein by reference.

24. FURTHER ASSURANCES. The Contractor, along with its agents and affiliates, shall, at its own cost and expense, execute any additional documents and take such further actions as may be reasonably required to carry out the provisions of this Agreement and give effect to the transactions contemplated hereby.

25. SEVERABILITY. In the event any of the provisions of this Agreement are held by a court of competent jurisdiction to be contrary to any state or federal law, the remaining provisions of this Agreement will remain in full force and effect.

26. ENTIRE AGREEMENT. This Agreement, which may be executed in a number of counterparts, each of which shall be deemed an original, constitutes the entire agreement and understanding between the parties, and supersedes all prior agreements and understandings with respect to the subject matter hereof.

Contractor Initials
Date 9/14/20

STATE OF NEW HAMPSHIRE

DEPARTMENT OF MILITARY AFFAIRS & VETERANS SERVICES
NEW HAMPSHIRE ARMY NATIONAL GUARD

NHARNG SMR - Building 1 Alterations
RFB-DMAVS-2027-03

EXHIBIT A
SPECIAL PROVISIONS

9/14/26

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Initials
Date 1/14/26

SECTION 1 – SPECIAL PROVISIONS

1. OVERVIEW

The following special provisions modify, change, delete or add to the General Provisions of the form P-37 agreement. Where any part of the General Provisions is modified or voided by these Special Provisions, the unaltered provisions for that part shall remain in effect.

A. The term "Contracting Officer" as used in this agreement shall mean the State's Contracting Officer as is specified at item #1.9 of the General Provisions of this agreement or his/her authorized representative. No individual shall be an authorized representative of the Contracting Officer unless he or she is so appointed in writing by the Contracting Officer, in which case such written appointment shall be provided to the Contractor.

B. The Contractor shall be responsible for correcting, at his own cost and expense, defective work, or damaged property when defects and damage are caused by the Contractor's employees, equipment, or supplies, or sub-contractors employed as a part of this agreement. The Contracting Officer may withhold all or part of payments due to the Contractor until defective work or damaged property caused by the Contractor, his employees, equipment, or supplies, or sub-contractors employed as a part of this agreement is placed in satisfactory condition.

C. **General Provisions** are amended as follows:

   a. **Provision 14. INSURANCE:** ***Add*** the following sub-sub-part:
   "14.1.3 Insurance against all claims arising from the Contractor's use of automobiles in the conduct of this agreement, in amounts of not less than $250,000.00 per person bodily injury liability, $500,000.00 per occurrence bodily injury liability and $50,000.00 property damage liability."

D. ***Add*** the following as Special Provisions to the extent not inconsistent with the express terms of this Agreement:

2. CONTRACT SECURITY

The Contractor shall within ten (10) days after the receipt of the Notice of Award furnish the Owner with a performance bond and a payment bond in penal sums equal to the amount of the Contract price conditioned upon the performance by the Contractor of all undertakings, covenants, terms, conditions and agreements of the Contract Documents, and upon the prompt payment by the Contractor to all persons supplying labor and materials in the prosecution of the Work provided by the Contract Documents. Such Bonds shall be executed by the Contractor and a corporate bonding company licensed to transact business in the State in which the Work is to be performed and named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Treasury Department Circular Number 570. The expense of these Bonds shall be borne by the Contractor.

Initials _____
Date 9/14/26

3. ACCESS TO RECORDS

The contractor shall grant access to any books, documents, papers, and records that are directly pertinent to this contract, to enable and support audits, examinations, excerpts, and transcriptions to the following entities and their duly authorized representatives:

A. The State of New Hampshire
B. The Federal Awarding Agency to include the Inspector General
C. The Comptroller General of the United States

4. RECORDS RETENTION

Between the Effective Date and three (3) years after the Completion Date, as often as the State, DMAVS, or Federal Government shall demand, the Contractor shall make available for audit purposes, all records that pertain to this Agreement. Upon demand the contractor shall provide copies of such documents which may include but are not limited to invoices, payrolls, records of personnel, and other information relating to all matters covered in this agreement.

5. NONDISCRIMINATION

The contractor covenants and agrees that no person shall be subject to discrimination or denied benefits in connection with the contractor's performance under this agreement. Accordingly, and to the extent applicable, the contractor covenants and agrees to comply with the following national policies prohibiting discrimination:

A. On the basis of race, color or national origin, in Title VI of the Civil Rights Act of 1964 (42 U.S.C. Section 2000d et seq.), as implemented by DoD regulations at 32 CFR part 195.
B. On the basis of race, color or national origin, in Executive Order 11246 as implemented by Department of Labor regulations at 41 CFR part 60.
C. On the basis of sex or blindness, in Title IX of the Education Amendments of 1972 (20 U.S.C. 1681, et seq.), as implemented by DoD regulations at 32 CFR part 196.
D. On the basis of age, in The Age Discrimination Act of 1975 (42 U.S.C. Section 6101 et seq.), as implemented by Department of Health and Human Services regulations at 45 CFR part 90.
E. On the basis of handicap, in Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. 794), as implemented by Department of Justice regulations at 28 CFR part 41 and DoD regulations at 32 CFR part 56.

6. WAGE RATE REQUIREMENTS *(Construction, Alteration, or Repair Contracts)*

For any contract in excess of $2,000.00 for the construction, alteration, or repair (including painting and decorating) of public buildings or public works, the contractor covenants and agrees to comply with the Davis-Bacon and Related Acts. The contractor further covenants and agrees to ensure compliance with the Davis-Bacon and Related Acts for any subcontract award under this contract. Under Davis-Bacon and Related Acts, contractors and subcontractors must pay their laborers and mechanics employed under the contract no less than the locally prevailing wages and fringe benefits for corresponding work on similar projects in the area.

Initials
Date 9/14/20

7. **LOBBYING** *(Non-Profit Organization Contracts)*

For any contract exceeding $100,000.00, the contractor covenants and agrees to submit to the Department of Military Affairs and Veterans Services the certification and any disclosure forms regarding lobbying that are required under 31 U.S.C. 1352, as implemented by the DoD (NGB) at 32 CFR part 28.

A. Nonprofit organizations described in section 501(c)(4) of title 26, United States Code (the Internal Revenue Code of 1968) may not engage in lobbying activities as defined in the Lobbying Disclosure Act of 1995 (2 U.S.C., chapter 26). If DMAVS determines that the nonprofit has engaged in lobbying activities, all payments under this and other contracts with the Department shall cease and the contract(s) shall be terminated unilaterally for material failure to comply with the provisions as outlined in this agreement.

8. DRUG FREE WORKPLACE

The Contractor covenants and agrees to comply with the requirements regarding drug-free workplace in of 32 CFR Part 26, which implements section 5151-5160 of the Drug-Free Workplace act of 1988 (Public Law 100-690, Title V, Subtitle D; 41 U.S.C. 701, et seq.).

9. ENVIRONMENTAL PROTECTION

The Contractor covenants and agrees that its performance under this Agreement shall comply with:

A. The requirements of Section 114 of the Clean Air Act (42 U.S.C. Section 7414);
B. Section 308 of the Federal Water Pollution Control Act (33 U.S.C. Section 1318), that relates generally to inspection, monitoring, entry reports, and information, and with all regulations and guidelines issued there under;
C. The Resources Conservation and Recovery Act (RCRA);
D. The Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA);
E. The National Environmental Policy Act (NEPA);
F. The Solid Waste Disposal Act
G. The applicable provisions of the Clean Air Act (42 U.S.C. 7401, et seq.) and Clean Water Act (33 U.S.C. 1251, et seq.), as implemented by Executive Order 11738 and Environmental Protection Agency (EPA) rules at 40 CFR part 31;
H. To identify any impact this award may have on the quality of the human environment and provide help as needed to comply with the National Environmental Policy Act (NEPA, at 42 U.S.C. 4321, et seq.) and any applicable federal, state, or local environmental regulation.

In accordance with the EPA rules, the parties further agree that the Contractor shall also identify to the Department any impact this award may have on:

A. The quality of the human environment and provide help the agency may need to comply with the National Environmental Policy Act (NEPA, at 42 U.S.C 4321, et seq.) and to prepare Environment Impact Statements or other required environmental documentation.

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a. In such cases, the recipient agrees to take no action that will have an adverse environmental impact (e.g., physical disturbance of a site such as breaking of ground) until the agency provides written notification of compliance with the environmental impact analysis process.

B. Flood-prone areas and provide help the agency may need to comply with the National Flood Insurance Act of 1968 and Flood Disaster Protection Act of 1973 (42 U.S.C. 4001, et seq.), which require flood insurance, when available, for federally assisted construction or acquisition in flood-prone areas.

C. Coastal zones and provide help the agency may need to comply with the Coastal Zone Management Act of 1972 (16 U.S.C. 1451, et seq.), concerning protection of U.S. coastal resources.

D. Coastal barriers and provide help the agency may need to comply with the Coastal Barriers Resource Act (16 U.S.C. 3501 et seq.), concerning preservation of barrier resources.

E. Any existing or proposed component of the National Wild and Scenic Rivers System and provide help the agency may need to comply with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271 et seq.).

F. Underground sources of drinking water in areas that have an aquifer that is the sole or principal drinking water source and provide help the agency may need to comply with the Safe Drinking Water Act (42 U.S.C 300H-3).

10. PURCHASE OF RECOVERED MATERIALS BY STATES OR POLITICAL SUBDIVISIONS OF STATES *(Construction, Alteration, or Repair Contracts)*

If, for the execution of this contract, the Contractor purchases items designated in Environmental Protection Agency (EPA) regulations in 40 CFR part 247, Subpart B, the contractor covenants and agrees to comply with applicable requirements within those EPA regulations, which implement section 6002 of the Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. 6962).

11. FLY AMERICA REQUIREMENTS

The contractor covenants and agrees to comply with the International Air Transportation Fair Competitive Practices Act of 1974 (49 U.S.C. 40118, also known as the "Fly America" act), as implemented at 41 CFR 301-10.131 through 301-10.143 which provides that U.S. Government-financed international air travel of passengers and transportation of personal effects or property must use a U.S. Flag air carrier or be performed under a cost-sharing arrangement with a U.S. carrier if such service is available.

A. The contractor shall include the requirements of the Fly America Act in all subcontracts that might involve international air transportation.

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12. USE OF UNITED STATES FLAG CARRIERS *(Construction, Alteration, or Repair Contracts)*

The contractor covenants and agrees to comply with the Department of Transportation regulations at 46 CFR 381.7(b) requiring at least 50 percent of equipment, materials, or commodities purchased or otherwise obtained with federal funds under cooperative agreement awards, and transported by ocean vessel, be transported on privately owned U.S. flag commercial vessels, if available.

13. DEBARMENT AND SUSPENSION

Non-federal entities and contractors are subject to the non-procurement debarment and suspension regulations implementing Executive Orders 12549 and 12698, 2 CFR part 180. These regulations restrict awards, sub awards, and contracts with certain parties that are debarred, suspended, or otherwise excluded for or ineligible for participation in Federal assistance programs or activities. The State complies with the DOD implementation of 2 CFR part 180 (at 2 CFR Part 1125) by checking the Excluded Parties List System (EPLS) at www.sam.gov to verify contractor eligibility to receive contracts and subcontracts resulting from the Federal Agreement which funds this contract. The state shall not solicit offers from, nor award contracts to contractors listed in EPLS. This verification shall be documented in the State and subrecipient contract files and shall be subject to audit by the grantor and Federal/State audit agencies.

14. INFRASTRUCTUIRE INVESTMENT AND JOBS ACT ("IIJA")

The DMAVS covenants and agrees that it will not expend any funds appropriated by Congress unless all of the iron, steel, manufactured products, and construction materials used in projects undertaken for the Department are produced in the United States. Grants and Cooperative Agreements Policy Letter, 22-06, Initial Implementation Guidance on Application of Buy America Preference in Federal Financial Assistance Programs for Infrastructure. The Contractor covenants and agrees to utilize American made iron, steel, manufactured products, and construction materials for the completion of the work under this agreement. The Contractor further agrees to notify the Contracting Officer in the event that American materials are not available.

15. UNIFORM RELOCATION ASSISTANCE AND REAL PRPERTY ACQUISITION POLICIES

The DMAVS covenants and agrees that it will comply with CFR 49 part 24, which implements the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. Section 4601 et seq.) and provides for fair and equitable treatment of persons displaced by federally assisted programs or persons whose property is acquired as a result of such programs.

16. COPELAND "ANTI-KICKBACK" ACT *(Construction, Alteration, or Repair Contracts)*

The contractor covenants and agrees that it will comply with the Copeland "Anti-Kickback" Act (18 U.S.C. Section 874) as supplemented in Department of Labor regulations (29 CFR Part 3). As

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applied to this agreement, the Copeland "Anti-Kickback" Act makes it unlawful to induce, by force, intimidation, threat of procuring dismissal from employment, or otherwise, any person employed in the construction or repair of public buildings or public works, financed in whole or in part by the United States, to give up any part of the compensation to which that person is entitled under a contract of employment.

17. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

For contracts in an among greater than $100,000.00 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act that involve the employment of mechanics or laborers and is not a type of contract excepted under 40 U.S.C. 3701, the contractor covenants and agrees that it will comply with the clauses specified in the Department of Labor (DoL) regulations at 29 CFR 5.5(b) to require use of wage standards that comply with the Contract Work Hours and Safety Standards Act (40 CFR, Subtitle II, Part A, Chapter 37), as implemented by the DoL at 29 CFR part 5, "Labor Standards Provisions Applicable to Contracts Governing Federally Financed and Assisted Construction". As applied to this contract, the Contract Work Hours and Safety Standards Act specifies that no laborer or mechanic doing any part of the work contemplated by this agreement shall be required or permitted to work more than 40 hours in any workweek unless paid for all additional hours at not less than 1.5 times the basic rate of pay.

18. NATIONAL DEFENSE AUTHORIZATION ACT (NDAA)

(for Fiscal Year (FY) 2019 (Public Law 115-232))

The contractor covenants and agrees that it will not use "covered telecommunications equipment or services," as that term is defined in Section 889 of the NDAA for FY 2019, as a substantial or essential component of any system or as critical technology as part of any system involved in the contractor's performance of this contract. The contractor further covenants and agrees that it will not subcontract any part of its performance under this contract to any entity that uses such covered telecommunications equipment or services as a substantial or essential component of any system or as critical technology as part of any system.

19. PROHIBITION ON CERTAIN INTERNAL CONFIDENTIALITY AGREEMENTS

The contractor agrees and covenants that it will not require its employees, contractors, or subrecipients seeking to report fraud, waste, or abuse to sign or comply with internal confidentiality agreements or statements prohibiting or otherwise restricting them from lawfully reporting that waste, fraud, or abuse to a designated investigative or law enforcement representative of a federal department or agency authorized to receive such information.

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STATE OF NEW HAMPSHIRE

DEPARTMENT OF MILITARY AFFAIRS & VETERANS SERVICES NEW HAMPSHIRE ARMY NATIONAL GUARD

NHARNG SMR - Building 1 Alterations
RFB-DMAVS-2027-03

EXHIBIT B
SCOPE OF SERVICES



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SECTION 1 – SCOPE OF SERVICES

1. GENERAL CONDITIONS

A. This Agreement consists of the following documents: Form P-37 and Exhibits A, B, C, D, and Attachments 6, 7, & 8 which are all incorporated herein by reference as if fully set forth herein.

B. The Exhibit B: Scope of Services shall include all the information and requirements about the project that are derived herein as well as the Project Manual (Attachment 6), the authorized construction drawings/documents and clarification sketches (Attachment 7) as well as any addendums.

C. The project consists of modifying and upgrading the HVAC system and associated controls. The project will include the Discipline(s) of: Demolition of existing systems, Mechanical, Plumbing, Electrical and some Architectural finishes.

a. Alternates 2, 3, & 4:

i. Alternate 2: Add cost to replace erv-2 and its controls in the same location.

ii. Alternate 3: Add cost to replace erv-3 and its controls in the same location.

iii. Alternate 4: Add cost to replace the controls for the existing terminal devices (cuh's, uh's, ftr's, hp-1 Through hp-4, heat exchangers and pumps located in building 1 room 167) not included in the primary scope and wire to the new network.

D. The Contractor will provide all labor, parts, materials, tools, equipment, supplies, transportation, vehicles, Personal Protective Equipment, and any other incidentals necessary to travel to the NHARNG State Military Reservation in Concord, NH, to perform the contract services specified herein.

E. For any unanticipated work required, a written proposal will be submitted to the agency primary contact for approval prior to work commencing.

2. CONTRACT TERM

This Agreement shall be effective upon Governor and Executive Council approval through May 31, 2027.

3. PRIMARY AND SECONDARY CONTACTS

The Contractor will report to and work in conjunction with a DMAVS/NHARNG Primary and Secondary Contact as designated by the Department. The initial Contacts will be:

Primary:
Ken Coombs
Architect/Project Manager
(603) 227-1466
kenneth.e.coombs5.nfg@army.mil

Secondary:
Ben Stevens
Design & Construction Branch Chief
(603) 724-1086
benjamin.m.stevens3.mil@army.mil

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The Department reserves the right to appoint an alternate Primary and Secondary Contact to assist in managing this contract.

SECTION 2 – PROJECT CONDITIONS

1. CONTRACT DOCUMENTS

A. The Contract Documents consist of the Contract Agreement, General Conditions, and Supplementary General Conditions, Drawings and Specifications, including all Addenda issued prior to execution of the Contract; Bonds where required; insurance certificates: and subsequently thereto, Change Orders issued in accordance with the General Conditions.

B. The Contract Documents shall be signed by the Department and the Contractor in as many original counterparts as may be mutually agreed. No Contract shall be considered as in effect until it has been fully executed by all of the parties thereto and the award concurred in by Governor and Council. If there is federal funding, it must also have the concurrence of the applicable Federal Agency having jurisdiction.

C. 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 of New Hampshire. No portion of this Contract shall be understood to waive the sovereign immunity of the State. This Contract shall not be amended, except as specified herein, except with the approval of the Governor and Council.

D. 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.

E. Should the Contract Documents disagree in themselves or with each other, the Contractor shall provide the better quality or greater quantity of work and or materials, unless specifically otherwise directed by written Addendum to the Contract.

F. 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.

G. 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.

H. 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 revision prior to the date of receiving Bids, except where otherwise indicated.

I. Where no explicit quality or standards for materials or workmanship is established for work, such work is to be of good quality for the intended use and consistent with the quality of the surrounding work and of the construction of the Project in general.

J. All manufactured articles, materials, and equipment shall be applied, installed, connected, erected, tested, cleaned, and conditioned in accordance with the manufacturer's written or

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printed directions and instructions, unless specifically indicated otherwise in the Contract Documents.

K. The Drawings are generally made to scale, but all working dimensions shall be taken from the figured dimensions or by actual measurements at the job. In case by scaling. Study and compare all the Drawings and verify all figures before laying out or constructing work. The Contractor shall be responsible for errors in his 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 Department.

L. The Mechanical, Fire Protection (sprinkler) and Electrical Drawings, when provided, are diagrammatic only, and are not intended to show the exact physical locations or configurations of work. Such work shall be installed to clear all obstructions, permit proper clearances by coordinating his work with other trades, and present an orderly appearance where exposed.

2. ACCESS TO THE WORK

A. The Contractor shall provide for access to the work for inspection by the Department and government officials having jurisdiction. The Consultant, Engineer, and officials of Local, State, and Federal Agencies in the case of such programs as they administer and their authorized representatives shall have access at all times to the work for inspection wherever it is in preparation or progress, and the Contractor shall provide proper facilities for such access and inspection.

3. CONTRACT ADMINISTRATION

A. The Department shall determine the amount, quality, and acceptability and fitness of all parts of the work, shall interpret the Contract Documents, and any Change Orders, and shall decide all other issues in connection with the work. The Department shall have the authority to approve or order changes in the work that alter the terms or conditions of the Contract. The Department shall confirm in writing any oral order, direction, requirements or determination.

B. When a Federal Agency participates in the cost of the work covered by this Contract, the work shall be under the observation and inspection of the Department, but subject to the inspection and approval of the proper officials of the Federal Agency.

4. ACCIDENT PROTECTION

A. 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 and any Subcontractors 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 his health of safety as determined by construction safety and health standards of the Occupational Safety and Health Administration, United States

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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 and are set forth in the Federal Register. 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.

5. HAZARDOUS MATERIALS

A. 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.

B. 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 Department notified. No further work shall be conducted in the area of the contaminated material until the site has been investigated and the Department has given approval to continue the work in the area. The Contractor shall fully cooperate with the Department and perform any remedial work as directed. Work shall continue in other areas of the Project unless otherwise directed.

C. 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 the Department so that a proper identification of the materials may be made and disposal procedures initiated as required.

D. Disposition of the hazardous material or toxic waste shall be made under the requirements and regulations of the Department of Environmental Services. Work required disposing of these materials and any remedial work shall be performed under a Supplemental Agreement or Contract item, if included in the Contract.

6. SUBCONTRACTS

A. Nothing contained in the Specifications or Drawings shall be construed as creating any contractual relationship between any Subcontractor and the Department. The Divisions or 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.

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B. The Contractor shall be as fully responsible to the Department for the acts and omissions of Subcontractors and of persons employed by them, as he is for the acts and omissions of persons directly employed by him.

C. The Contractor shall, without additional expense to the State, utilize the services of specialty Subcontractors, as required.

D. The Department will not normally undertake to settle any differences between the Contractor and his Subcontractors or between Subcontractors.

E. 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 as regards terminating any subcontract that the Department may exercise over the Contractor under any provisions of the Contract Documents.

F. Within fifteen (15) days after the award of the Contract, the Contractor shall submit a complete list of all of the Subcontractors setting forth in detail the work they will be responsible for. If a subcontractor is added during the construction process the Contractor will revise the list and resubmit to the Department.

7. RESPONSIBILITY OF CONTRACTOR TO ACT IN EMERGENCY

A. In case of any emergency that threatens loss or injury of property, and/or safety of life, the Contractor shall act, without previous instructions from the Department, as the situation may warrant. He shall notify the Department thereof immediately thereafter. Any compensation claimed by the Contractor together with substantiating documents in regard to expense, shall be submitted to the Department and the amount of compensation shall be determined by agreement.

8. SEPARATE CONTRACTS

A. The Department may award other Contracts in connection with the Project, the work under which will proceed simultaneously with the execution of this Contract. The Contractor shall coordinate operations with those of other Contractors.

9. MUTUAL RESPONSIBILITY OF CONTRACTORS

A. If the Contractor or any of his/her Subcontractors or employee's 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 State because of any loss so sustained, the Department shall notify the Contractor and/or their subcontractors, who shall indemnify and hold harmless the Department against any expenses or judgment arising there from.

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10. PAYMENTS TO CONTRACTOR

A. The Department will manifest payments to the Contractor each calendar month on the basis of duly certified and approved estimate 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.

B. At least ten (10) days before the end of the billing period, the Contractor shall submit to the Department an itemized Requisition for Payment, supported by such data substantiating the Contractor's right to payment as the Department may require. If payment is to be made on account of materials or equipment not incorporated in the work, but delivered and suitably stored at the site, such payment shall be conditional upon submission by the Contractor of bills of sale or such other procedure satisfactory to the Department to establish the State's title to such materials or equipment or otherwise protect the State's interest including applicable insurance.

C. Immediately upon receipt of the Department Approved Monthly Requisition for Payment, Contractor shall post same at the Contractor's Field Office or project site in a location where Subcontractors and Suppliers have clear access.

D. A five (5) percent retainage of the value of the work performed on each partial estimate will be deducted and retained by the Department until after completion of the entire Contract in an acceptable manner. The balance remaining after the specified percentage has been retained, less all previous payments, will be certified for payment on each partial estimate.

E. Within thirty (30) days after acceptance, the Department shall pay to the Contractor the amount of the Contract less all prior payments. All prior payments and estimates, including those relative to extra work, shall be subject to correction by this payment, which is throughout this Contract called the Final Payment.

F. 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 Department **may** release a portion of the retained amount.

G. 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 Department. 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

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of canceled checks for all such materials must be submitted to the Department 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 Department, 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 State to require the fulfillment of all the terms of the Contract.

H. Payment for Material Not on Hand:

a. The Department will not pay for products and or materials that have not been delivered and stored properly on the construction site.

I. 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 Department, 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.

J. Final Payment:

a. Application for Final Payment received from the Contractor will be processed for payment not less than 60 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 change 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.

K. 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 Department 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 warrantees provided by the Contractor with respect to this project.

11. LIMITATION OF CONSTRUCTION OPERATIONS

A. The normal working hours will be from 7:00 am until 3:30 pm M-F unless otherwise agreed in writing by the department.

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B. The contractor may be displaced at any time with no notice in the event of a military mission that takes priority over construction.
C. In the State of New Hampshire, legal holidays occur on:
    a. New Year's Day
    b. Washington's Birthday
    c. Memorial Day Fourth of July
    d. Labor Day
    e. Veterans' Day
    f. Thanksgiving Day and Day After
    g. Christmas Day

D. Whenever a holiday is observed on a Friday or a Monday. The Contractor shall be required to suspend work for three (3) calendar days.
E. No work shall be performed on Saturday, Sundays or legal holidays except in cases of emergency and upon permission of the Department.

12. CONTRACTOR'S TITLE TO MATERIALS

A. 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 he has good title to all materials and supplies for which he accepts partial payment. If any claim is made with respect to materials provided by the contactor, subcontractors, or Independent Contractors, the Contractor shall defend any such claim and shall pay any judgment or settlement thereon.

13. CHANGES IN WORK

A. The Department 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 this Contract and within the general scope thereof.
B. The order shall stipulate the mutual agreed upon lump sum price, which shall be added to or deducted from the Contract Price. The Contractor shall furnish an itemized breakdown of the prices used in computing the value of any change that might be ordered.
C. The compensation herein provided shall be accepted by the Contractor as payment in full, including superintendence, bond, overhead, and profit, for extra work performed on a force account basis. 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 Department.

14. PERMITS AND FEES

A. The selected Contractor is to obtain and pay for all construction licenses, permits, and

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fees as may be required by law for construction of State's facility, and 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.

15. PATENTS

A. The Contractor shall hold and save the Department 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 manufactured or used in the performance of the Contract, including its use, unless otherwise specifically stipulated in the Contract Documents.

16. ASSIGNMENTS

A. 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 Department and of all Sureties executing any Bonds on behalf of the Contractor if in connection with said Contract.

17. SUPERINTENDENCE BY CONTRACTOR

A. The Contractor shall employ a competent Foreman or Superintendent, satisfactory to the Department, on the work site **at all times** to supervise the work in progress, with authority to act for him. The Contractor shall not change superintendents without permission from the Department 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 Department 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 Department, the Contractor agrees to a stipulated penalty of up to $500.00 per day, in addition to any liquidated damages provided hereunder.

18. FAILURE TO COMPLETE WORK ON TIME

A. 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 Section C below will be deducted from any money due the Contractor. This deduction will be made. not

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as a penalty, but as fixed, agreed liquidated damages for inconvenience to the Department and for reimbursing the Department 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 Department for such deficiency.

B. If the Department 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 Department of any of its rights under the Contract. When the final acceptance has been duly made by the Department, any liquidated damage charges shall end.

C. The fixed, agreed, liquidated damages shall be assessed in accordance with the following schedule.

Original Contract Amount		Amount of Liquidated damages per day
From more than:	to and including:	
0	25,000	$200.00
25,000	50,000	$300.00
50,000	100,000	$400.00
100,000	500,000	$500.00

19. SUBSTANTIAL COMPLETION AND FINAL INSPECTION

A. When the Contractor believes the project is substantially complete, they shall submit an application for substantial completion to the Department. The Contractor shall submit to the Department a list of items of work to be completed or corrected, accompanied by a cost value of these items. The Department will also provide a "punch List" of items to be completed based on their interpretation of the required finished product. The failure to include any items on 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 Department which determines that the work is substantially complete, a certificate of Substantial Completion shall be issued which will establish the Date of Substantial Completion and state the responsibilities of the Department and the Contractor for such as security, maintenance, heat, utilities, damage to the work and insurance, any other pertinent issues and fix the time limit within which the Contractor shall complete the items listed herein. Warranties required by the Contract Documents shall commence on the Date of Substantial Completion unless otherwise provided in the Certificate of Substantial Completion.

B. If the Contractor fails to proceed to complete the items on the "punch list," then in addition to the corrective measures listed in the Certificate of Substantial Completion, the Department 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.

C. Upon written notice that the work is ready for final inspection and acceptance, the

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Department shall promptly make such inspection, and when they find the work acceptable under the Contract Documents and the Contract fully performed, the Contractor will be provided written notice to that effect. The Contractor shall provide all certificates and reports, as required, throughout the contract and shall coordinate their preparation and submission. Failure to submit such certificates and reports shall be considered default of contract.

20. TERMINATION OF CONTRACT WITH FAULT

A. If the Contractor:
   a. Fails to begin work under Contract within the time specified in the notice to proceed, or
   b. Fails to perform the work with sufficient workmen 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. Fails to pay subcontractors and material/product suppliers, or
   h. Makes an assignment for the benefit of creditors, or
   i. For any other causes whatsoever, fails to carry on the work in an acceptable manner.

B. The Department will give notice, in writing, to the Contractor and his Surety for such delay, neglect, and default for any item identified above.
   a. If the Contractor or Surety does not proceed in accordance with the Notice, then the Department will, upon the Contractor's failure to comply with such Notice, have full power and authority without violating the Contract, to take the prosecution of the work out of the hands of the Contractor. The Department may enter into an agreement for the completion of said Contract according to the terms and conditions thereof or use such other methods as in his opinion will be required for the completion of said Contract in an acceptable manner.
   b. All extra costs and charges incurred by the Department 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 Department, the amount of such excess.

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21. TERMINATION OF CONTRACT WITHOUT FAULT

A. Except in cases controlled by the preceding section, the Department, for any cause, including, but not limited to an order of any Federal authority or petition of the Contractor due to circumstances beyond his control may by written notice to the Contractor and the Surety terminate the Contract or any portion thereof subject to the Condition(s) i, ii, iii and iv provided below.

B. Notwithstanding anything to the contrary contained in these condition, it is understood and agreed by the parties hereto that all obligations of the Department 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 Department 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 State funds the Department 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 or (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 Department. 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 his responsibilities for the work completed nor shall it relieve his Surety of its obligations for and concerning any claims arising out of the work performed.

22. ASSIGNMENT PROVISION

A. The Contractor hereby agrees that it will assign to the Department 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 or contracts in restraint of trade which affect

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the price of goods or services obtained by the Department under this Contract, if so requested by the Department.

SECTION 3 – EXECUTION REQUIREMENTS

1. 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 the Department review.

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.

2. FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned. Clean new light fixtures free from dust, dirt and fingerprints.

D. Replace filters of operating equipment.

E. Clean debris from roofs, roof drains, downspouts, and drainage systems.

F. Clean site, sweep paved areas, rake landscaped surfaces.

G. Remove waste and surplus materials, rubbish, and construction facilities from site.

3. STARTING OF SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify the Department seven days prior to start-up of each item.

C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

G. Execute start-up under supervision of applicable manufacturer's representative and Contractors' personnel in accordance with manufacturer's instructions.

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H. Submit a written report stating that the equipment or system has been properly installed and is functioning correctly.

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 manufacturers.
F. Prohibit traffic from landscaped areas.

5. PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
    a. Drawings.
    b. Specifications.
    c. Addenda.
    d. Change Orders and other modifications to the Contract.
    e. Reviewed Shop Drawings, Product Data, approved submittals and Samples.
    f. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure data is complete and accurate, enabling future reference by the Department.
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:
    a. Manufacturer's name and product model and number.
    b. Product substitutions or alternates utilized.
    c. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
    a. Measured depths of' foundations in relation to finish floor datum.
    b. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

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c. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
d. Field changes of dimension and detail.
e. Details not on original Contract drawings.
f. Contractor to provide record drawings in AutoCad or Revit format compatible with current Department software as well as in PDF format.
g. Contractor to supply two (2) full size paper sets of record drawings to Department.

G. Submit documents to the Department prior to final payment and release of retainage.

6. OPERATION AND MAINTENANCE DATA

A. Submit data bound in 8·1/2 x 11 inch text pages, three D side ring binders with durable plastic covers. (2 complete copies of all materials required.)
B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
D. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
    a. Part I: Directory, listing names, addresses, and telephone numbers of Architect/Engineers), Contractor, Subcontractors, and major equipment suppliers.
    b. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
        i. Significant design criteria.
        ii. List of equipment.
        iii. Parts list for each component.
        iv. Operating instructions.
        v. Maintenance instructions equipment and systems.
        vi. Maintenance instructions for special finishes, including recommended cleaning methods, materials and schedules, and special precautions identifying detrimental agents.

    c. Part 3: Project documents and certificates, including the following as required:
        i. Shop drawings and product data.
        ii. Air and water balance reports.
        iii. Certificates.

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iv. Originals and Photocopies of warranties and bonds.

7. MANUAL FOR MATERIALS AND FINISHES

A. Submit one copy of preliminary draft or proposed formats and outlines of contents before start of Work. The Department 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 the Department, submit documents within ten days after acceptance.

C. Submit one copy of completed volumes prior to Substantial Completion. Draft copy be reviewed and returned with Architect/Engineer comments. Revise content of document sets as required prior to final submission.

D. Submit two sets of revised final volumes in final form prior to final inspection.

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.

8. MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Contract Administrator 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 the Department, submit documents within ten days after acceptance.

C. Submit one copy of completed volumes 15 days prior to Substantial Completion. Draft copy shall be reviewed and returned after Substantial Completion, with Architect/Engineer comments. Revise content of document sets as required prior to final submission.

D. Submit two sets of revised final volumes in final form prior to final inspection.

E. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.

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F. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed and/or by label machine.
G. Include color coded wiring diagrams as installed.
H. Operating Procedures: Include stall-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and special operating instructions.
I. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
J. Include servicing and lubrication schedule, and list of lubricants required.
K. Include manufacturer's printed operation and maintenance instructions.
L. Include sequence of operation by controls manufacturer.
M. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
N. Include control diagrams by controls manufacturer as installed.
O. Include Contractor's coordination drawings, with color coded piping diagrams as installed.
P. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
Q. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
R. Include test and balancing reports as specified in Section 01400.
S. Additional Requirements: As specified in individual product specification sections.
T. Include listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

9. SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.
B. Deliver to Project site and place in location as directed by State; obtain receipt prior to final payment.

10. 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.

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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:
    a. For equipment or component parts of equipment put into service during construction with State's permission, submit documents within ten days after acceptance.
    b. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.
    c. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing date or acceptance as beginning or warranty or bond period.

11. MAINTENANCE SERVICE

A. Furnish service and maintenance of components indicated in specification sections during warranty period.
B. Examine system components at frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.
D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of the Department.

12. 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 Department, 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 Department and at his own expense:
    a. Place in satisfactory condition in every particular, all such guaranteed work, correct all defects therein.
    b. Make good all damage to the building or site, or equipment or contents thereof; which in the opinion of the Department 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.
    c. Make good any work or material, or the equipment and contents of said building or site disturbed in fulfilling any such guarantee.

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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 Department 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 Department 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.

SECTION 4 – SUBMITTAL PROCEDURES

1. SUBMITTALS

A. Submittals shall be made for all materials to be used in construction of the project for review and acceptance of the Department PRIOR to installation of said materials.
B. The word "Submittals" shall include all products and materials that will become part of the finished product whether or not they are specified in the construction documents. This shall also include any shop drawings that need to be approved for any kind of layout of installation. (i.e.: Rebar, steel fabrication, etc...)
C. Shop drawings will be reviewed for the limited purpose of checking for conformance with information given and design concept expressed in the contract documents.
D. Contractor to indicate any special utility and/or electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances on shop drawings as applicable.
E. Transmit each submittal electronically via e-mail with a cover sheet and all pertinent information for review to the Department and the Department's Consultant simultaneously. Schedule submittals to expedite the Project.
F. Sequentially number transmittal forms and separate items logically. Mark revised submittals with original number and sequential alphabetic suffix.
G. Identify Project, Contractor, subcontractor and supplier; pertinent drawing and detail number, and specification section number, appropriate to submittal.
H. 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

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Contract Documents. Incomplete items or items submitted without the Contractor's signed stamp of approval thereon will be returned rejected.

I. For each submittal for review, allow 14 days excluding delivery time to and from Architect, Engineer and the Department and Contractor.
J. The Department and the Department's Consultant will review submittals and coordinate return of same to the Contractor.
K. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of completed Work.
L. Allow space on submittals for Contractor and Architect or Engineer review stamps.
M. When revised for resubmission, identify changes made since previous submission.
N. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.
O. Work shall not begin until submittal items have been approved and returned to General Contractor by the Department.
P. Contractor shall keep a binder on site of all approved submittals for review by the Department and their consultants at any time during construction.

2. CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial schedule at Preconstruction Meeting.
B. Submit revised Progress Schedules with each Application for Payment.
C. Distribute copies of revised 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 section of Work, identifying first work day of each week.

3. SAMPLES

A. 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 individual specification sections or as noted on plans:
    a. Submit to the Department for aesthetic, color, or finish selection.
    b. Submit samples of finishes from full range of manufacturers' standard colors, textures, and patterns for the Department and Architect/Engineer selection.
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; the Department will retain one sample and Architect or Engineer will retain one sample.

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F. Reviewed samples which may be used in the Work are indicated in individual specification sections.

4. TEST REPORTS

A. Submit for Department and Architect and Engineer's knowledge as required per plans or individual specification sections.

B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

5. CERTIFICATES

A. When specified in individual specification sections, submit certification by manufacturer, installation/application subcontractor, or Contractor, to the Department 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 Department.

6. 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 Department in quantities specified for Product Data.

B. Indicate special procedures, perimeter conditions requiring special attention and special environmental criteria required for application or installation.

7. CONSTRUCTION PHOTOGRAPHS

A. Provide photographs of site and construction throughout progress of Work.

B. Contractor will **NOT** take any photographs of military personnel or equipment.

C. Contractor will **NOT** use any project photographs for any reason other than stated in this section without prior written consent of the Department.

D. Each month submit photographs with Application for Payment.

E. Photographs: Submit digital images via email.

F. In addition to progress photos, contractor is to take four site photographs from differing directions and four interior photographs of each building area indicating relative progress of the work, five days maximum, prior to submitting.

G. Take photographs as evidence of existing project conditions.

H. Identify each image, identify name of Project, orientation of view, date and time of view.

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SECTION 5 – TEMPORARY FACILITIES AND CONTROLS

1. TEMPORARY ELECTRICITY

A. The Department will pay cost of energy used. Exercise measures to conserve energy.
B. Provide flexible power cords as required for portable construction tools and equipment.
C. Provide main service disconnect and over-current protection at convenient location.
D. Permanent convenience receptacles may be utilized during construction.

2. TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain lighting for construction operations.
B. Provide and maintain lighting to interior work areas after dark for security purposes.
C. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps for specified lighting levels.
D. Maintain lighting and provide routine repairs,
E. Permanent building lighting may be utilized during construction.

3. TEMPORARY HEATING

A. Existing building heating system may be used during construction. Exercise measures to conserve energy.

4. TEMPORARY COOLING

A. Existing building cooling system may be used during construction. Exercise measures to conserve energy.

5. TEMPORARY VENTILATION

A. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
B. Provide temporary fan units as required to maintain clean air for construction operations.

6. TELEPHONE SERVICE

A. Contractor may not use internal state/federal phone system.

7. WATER SERVICE

A. The Department will pay cost of temporary water used. Exercise measures to conserve energy. Utilize Department's existing water system, extend and supplement with temporary devices as needed to maintain specified conditions for construction operations.

8. TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Existing facility use is not permitted. Provide facilities at time of project mobilization.

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9. FIELD OFFICES AND SHEDS

A. If the contractor decides to have a field office the location shall be coordinated with the department prior to placement. There is limited space available in the construction area for storage or a field office.

B. Provide Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations with steps and landings at entrance doors. Maintain during progress of Work; remove at completion of Work.

C. Storage Areas And Sheds: Size to storage requirements fill products of individual Sections, allowing for access and orderly provision for maintenance and for inspection of products.

D. Maintenance and Cleaning: Maintain approach walks free of mud, water, and snow.

E. Removal: At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

10. PARKING

A. Contractor and subcontractors to park in department directed spaces only.

11. PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing spaces.

C. Broom and vacuum clean interior areas prior to start of surface finishing and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and rubbish from site weekly and dispose off-site.

E. Elevator may be used for removal of construction waste. Contractor is responsible for maintaining cleanliness of said elevator as it is the only one in the building.

12. BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas to allow for the Department's use of the site and facility, and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Protect non-owned vehicular traffic, stored materials, site and structures from damage.

13. ENCLOSURES AND FENCING

A. Interior Enclosures:

a. Provide temporary partitions and ceilings as indicated on Drawings to separate work areas from Department occupied areas, to prevent penetration of dust and moisture into Department occupied areas, and to prevent damage to existing materials and equipment.

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b. Construction: Framing with reinforced polyethylene and plywood sheet materials with closed joints and scaled edges at intersections with existing surfaces.

14. SECURITY

A. Security Program:
   a. Protect new Work and existing premises from theft, vandalism, and unauthorized entry.

B. Entry Control.
   a. Restrict entrance of persons and vehicles into Project site and existing facilities,
   b. Allow entrance only to authorized persons with proper identification.
   c. Maintain log of workers and visitors, make available to Department on request.
   d. Coordinate access of Department personnel to site in coordination with Department security forces.

C. Personnel Identification
   a. Maintain list of accredited persons, submit copy to Department on request.
   b. A driver's license or other acceptable positive identification will be required.

15. DUST CONTROL

A. Execute Work by methods to minimize raising dust from construction operations.
B. Provide positive means to prevent air-borne dust from dispersing into atmosphere.
C. After completion of work, clean all interior work surfaces.

16. POLLUTION CONTROL

A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.
B. Comply with pollution and environmental control requirements of authorities having jurisdiction.

17. RODENT CONTROL

A. Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

18. REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Final Application for Payment.
B. Clean and repair damage caused by installation or use of temporary work.
C. Restore existing facilities used during construction to original condition.

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SECTION 6 – TEMPORARY FACILITIES AND CONTROLS

1. REQUISITION FOR PAYMENT

A. Submit one copy of each application on the AIA Application and Certificate for Payment G702 and Continuation sheet G703 or another document/form that has been previously approved by the Department.

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 the General Conditions.

E. Submit with transmittal letter to the attention of the project Architect/Engineer for review and approval.

F. Substantiating Data: When the Department requires substantiating information, submit data justifying dollar amounts in question.

2. SCHEDULE OF VALUES

A. Submit printed schedule on AlA Form G703 - Continuation Sheet for G702 or approved equal. (See item 1.A above)

B. Submit Schedule of Values 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, insurance, general conditions, allowances etc.

D. Include a separate line item for closeout to include record drawings, owner's manuals and other pertinent information due to the Department.

E. 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.

F. Revise schedule to list approved Change Orders, with each Requisition or Payment.

3. UNIT PRICES

A. Authority: Measurement methods are delineated in individual specification sections.

B. Measurement methods delineated in individual specification sections complement criteria of this section. In event of conflict, requirements of individual specification section govern,

C. Take measurements and compute quantities. Architect/Unit Quantities: Quantities and measurements indicated in Bid Form are for contract purposes only. Quantities and measurements supplied or placed in the Work shall determine payment

   a. When actual Work requires more or fewer quantities than those quantities indicated, provide required quantities at unit sum/prices contracted.

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D. Payment Includes: Full compensation for required labor, products, tools, equipment, plant and facilities, transportation, services, and incidentals; erection, application or installation of item of the Work; overhead and profit,

E. Final payment for Work governed by unit prices will be made on basis of actual measurements and quantities accepted by Architect/Engineer multiplied by unit sum/price for Work incorporated in or made necessary by the Work.

F. Measurement of Quantities: Measurement by Weight: Concrete reinforcing steel, rolled or formed steel or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.

G. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.

H. Measurement by Area: Measured by square dimension using mean length and width or radius.

I. Linear Measurement: Measured by linear dimension, at item centerline or mean chord.

J. Stipulated Sum/Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as completed item or unit of the Work.

4. 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 Department 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 Department may issue a Proposal Request including a detailed description of proposed changes with supplementary or revised Drawings and specifications, with or without 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 Department, 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 Department. Submit the breakdown of the following items on a Department Change Order Form for review and approval by the Department:

   a. The Contractor shall include the following indirect costs for work performed by the General Contractor as part of the Contractors' price:

      i. Worker's Compensation and Employee Liability.

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ii. Unemployment and Social Security Taxes.

b. In addition to the above indirect costs the General Contractor shall be allowed the following markups:
   i. Twenty percent (20%). Said twenty percent (20%) shall be all inclusive for overhead, supervision, and profit for Work performed by the General Contractor.
   ii. Ten percent (10%) on that part of work performed by all Subcontractors.
c. On any change that involves a net credit to the State, no allowance for overhead, supervision and profit shall be figured.
d. Contractor shall provide back-up information for all change order pricing.
e. 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 Department may issue a directive instructing the Contractor to proceed with changes in the Work, for subsequent inclusion in a 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 Department will determine change allowable in Contract Sum/Price and Contract Time as provided in Contract Documents.
   a. 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.

I. 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, Status, and Approved Amounts. In addition, a current balance remaining shall be included. Change Orders will be processed per the following procedures:
   a. The Department reviews cost for Change in Work. If needed the Department will request additional items, back-up information, and request any possible changes or clarifications.
   b. Contractor can proceed with Change Order Work with direction from

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the Department.

c. Contractor shall not proceed with any work that will exceed the amount of Allowance remaining.
d. Fully signed and executed Change Order is issued by the Department to the Consultant and Contractor.

J. Correlation Of Contractor Submittals:
   a. 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.
   b. 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.
   c. Promptly enter changes in Project Record Documents.

5. DEFECT ASSESSMENT

A. Any work or materials found to be defective or not in compliance with the plans and specifications in the determination of the Department shall be handled in the following manner.
B. Replace the Work, or portions or the Work, not conforming to specified requirements.
C. If, in the opinion of the Department, it is not practical to remove and replace the Work, the Department will direct appropriate remedy or adjust payment.
D. The defective Work may remain, but unit sum/price will be adjusted to new sum/price at discretion of the Department.
E. Defective Work will be repaired to instructions of and acceptance by the Department and unit sum/price will be adjusted to new sum/price at discretion of the Department.
F. Authority of the Department to assess defects and identify payment adjustments, is final.
G. Non-Payment For Rejected Products: Payment will not be made for rejected products for any of the following:
   a. Products wasted or disposed of in a manner that is not acceptable.
   b. Products determined as unacceptable before or after placement.
   c. Products not completely unloaded from transporting vehicle.
   d. Products placed beyond lines and levels of required Work.
   e. Products remaining on hand after completion of the Work.
   f. Loading, hauling, and disposing of rejected products.

6. ALTERNATES

A. Alternates quoted on Proposal Forms will be reviewed and accepted or rejected at the Department's discretion. Accepted Alternates will be identified in the Department - Contractor Agreement.
B. Coordinate related work and modify surrounding work.

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7. ALLOWANCES

A. Allowances: If included in the Contract, a stipulated amount of funding for use only upon the Department's instruction. An allowance will make money available for modifications and/or additions to contract items due to owner initiated changes, unforeseen conditions, for unknown, latent or differing existing conditions, for testing of hazardous materials or for the removal of hazardous materials, asbestos, lead, mercury, sealant etc. that are encountered by construction

B. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from an Allowance. The cost of the bond for the amount of Allowance shall be included as part of the lump sum base bid.

C. Funds will be drawn from an Allowance only by Change Order. Contractor can proceed with Change Order Work against Allowance with direction from the Department. The Contractor shall not proceed with any work that will exceed the amount of Allowance remaining.

D. Notwithstanding the Contractor's objection, the Department may at any time reduce the funds remaining in the Allowance by Change Order.

E. At Final Payment of the Contract, funds remaining in the Allowance will be credited to the Department.

8. TESTING AND INSPECTION

A. Testing and Inspecting: Cost to engage testing and inspecting agency; execution of tests and inspecting; and reporting results are to be paid by the Contractor.

B. Testing as required by plan and specification shall be performed by an independent certified testing agency that may not be a subsidiary or employee of the Contractor.

C. Contractor shall make all testing information readily available to the Department for review before proceeding to the next phase of any such tested work.

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STATE OF NEW HAMPSHIRE

DEPARTMENT OF MILITARY AFFAIRS & VETERANS SERVICES
NEW HAMPSHIRE ARMY NATIONAL GUARD

NHARNG SMR - Building 1 Alterations
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EXHIBIT C
CONTRACT PRICE

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SECTION 1 – CONTRACT PRICE

The Department of Military Affairs and Veterans Services will pay the Contractor a maximum total of $897,630.00. This amount shall not be exceeded without issuance of an amendment to this agreement and approval by the Governor and Executive Council of the State of New Hampshire.

The undersigned, having carefully examined the specifications for the referenced services, hereby proposes to furnish all materials and to perform all work for the above-captioned project in strict accordance with said specifications for the following price amount.

Contract price:	$ 411,700.00
Allowance for unforeseen conditions and/or owner-initiated changes:	$ 60,000.00
Add Alt #2 - Replace ERV-2 and its controls in the same location:	$ 217,050.00
Add Alt #3 - Replace ERV-3 and its controls in the same location:	$ 217,050.00
Add Alt #4 - Replace the controls for the existing terminal devices:	$ 51,830.00
Total contract price:	**$ 897,630.00**

SECTION 2 – TERMS OF PAYMENT

A. The Department will manifest payments to the Contractor each calendar month on the basis of duly certified and approved estimate 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.

B. At least ten (10) days before the end of the billing period, the Contractor shall submit to the Department an itemized Requisition for Payment, supported by such data substantiating the Contractor's right to payment as the Department may require. If payment is to be made on account of materials or equipment not incorporated in the work, but delivered and suitably stored at the site, such payment shall be conditional upon submission by the Contractor of bills of sale or such other procedure satisfactory to the Department to establish the State's title to such materials or equipment or otherwise protect the State's interest including applicable insurance.

C. Immediately upon receipt of the Department Approved Monthly Requisition for Payment, the Contractor shall post same at the Contractor's Field Office or project site in a location where Subcontractors and Suppliers have clear access.

D. A 5% retainage of the value of the work performed on each partial estimate will be deducted and retained by the Department until after completion of the entire Contract in an acceptable manner. The balance remaining after the specified percentage has been retained,

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less all previous payments, will be certified for payment on each partial estimate.

E. 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 Department may release a portion of the retained amount.

F. 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% 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 Department. 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 $100,000.00 or 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 Department within forty-five (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 Department, 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 State to require the fulfillment of all the terms of the Contract.

G. Payment for Material not on hand:
    a. The Department will not pay for products and or materials that have not been delivered and stored properly on the construction site.

H. 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 Department 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.

I. Final Payment:
    a. Within thirty (30) days after acceptance, the Department shall pay to the Contractor the amount of the Contract less all prior payments. All prior payments and

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estimates, including those relative to extra work, shall be subject to correction by this payment, which is throughout this Contract called the Final Payment.

b. Application for Final Payment received from the Contractor will be processed for payment not less than 60 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 change 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.

J. 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 Department 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 warrantees provided by the Contractor with respect to this project.

Invoices will be submitted to:

Department of Military Affairs and Veterans Services
Attn: State Business Office
1 Minuteman Way, Bldg. 1
Concord, NH 03301-5652

SECTION 3 – METHOD OF PAYMENT

A. Payment shall be made by mailing a bank draft or electronic funds transfer as established by submitting or updating an Alternate W-9 Form to the State of New Hampshire.

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STATE OF NEW HAMPSHIRE

DEPARTMENT OF MILITARY AFFAIRS & VETERANS SERVICES
NEW HAMPSHIRE ARMY NATIONAL GUARD

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EXHIBIT D
ENVIRONMENTAL MANAGEMENT SYSTEM

9/14/26

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SECTION 1 – NOTICE FOR CONTRACTORS AND CONTRACTOR EMPLOYEES

1. OVERVIEW

The New Hampshire Army National Guard (NHARNG) has implemented an environmental Management System (eMS), in accordance with Executive Orders 13423 and 13514, to guide its operations in an environmentally sound manner. Under its eMS, the NHARNG has identified significant activities, products or services that can interact with the environment (known as aspects) and potential environmental impacts from its operations.

A. The significant environmental aspects are listed below:
   a. Energy Use
   b. Vehicle Travel (fleet) Between Workstations

B. These significant aspects and their associated impacts are closely monitored by the NHARNG. Further, the NHARNG is tracking the success of the implementation plans established to achieve the NHARNG's objectives. For the purposes of this notice, applicability is limited to those actions that the contractor or subsequent employees are likely to perform on NHARNG properties.

C. The primary purpose of this notice is to communicate the three basic tenets of the NHARNG's eMS policy:
   a. eMS (ISO 14001) is the management system the NHARNG uses to implement the Adjutant General's Environmental Policy.
   b. The eMS Environmental Policy commits the NHARNG to comply with environmental laws and regulations, to prevent pollution and to promote continual improvement of the eMS.
   c. Contractors are responsible for knowing the environmental impacts of their services and must understand the management requirements for any activities that could affect any of NHARNG's significant aspects, or that could result in potential environmental impacts.

2. ENERGY USE

The NHARNG is committed to reducing its consumption of energy. Reducing energy consumption may be realized by turning off electrical equipment when not in use, or reducing heating temperatures/increasing cooling temperatures, using alternative fuels (if available, such as E85 or biodiesel), etc. Contracts that include the use or installation of equipment will seek the most energy-efficient technology within the scope of the contract.

3. VEHICLE TRAVEL (FLEET) BETWEEN WORKSTATIONS

The NHARNG is committed to preventing pollution through monitoring of Federal GSA Fleet vehicle usage. Usage of fleet vehicles by contractors is prohibited.

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4. CONTACT INFORMATION

The Department of Military Affairs and Veterans Services Environmental Staff (603) 227-1439

5. RESOURCES PROVIDED UPON CONTRACTOR REQUEST

NHARNG Integrated Cultural Resources Management Plan (ICRMP)
NHNG Green Procurement Plan
Facility Specific Integrated Contingency Plans (ICPs); established for the State Military Reservation, Manchester RC / FMS, Army Aviation Support Facility (AASF)
NHARNG Hazardous Waste Management Plan

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SECTION 23 0923
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 DESCRIPTION

A. The B1 JFHQ and B2 CST are connected buildings, each served by existing DDC controls.

1. B1 has a mix of controls platforms from a history of upgrades, from a heat pump system to a VAV system. These multiple platforms will be updated by this project to, generally, convert all major HVAC equipment to new controllers and to a new communication network.
2. B1 has two existing building controllers (B-BC). Project intent is to replace these with a single JACE building controller. All existing LAN network protocols shall be maintained to continue serving remaining equipment not scheduled to receive new equipment or terminal unit AAC or ASC controllers.
3. B2 has an existing controller. Project intent is to replace this controller with a new B-BC (JACE) of the same specs as the B1 controller.
4. Front ends. Each building is currently served by their own workstations. Project intent is to set up the two new JACEs to communicate with a single workstation located in B1.

B. B1 existing DDC system has multiple communication protocols, with the main backbone a legacy JCI Metasys N2 network.

1. The majority of the N2 network controllers shall be migrated to the new MS/TP network. The remaining N2 equipment controllers, located on all floors, shall be re-connected to maintain communication to the new Jace.
2. All other network protocols serving existing equipment shall be maintained fully functional.

C. B2 existing DDC system is a JCI BACnet MS/TP network protocol.

1. Certain mechanical equipment currently reporting to the B2 Network Engine (such as B1 chillers, boilers & pumps located in remote equipment shed) are to be migrated from the B2 comm network onto the B1 network.
2. Certain mechanical equipment reporting to the B2 Network Engine (such as pumps and HX's located in the ground floor Mechanical room off the Drill Hall labelled Remote Heating/Cooling plant) are to be migrated from the B2 comm network onto the B1 network.
3. All other equipment and devices serving B1 shall be migrated to the B1 network.

D. Facility Operation – The buildings are both occupied and shall remain occupied during the work. All work and equipment outages shall be carefully coordinated and scheduled with the Owner to minimize the impact to occupants. Schedule work with a minimum of two weeks' notice to Owner.

E. General Contractor shall provide all Mech (Div. 23) & Elect (Div. 26 & 28) scope items including direct-digital control system(s) as indicated on the project documents, point list, interoperability tables, drawings and as described in these specifications. Include a complete and working direct-digital control system. Include all engineering, programming, configuration/setup hardware and

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software, controls and installation materials, installation labor, startup, training, final project documentation and warranty.

1. The direct-digital control system(s) shall consist of high-speed, peer-to-peer network of DDC controllers, a control system server, all configuration and setup software and hardware devices, and an Engineering Control Center (workstation). Provide a remote user using a standard HTML5 web browser to access the control system graphics and change adjustable setpoints with the proper password.
2. All new building controllers shall be native BACnet. All new BACnet workstations, controllers, devices and components shall be listed by BACnet Testing Laboratories. All new BACnet workstations, controllers, devices and components shall be accessible using a HTML5 Web browser interface. Browsers shall not require the use of an extension or add on software in order to access aforementioned workstations, controllers, devices, and components.
   a. If used, gateways shall be BTL listed.
   b. If used, gateways shall provide all object properties and read/write services shown on interoperability schedules.
3. The work administered by this Section of the technical specifications shall include all labor, materials, special tools, equipment, enclosures, power supplies, software, software licenses, Project specific software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, submittals, testing, verification, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, Warranty, specified services and any other items required for a complete and fully functional Controls System.
4. The control systems shall be designed such that each mechanical system shall operate under stand-alone mode. The contractor administered by this Section of the technical specifications shall provide controllers for each mechanical system. In the event of a network communication failure, or the loss of any other controller, the control system shall continue to operate independently. Failure of the ECC workstation shall have no effect on the field controllers, including those involved with global strategies.
5. The control system shall accommodate 1 Engineering Control Center(s) and the control system shall accommodate 5 web-based Users simultaneously, and the access to the system should be limited only by operator password and Owner-identified access requirements.

F. Some products are furnished but not installed by the contractor administered by this Section of the technical specifications. The contractor administered by this Section of the technical specifications shall formally coordinate in writing and receive from other contractors formal acknowledgements in writing prior to submission the installation of the products. These products include but are not limited to the following:

1. Control valves.

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2. Sensor wells and sockets in piping.
3. Terminal unit controllers.

G. Some products are not provided by, but are nevertheless integrated with the work executed by, the contractor administered by this Section of the technical specifications. These products include but are not limited to the following:

1. Fire alarm systems, duct smoke integration at a minimum. This interface shall require multiple existing relays, to be monitored.
2. Advanced utility metering systems. These systems may take information from the control system or its component meters and sensors.
3. Boiler and/or chiller controls. These controls, if not native BACnet, will require a BACnet Gateway.
4. Terminal units' velocity sensors
5. Unitary HVAC equipment (rooftop air conditioning units, split systems, packaged pumping stations) controls. These include:
   a. Discharge temperature control.
   b. Economizer control.
   c. Flowrate control.
   d. Setpoint reset.
   e. Time of day indexing.
   f. Status alarm.
6. Variable frequency drives. These controls, if not native BACnet, will require a BACnet Gateway.
7. The following systems have limited control (as individually noted below) from the ECC:
   a. Constant temperature rooms: temperature out of acceptable range and status alarms.
   b. Emergency generators: status alarms.
   c. Domestic water heating systems: low temperature, high temperature and status alarms.
   d. Building lighting systems: on/off and scene control.
   e. Sanitary sewage pumps: status alarm.

H. Responsibility Table:

Work/Item/System	Furnish	Install	Low Voltage Wiring	Line Power
Control system low voltage and communication wiring	23 09 23	23 09 23	23 09 23	N/A
Terminal units	23	23	N/A	26
Controllers for terminal units	23 09 23	23	23 09 23	16
LAN conduits and raceway	23 09 23	23 09 23	N/A	N/A

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Work/Item/System	Furnish	Install	Low Voltage Wiring	Line Power
Automatic dampers (not furnished with equipment)	23 09 23	23	N/A	N/A
Automatic damper actuators	23 09 23	23 09 23	23 09 23	23 09 23
Manual valves	23	23	N/A	N/A
Automatic valves	23 09 23	23	23 09 23	23 09 23
Pipe insertion devices and taps, flow and pressure stations.	23	23	N/A	N/A
Thermowells	23 09 23	23	N/A	N/A
Current Switches	23 09 23	23 09 23	23 09 23	N/A
Control Relays	23 09 23	23 09 23	23 09 23	N/A
Power distribution system monitoring interfaces	23 09 23	23 09 23	23 09 23	26
Interface with chiller/boiler controls	23 09 23	23 09 23	23 09 23	26
Chiller/boiler controls interface with control system	23	23	23 09 23	26
All control system nodes, equipment, housings, enclosures and panels.	23 09 23	23 09 23	23 09 23	26
Smoke detectors	28 (	28	28	28
Fire/Smoke Dampers	23	23	28	28
Smoke Dampers	23	23	28	28
Fire Dampers	23	23	N/A	N/A
Chiller/starter interlock wiring	N/A	N/A	26	26
Chiller Flow Switches	23	23	23	N/A
Boiler interlock wiring	23	23	23	26
Boiler Flow Switches	23	23	23	N/A
Water treatment system	23	23	23	26
VFDs	23	26	23 09 23	26
Fume hood controls	23 09 23	23 09 23	23 09 23	26
Computer Room A/C Unit field-mounted controls	23	23	26	26

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Work/Item/System	Furnish	Install	Low Voltage Wiring	Line Power
Control system interface with CRU A/C controls	23 09 23	23 09 23	23 09 23	26
CRU A/C unit controls interface with control system	23	23 09 23	23 09 23	26
Fire Alarm shutdown relay interlock wiring	28	28	28	26
Control system monitoring of fire alarm smoke control relay	28	28	23 09 23	28
Fan Coil Unit controls (not furnished with equipment)	23 09 23	23 09 23	23 09 23	26
Unit Heater controls (not furnished with equipment)	23 09 23	23 09 23	23 09 23	26
Packaged RTU space-mounted controls (not furnished with equipment)	23 09 23	23 09 23	23 09 23	26
Packaged RTU unit-mounted controls (not furnished with equipment)	23 09 23	23 09 23	23 09 23	26
Starters, HOA switches	23	23	N/A	26

I. This facility's existing direct-digital control (DDC) system is manufactured by Johnson Controls / Tridium, and its B-BC Building Controller (JACEs) are located in multiple locations between B1 & 2. The existing system utilizes multiple top-end protocols, including N2, LON, and FC Bus. The existing system's workstations (ECC or B-OWS) and controllers were installed and updated over several years. The contractor administered by this Section of the technical specifications shall observe the capabilities, existing I/O points, graphics features, communication network, services, spare capacity of the existing control system and its ECC prior to beginning work.

1. Remove existing direct-digital control system ECC, communications network serving only new controllers with existing communications network to remain for controllers to remain, and specific equipment controllers as noted in project documents. Replace with new BACnet ECC, network and controllers compliant with this Section of the technical specifications.

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Provide a programmable internetworking gateway allowing for real-time communication between the existing direct-digital control system and the new BACnet control system. Real-time communication shall provide all object properties and read/write services shown on interoperability schedules. The contractor administered by this Section of the technical specifications shall provide all necessary investigation and site-specific programming to execute the interoperability schedules.

a. The combined system shall operate and function as one complete system including one database of control point objects and global control logic capabilities. The upgraded ECC shall continue to communicate with the remaining direct-digital control system's devices. The upgraded ECC shall communicate directly with the new native-BACnet devices over the new and existing control system's communications network. Facility operators shall have complete operations and control capability over all systems, new and existing including; monitoring, trending, graphing, scheduling, alarm management, global point sharing, global strategy deployment, graphical operations interface and custom reporting as specified.

J. Unitary standalone systems including Unit Heaters, Cabinet Unit Heaters, Fan Coil Units, Base Board Heaters, thermal comfort ventilation fans, and similar units for control of room environment conditions may be equipped with integral controls furnished and installed by the equipment manufacturer or field mounted. Refer to equipment specifications and as indicated in project documents. Application of standalone unitary controls is limited to at least those systems wherein remote monitoring, alarm and startup are not necessary. Examples of such systems include:

1. Vestibule heater
2. Exterior stair heater

K. The direct-digital control system shall start and stop equipment, move (position) damper actuators and valve actuators, and vary speed of equipment to execute the mission of the control system. Use electricity as the motive force for all damper and valve actuators.

1.02 RELATED WORK

A. Section 23 72 00, Air-to-Air Energy Recovery Equipment.

1.03 DEFINITION

A. Algorithm: A logical procedure for solving a recurrent mathematical problem; A prescribed set of well-defined rules or processes for the solution of a problem in a finite number of steps.

B. Analog: A continuously varying signal value (e.g., temperature, current, velocity etc.

C. BACnet: A Data Communication Protocol for Building Automation and Control Networks -as defined by ANSI/ASHRAE Standard 135. This communications protocol allows diverse building automation devices to communicate data and services over a network.

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D. BACnet/IP: Annex J of Standard 135. It defines and allows for using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP sub-networks that share the same BACnet network number.

E. BACnet: Annex L of Standard 135. Defines standardized device profile list of controllers & devices. Includes B-BC, B-AAC, B-ASC, B-OWS, B-SA, B-SS among others.

F. BACnet Internetwork: Two or more BACnet networks connected with routers. The two networks may use different LAN technologies.

G. BACnet Network: One or more BACnet segments that have the same network address and are interconnected by bridges at the physical and data link layers.

H. BACnet Segment: One or more physical segments of BACnet devices on a BACnet network, connected at the physical layer by repeaters.

I. BACnet Broadcast Management Device (BBMD): A communications device which broadcasts BACnet messages to all BACnet/IP devices and other BBMDs connected to the same BACnet/IP network.

J. BACnet Interoperability Building Blocks (BIBBs): BACnet Interoperability Building Blocks (BIBBs) are collections of one or more BACnet services. These are prescribed in terms of an "A" and a "B" device. Both of these devices are nodes on a BACnet internetwork.

K. BACnet Testing Laboratories (BTL). The organization responsible for testing products for compliance with the BACnet standard, operated under the direction of BACnet International.

L. Baud: It is a signal change in a communication link. One signal change can represent one or more bits of information depending on type of transmission scheme. Simple peripheral communication is normally one bit per Baud. (e.g., Baud rate = 78,000 Baud/sec is 78,000 bits/sec, if one signal change = 1 bit).

M. Binary: A two-state system where a high signal level represents an "ON" condition and an "OFF" condition is represented by a low signal level.

N. BMP or bmp: Suffix, computerized image file, used after the period in a DOS-based computer file to show that the file is an image stored as a series of pixels.

O. Bus Topology: A network topology that physically interconnects workstations and network devices in parallel on a network segment.

P. Control Unit (CU): Generic term for any controlling unit, stand-alone, microprocessor based, digital controller residing on secondary LAN or Primary LAN, used for local controls or global controls

Q. Deadband: A temperature range over which no heating or cooling is supplied, i.e., 22-25 degrees C (72-77 degrees F), as opposed to a single point change over or overlap).

R. Device: a control system component that contains a BACnet Device Object and uses BACnet to communicate with other devices.

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S. Device Object: Every BACnet device requires one Device Object, whose properties represent the network visible properties of that device. Every Device Object requires a unique Object Identifier number on the BACnet internetwork. This number is often referred to as the device instance.

T. Device Profile: A specific group of services describing BACnet capabilities of a device, as defined in ASHRAE Standard 135, Annex L. Standard device profiles include BACnet Operator Workstations (B-OWS), BACnet Building Controllers (B-BC), BACnet Advanced Application Controllers (B-AAC), BACnet Application Specific Controllers (B-ASC), BACnet Smart Actuator (B-SA), and BACnet Smart Sensor (B-SS). Each device used in new construction is required to have a PICS statement listing which service and BIBBs are supported by the device.

U. Diagnostic Program: A software test program, which is used to detect and report system or peripheral malfunctions and failures. Generally, this system is performed at the initial startup of the system.

V. Direct Digital Control (DDC): Microprocessor based control including Analog/Digital conversion and program logic. A control loop or subsystem in which digital and analog information is received and processed by a microprocessor, and digital control signals are generated based on control algorithms and transmitted to field devices in order to achieve a set of predefined conditions.

W. Distributed Control System: A system in which the processing of system data is decentralized and control decisions can and are made at the subsystem level. System operational programs and information are provided to the remote subsystems and status is reported back to the Engineering Control Center. Upon the loss of communication with the Engineering Control center, the subsystems shall be capable of operating in a stand-alone mode using the last best available data.

X. Download: The electronic transfer of programs and data files from a central computer or operation workstation with secondary memory devices to remote computers in a network (distributed) system.

Y. DXF: An AutoCAD 2-D graphics file format. Many CAD systems import and export the DXF format for graphics interchange.

Z. Electrical Control: A control circuit that operates on line or low voltage and uses a mechanical means, such as a temperature sensitive bimetal or bellows, to perform control functions, such as actuating a switch or positioning a potentiometer.

AA. Electronic Control: A control circuit that operates on low voltage and uses a solid-state components to amplify input signals and perform control functions, such as operating a relay or providing an output signal to position an actuator.

BB. Engineering Control Center (ECC): The centralized control point for the intelligent control network. The ECC comprises of personal computer and connected devices to form a single workstation.

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CC. Ethernet: A trademark for a system for exchanging messages between computers on a local area network using coaxial, fiber optic, or twisted-pair cables.

DD. Firmware: Firmware is software programmed into read only memory (ROM) chips. Software may not be changed without physically altering the chip.

EE. Gateway: Communication hardware connecting two or more different protocols. It translates one protocol into equivalent concepts for the other protocol. In BACnet applications, a gateway has BACnet on one side and non-BACnet (usually proprietary) protocols on the other side.

FF. GIF: Abbreviation of Graphic interchange format.

GG. Graphic Program (GP): Program used to produce images of air handler systems, fans, chillers, pumps, and building spaces. These images can be animated and/or color-coded to indicate operation of the equipment.

HH. Graphic Sequence of Operation: It is a graphical representation of the sequence of operation, showing all inputs and output logical blocks.

II. I/O Unit: The section of a digital control system through which information is received and transmitted. I/O refers to analog input (AI, digital input (DI), analog output (AO) and digital output (DO). Analog signals are continuous and represent temperature, pressure, flow rate etc., whereas digital signals convert electronic signals to digital pulses (values), represent motor status, filter status, on-off equipment etc.

JJ. JPEG: A standardized image compression mechanism stands for Joint Photographic Experts Group, the original name of the committee that wrote the standard.

KK. Local Area Network (LAN): A communication bus that interconnects operator workstation and digital controllers for peer-to-peer communications, sharing resources and exchanging information.

LL. Network Repeater: A device that receives data packet from one network and rebroadcasts to another network. No routing information is added to the protocol.

MM. MS/TP: Master-slave/token-passing (ISO/IEC 8802, Part 3). It uses twisted-pair wiring for relatively low speed and low cost communication.

NN. Native BACnet Device: A device that uses BACnet as its primary method of communication with other BACnet devices without intermediary gateways. A system that uses native BACnet devices at all levels is a native BACnet system.

OO. Network Number: A site-specific number assigned to each network segment to identify for routing. This network number must be unique throughout the BACnet internetwork.

PP. Object: The concept of organizing BACnet information into standard components with various associated properties. Examples include analog input objects and binary output objects.

QQ. Object Identifier: An object property used to identify the object, including object type and instance. Object Identifiers must be unique within a device.

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RR. Object Properties: Attributes of an object. Examples include present value and high limit properties of an analog input object. Properties are defined in ASHRAE 135; some are optional and some are required. Objects are controlled by reading from and writing to object properties.

SS. Operating system (OS): Software, which controls the execution of computer application programs.

TT. Peripheral: Different components that make the control system function as one unit. Peripherals include monitor and I/O unit.

UU. Peer-to-Peer: A networking architecture that treats all controllers as equal partners- any device can initiate and respond to communication with other devices.

VV. PICS: Protocol Implementation Conformance Statement, describing the BACnet capabilities of a device. All BACnet devices have published PICS.

WW. PID: Proportional, integral, and derivative control, used to control modulating equipment to maintain a setpoint.

XX. Repeater: A network component that connects two or more physical segments at the physical layer.

YY. Router: a component that joins together two or more networks using different LAN technologies. Examples include joining a BACnet Ethernet LAN to a BACnet MS/TP LAN.

ZZ. Sensors: devices measuring state points or flows, which are then transmitted back to the DDC system.

AAA. Thermostats: devices measuring temperatures, which are used in control of standalone or unitary systems and equipment not attached to the DDC system.

1.04 QUALITY ASSURANCE

A. Criteria:

1. Single Source Responsibility of subcontractor: Either the DDC Contractor or the System Integrator shall obtain hardware and software supplied under this Section and delegate the responsibility to a single source controls installation subcontractor. The Integration subcontractor shall be responsible for the complete design, installation, integration, and commissioning of the system. The controls subcontractor shall be in the business of design, installation and service of such building automation control systems similar in size and complexity.
2. Equipment and Materials: Equipment and materials shall be cataloged products of manufacturers regularly engaged in production and installation of HVAC control systems. Products shall be manufacturer's latest standard design and have been tested and proven in actual use.
3. The controls subcontractor shall provide a list of no less than five similar projects which have building control systems as specified in this Section. These projects must be on-line and

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functional such that the New Hampshire Army National Guard (NHARNG) representative could observe the control systems in full operation.

4. The controls subcontractor shall have an in-place facility within the continental US, spare parts inventory for the next five (5) years, and necessary test and diagnostic equipment to support the control systems.
5. The controls subcontractor shall have minimum of three years of experience in design and installation of building automation systems similar in performance to those specified in this Section. Provide evidence of experience by submitting resumes of the project manager, the local branch manager, project engineer, the application engineering staff, and the electronic technicians who would be involved with the supervision, the engineering, and the installation of the control systems. Training and experience of these personnel shall not be less than three years. Failure to disclose this information will be a ground for disqualification of the supplier.
6. Provide a competent and experienced Project Manager employed by the Controls Contractor. The Project Manager shall be supported as necessary by other Contractor employees in order to provide professional engineering, technical and management service for the work. The Project Manager shall attend scheduled Project Meetings as required and shall be empowered to make technical, scheduling and related decisions on behalf of the Controls Contractor.

B. Codes and Standards:

1. All work shall conform to the applicable Codes and Standards.
2. Electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference, and be so labeled.

1.05 PERFORMANCE

A. The system shall conform to the following: Where performance is listed in two or more places, the more stringent requirement shall apply.

1. Graphic Display: The system shall display up to four (4) graphics on a single screen with a minimum of twenty (20) dynamic points per graphic. All current data shall be displayed within ten (10) seconds of the request.
2. Graphic Refresh: The system shall update all dynamic points with current data within five (5) seconds. Data refresh shall be automatic, without operator intervention.
3. Object Command: The maximum time between the command of a binary object by the operator and the reaction by the device shall be two (2) seconds. Analog objects shall start to adjust within two (2) seconds.
4. Object Scan: All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or work-station will be current, within the prior six (6) seconds.

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5. Alarm Response Time: The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed ten (10) seconds.
6. Program Execution Frequency: Custom and standard applications shall be capable of running as often as once every five (5) seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
7. Multiple Alarm Annunciations: All workstations on the network shall receive alarms within five (5) seconds of each other.
8. Performance: Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every one (1) second. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
9. Reporting Accuracy: Listed below are minimum acceptable reporting end-to-end accuracies for all values reported by the specified system:

Measured Variable	Reported Accuracy
Space temperature	±0.5 degrees C (±1 degrees F)
Ducted air temperature	±0.5 degrees C [±1 degrees F]
Outdoor air temperature	±1.0 degrees C [±2 degrees F]
Dew Point	±1.5 degrees C [±3 degrees F]
Water temperature	±0.5 degrees C [±1 degrees F]
Relative humidity	±2 percent RH
Water flow	±1 percent of reading
Air flow (terminal)	±5 percent of reading
Air flow (measuring stations)	±5 percent of reading
Carbon Monoxide (CO)	±5 percent of reading
Carbon Dioxide (CO_2)	±50 ppm
Air pressure (ducts)	±25 Pa [±0.1 inch wg]
Air pressure (space)	±0.3 Pa [±0.001 inch wg]
Water pressure	±2 percent of full scale *Note 1
Electrical Power	±0.5 percent of reading

Note 1: for both absolute and differential pressure

10. Control stability and accuracy: Control sequences shall maintain measured variable at setpoint within the following tolerances:

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±50 Pa (±0.2 inch wg)	0–1.5 kPa (0–6 inch wg)
Air Pressure	±3 Pa (±0.01 inch wg)	-25 to 25 Pa (-0.1 to 0.1 inch wg)

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Controlled Variable	Control Accuracy	Range of Medium
Airflow	±5 percent of full scale	
Space Temperature	±1.0°C (±2.0 degrees F)	
Duct Temperature	±1.5°C (±3 degrees F)	
Humidity	±4 percent RH	
Fluid Pressure	±10 kPa (±1.5 psig)	0–1 MPa (1–150 psig)
Fluid Pressure	±250 Pa (±1.0 inch wg)	0–12.5 kPa (0–50 inch wg) differential

11. Extent of direct digital control: control design shall allow for at least the points indicated on the points lists on the drawings.

1.06 WARRANTY

A. Labor and materials for control systems shall be warranted for a minimum period of one (1) year.

B. Existing control system failures during the warranty period shall be adjusted, repaired, or replaced at no cost or reduction in service to the owner. The system includes all computer equipment, transmission equipment, and all sensors and control devices.

C. The Controls supplier shall have on-call technical support coverage to include normal business hours, after business hours, weekends, & holidays to dispatch qualified personnel to the job site to provide timely resolution of issues. On-line remote connectivity is not available nor acceptable. Response shall be within two (2) hours of initial problem reporting. The Controls supplier shall then dispatch qualified personnel to the job site to resolve the problem within 24 hours after the problem is reported.

D. Controls subcontractor shall be responsible for temporary operations and maintenance of the control systems during the construction period until final commissioning, training of facility operators and acceptance of the project by NHARNG. All equipment outages to be coordinated with Owner and arranged to impact only specific occupant "units" per the Owner.

E. Warranty Period Support – Provide on-going project support throughout the warranty period. Include up to forty (40) hours of on-site EMS issues resolution, including Owner comment incorporation, programming, graphics, field modifications or other services as required by the Owner to update or rectify the controls system.

1.07 SUBMITTALS

A. Submit shop drawings in accordance with Division 1.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC", with applicable paragraph identification.

C. Manufacturer's Literature and Data Including:

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1. A wiring diagram for each type of input device and output device including DDC controllers, modems, repeaters, etc. Diagram shall show how the device is wired and powered, showing typical connections at the digital controllers and each power supply, as well as the device itself. Show for all field connected devices, including but not limited to, control relays, motor starters, electric or electronic actuators, and temperature pressure, flow and humidity sensors and transmitters.
2. A diagram of each terminal strip, including digital controller terminal strips, terminal strip location, termination numbers and the associated point names.
3. Control dampers and control valves schedule, including the size and pressure drop.
4. Control air-supply components, and computations for sizing compressors, receivers and main air-piping, if pneumatic controls are furnished.
5. Catalog cut sheets of all equipment used. This includes, but is not limited to, software (by manufacturer and by third parties), DDC controllers, panels, peripherals, airflow measuring stations and associated components, and auxiliary control devices such as sensors, actuators, and control dampers. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted. Each submitted piece of literature and drawings should clearly reference the specification and/or drawings that it supposed to represent.
6. An evaluation of equipment performance at design conditions to prove equipment meets code requirements, listing code and year of compliance.
7. Sequence of operations for each system and the associated control diagrams. Equipment and control labels shall correspond to those shown on the drawings.
8. Color prints of proposed graphics with a list of points for display.
9. Furnish a BACnet Protocol Implementation Conformance Statement (PICS) for each BACnet-compliant device.
10. Schematic wiring diagrams for all control, communication and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers' model numbers and functions. Show all interface wiring to the control system.
11. An instrumentation list for each controlled system. Each element of the controlled system shall be listed in table format. The table shall show element name, type of device, manufacturer, model number, and product data sheet number.
12. Riser diagrams of wiring between central control unit (CCU) and all control panels.
13. Plan drawings showing routing of LAN and locations of control panels, controllers, routers, gateways, ECC, and larger controlled devices.
14. Construction details for all installed conduit, cabling, raceway, cabinets, and similar. Construction details of all penetrations and their protection.

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15. Quantities of submitted items may be reviewed but it is the responsibility of the contractor administered by this Section of the technical specifications to provide sufficient quantities for a complete and working system.

D. Product Certificates: Compliance with Article, QUALITY ASSURANCE.

E. Validation Test Plan: Along with manufacturer's literature, product certificates, wiring and functional diagrams, and sequence of operations, submit for review and approval a Validation Test Plan which is specific to the work of this project and which references the specific controls component nomenclatures found in the control contractor's wiring and functional diagrams and the specific sequences of controls for this project and which describes how the contractor will implement the controls system validation and demonstration as specified in paragraph 3.2 SYSTEM VALIDATION AND DEMONSTRATION found in this section.

F. Licenses: Provide licenses for all software residing on and used by the Controls Systems, ECC, and portable OWS and transfer these licenses to the Owner prior to completion.

G. As Built Control Drawings:

1. Furnish one (1) electronic copy of as-built drawings for each control system. The documents shall be submitted for approval prior to final completion.
2. Furnish one (1) set of applicable control system prints for each mechanical system for wall mounting. The documents shall be submitted for approval prior to final completion.
3. Furnish one (1) flash drive to include all CAD DWG and/or .DXF format for the drawings noted in subparagraphs above and all programing and features to Owner with DDC system name label.

H. Operation and Maintenance (O/M) Manuals):

1. Submit in accordance with requirements in Specification Division 1.
2. Include the following documentation:
   a. General description and specifications for all components, including logging on/off, alarm handling, producing trend reports, overriding computer control, and changing set points and other variables.
   b. Detailed illustrations of all the control systems specified for ease of maintenance and repair/replacement procedures, and complete calibration procedures.
   c. One copy of the final version of all software provided including operating systems, programming language, operator workstation software, and graphics software. Copy shall be provided on flash drive to Owner.
   d. Complete troubleshooting procedures and guidelines for all systems.
   e. Complete operating instructions for all systems.
   f. Recommended preventive maintenance procedures for all system components including a schedule of tasks for inspection, cleaning and calibration. Provide a list of recommended spare parts needed to minimize downtime.

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g. Training Manuals: Submit the course outline and training material to the Owner for approval three (3) weeks prior to the training to NHARNG facility personnel. These persons will be responsible for maintaining and the operation of the control systems, including programming. The Owner reserves the right to modify any or all of the course outline and training material.

h. Licenses, guaranty, and other pertaining documents for all equipment and systems.

I. Submit Performance Report to Owner prior to final inspection.

1.08 INSTRUCTIONS

A. Instructions to Owner operations personnel: Perform in accordance with requirements in Specification Division 1, and as noted below. Contractor shall also video tape instruction sessions noted below.

1. Training shall comprise of on-the-job training during startup, checkout period, and performance test period. NHARNG facilities personnel will work with the Contractor's installation and test personnel on a daily basis during startup and checkout period. During the performance test period, controls subcontractor will provide 4 hours of instructions, given in multiple training sessions (each no longer than two hours in length), to the NHARNG facilities personnel.
2. The O/M Manuals shall contain approved submittals as outlined in Article 1.7, SUBMITTALS. The Controls subcontractor will review the manual contents with Owner facilities personnel during second phase of training.
3. Training shall be given by direct employees of THE CONTROLS system subcontractor.

1.09 PROJECT CONDITIONS (ENVIRONMENTAL CONDITIONS OF OPERATION)

A. The ECC and peripheral devices and system support equipment shall be designed to operate in ambient condition of 32 to 120 degrees F at a relative humidity of 20 to 95 percent non-condensing.

B. The Controllers used outdoors shall be mounted in NEMA 4 waterproof enclosures and shall be rated for operation at –40 to 65 degrees C (-40 to 150 degrees F). Indoor mounted controllers shall be the default mounting location, with outdoor mounting only where absolutely necessary.

C. All electronic equipment shall operate properly with power fluctuations of plus 10 percent to minus 15 percent of nominal supply voltage.

D. Sensors and controlling devices shall be designed to operate in the environment which they are sensing or controlling.

1.10 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.

B. American National Standards Institute, Telecommunications Industry Association (ANSI/TIA):

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C. 568.2-D..... BACnet A Data Communication Protocol for Building Automation and Control Networks

D. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):
135-2024 ..... BACnet A Data Communication Protocol for Building Automation and Control Networks
147-2019 ..... Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems

E. Federal Communication Commission (FCC):
Rules and Regulations Title 47 Chapter 1-2014 Part 15: Radio Frequency Devices

F. Institute of Electrical and Electronic Engineers (IEEE):
802.3-2022 ..... Standard for Ethernet

G. National Fire Protection Association (NFPA):
70-2026 ..... National Electric Code

PART 2 PRODUCTS

2.01 MATERIALS

A. Use new products that the manufacturer is currently manufacturing and that have been installed in a minimum of 25 installations. Spare parts shall be available for at least ten years after completion of this contract.

2.02 CONTROLS SYSTEM ARCHITECTURE

A. General

1. The Controls Systems shall consist of multiple Nodes and associated equipment connected by industry standard digital and communication network arrangements.
2. The ECC, building controllers and principal communications network equipment shall be standard products of recognized major manufacturers available through normal PC and computer vendor channels – not "Clones" assembled by a third-party subcontractor.
3. The networks shall, at minimum, comprise, as necessary, the following:
   a. A fixed ECC and a portable operator's terminal.
   b. Network computer processing, data storage and BACnet-compliant communication equipment including workstations and digital data processors.
   c. BACnet-compliant routers, bridges, switches, hubs, modems, gateways, interfaces and similar communication equipment.
   d. Active processing BACnet-compliant building controllers connected to other BACnet-compliant controllers together with their power supplies and associated equipment.
   e. Addressable elements, sensors, transducers and end devices.
   f. Third-party equipment interfaces and gateways as described and required by the Contract Documents.
   g. Other components required for a complete and working Control Systems as specified.

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B. The Specifications for the individual elements and component subsystems shall be minimum requirements and shall be augmented as necessary by the Contractor to achieve both compliance with all applicable codes, standards, and to meet all requirements of the Contract Documents.

C. Network Architecture

1. The Controls communication network shall utilize BACnet communications protocol operating over cable Ethernet connection, and MS/TP. Ethernet connection shall operate at a minimum speed of 100 Mb/sec.
2. The networks shall utilize only copper and optical fiber communication media as appropriate and shall comply with applicable codes, ordinances and regulations.
3. Data drops (single port) shall be provided by the Contractor. The NHARNG (Owner) will provide the IP address and related data to establish communication.
4. All necessary telephone and Internet Service Provider services and connections will be provided by the Owner (NHARNG).

D. Third Party Interfaces:

1. The contractor administered by this Section of the technical specifications shall include necessary hardware, equipment, software and programming to allow data communications between the controls systems and building systems supplied by other trades.
2. Other manufacturers and contractors supplying other associated systems and equipment shall provide their necessary hardware, software and startup at their cost and shall cooperate fully with the contractor administered by this Section of the technical specifications in a timely manner and at their cost to ensure complete functional integration.

E. Workstation (ECC or OWS):

1. The ECC shall not store any control system programming; all EMS programming shall be stored in the B-BC building controllers (JACEs), with ECC storage intended to store trending information, alarm history, and transaction logs.
2. Equip the ECC with the same software tool set that is located in the BACnet building controllers for system configuration and custom logic definition and color graphic configuration.
3. Access to all information on the ECC shall be through the same browser functionality used to access individual nodes. When logged onto the ECC the operator will be able to also interact with any other controller on the control system as required for the functional operation of the controls systems. The contractor administered by this Section of the technical specifications shall provide all components necessary for the ECC.
4. The ECC shall be utilized for controls systems application configuration, for archiving, reporting and trending of data, for operator transaction archiving and reporting, for network

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information management, for alarm annunciation, for operator interface tasks, for controls application management and similar.

5. The ECC shall utilize IT industry standard database platforms which utilize a database declarative language designed for managing data in relational database management systems (RDBMS) such as SQL.

2.03 COMMUNICATION

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135, BACnet.

1. The Data link / physical layer protocol between the ECC and all B-BC's (for communication) acceptable to the Owner throughout its facilities is Ethernet (ISO 8802-3) and BACnet-MS/TP.

B. Each controller shall have a communication port for connection to an operator interface.

C. Internetwork operator interface and value passing shall be transparent to internetwork architecture.

1. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, reports, system software, and custom programs shall be viewable and editable from each internet controller.
2. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute specified control system operation. An authorized operator shall be able to edit cross-controller links by typing a standard object address.

D. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring. Expansion shall not require operator interface hardware additions or software revisions.

E. ECCs and Controllers with real-time clocks shall use the BACnet Time Synchronization service. The system shall automatically synchronize system clocks daily from an operator-designated device via the internetwork. The system shall automatically adjust for daylight savings and standard time as applicable.

2.04 ENGINEERING CONTROL CENTER (ECC)

A. The ECC shall reside on a high-speed network with controllers as shown on system drawings. The ECC and each standard browser connected to server shall be able to access all system information.

B. ECC and controllers shall communicate using BACnet protocol. ECC and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ASHRAE/ANSI 135, BACnet Annex J.

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C. Hardware: ECC shall conform to the BACnet Advanced Workstation (B-AWS) Profile and shall be BTL-Listed as a B-AWS device.

1. ECC shall be based on commercially available server grade hardware. Computers based on desktop architectures shall not be permitted. ECC shall not be equipped with remote management capabilities.
2. Processor(s):
   a. Processors shall be either Intel Xeon or AMD EPYC chips sets designed specifically for workstation use. Desktop processors will not be allowed.
   b. Minimum core count shall be 16 cores. Each Core shall be capable of executing 2 threads simultaneously.
   c. Minimum base clock speed shall be 3.0 GHz.
3. Memory:
   a. Engineering Control Center shall be equipped with a minimum of 32G of DDR4 Error Correcting Code (ECC) memory. After installation of required 32G of RAM, the motherboard must still have a minimum of 2 DIMM slots open for expansion. Motherboard shall be capable of minimum of 64GB of ECC memory.
   b. Minimum speed shall be 2133MHz for memory.
4. Storage:
   a. ECC shall be equipped with a storage drive with a minimum capacity of either 2 TB, or sufficient storage to log trending data of all system I/O points at a sampling period of 15 seconds for 365 days, whichever is larger. Provide storage via an internal solid-state drive (SSD).
5. Case:
   a. Real-time clock:
      1) Accuracy: Plus or minus 1 minute per month.
      2) Time Keeping Format: 24-hour time format including seconds, minutes, hours, date, day, and month; automatic reset by software.
      3) Clock shall function for one year without power.
      4) Provide automatic time correction once every 24 hours by synchronizing clock with the Time Service Department of the U.S. Naval Observatory.
   b. Serial ports: Four USB ports and two RS-232-F serial ports for general use, with additional ports as required. Data transmission rates shall be selectable under program control.
   c. Parallel port: Enhanced.
   d. Sound card: For playback and recording of digital WAV sound files associated with audible warning and alarm functions.

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e. Color monitor: PC compatible, not less than 27 inches, LCD type, with a minimum resolution of 2560 by 1440 pixels, non-interlaced, and a maximum dot pitch of 0.28 mm.
f. Keyboard: Minimum of 64 characters, standard ASCII character set based on ANSI INCITS 154.
g. Mouse: Standard, compatible with installed software.
h. Network interface card (NIC): integrated 10-100-1000 Base-TX Ethernet NIC with an RJ45 connector or a 100Base-FX Ethernet NIC with an SC/ST connector.

D. ECC Software:

1. Provide for automatic system database save and restore on the ECC's hard disk a copy of the current database of each Controller. This database shall be updated whenever a change is made in any system panel. In the event of a database loss in a building management panel, the ECC shall automatically restore the database for that panel.
2. Provide for manual database save and restore. An operator with proper clearance shall be able to save the database from any system panel. The operator also shall be able to clear a panel database and manually initiate a download of a specified database to any panel in the system.
3. Provide a method of configuring the system. This shall allow for future system changes or additions by users with proper clearance.
4. All system and ancillary programming shall reside on the building controller(s), B-BC (JACE). Programming on the workstation ECC shall be limited to that only required for functionality. The system shall permit the NHARNG to replace the workstation with no interruption to service, monitoring, controls, alarms, trending or other system functions.
5. Operating System. Furnish a concurrent multi-tasking operating system. The operating system shall also support the use of other common software applications. Acceptable operating systems are Windows Server 2025.
6. System Graphics. The operator workstation software shall be graphically oriented. The system shall allow display of up to 10 graphic screens at once for comparison and monitoring of system status. Provide a method for the operator to easily move between graphic displays and change the size and location of graphic displays on the screen. The system graphics shall be able to be modified while on-line. An operator with the proper password level shall be able to add, delete, or change dynamic objects on a graphic. Dynamic objects shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation by shifting image files based on the status of the object.
7. Custom Graphics. Custom graphic files shall be created with the use of a graphics generation package furnished with the system. The graphics generation package shall be a graphically based system that uses the mouse to create and modify graphics that are saved in industry standard formats such as PCX, TIFF, and GEM. The graphics generation package also shall

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provide the capability of capturing or converting graphics from other programs such as Designer, AutoCAD or Revit.

8. Graphics Library. Furnish a complete library of standard HVAC equipment graphics such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. This library also shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program.
9. The Controls Systems Operator Interfaces shall be user friendly, readily understood and shall make maximum use of colors, graphics, icons, embedded images, animation, text based information and data visualization techniques to enhance and simplify the use and understanding of the displays by authorized users at the ECC. The operating system shall be Windows 11 latest version, or better, and shall support the third party software.
10. Provide graphical user software, which shall minimize the use of keyboard through the use of the mouse and "point and click" approach to menu selection.
11. The software shall provide a multi-tasking type environment that will allow the user to run several applications simultaneously. The mouse or Alt-Tab keys shall be used to quickly select and switch between multiple applications. The operator shall be able automatically export data to and work in Microsoft Word, Excel, and other Windows based software programs, while concurrently on-line system alarms and monitoring information.
12. User access shall be protected by a flexible and Owner re-definable software-based password access protection. Password protection shall be multi-level and partition able to accommodate the varied access requirements of the different user groups to which individual users may be assigned. Provide the means to define unique access privileges for each individual authorized user. Provide the means to on-line manage password access control under the control of a project specific Master Password. Provide an audit trail of all user activity on the Controls Systems including all actions and changes.
13. The system shall be completely field-programmable from the common operator's keyboard thus allowing hard disk storage of all data automatically. The software shall provide the following functionality as a minimum:
    a. Point database editing, storage and downloading of controller databases.
    b. Scheduling and override of building environmental control systems.
    c. Collection and analysis of historical data.
    d. Alarm reporting, routing, messaging, and acknowledgement.
    e. Definition and construction of dynamic color graphic displays.
    f. Real-time graphical viewing and control of environment.
    g. Scheduling trend reports.
    h. Program editing.

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i. Operating activity log and system security.
j. Transfer data to third party software.

14. Provide functionality such that using the least number of steps to initiate the desired event may perform any of the following simultaneously:
    a. Dynamic color graphics and graphic control.
    b. Alarm management.
    c. Event scheduling.
    d. Dynamic trend definition and presentation.
    e. Program and database editing.
    f. Each operator shall be required to log on to the system with a username and password to view, edit or delete the data. System security shall be selectable for each operator, and the password shall be able to restrict the operator's access for viewing and changing the system programs. Each operator shall automatically be logged off the system if no keyboard or mouse activity is detected for a selected time.
15. Graphic Displays:
    a. The workstation shall allow the operator to access various system schematics and floor plans via a graphical penetration scheme, menu selection, or text-based commands. Graphic software shall permit the importing of AutoCAD, Revit or scanned pictures in the industry standard format (such as PCX, BMP, GIF, and JPEG) for use in the system.
    b. System Graphics shall be project specific and schematically correct for each system. (i.e.: coils, fans, dampers located per equipment supplied with project.) Standard system graphics that do not match equipment or system configurations are prohibited. Operator shall have capability to manually operate the entire system from each graphic screen at the ECC. Each system graphic shall include a button/tab to a display of the applicable sequence of operation.
    c. Dynamic temperature values, humidity values, flow rates, and status indication shall be shown in their locations and shall automatically update to represent current conditions without operator intervention and without pre-defined screen refresh values.
    d. Color shall be used to indicate status and change in status of the equipment. The state colors shall be user definable.
    e. A clipart library of HVAC equipment, such as chillers, boilers, air handling units, fans, terminal units, pumps, coils, standard ductwork, piping, valves and laboratory symbols shall be provided in the system. The operator shall have the ability to add custom symbols to the clipart library.
    f. A dynamic display of the site-specific architecture showing status of the controllers, the ECC and network shall be provided.

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g. The windowing environment of the workstation shall allow the user to simultaneously view several applications at a time to analyze total building operation or to allow the display of graphic associated with an alarm to be viewed without interrupting work in progress. The graphic system software shall also have the capability to split screen, half portion of the screen with graphical representation and the other half with sequence of operation of the same HVAC system.

16. Trend reports shall be generated on demand or pre-defined schedule and directed to monitor display, a printable report or disk. As a minimum, the system shall allow the operator to easily obtain the following types of reports:
    a. A general list of all selected points in the network.
    b. List of all points in the alarm.
    c. List of all points in the override status.
    d. List of all disabled points.
    e. List of all points currently locked out.
    f. List of user accounts and password access levels.
    g. List of weekly schedules.
    h. List of holiday programming.
    i. List of limits and dead bands.
    j. Trend graphs capable of showing greater than six variables of differing ranges and units.
    k. Custom reports.
    l. System diagnostic reports, including, list of digital controllers on the network.
    m. List of programs.
17. ASHRAE Standard 147 Report: System shall be capable of providing a daily report that shows the operating condition of each chiller as recommended by ASHRAE Standard 147. All required points shall be mapped and trended, available to the Owner in the future at their discretion. At a minimum, this report shall include:
    a. Chilled water (or other secondary coolant) inlet and outlet temperature
    b. Chilled water (or other secondary coolant) flow
    c. Chilled water (or other secondary coolant) inlet and outlet pressures
    d. Evaporator refrigerant pressure and temperature
    e. Condenser refrigerant pressure and liquid temperature
    f. Condenser water inlet and outlet temperatures
    g. Condenser water flow
    h. Refrigerant levels
    i. Oil pressure and temperature
    j. Oil level
    k. Compressor refrigerant discharge temperature

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l. Compressor refrigerant suction temperature
m. Addition of refrigerant
n. Addition of oil
o. Vibration levels or observation that vibration is not excessive
p. Motor amperes per phase
q. Motor volts per phase
r. Ambient temperature (dry-bulb and wet-bulb)
s. Date and time logged

18. Electrical, Gas, and Weather Reports
    a. System shall be capable of providing the reports noted below. All required points shall be mapped and trended, available to the Owner in the future at their discretion.
    b. Electrical Meter Report: Provide a monthly report showing the daily electrical consumption and peak electrical demand with time and date stamp for each building meter.
    c. Provide an annual (12-month) summary report showing the monthly electrical consumption and peak demand with time and date stamp for each meter.
    d. Gas Meter Report: Provide a monthly report showing the daily natural gas consumption for each meter. Provide an annual (12-month) report that shows the monthly consumption for each meter.
    e. Weather Data Report: Provide a monthly report showing the daily minimum, maximum, and average outdoor air temperature, as well as the number of heating and cooling degree-days for each day. Provide an annual (12-month) report showing the minimum, maximum, and average outdoor air temperature for the month, as well as the number of heating and cooling degree-days for the month.
19. Scheduling and Override:
    a. Provide override access through menu selection from the graphical interface and through a function key.
    b. Provide a calendar type format for time-of-day scheduling and overrides of building control systems. Schedules reside in the building controller(s) . The digital controllers shall ensure equipment time scheduling when the ECC is off-line. The ECC shall not be required to execute time scheduling. Provide the following spreadsheet graphics as a minimum:
        1) Weekly schedules.
        2) Zone schedules, minimum of 100 zones.
        3) Scheduling up to 365 days in advance.
        4) Scheduled reports to print at workstation.
20. Collection and Analysis of Historical Data:

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a. Provide trending capabilities that will allow the operator to monitor and store records of all activity across all system I/O points over an extended period. Points may be trended automatically on time-based intervals or change of value, both of which shall be user definable. The trend interval could be fifteen (15) seconds to 24 hours. Trend data shall be stored on hard disk for future diagnostic and reporting. Additionally, trend data may be archived to network drives or removable disk media for off-site retrieval.

b. Reports may be customized to include individual points or predefined groups of at least six points. Provide additional functionality to allow pre-defined groups of up to 250 trended points to be easily accessible by other industry standard word processing and spreadsheet packages. The reports shall be time and date stamped and shall contain a report title and the name of the facility.

c. Provide additional functionality that will allow the operator to view real time trend data on trend graph displays. A minimum of 20 points may be graphed regardless of whether they have been predefined for trending. In addition, the user may pause the graph and take snapshots of the screens to be stored on the workstation disk for future reference and trend analysis. Exact point values may be viewed, and the graph may be printed. Operator shall be able to command points directly on the trend plot by double clicking on the point.

21. Alarm Management:
    a. Alarm routing shall allow the operator to send alarm notification to a selected device or operator workstation based on time of day, alarm severity, or point type.
    b. Alarm notification shall be provided via two alarm icons, to distinguish between routine, maintenance type alarms and critical alarms. The critical alarms shall display on the screen at the time of its occurrence, while others shall display by clicking on their icon.
    c. Alarm display shall list the alarms with highest priority at the top of the display. The alarm display shall provide selector buttons for display of the associated point graphic and message in English language. The operator shall be able to sort out the alarms.
    d. Alarm messages shall be customized for each point to display detailed instructions to the operator regarding actions to take in the event of an alarm.
    e. An operator with proper security level access may acknowledge and clear the alarm. All that have not been cleared shall be archived at workstation disk.
    f. Alarms that are Owner identified as non-critical shall auto reset the controlled function. Manual or remote manual reset alarms shall be limited to critical alarms only. An example of a critical alarm is a hydronic coil freezestat with clear water.
22. Remote Communications: The system shall include the capability to remote communicate in the event of an alarm, however this feature shall be disabled and not used in this application.
23. System Configuration:

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a. Network control strategies shall not be restricted to a single digital controller but shall be able to include data from all other network devices to allow the development of global control strategies.

b. Provide automatic backup and restore of all digital controller databases on the workstation hard disk. In addition to all backup data, all databases shall be performed while the workstation is on-line without disturbing other system operations.

2.05 PORTABLE OPERATOR'S TERMINAL (POT)

A. Not included

2.06 BACnet PROTOCOL ANALYZER

A. For ease of troubleshooting and maintenance, provide a BACnet protocol analyzer. Provide its associated fittings, cables and appurtenances, for connection to the communications network. The BACnet protocol analyzer shall be able to, at a minimum: capture and store to a file all data traffic on all network levels; measure bandwidth usage; filter out (ignore) selected traffic.

2.07 BACnet DEVICES

A. All BACnet Devices – controllers, gateways, routers, actuators, Operator Displays, and sensors shall conform to BACnet Device Profiles and shall be BACnet Testing Laboratories (BTL) -Listed as conforming to those Device Profiles. Protocol Implementation Conformance Statements (PICSs), describing the BACnet capabilities of the Devices shall be published and available for the Devices through links in the BTL website.

1. BACnet Building Controllers, shall conform to the BACnet B-BC Device Profile, and shall be BTL-Listed as conforming to the B-BC Device Profile. The Device's PICS shall be submitted.
2. BACnet Advanced Application Controllers shall conform to the BACnet B-AAC Device Profile and shall be BTL-Listed as conforming to the B-AAC Device Profile. The Device's PICS shall be submitted.
3. BACnet Application Specific Controllers shall conform to the BACnet B-ASC Device Profile and shall be BTL-Listed as conforming to the B-ASC Device Profile. The Device's PICS shall be submitted.
4. BACnet Smart Actuators shall conform to the BACnet B-SA Device Profile and shall be BTL-Listed as conforming to the B-SA Device Profile. The Device's PICS shall be submitted.
5. BACnet Smart Sensors shall conform to the BACnet B-SS Device Profile and shall be BTL-Listed as conforming to the B-SS Device Profile. The Device's PICS shall be submitted.
6. BACnet routers and gateways shall conform to the BACnet B-OTH Device Profile, and shall be BTL-Listed as conforming to the B-OTH Device Profile. The Device's PICS shall be submitted.

2.08 CONTROLLERS

A. General. Provide an adequate number of BTL listed B-BC building controllers, BTL listed B-AAC, BTL listed B-ASC, BTL listed B-SA, and BTL listed B-SS's to achieve the performance specified

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in the Part 1 Article on "System Performance." Each of these controllers shall meet the following requirements.

1. Communication.
   a. Each B-BC (Building) controller shall reside on a BACnet network using the ISO 8802-3 (Ethernet) Data Link/Physical layer protocol for its communications.
   b. Each B-BC controller shall provide a service communication port using BACnet Data Link/Physical layer protocol for connection to a portable operator's terminal. If this port is not available built into the controller, contractor is to install a 6 port unmanaged switch inside the B-BC control cabinet.
2. Keypad. A local keypad and display shall be provided for each controller. The keypad shall be provided for interrogating and editing data. Provide a system security password to prevent unauthorized use of the keypad and display.
3. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
4. Memory. The controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
5. The controller shall be able to operate at 90 percent to 110 percent of nominal voltage rating and shall perform an orderly shutdown less than 80 percent nominal voltage. Controller operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 watt at 1 meter (3 feet).
6. Transformer. Power supply for the ASC must be rated at a minimum of 125 percent of B-ASC power consumption and shall be of the fused or current limiting type.

B. Provide BTL-Listed B-ASC application specific controllers for each piece of equipment for which they are constructed. Application specific controllers shall communicate with other BACnet devices on the internetwork using the BACnet Read (Execute) Property service.

1. Each B-ASC shall be capable of stand-alone operation and shall continue to provide control functions without being connected to the network.
2. Each B-ASC will contain sufficient I/O capacity to control the target system.
3. Communication.
   a. Each controller shall reside on a BACnet network using the ISO 8802-3 (Ethernet) or ISO 16484-5 (MS/TP) Data Link/Physical layer protocol for its communications. Each building controller also shall perform BACnet routing if connected to a network of custom application and application specific controllers.
   b. Each controller shall have a BACnet Data Link/Physical layer compatible connection for a laptop computer or a portable operator's tool. This connection shall be extended to a space temperature sensor port where shown.

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4. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
5. Memory. The application specific controller shall use nonvolatile memory and maintain all BIOS and programming information in the event of a power loss.
6. Immunity to power and noise. Controllers shall be able to operate at 90 percent to 110 percent of nominal voltage rating and shall perform an orderly shutdown below 80 percent. Operation shall be protected against electrical noise of 5-120 Hz and from keyed radios up to 5 watts at 1 meter (3 feet).

C. Direct Digital Controller Software

1. The software programs specified in this section shall be commercially available, non-proprietary, concurrent, multi-tasking operating system and support the use of software application that operates under Microsoft Windows, such as Tridium Niagara.
2. Licenses- Provide Owner full system access permissions and all software and hardware licenses in the Owner's name, valid for minimum period of five (5) years.
3. All points shall be identified by up to 30-character point name and 16-character point descriptor. The same names shall be used at the ECC.
4. All control functions shall execute within the stand-alone control units. All new controllers installed will also include all software and/or hardware required to program, commission, or alter the sequence of operation of said controller(s). Controllers requiring software or hardware that is not commercially available or proprietary will not be allowed. Installation of software and/or hardware for controller configuration will be the responsibility of the DDC contractor. Owner will direct to install said hardware and/or software on either the B-OWS or B-BC. The NHARNG shall be able to customize control strategies and sequences of operations defining the appropriate control loop algorithms and choosing the optimum loop parameters without requiring the services of a DDC contractor.
5. All controllers shall be capable of being programmed to utilize stored default values for assured fail-safe operation of critical processes. Default values shall be invoked upon sensor failure or, if the primary value is normally provided by the central or another CU, or by loss of bus communication. Individual application software packages shall be structured to assume a fail-safe condition upon loss of input sensors. Loss of an input sensor shall result in output of a sensor-failed message at the ECC. Each B- BC and B-AAC shall have capability for local readouts of all functions. The B-ASC shall be read remotely.
6. All DDC control loops shall be able to utilize any of the following control modes:
   a. Two position (on-off, slow-fast) control.
   b. Proportional control.
   c. Proportional plus integral (PI) control.

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d. Proportional plus integral plus derivative (PID) control. All PID programs shall automatically invoke integral wind up prevention routines whenever the controlled unit is off, under manual control of an automation system or time-initiated program.
e. Automatic tuning of control loops.

7. System Security: Operator access shall be secured using individual password and operator's name. Passwords shall restrict the operator to the level of object, applications, and system functions assigned to them. A minimum of three (3) levels of security for operator access shall be provided.
8. Application Software: The controllers shall provide the following programs as a minimum for the purpose of optimizing energy consumption while maintaining comfortable environment for occupants. All application software shall reside and run in the system digital controllers. Editing of the application shall occur at the ECC or B-BC, when it is necessary, to access directly the programmable unit.
   a. Economizer: An economizer program shall be provided for VAV systems. This program shall control the position of air handler relief, return, and outdoor dampers. If the outdoor air dry bulb temperature and humidity fall below changeover set point the energy control center will modulate the dampers to provide 100 percent outdoor air. The operator shall be able to override the economizer cycle and return to minimum outdoor air operation at any time.
   b. Night Setback/Morning Warm up Control: The system shall provide the ability to automatically adjust set points for this mode of operation.
   c. Optimum Start/Stop (OSS): Optimum start/stop program shall automatically be coordinated with event scheduling. The OSS program shall start HVAC equipment at the latest possible time that will allow the equipment to achieve the desired zone condition by the time of occupancy, and it shall also shut down HVAC equipment at the earliest possible time before the end of the occupancy period and still maintain desired comfort conditions. The OSS program shall consider both outside weather conditions and inside zone conditions. The program shall automatically assign longer lead times for weekend and holiday shutdowns. The program shall poll all zones served by the associated AHU and shall select the warmest and coolest zones. These shall be used in the start time calculation. It shall be possible to assign occupancy start times on a per air handler unit basis. The program shall meet the local code requirements for minimum outdoor air while the building is occupied. Modification of assigned occupancy start/stop times shall be possible via the ECC.
   d. Event Scheduling: Provide a comprehensive menu driven program to automatically start and stop designated points or a group of points according to a stored time. This program shall provide the capability to individually command a point or group of points. When

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points are assigned to one common load group it shall be possible to assign variable time advances/delays between each successive start or stop within that group. Scheduling shall be calendar based and advance schedules may be defined up to one year in advance. Advance schedule shall override the day-to-day schedule. The operator shall be able to define the following information:

1) Time, day.
2) Commands such as on, off, auto.
3) Time delays between successive commands.
4) Manual overriding of each schedule.
5) Allow operator intervention.

e. Alarm Reporting: The operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the ECC based on time and events. An alarm shall be able to start programs, login the event, print and display the messages. The system shall allow the operator to prioritize the alarms to minimize nuisance reporting and to speed operator's response to critical alarms. A minimum of three (3) priority levels of alarms shall be provided for each point.

f. Remote Communications: The system shall have the ability to remote communicate in the event of an alarm, however this feature shall be disabled and not used in this application.

g. Maintenance Management (PM): The program shall monitor equipment status and generate maintenance messages based upon the operators defined equipment run time, starts, and/or calendar date limits. A preventative maintenance alarm shall be printed indicating maintenance requirements based on pre-defined run time. Each preventive message shall include point description, limit criteria and preventative maintenance instruction assigned to that limit. A minimum of 480-character PM shall be provided for each component of units such as air handling units.

h. Chilled water Plant Operation: This program shall have the ability to sequence the multiple chillers to minimize energy consumption. The program shall provide sequence of operation as described on the drawings and include the following as a minimum:

1) Automatic start/stop of chillers and auxiliaries in accordance with the sequence of operation shown on the drawings, while incorporating requirements and restraints, such as starting frequency of the equipment imposed by equipment manufacturers.
2) Secondary chilled water pumps and controls.
3) Generate chilled water plant load profiles for different seasons for use in forecasting efficient operating schedule.
4) The chilled water plant program shall display the following as a minimum:
   a) Secondary chilled flow rate.

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b) Secondary chilled water supply and return temperature.
c) Condenser water supply and return temperature.
d) Outdoor air dry bulb temperature.
e) Outdoor air wet bulb temperature.
f) Ton-hours of chilled water per day/month/year.
g) On-off status for each chiller.
h) Chilled water flow rate.
i) Chilled water supply and return temperature.
j) Operating set points-temperature and pressure.
k) Kilowatts and power factor.
l) Current limit set point.
m) Date and time.
n) Operating or alarm status.
o) Operating hours.

2.09 SENSORS (AIR, WATER)

A. Sensors' measurements shall be read back to the DDC system, and shall be visible by the ECC.

B. Temperature and Humidity Sensors shall be electronic, vibration and corrosion resistant for wall, immersion, and/or duct mounting. Provide all remote sensors as required for the systems.

1. Temperature Sensors: thermistor type for terminal units and Resistance Temperature Device (RTD) with an integral 4-20 mA or 0-10 VDC transmitter type for all other sensors.
   a. Duct sensors shall be rigid or averaging type as shown on drawings. Averaging sensor shall be a minimum of 1 linear foot of sensing element for each square feet of cooling/heating coil face area.
   b. Immersion sensors shall be provided with a separable well made of stainless steel, bronze or Monel material. Pressure rating of well is to be consistent with the system pressure in which it is to be installed. Temperature well shall be filled with a thermal compound compatible with installed sensor.
   c. All space sensors shall be equipped with in-space User set-point adjustment, override switch, numerical temperature display on sensor cover, and BACnet communication port. Match room thermostats. Provide a tooled-access cover.
      1) Public space sensor: setpoint adjustment shall be only through the ECC or through the DDC system's diagnostic device/laptop. Do not provide in-space User set-point adjustment. Provide a stainless-steel blank plate sensor with control vendor logo or markings if needed to restrict in-space User set-point adjustment.
   d. Outdoor air temperature sensors shall have watertight inlet fittings and be shielded from direct sunlight.
   e. Wire: Twisted, shielded-pair cable.

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f. Output Signal: 4-20 mA or 0-10 VDC.

2. Humidity Sensors: Bulk polymer sensing element type.
   a. Duct and room sensors shall have a sensing range of 20 to 80 percent with accuracy of ± 2 to ± 5 percent RH, including hysteresis, linearity, and repeatability.
   b. Outdoor humidity sensors shall be furnished with element guard and mounting plate and have a sensing range of 0 to 100 percent RH.
   c. Continuous Output Signal: 4-20 mA or 0-10 VDC.

C. Static Pressure Sensors: Non-directional, temperature compensated.
   1. 4-20 mA or 0-10 VDC output signal.
   2. 0 to 5 inches wg for duct static pressure range.
   3. 0 to 0.25 inch wg for Building static pressure range.

D. In-Line Magnetic Water Flow Sensors:
   1. Inline Type: Class 150 flanged with hard rubber liner, 2-1/2 inch.
   2. Insertion Type: Include ball valve and threadolet.
   3. Conductive Liquid Flow Capacity Range: As indicated on drawings.
   4. Construction: Stainless steel or aluminum sensor integral to NEMA EN 10250 Type 4 or 4X stainless steel or aluminum enclosure with numeric display for consumption reading.
   5. Liquid Conductivity: 5 mS/cm, minimum.
   6. Accuracy: 0.02 percent of value applied to manufacturer specified velocity range.
   7. Hardwired Output: Two-wire, 0 to 10 VDC, non-loop powered.
   8. Network Communications Link: HART communications link.
   9. BAS, SCADA, or other Integrated Automation Link: ASHRAE Std 135BACnet MS/TP.
   10. Service Pressure and Temperature: Up to 400 psi and 15 to 250 degrees F liquid side, 150 degrees F ambient.

E. Flow switches:
   1. Shall be either paddle or differential pressure type.
      a. Paddle-type switches (liquid service only) shall be UL Listed, SPDT snap-acting, adjustable sensitivity with NEMA 4 enclosure.
      b. Differential pressure type switches (air or water service) shall be UL listed, SPDT snap acting, NEMA 4 enclosure, with scale range and differential suitable for specified application.

F. Current Switches: Current operated switches shall be self powered, solid state with adjustable trip current as well as status, power, and relay command status LED indication. The switches shall be selected to match the current of the application and output requirements of the DDC systems.

G. Water Overflow Indicators:
   1. Float Switches: Float switch manufactured to close a normally open electrical contact when water level rises at the bottom of a drain pan or sump. All parts that come in contact with

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water shall be plastic, brass, or stainless steel. Select switch configuration for reliable operation in the specific location it is to be used (primary drain pan, primary humidifier drain pan, secondary pan, pump sump etc.) Contact rating 4A at 24 VAC maximum and 100 mA at 5 VDC minimum. For installation the switch shall be clamped to the side of the fan or sump. Switches that required drilling through the side of the pan or sump shall be prohibited.

2. Water Sensors: 24 VAC powered solid state single pole – double throw contacts that closes upon the sensor's detection of water at the bottom of pan, sump, floor etc. Sensor designed to be placed at the bottom of the pan, floor etc. where it will detect moisture. Sensor design shall incorporate water sensor array inside a hydrophilic pad designed to absorb and alarm with only a small amount of water. Contact rating 4A at 24 VAC maximum and 100 mA at 5 VDC minimum.

2.10 CONTROL CABLES

A. General:

1. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
2. Cable conductors to provide protection against induction in circuits. Crosstalk attenuation within the System shall be in excess of -80 dB throughout the frequency ranges specified.
3. Minimize the radiation of RF noise generated by the System equipment so as not to interfere with any audio, video, data, computer main distribution frame (MDF), telephone customer service unit (CSU), and electronic private branch exchange (EPBX) equipment the System may service.
4. The as-installed drawings shall identify each cable as labeled, used cable, and bad cable pairs.
5. Label system's cables on each end. Test and certify cables in writing to the Owner before conducting proof-of-performance testing. Minimum cable test requirements are for impedance compliance, inductance, capacitance, signal level compliance, opens, shorts, cross talk, noise, and distortion, and split pairs on all cables in the frequency ranges used. Make available all cable installation and test records at demonstration to the Owner. All changes (used pair, failed pair, etc.) shall be posted in these records as the change occurs.
6. Power wiring shall not be run in conduit with communications trunk wiring or signal or control wiring operating at 100 volts or less.

B. Analogue control cabling shall be not less than No. 18 AWG solid or stranded, with thermoplastic insulated conductors.

C. Copper digital communication cable between the ECC and the B-BC and B-AAC controllers shall be 100BASE-TX Ethernet, Category 6 or 6a, not less than minimum 24 American Wire Gauge

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(AWG) solid, Shielded Twisted Pair (STP) or Unshielded Twisted Pair (UTP), with thermoplastic insulated conductors, enclosed in a thermoplastic outer jacket.

1. Other types of media commonly used within IEEE Std 802.3 LANs (e.g., 10Base-T and 10Base-2) shall be used only in cases to interconnect with existing media.

D. All MS/TP communications cables for devices utilizing the EIA-485 standard must be listed for use on EIA-485 networks by the manufacturer of the cable. This requirement overrides any cable recommendation by the controller manufacturer. The use of EIA-485 communication cables shall not affect the warranty from the installing DDC contractor. Cables shall have the following characteristic:

1. Nominal Impedance: 100-130 Ohms
2. Twisted/shielded construction of 1, 1.5, or 2 pairs depending on controller requirements.
3. Be plenum rated when required
4. Cables designated for use by the cable manufacturer for use in PA or Speaker systems shall not be allowed, regardless of recommendations by the controller manufacturer.

E. All control & communication cables shall be fully tested for functionality. This shall include all existing & new cables. All existing cables to be re-used with the new system shall be warranted by the Contractor to the same level as the new cabling.

F. Optical digital communication fiber, if used, shall be Multimode or Single mode fiber, 62.5/125 micron for multimode or 10/125 micron for single mode micron with SC or ST connectors as specified in TIA-568-C.1. Terminations, patch panels, and other hardware shall be compatible with the specified fiber. Fiber-optic cable shall be suitable for use with the 100Base-FX or the 100Base-SX standard (as applicable) as defined in IEEE Std 802.3.

2.11 THERMOSTATS AND HUMIDISTATS

A. Room thermostats controlling unitary standalone heating and cooling devices not connected to the DDC system shall have three modes of operation (heating - null or dead band - cooling). Wall mounted thermostats shall have plastic thermo-resin finish or Owner specified color, setpoint range and temperature display and external adjustment:

1. Electronic Thermostats: Solid-state, microprocessor based, BACnet enabled programmable to daily, weekend, and holiday schedules.
   a. Public Space Thermostat: Public space thermostat shall have a thermistor sensor and shall not have a visible means of set point adjustment. Adjustment shall be via the digital controller to which it is connected.
   b. Battery replacement without program loss.

B. Strap-on aquastat shall be enclosed in a dirt-and-moisture proof housing with adjustable temperature switching point and minimum single pole, double throw switch. Variable setpoint and variable differential ranges selected for the application. Provide manual or automatic reset to match existing device..

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C. Freezestats shall have a minimum of 300 mm (one linear foot) of sensing element for each 0.093 square meter (one square foot) of coil area. A freezing condition at any increment of 300 mm (one foot) anywhere along the sensing element shall be sufficient to operate the thermostatic element. Freezestats shall be manually-reset.

D. Room Humidistats: Provide fully proportioning humidistat with adjustable throttling range for accuracy of settings and conservation. The humidistat shall have set point scales shown in percent of relative humidity located on the instrument. Systems showing moist/dry or high/low are prohibited.

E. Low Signal Selector High Limit Duct Humidistat: Duct mounted high limit humidistat mounted downstream of the humidifier steam injection grid to protect the ductwork and other components from moisture in the event of humidifier loop problems. Typically set at 70 percent to 80 percent RH the device provides proportional signal back to steam control equipment as duct humidity approaches high limit setpoint thus providing more accurate control. Duct mounted device with polymer sensor:

1. Output 4 to 20 milliamp or 0-10 VDC.
2. Setpoint range 60 percent RH to 95 percent RH.
3. Proportional Band range 5 percent to 30 percent.
4. Auxiliary contacts for alarms.
5. Accuracy 2 percent RH and drift less than 0.5 percent per year.

2.12 CARBON DIOXIDE SENSORS

A. Carbon Dioxide (CO2) Sensors, Duct and Wall:

1. Manufacturers:
   a. Greystone Energy Systems, Inc.: www.greystoneenergy.com/#sle.
   b. Macurco, a brand of Aerionics, Inc.: www.macurco.com/#sle.
   c. Veris Industries: www.veris.com/#sle.
   d. Substitutions: See Division 1.
2. General: Provide nondispersive infrared (NDIR), diffusion sampling CO2 sensors with integral transducers and linear output.
3. Air Temperature: Range of 32 to 122 degrees F.
4. Relative Humidity: Range of 0 to 95 percent (noncondensing).
5. Power Input: Class 2; 20 to 30VDC or 24VAC 50/60 Hz.
6. Measurement Characteristics:
   a. Accuracy: ±30 ppm ±3% of measured value.
   b. Range: 0 to 2000/5000 ppm (selectable).
   c. Resolution: 1 ppm.
   d. Repeatability: ±20 ppm ±1% of measured value.
   e. Response Time: <60 seconds for 90% step change.

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7. Calibration Characteristics:
   a. Automatically compensating algorithm for sensor drift due to sensor degradation.
   b. Maximum Drift: 2 percent.
   c. User calibratable with a minimum calibration interval of 5 years.
8. Construction:
   a. Sensor Chamber: Noncorrosive material for neutral effect on carbon dioxide sample.
   b. Provide duct mounted sensors with duct probe designed to protect sensing element from dust accumulation and mechanical damage.
   c. Housing: High impact ABS plastic.
9. Temperature Sensor: Solid state, integrated circuit.
   a. Accuracy: ±0.4 degrees F.
   b. Resolution: 0.1 degrees F.
   c. Output Range: 32 to 122 degrees F.

2.13 FINAL CONTROL ELEMENTS AND OPERATORS

A. Fail Safe Operation: Control valves and dampers shall provide "fail safe" operation in either the normally open or normally closed position as required for freeze, moisture, and smoke or fire protection.

B. Spring Ranges: Range as required for system sequencing and to provide tight shut-off.

C. Power Operated Control Dampers (other than VAV Boxes): Factory fabricated, balanced type dampers. All modulating dampers shall be opposed blade type and gasketed. Blades for two-position, duct-mounted dampers shall be parallel, airfoil (streamlined) type for minimum noise generation and pressure drop.
   1. Leakage: All outside air and exhaust air dampers shall be Class 1A ultra-low leakage. All other control dampers shall meet Class I. Maximum leakage in closed position for Class IA shall not exceed 3 CFM/Square ft at 1" water gauge differential pressure for outside air and exhaust dampers and 4 CFM/square feet at 25 mm (1 inches) differential pressure for other dampers.
   2. Frame shall be galvanized steel channel with seals as required to meet leakage criteria.
   3. Blades shall be galvanized steel or aluminum, 200 mm (8 inch) maximum width, with edges sealed as required.
   4. Bearing shall be nylon, bronze sleeve or ball type.
   5. Hardware shall be zinc-plated steel. Connected rods and linkage shall be non-slip. Working parts of joints shall be brass, bronze, nylon or stainless steel.
   6. Maximum air velocity and pressure drop through free area of the dampers:
      a. Smoke damper in air handling unit: 305 meter per minute (1000 fpm).
      b. Duct mounted damper: 600 meter per minute (2000 fpm).
      c. Maximum static pressure loss: 50 Pascal (0.20 inches water gauge).

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D. Smoke Dampers and Combination Fire/Smoke Dampers: Contractor to notify Owner and engineer of any existing devices.

E. Control Valves:

1. Valves shall be rated for a minimum of 150 percent of system operating pressure at the valve location but not less than 900 kPa (125 psig).
2. Valves 50 mm (2 inches) and smaller shall be bronze body with threaded or flare connections.
3. Valves 60 mm (2 1/2 inches) and greater shall be bronze or iron body with flanged connections.
4. Brass or bronze seats except for valves controlling media greater than 100 degrees C (210 degrees F), which shall have stainless steel seats.
5. Flow characteristics:
   a. Three way modulating valves shall be globe pattern. Position versus flow relation shall be linear relation for steam or equal percentage for water flow control.
   b. Two-way modulating valves shall be controllable ball valves pattern. Position versus flow relation shall be linear for steam and equal percentage for water flow control.
   c. Two-way 2-position valves shall be ball or butterfly type.
6. Maximum pressure drop:
   a. Two position steam control: 20 percent of inlet gauge pressure.
   b. Modulating Steam Control: 80 percent of inlet gauge pressure (acoustic velocity limitation).
   c. Modulating water flow control, greater of 3 meters (10 feet) of water or the pressure drop through the apparatus.
7. Two position water valves shall be line size.

F. Damper and Valve Operators and Relays:

1. Electric operator shall provide full modulating control of dampers and valves. For dampers a linkage and pushrod shall be furnished for mounting the actuator on the damper frame internally in the duct, externally in the duct, externally on the duct wall, or shall be furnished with a direct-coupled design. Metal parts shall be aluminum, mill finish galvanized steel, or zinc plated steel or stainless steel. Provide actuator heads which allow for electrical conduit attachment. The motor(s) shall have sufficient closure torque to allow for complete closure of valve or damper under pressure with minimum 10% excess torque available. Provide multiple motors as required to achieve sufficient close-off torque.
   a. Minimum valve close-off pressure shall be equal to the system pump's dead-head pressure, minimum 75 psig.
2. Electronic damper operators: Metal parts shall be aluminum, mill finish galvanized steel, or zinc plated steel or stainless steel. Provide actuator heads which allow for electrical conduit

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attachment. The motors shall have sufficient closure torque to allow for complete closure of valve or damper under pressure with an additional 10% capacity. Provide multiple motors as required to achieve sufficient close-off torque.

a. VAV Box actuator shall be mounted on the damper axle or shall be of the air valve design, and shall provide complete modulating control of the damper. The motor shall have a closure torque of 35-inch pounds minimum with full torque applied at close off to attain minimum leakage.

3. See and coordinate drawings for required control operation.

2.14 AIR FLOW CONTROL

A. Airflow and static pressure shall be controlled via digital controllers with inputs from airflow control measuring stations and static pressure inputs as specified. Controller outputs shall be analog or pulse width modulating output signals. The controllers shall include the capability to control via simple proportional (P) control, proportional plus integral (PI), proportional plus integral plus derivative (PID), and on-off. The airflow control programs shall be factory-tested programs that are documented in the literature of the control manufacturer.

B. Air Flow Measuring Station -- Electronic Thermal Type:

1. Air Flow Sensor Probe:

a. Each air flow sensor shall contain two individual thermal sensing elements. One element shall determine the velocity of the air stream while the other element shall compensate for changes in temperature. Each thermal flow sensor and its associated control circuit and signal conditioning circuit shall be factory calibrated and be interchangeable to allow replacement of a sensor without recalibration of the entire flow station. The sensor in the array shall be located at the center of equal area segment of the duct or fan inlet and the number of sensors shall be adequate to accommodate the expected velocity profile and variation in flow and temperature. The airflow station shall be of the insertion type in which sensor support structures are inserted from the outside of the ducts to make up the complete electronic velocity array.

b. Thermal flow sensor shall be constructed of hermetically sealed thermistors or nickel chromium or reference grade platinum wire, wound over an epoxy, stainless steel or ceramic mandrel and coated with a material suitable for the conditions to be encountered. Each dual sensor shall be mounted in an extruded aluminum alloy strut.

c. Accuracy: ±3% of reading

d. Calibrated Range: 0 to 5000 fpm, -20 to 160°F

e. Environmental Limits: -20°F to 160°F (probes), -20°F to 120°F (transmitter).

2. Air Flow Sensor Grid Array:

a. Each sensor grid shall consist of a lattice network of temperature sensors and linear integral controllers (ICs) situated inside an aluminum casing suitable for mounting in a

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duct. Each sensor shall be mounted within a strut facing downstream of the airflow and located so that it is protected on the upstream side. All wiring shall be encased (out of the air stream) to protect against mechanical damage.

b. The casing shall be made of welded aluminum of sufficient strength to prevent structural bending and bowing. Steel or iron composite shall not be acceptable in the casing material.

c. Pressure drop through the flow station shall not exceed 4 Pascal (0.015 inch WG) at 1,000 meter per minute (3,000 FPM).

3. Electronics Panel:

a. Electronics Panel shall consist of a surface mounted enclosure complete with solid-state microprocessor and software.

b. Electronics Panel shall be A/C powered 24 VAC and shall have the capability to transmit signals of 4-20 ma or 0-10 VDC type or PWM type for use in control of the HVAC Systems. The electronic panel shall have the capability to accept user defined scaling parameters for all output signals.

c. Electronics Panel shall have the capability to digitally display airflow in CFM and temperature in degrees F. The displays shall be provided as an integral part of the electronics panel. The electronic panel shall have the capability to totalize the output flow in CFM for two or more systems, as required. A single output signal shall be provided which will equal the sum of the systems totalized. Output signals shall be provided for temperature and airflow. Provide remote mounted air flow or temperature displays where indicated on the plans.

d. Electronics Panel shall have the following:

1) Minimum of 12-bit A/D conversion.

2) Field adjustable digital primary output offset and gain.

3) Airflow analog output scaling of 100 to 10,000 FPM.

4) Temperature analog output scaling from -45 degrees C to 70 degrees C (-50 degrees F to 160 degrees F).

5) Analog output resolution (full scale output) of 0.025 percent.

e. All readings shall be in I.P. units.

4. Thermal flow sensors and its electronics shall be installed as per manufacturer's instructions. The required probe sensor density shall be per manufacturer's instructions, dependent on duct dimensions.

5. Complete installation shall not exhibit more than ± 2.0 percent error in airflow measurement output for variations in the angle of flow of up to 10 percent in any direction from its calibrated orientation. Repeatability of readings shall be within ± 0.25 percent.

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C. Static Pressure Measuring Station: shall consist of one or more static pressure sensors and transmitters along with relays or auxiliary devices as required for a complete functional system. The span of the transmitter shall not exceed two times the design static pressure at the point of measurement. The output of the transmitter shall be true representation of the input pressure with plus or minus 25 Pascal (0.1 inch) W.G. of the design input pressure:

1. Static pressure sensors shall have the same requirements as Airflow Measuring Devices except that total pressure sensors are optional, and only multiple static pressure sensors positioned on an equal area basis connected to a network of headers are required.
2. For systems with multiple major or main trunk supply ducts, furnish a static pressure transmitter for each trunk duct. The transmitter signal representing the lowest static pressure shall be selected and this shall be the input signal to the controller.
3. The controller shall receive the static pressure transmitter signal and Control Unit (CU) shall provide a control output signal to the supply fan capacity control device. The control mode shall be proportional plus integral (PI) (automatic reset) and where required shall also include derivative mode.
4. In systems with multiple static pressure transmitters, provide a switch located near the fan discharge to prevent excessive pressure during abnormal operating conditions. High-limit switches shall be manually reset.

D. Constant Volume Control Systems shall consist of an air flow measuring station along with such relays and auxiliary devices as required to produce a complete functional system. The transmitter shall receive its air flow signal or differential pressure signal from the flow measuring station and shall have a span not exceeding three times the design flow rate. The CU shall receive the transmitter signal and shall provide an output to the fan volume control device to maintain a constant flow rate. The CU shall provide proportional plus integral (PI) (automatic reset) control mode and where required also inverse derivative mode. Overall system accuracy shall be plus or minus the equivalent of 2 Pascal (0.008 inch) velocity pressure as measured by the flow station.

E. Airflow Synchronization:

1. Systems shall consist of an air flow measuring station for each main supply and return duct, the CU and such relays, as required to provide a complete functional system that will maintain a constant flow rate difference between supply and return air to an accuracy of ±10 percent. In systems where there is no suitable location for a flow measuring station that will sense total supply or return flow, provide multiple flow stations with a differential pressure transmitter for each station. Signals from the multiple transmitters shall be added through the CU such that the resultant signal is a true representation of total flow.
2. The total flow signals from supply and return air shall be the input signals to the CU. This CU shall track the return air fan capacity in proportion to the supply air flow under all conditions.

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2.15 SAFETY

A. Provide hard-wired interlocked connections for such all safety devices, such as freeze stats, smoke detectors, smoke dampers, and refrigerant leak detection devices. All safety devices shall be provided with additional dry contacts and shall be connected to the DDC system for monitoring and sequencing.

PART 3 EXECUTION

3.01 INSTALLATION

A. General:

1. Examine project plans for control devices and equipment locations; and report any discrepancies, conflicts, or omissions to Owner for resolution before proceeding for installation.
2. Install equipment, piping, wiring /conduit parallel to or at right angles to building lines.
3. Install all equipment and piping in readily accessible locations. Do not run tubing and conduit concealed under insulation or inside ducts.
4. Mount control devices, tubing and conduit located on ducts and apparatus with external insulation on standoff support to avoid interference with insulation.
5. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
6. Run tubing and wire connecting devices on or in control cabinets parallel with the sides of the cabinet neatly racked to permit tracing.
7. Install equipment level and plumb.

B. Electrical Wiring Installation:

1. All wiring and cabling shall be installed in conduits. Install conduits and wiring in accordance with Specification Division 26 – ELECTRICAL. Conduits carrying control wiring and cabling shall be dedicated to the control wiring and cabling: these conduits shall not carry power wiring. Provide plastic end sleeves at all conduit terminations to protect wiring from burrs.
2. Install analog signal, and analog and digital communication cables in conduit and in accordance with ANSI/TIA 568.2-D:
   a. Provide 23AWG 4-Pair solid bare copper conductors, overall aluminum foil shield – F/UTP, bandwidth tested up to 750MHz & 1G/10G Ethernet up to 328 ft, PoE/PoE+/PoE++ (IEEE 802.3af/at/bt), 4PPoE up to 100W, cETLus Certified, RoHS-3 & ANSI/TIA 568.2-E compliant.
3. Install conduit and wiring between operator workstation(s), digital controllers, electrical panels, indicating devices, instrumentation, miscellaneous alarm points, thermostats, and relays as shown on the drawings or as required under this section.

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4. Install all electrical work required for a fully functional system and not shown on electrical plans or required by electrical specifications. Where low voltage (less than 50 volt) power is required, provide suitable Class B transformers.
5. Install all system components in accordance with local Building Code and National Electric Code.
    a. Splices: Splices in shielded and coaxial cables shall consist of terminations and the use of shielded cable couplers. Terminations shall be in accessible locations. Cables shall be harnessed with cable ties.
    b. Equipment: Fit all equipment contained in cabinets or panels with service loops, each loop being at least 300 mm (12 inches) long. Equipment for fiber optics system shall be rack mounted, as applicable, in ventilated, self-supporting, code gauge steel enclosure. Cables shall be supported for minimum sag.
    c. Cable Runs: Keep cable runs as short as possible. Allow extra length for connecting to the terminal board. Do not bend flexible coaxial cables in a radius less than ten times the cable outside diameter.
    d. Use vinyl tape, sleeves, or grommets to protect cables from vibration at points where they pass around sharp corners, through walls, panel cabinets, etc.
6. Conceal cables, except in mechanical rooms and areas where other conduits and piping are exposed.
7. Permanently label or code each point of all field terminal strips to show the instrument or item served. Color-coded cable with cable diagrams may be used to accomplish cable identification.
8. Grounding: ground electrical systems per manufacturer's written requirements for proper and safe operation.

C. Install Sensors and Controls:

1. Temperature Sensors:
    a. Install all sensors and instrumentation according to manufacturer's written instructions. Temperature sensor locations shall be readily accessible, permitting quick replacement and servicing of them without special skills and tools.
    b. Calibrate sensors to accuracy specified, if not factory calibrated.
    c. Use of sensors shall be limited to its duty, e.g., duct sensor shall not be used in lieu of room sensor.
    d. Install room sensors permanently supported on wall frame. They shall be mounted at 1.5 meter (5.0 feet) above the finished floor unless otherwise noted on the plans or drawings. Utilize existing mounting boxes where available.

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e. Mount sensors rigidly and adequately for the environment within which the sensor operates. Separate extended-bulb sensors form contact with metal casings and coils using insulated standoffs.
f. Sensors used in mixing plenums shall be of the averaging of type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.
g. All pipe mounted temperature sensors shall be installed in wells.
h. All wires attached to sensors shall be air sealed in their conduits or in the wall to stop air transmitted from other areas affecting sensor reading.
i. Permanently mark terminal blocks for identification. Protect all circuits to avoid interruption of service due to short-circuiting or other conditions. Line-protect all wiring that comes from external sources to the site from lightning and static electricity.

2. Pressure Sensors:
   a. Install duct static pressure sensor tips facing directly downstream of airflow.
   b. Install high-pressure side of the differential switch between the pump discharge and the check valve.
   c. Install snubbers and isolation valves on steam pressure sensing devices.
3. Actuators:
   a. Mount and link damper and valve actuators according to manufacturer's written instructions.
   b. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed position.
   c. Check operation of valve/actuator combination to confirm that actuator modulates valve smoothly in both open and closed position.
4. Flow Switches:
   a. Install flow switch according to manufacturer's written instructions.
   b. Mount flow switch a minimum of 10 pipe diameters up stream and 5 pipe diameters downstream or 600 mm (2 feet) whichever is greater, from fittings and other obstructions.
   c. Assure correct flow direction and alignment.
   d. Mount in horizontal piping-flow switch on top of the pipe.

D. System Integration:
1. Third party interfaces: Contractor shall integrate real-time data from building systems by other trades and databases originating from other manufacturers as specified and required to make the system work as one system.

E. Installation of digital controllers and programming:

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1. Provide a separate digital control panel for each major piece of equipment, such as air handling unit, chiller, pumping unit etc. Points used for control loop reset such as outdoor air, outdoor humidity, or space temperature could be located on any of the remote control units.
2. Provide sufficient internal memory for the specified control sequences and trend logging. There shall be a minimum of 25 percent of available memory free for future use.
3. System point names shall be human readable, permitting easy operator interface without the use of a written point index.
4. Provide software programming for the applications intended for the systems specified, and adhere to the strategy algorithms provided./
5. Provide graphics for each piece of equipment and floor plan in the building. This includes each chiller, air handling unit, fan, terminal unit, boiler, pumping unit etc. These graphics shall show all points dynamically as specified in the point list.

3.02 SYSTEM VALIDATION AND DEMONSTRATION

A. As part of final system acceptance, a system demonstration is required (see below). Prior to start of this demonstration, the contractor is to perform a complete validation of all aspects of the controls and instrumentation system.

B. Validation

1. Prepare and submit for approval a validation test plan including test procedures for the performance verification tests. Test Plan shall be submitted for review with the control system submittal as indicated in paragraph 1.7 Submittals. Test Plan address all specified functions of the ECC and all specified sequences of operation. Explain in detail actions and expected results used to demonstrate compliance with the requirements of this specification. Explain the method for simulating the necessary conditions of operation used to demonstrate performance of the system. Test plan shall include a test check list to be used by the Installer's agent to check and initial that each test has been successfully completed. Deliver test plan documentation for the performance verification tests to the owner's representative 30 days prior to start of performance verification tests. Provide draft copy of operation and maintenance manual with performance verification test.
2. After approval of the validation test plan, installer shall carry out all tests and procedures therein. Installer shall completely check out, calibrate, and test all connected hardware and software to ensure that system performs in accordance with approved specifications and sequences of operation submitted. Installer shall complete and submit Test Check List.

C. Demonstration

1. System operation and calibration to be demonstrated by the installer in the presence of the Architect or CxA on random samples of equipment as dictated by the Owner. Should random sampling indicate improper work, the owner reserves the right to subsequently witness complete calibration of the system at no addition cost to the Owner.

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2. Make accessible, personnel to provide necessary adjustments and corrections to systems as directed by balancing agency.

3. The following witnessed demonstrations of field control equipment shall be included:
   a. Observe HVAC systems in shut down condition. Check dampers and valves for normal position.
   b. Test application software for its ability to communicate with digital controllers, operator workstation, and uploading and downloading of control programs.
   c. Demonstrate the software ability to edit the control program off-line.
   d. Demonstrate reporting of alarm conditions for each alarm and ensure that these alarms are received at the assigned location, including operator workstations.
   e. Demonstrate ability of software program to function for the intended applications-trend reports, change in status etc.
   f. Demonstrate via graphed trends to show the sequence of operation is executed in correct manner, and that the HVAC systems operate properly through the complete sequence of operation, e.g., seasonal change, occupied/unoccupied mode, and warm-up condition.
   g. Demonstrate hardware interlocks and safeties functions, and that the control systems perform the correct sequence of operation after power loss and resumption of power loss.
   h. Prepare and deliver to the VA graphed trends of all control loops to demonstrate that each control loop is stable and the set points are maintained.
   i. Demonstrate that each control loop responds to set point adjustment and stabilizes within one (1) minute. Control loop trend data shall be instantaneous and the time between data points shall not be greater than one (1) minute.
4. Witnessed demonstration of ECC functions shall consist of:
   a. Running each specified report.
   b. Display and demonstrate each data entry to show site specific customizing capability. Demonstrate parameter changes.
   c. Step through penetration tree, display all graphics, demonstrate dynamic update, and direct access to graphics.
   d. Execute digital and analog commands in graphic mode.
   e. Demonstrate DDC loop precision and stability via trend logs of inputs and outputs (6 loops minimum).
   f. Demonstrate Energy Management System (EMS) performance via trend logs and command trace.
   g. Demonstrate scan, update, and alarm responsiveness.
   h. Demonstrate spreadsheet/curve plot software, and its integration with database.
   i. Demonstrate on-line user guide, and help function and mail facility.

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j. Demonstrate digital system configuration graphics with interactive upline and downline load, and demonstrate specified diagnostics.

k. Demonstrate multitasking by showing dynamic curve plot, and graphic construction operating simultaneously via split screen.

l. Demonstrate class programming with point options of beep duration, beep rate, alarm archiving, and color banding.

3.03 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Owner.

3.04 DEMONSTRATION AND TRAINING

A. See Division 1 for demonstration and training requirements.

B. Provide services of manufacturer's technical representative for up to 16 hours in up to four (4) sessions to instruct each Owner personnel responsible in the operation and maintenance of the system.

C. Contractor to record attendance at each session with all pertinent training data and personnel contract information recorded. Contractor to provide attendance sheets to Owner for each training session.

3.05 CONSTRUCTION WASTE MANAGEMENT

A. General: Comply with Contractor's Waste Management Plan and Division 1.

B. To the greatest extent possible, separate reusable and recyclable products from contaminated waste and debris in accordance with the Contractor's Waste Management Plan. Place recyclable and reusable products in designated containers and protect from moisture and contamination.

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SECTION 237200
AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Energy recovery ventilators.

1.02 RELATED REQUIREMENTS

A. Section 230923 - Direct-Digital Control System for HVAC.

1.03 REFERENCE STANDARDS

A. AHRI 1060 (I-P) - Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment; 2023.

B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2025.

D. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

E. IECC - International Energy Conservation Code, 2018, adopted by NH on 7/1/2022.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

H. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Division 1 for submittal procedures.

B. Product Data: Manufacturer's installation instructions, product data, and engineering calculations.

C. Code Compliance: Submit an evaluation of equipment performance at design conditions to prove equipment meets code requirements, listing code and year of compliance.

D. Shop Drawings: Show design and assembly of energy recovery unit and installation and connection details. Provide separate drawing showing curb adapter.

E. Samples: Submit equipment finish samples showing custom paint colors.

F. Closeout Submittals: Submit manufacturer's operation and maintenance instructions.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 1 for additional provisions.
   2. Extra Stock Materials: One set of filters.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

Initial: SAC
Date: 9/16/26

1.07 WARRANTY

A. See Division 1 for additional warranty requirements.

B. Manufacturer Warranty: Provide 1-year manufacturer warranty for equipment including parts, materials, workmanship, and operation commencing on date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.

C. Motor Warranty: Provide 36-month manufacturer warranty against breakdowns, malfunctions, or defects in material and workmanship under expected service conditions.

D. Energy Wheel Warranty: Provide 5-year manufacturer warranty against desiccant coating or wheel material and workmanship defects including issues arising from reduced performance under circumstances of normal use from listed design figures.

PART 2 PRODUCTS

2.01 ENERGY RECOVERY VENTILATOR

A. Manufacturers:
1. Greenheck; www.greenheck.com/#sle.
2. Munters Corporation; www.munters.com/#sle.
3. Company; EnERVent+ Series: www.ruskin.com/#sle.
4. FlaktGroup SEMCO: https://www.semcohvac.com/#sle.

B. Basis of Design: FlaktGroup SEMCO: https://www.semcohvac.com/#sle.

C. Installation: Outdoor, roof-mounted.

D. ERV Equipment Performance Requirements:
1. See Mechanical Drawings for individual unit operating conditions.
2. Meet code requirements for latent heat, sensible heat, and total heat effectiveness.

E. ERV Equipment Construction Requirements:
1. Energy Recovery Exchanger Type: Energy wheel.
2. Supply and Return Duct Connection Orientation: Vertical supply and return, through roof, into bottom of unit.
3. Casing and Frame:
   a. Frame: Galvanized steel body or welded extruded aluminum tubular frame capable of supporting components and casings including integral base lifting holes.
   b. Double Wall Panels: Minimum of 20 gauge, 0.036 inch galvanized steel, G60 minimum.
      1) Provide means of preventing water accumulation on unit, such as fabricated sloped roof or other.
   c. Doors: Construct doors of same construction and thickness as wall panels. Include p-shaped extruded neoprene gasket, prop rod, chain with spring, exterior handle, and interior 3-point latching device. Label each door to identify equipment located within.
   d. Insulation Requirements:
      1) Mold Resistance: "Pass" when tested in accordance with ASTM C1338.
      2) Fungal Resistance: No growth when tested in accordance with ASTM G21.
      3) Bacteria Resistance: No growth when tested in accordance with UL 181.
      4) Flame spread index of 25 or less and maximum smoke developed index of 50.
   e. Isolation and Sealing: Form continuous, thermally isolated, weathertight seal between inner wall of panels and structural framing with closed cell PVC foam gasketing and seal seams to prevent job site caulking.
   f. Access Panels: Provide access to components through a large, tightly sealed and easily removable hinged or screwed access panel.
   g. Finish: Polyurethane enamel over weather-protected, corrosion-resistant assembly.
   h. Nameplate: Permanent name plate listing manufacturer, model number, serial number, voltage with tolerance, and amp ratings mounted inside door near electrical panel.

Initial: SJC
Date: 9/4/26

4. Supply and Exhaust Fans:
   a. Provide separate non-overloading, statically and dynamically balanced, draw-through, forward curved centrifugal fan or fan-array for each air stream.
   b. Fan Motor: Variable Frequency Drive, high efficiency, load matched, belt-driven, open drip proof, thermal overload protected TEFC motor with variable-sheave belt drive, and adjustable-removable motor-slide base. Size drives to 150 percent of load, minimum.
   c. Belt Guards: Full sized, hinged, painted with high-visibility safety color, and accessible with standard tools.
   d. Motor and Drive Bearings: Permanently lubricated sealed ball bearings rated for not less than 200,000 hours of operation with accessible greased fittings.
5. Dampers and Louvers:
   a. Sealing Performance: Class 1A.
   b. Service Ratings: Up to 6 in-wc closed and 3,000 fpm when open.
   c. Frame: Minimum of 20 gauge, 0.0359 inch galvanized steel channel with rear flange, prepunched mounting holes, and welded corner clips for maximum rigidity.
   d. Exhaust Damper: Parallel blade with motorized damper actuator for exhaust air stream isolation.
   e. Outdoor-Intake Louver: Parallel blade with motorized damper actuator. Provide weatherhood with 0.5" intake insect screen and mist eliminator.
6. Filter Sections:
   a. Outdoor-Intake and Exhaust Sides: 2 inch thick, aluminum mesh filters.
   b. Filter Racks: Bolt-on rack constructed of aluminum. Include hinged side access door and snap fasteners.
7. Roof Curbs:
   a. Curb Adapter: Provide curb adapter to existing curb, no greater than 24" height. Utilize existing curb with new curb adapter.
   b. Gaskets: Provide closed cell PVC foam, field installed top of curb.
8. Vibration Isolation: Provide corrosion-resistant vibration isolation products for internal motors and other revolving parts. See Division 23.
9. Electrical:
   a. 460 VAC, 3-phase with single-point power connection to non-fused main disconnect interlocked with control panel and other components.
   b. Install internal wiring in accordance with NFPA 70 within flexible, liquid tight steel conduit.
10. Controls and Local Control Panel:
    a. Unit Controls: Factory supplied DDC with sensors, limit switches, and frost control.
       1) Provide with discharge air temperature sensor and airflow monitoring station, see Division 23.
    b. Provide fused disconnect within local control panel with power supplies, transformers, terminal strip or terminal blocks for interface of field installed components.
    c. Service Status: Provide both local and remote indication of sensor readings and status of safeties and other status items including power on, wheel-rotation alarm, outside-air loaded filter and exhaust-air loaded filter.
    d. Provide temperature, humidity, dewpoint temperature, CO2, and wheel rotation sensors.
    e. Freeze Protection Thermostat: Provide manufacturer's stop/jog control, and configure to stop unit when outdoor air intake temperature drops below 38 degrees F, adjustable.
11. BAS Controller Communication: ASHRAE Std. 135 BACnet MS/TP.
12. Configuration: Adjust listed requirements in conformance with ASHRAE Std 90.1 I-P.
13. Certification: AHRI 1060 (I-P) labeled, include copy of published ratings for operating conditions.

Initial: SJC
Date: 9/14/26

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that structure is ready for installation including openings, ductwork, mechanical utilities, and electrical utilities.

B. Rooftop Installation: Provide curb adapter to existing curb, no greater than 24" height.

3.02 INSTALLATION

A. Install equipment in accordance with manufacturer's written installation instructions.

B. Do not obstruct maintenance access to equipment piping, electrical conduit, or any other utility.

C. Vibration Isolation: Provide corrosion-resistant equipment isolation products; see Division 23.

D. Outdoor Installation: Use concealed means of attachment. Minimize penetrations through top of roof. Provide weather tight seal at required penetrations. Provide drip edge around roof perimeter. Do not locate roof panel joints above doors.

E. Electrical: Provide equipment raceway, wiring, and cables; see Division 26.

F. Coordinate installation and fire alarm system interface of system compatible duct-mounted smoke detectors and other appurtenances following NFPA 90A guidelines.

G. Start system and adjust controls and equipment for satisfactory operation.

H. Coordinate hardwired or software interfacing links to enable coordinate as minimum start-stop, occupied, unoccupied functions as well as specific schedules and setpoints functions with other DDC controls onboard airside systems serving common spaces; see Division 23.

I. Coordinate BAS, BMS, or Integrated Automation linking between unit controller(s) and remote front-end interface.

3.03 SYSTEM STARTUP

A. Provide services of manufacturer's authorized representative to provide start up of unit.

B. Provide start up report to EOR upon completion of equipment start up verification.

3.04 CLEANING

A. Clean filters, air plenums, interior and exposed-to-view surfaces prior to Substantial Completion.

3.05 CLOSEOUT ACTIVITIES

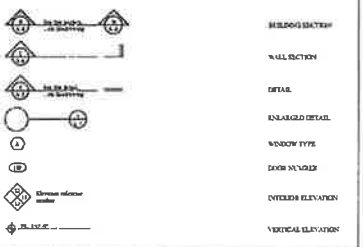
A. Demonstrate proper operation of equipment to Owner's designated representative.

B. Training: Train Owner's personnel on operation and maintenance of system.
   1. Training Reference: Operation and maintenance manual and additional training materials as required.
   2. Provide minimum of two hours of training.

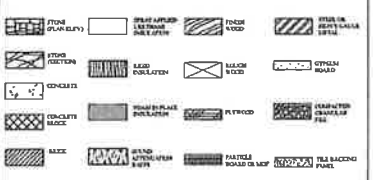
END OF SECTION 237200

Initial: SJC
Date: 9/14/26

DRAWING SYMBOLS



CONSTRUCTION MATERIALS



ABBREVIATIONS

ABV	above	FE	Leach fence	PNT	paint(ed)
ACT	acoustic ceiling tile	FE	fire extinguisher	PR	pair
ADJ	adjustable	FLG	flashing	PL	plate
AFF	above finish floor	FD	floor drain	PT	pressure treated
ALUM	aluminum	FRT	fire retardant	PWD	plywood
ANC	anchor, anchorage	FTG	footing	REF	refrigerator
ARCH	architect(ural)	FND	foundation	R	riser
BSMT	basement	GA	gage, gauge	RU	room
BIT	bituminous	GALV	galvanized	RO	rough opening
BLKG	blocking	GC	general contractor (s)	SAC	suspended acoustic ceiling
BD	board	GWB	gypsum wall board	SMTH	smething
BOT	bottom	GFE	Government furnished equipment	SQM	square meter
BLK	brick	GFCI	Government furnished contractor install	SPEC	specification(s)
BLDG	building			SQ	square
BTWN	between		cross-wire conduit	SS	stainless steel
CB	catch basin	NTEL	weight determine	STD	standard
CJ	control joint			SD	storm drain
CLG	ceiling	WWD	hardwood	STRUC	structural
CT	corridor tile	HVAC	heating, ventilating & air conditioning	SYS	system
CO	clean out			TBP	tile backing panel
CL	closet	HT	height	TDD	thermal dimensions studies
CLR	clear(ance)	HOR	horizontal	TEL	telephone
COL	column	ID	inside diameter	TG	tempered glass
CONC	concrete	INSUL	insulation	THK	thick(ness)
CMU	concrete masonry unit	JAN	janitor	TH	threshold
CONT	continuous or continue	JT	joint	T&G	tongue & groove
DF	dampproofing	LAV	lavatory	TOC	top of concrete
DRM	dormitory, dormitories	MAX	maximum	TOM	top of masonry
DWT	dental	MBOI	mechanical	TOS	top of steel
DIA	diameter	MFR	manufacturer	TOW	top of wall
DTPD	drop ped	MIN	minimum	T	tread
DF	drinking fountain	MO	masonry opening	TYP	typical
ELEC	electric(al)	MTL	metal	UNO	unless noted otherwise
EL	elevation	MIN	minimum	VERT	vertical
ELEV	elevator	NIC	not in contract	VCT	vinyl composition tile
EQ	equal	NTS	not to scale	VB	vapor barrier
EXG	existing	OC	on center	VT	vinyl tile
EXT	exterior	OD	outside diameter	WG	wire glass
FG	fiberglass	OPNG	opening	W/O	with out
FIN	finish			WD	wood

NEW HAMPSHIRE ARMY NATIONAL GUARD

SMR

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BUILDING 1 ALTERATIONS

1 MINUTEMAN WAY,
CONCORD, NH

JULY 16, 2026

LIST OF DRAWINGS

COVER SHEET

ARCHITECTURAL DRAWINGS

A-1.0 FIRST FLOOR PLAN
A-1.1 SECOND FLOOR PLAN
A-1.2 ROOF PLAN

MECHANICAL DRAWINGS

M0.1 MECHANICAL GENERAL NOTES, LEGENDS, AND SCOPE
M0.2 AHU SERVICE MAP
M1.0 SMR B1 & B2 NETWORK ARCHITECTURE
M1.1 SMR B1 1ST FLOOR NORTH
M1.2 SMR B1 1ST FLOOR SOUTH
M2.1 SMR B1 2ND FLOOR NORTH
M2.2 SMR B1 2ND FLOOR SOUTH
M2.3 SMR B1 ROOF PLAN
M3.3 SMR B2 1ST FLOOR PARTIAL PLAN AND SCOPE NOTES
M5.0 SMR B1 AHU-1 / FCU-1 CONTROLS DIAGRAM
M5.1 SMR B1 AHU-2,3,4 / EDU-1 CONTROLS DIAGRAM
M5.2 SMR B1 AHU-5 / FCU-2 CONTROLS DIAGRAM
M5.3 SMR B1 VAV - EF & MUA CONTROLS DIAGRAM

ALLOWANCES

ALLOWANCE #1 - XXXX:
SELECT REPLACEMENT CEILING TILE, GRID SYSTEM AND GWB CEILING SYSTEMS IN ROOMS INDICATED FOR NEW CONSTRUCTION. CEILING NEEDS MAY BE ENGAGED DURING LATE WORK. ALLOW EXISTING CEILING TILE AND GRID PATCH, PAINT, AND REPLACE TO MATCH EXISTING COLOR AND PATTERN.

ALLOWANCE #2 - XXXX:
REMOVE AND REPLACE ALL OF THE EXISTING WOOD DOOR AND FRAME (IN EXISTING WOOD WALLS) WITH NEW DOOR AND FRAME OF SIMILAR SIZE AND STYLE AS EXISTING DOOR AND FRAME. ALLOW FOR 6 DOORS AND FRAMES.

ALLOWANCE #3 - XXXX:
PROVIDE CCTV SYSTEM AND PROGRAMMING TO INCLUDE 4 CAMERAS, INSTALLED AT LOCATIONS AS DIRECTED BY OWNER.

ALTERNATES:

ALTERNATE 1, 2, & 3:
BASE BID:
ALTERNATE 1:
ALTERNATE 2:
ALTERNATE 3:

ALTERNATE 4:
BASE BID:
ALTERNATE 4:

LOCATION PLAN



VICINITY PLAN



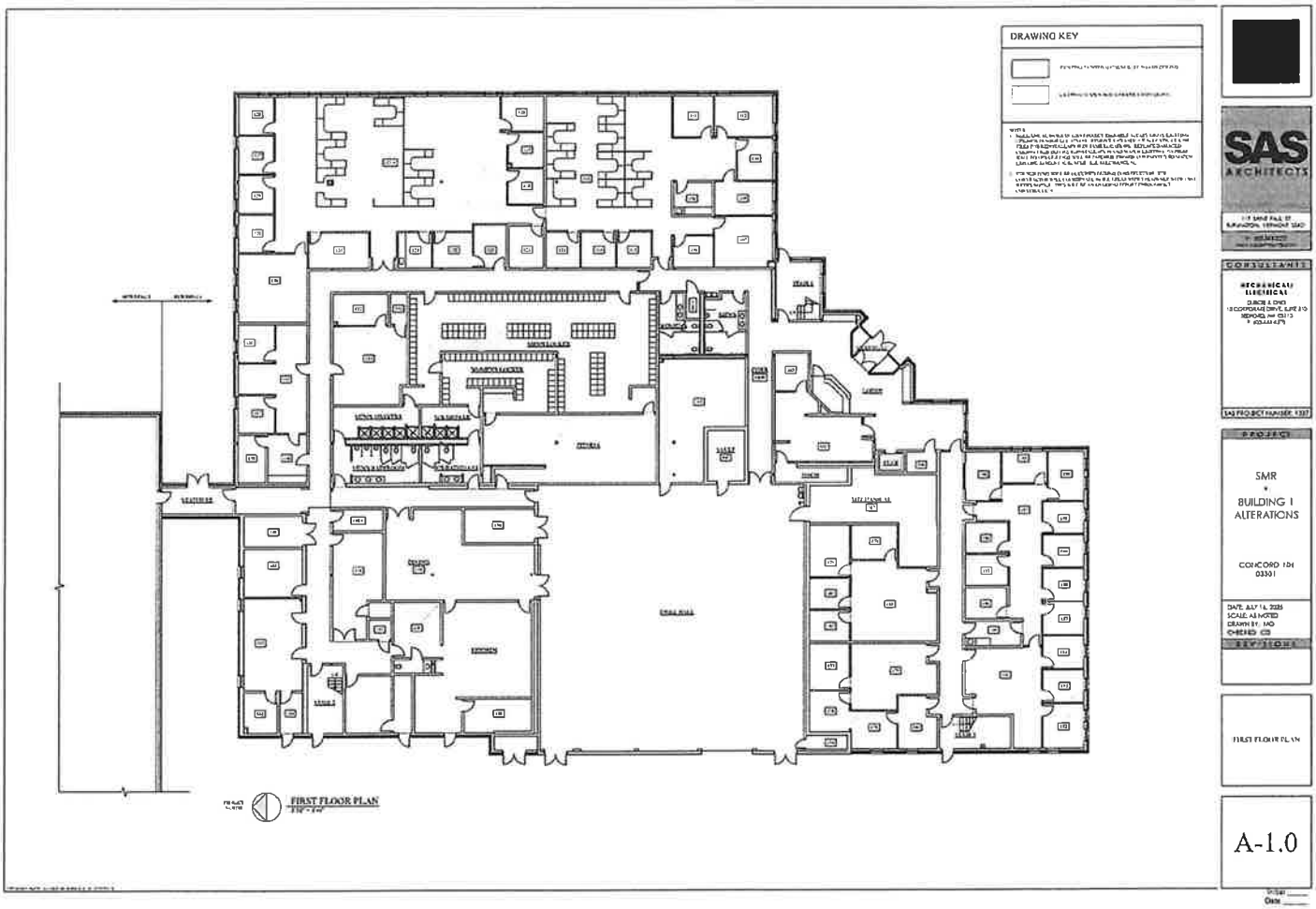
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CONSULTANTS

MECHANICAL / ELECTRICAL

Initial _____
Date _____

9/14/26



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CONSULTANTS

MECHANICAL/ ELECTRICAL

SAS PROJECT NUMBER 1337

PROJECT

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+
BUILDING 1
ALTERATIONS

CONCORD NH
03301

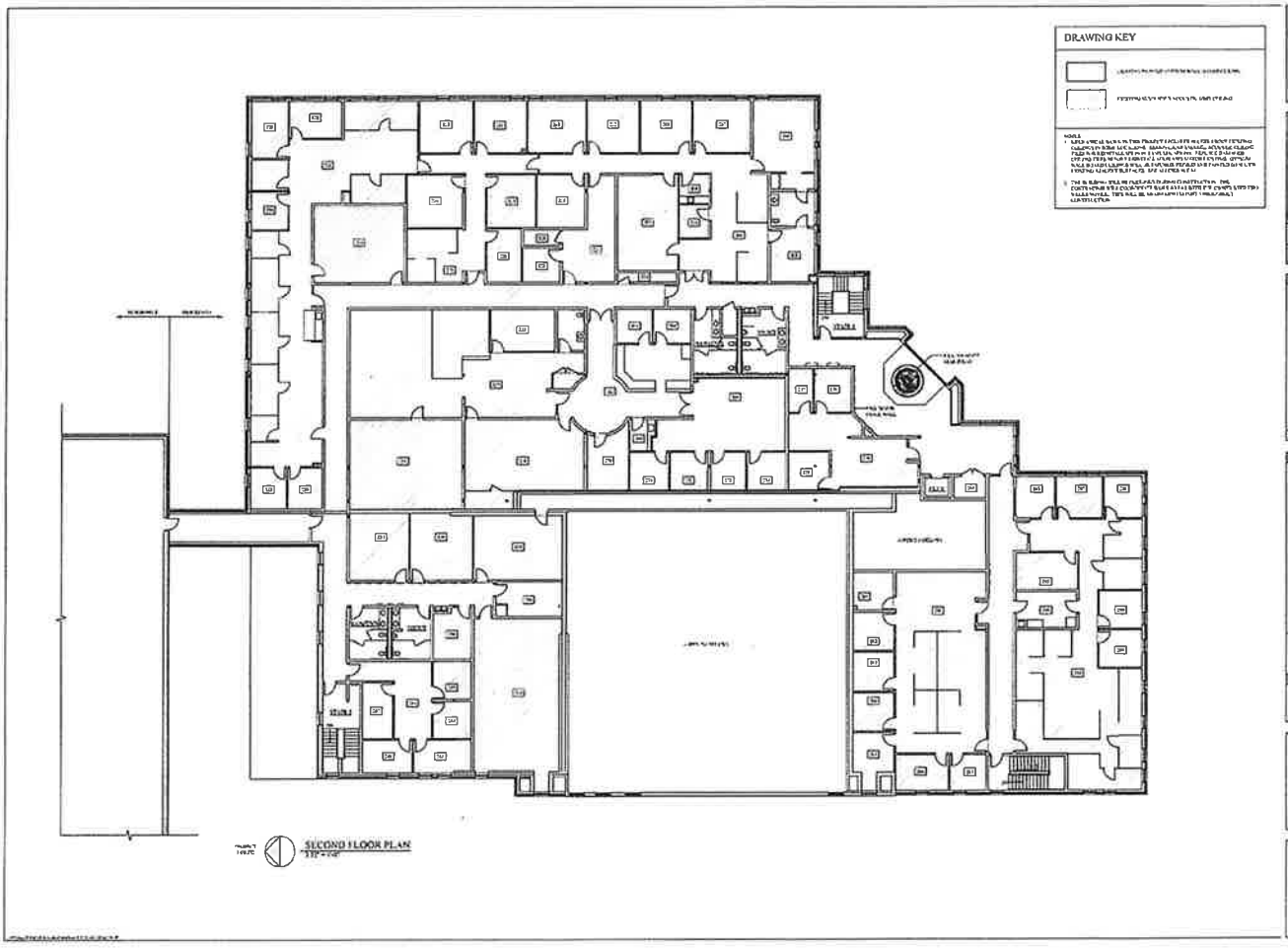
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REVISIONS

FIRST FLOOR PLAN

A-1.0

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9/14/26



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PROJECT

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BUILDING 1
ALTERATIONS

CONCORD, NH
03301

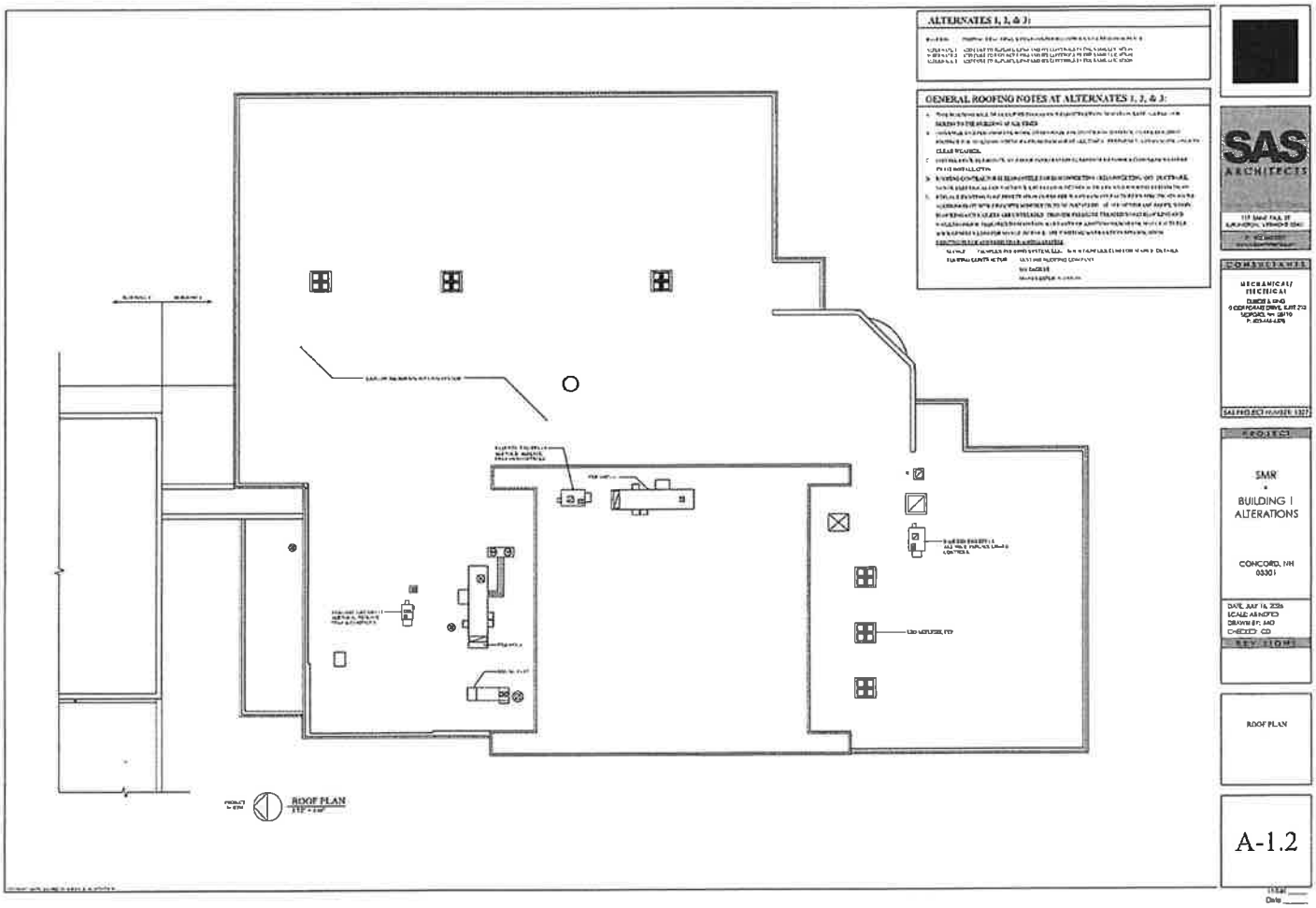
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REVISIONS

SECOND FLOOR PLAN

A-1.1

SAS 9/14/26


ALTERNATES 1, 2, & 3:
GENERAL ROOFING NOTES AT ALTERNATES 1, 2, & 3:
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MECHANICAL/ ELECTRICAL
SMR
BUILDING 1 ALTERATIONS
CONCORD, NH 03301
ROOF PLAN
A-1.2
ROOF PLAN

9/14/26

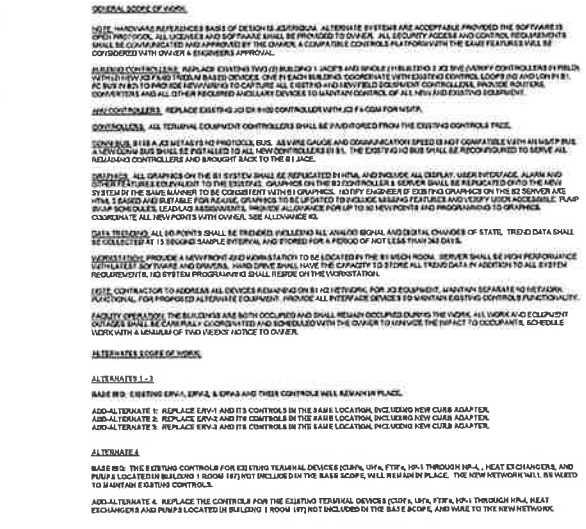
MECHANICAL LEGEND



MECHANICAL GENERAL NOTES







PROJECT DESCRIPTION

DEMO AND REPLACE THE EXISTING EMS CONTROLS SYSTEM COMPONENTS WITH MODERN CONTROL DEVICES, MAINTAIN EXISTING FUNCTIONALITY WHILE MODIFYING THE COMMUNICATION PROTOCOLS TO BMS DEVICES, AND ADJUSTING HOW SOME CONTROLS WIRING IS ROUTED. PROJECT IS TO OCCUR DURING EXISTING BUILDING OCCUPATION AND REQUIRES COORDINATION OF WORK WITH OCCUPANTS. PROJECT HAS ADD-ALTS FOR ERV REPLACEMENT AND FOR THE REPLACEMENT OF TERMINAL DEVICE CONTROLLERS.

APPLICABLE CODES

IEBC-2018 (AMENDED)
IEBC-2021 (AMENDED)
IMC-2021 (AMENDED)

ALTERNATE 1 - 3

ALTERNATE 4







PROJECT

SMR
+
BUILDING 1
ALTERATIONS

COFCORO, NH
03301



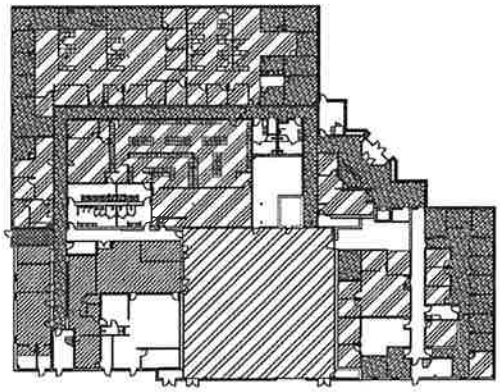
REVISIONS

MECHANICAL GENERAL NOTES, LEGENDS, AND SCOPE

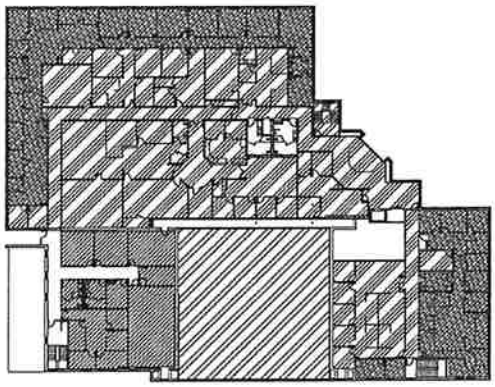
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Date ____

	LOCATION
AHU-1	ROOF
AHU-2	MECH ROOM
AHU-3	MECH ROOM
AHU-4	ROOF
AHU-5	CST/GARAGES



LEVEL 1



LEVEL 2

HVAC INPUTS & OUTPUTS

MECHANICAL LAYOUT PROVIDED FROM CAD POINT + EQUIPMENT SELECTIONS CENTER AIR-VAULT DRAWINGS DATED [illegible] WITH FORMAT TITLE BLOCK.

LAYOUT WAS INTERPRETED AS ACCURATE BACKGROUND AND INPUT FROM [illegible] ON 5/1/2026.

LAYOUT SHOWN MAY NOT REFLECT CURRENT FIELD CONDITIONS

SAS ARCHITECTS

CONSULTANTS

MECHANICAL/ ELECTRICAL

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PROJECT

SMR
BUILDING I
ALTERATIONS

CONCORD, NH
03301

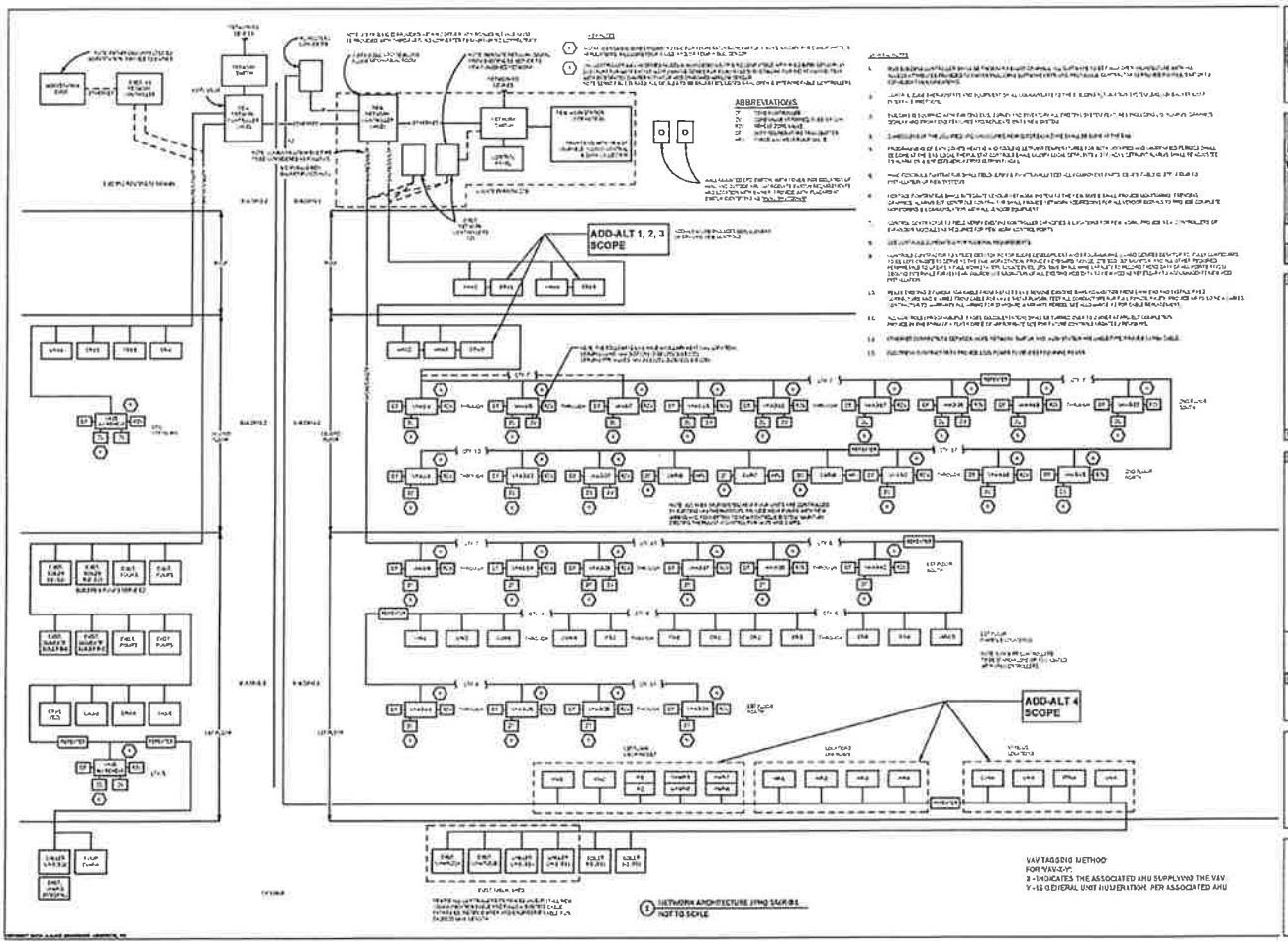
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REVISIONS

AHU SERVICE MAP

M0.2

9/14/26



CONSULTANTS

MECHANICAL/
ELECTRICAL

PROJECT

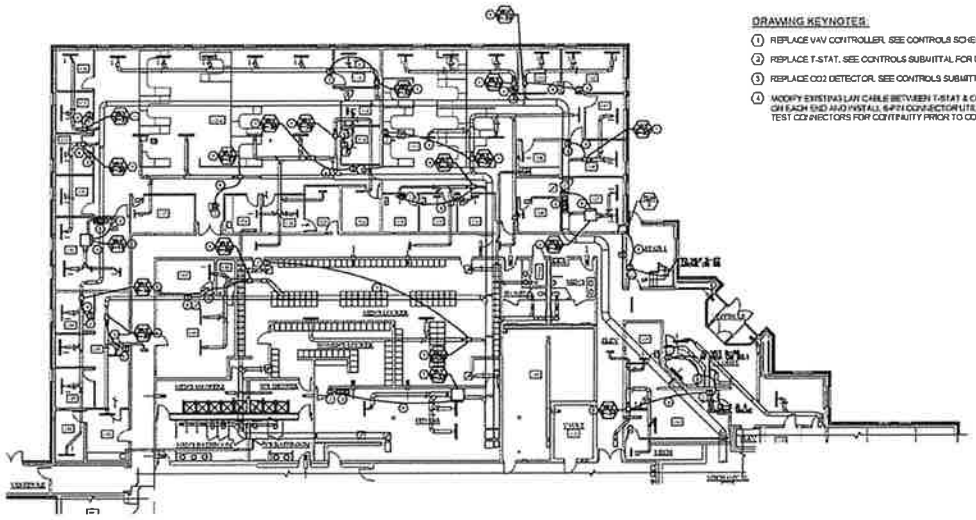
SMR
+
BUILDING 1
ALTERATIONS

CONCORD, NH
03301

SMR B1 & B2
NETWORK
ARCHITECTURE

M1.0

Date



DRAWING KEYNOTES:

1. REPLACE VAV CONTROLLER. SEE CONTROLS SCHEMATIC FOR DEVICE INFORMATION.
2. REPLACE T-STAT. SEE CONTROLS SUBMITTAL FOR DEVICE INFORMATION.
3. REPLACE CO2 DETECTOR. SEE CONTROLS SUBMITTAL FOR DEVICE INFORMATION.
4. MODIFY EXISTING LAN CABLE BETWEEN T-STAT & CONTROLLER. REMOVE 6-PIN CONNECTOR ON EACH END AND INSTALL 6-PIN CONNECTOR UTILIZING 4 CONDUCTORS CONSISTENTLY. TEST CONNECTORS FOR CONTINUITY PRIOR TO CONNECTION TO DEVICES.

FIRST FLOOR MECHANICAL PLAN - NORTH



MECHANICAL LAYOUT PROVIDED FROM [illegible]

LAYOUT SHOWN MAY NOT REFLECT CURRENT FIELD CONDITIONS

SAS ARCHITECTS

CONSULTANTS

MECHANICAL/ ELECTRICAL

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PROJECT

SMR
+
BUILDING 1 ALTERATIONS

CONCORD, NH
03301

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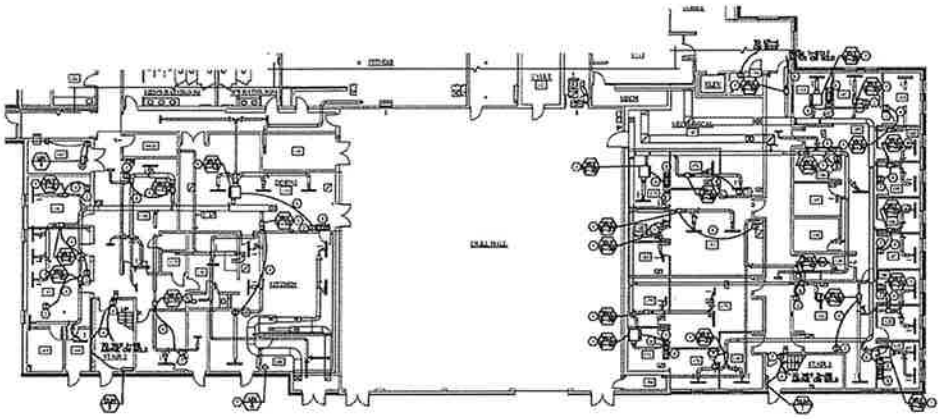
REVISIONS

SMR B1
1ST FLOOR
NORTH

M2.0

Date

9/14/26



FIRST FLOOR MECHANICAL PLAN - SOUTH



DRAWING KEYNOTES:

1. REPLACE VAV CONTROLLER. SEE CONTROLS SCHEMATIC FOR DEVICE INFORMATION.
2. REPLACE T-STAT. SEE CONTROLS SUBMITTAL FOR DEVICE INFORMATION.
3. REPLACE CO2 DETECTOR. SEE CONTROLS SUBMITTAL FOR DEVICE INFORMATION.
4. MODIFY EXISTING LAN CABLE BETWEEN T-STAT & CONTROLLER. REMOVE 6-PIN CONNECTOR ON EACH END AND INSTALL 4-PIN CONNECTOR UTILIZING 3 CONDUCTORS CONSISTENTLY. TEST CONNECTORS FOR CONTINUITY PRIOR TO CONNECTION TO DEVICES.
5. UNIT HEATER LOCATED IN KITCHEN STORAGE ROOM. BASE BID SCOPE IS FOR CONTROLS REWIRE TO UNIT, ADD DEVICE TO EMS, INCLUDING ALL ALARMS AND I/O TIED IN.

MECHANICAL LAYOUT PROVIDED FROM [illegible] DRAWINGS DATED 5/4/2026

LAYOUT SHOWN MAY NOT REFLECT CURRENT FIELD CONDITIONS

SAS ARCHITECTS

CONSULTANTS

MECHANICAL/ ELECTRICAL

SAS PROJECT NUMBER: 1337

PROJECT

SMR
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BUILDING 1
ALTERATIONS

CONCORD, NH
03301

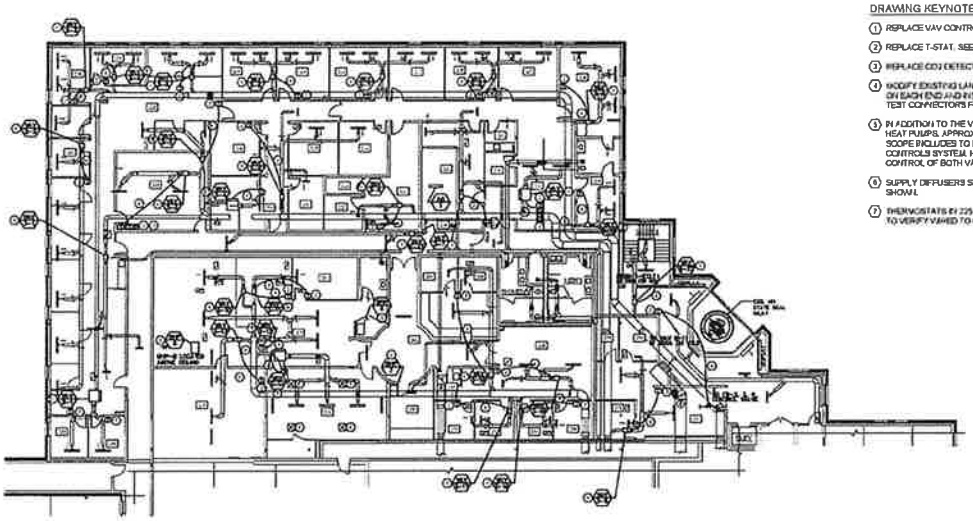
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REVISIONS

SMR B1
1ST FLOOR
SOUTH

M2.1

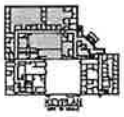
Date 9/14/26



SECOND FLOOR MECHANICAL PLAN - NORTH

DRAWING KEYNOTES:

1. REPLACE VAV CONTROLLER. SEE CONTROLS SCHEMATIC FOR DEVICE INFORMATION.
2. REPLACE T-STAT. SEE CONTROLS SUBMITTAL FOR DEVICE INFORMATION
3. REPLACE CO2 DETECTOR. SEE CONTROLS SUBMITTAL FOR DEVICE INFORMATION
4. MODIFY EXISTING LAN CABLE BETWEEN T-STAT & CONTROLLER. REMOVE 8-PIN CONNECTOR ON EACH END AND INSTALL 6-PIN CONNECTOR UTILIZING 6 CONDUCTORS CONSISTENTLY. TEST CONNECTORS FOR CONTINUITY PRIOR TO CONNECTION TO DEVICES.
5. IN ADDITION TO THE VAVS SHOWN ON THE PLANS, THE JOC AREA IS SERVED BY THREE (3) HEAT PUMPS. APPROXIMATE LOCATIONS FOR GHP-6, 7, AND 8 ARE AS SHOWN. BASE BID SCOPE INCLUDES TO PROVIDE HEAT PUMPS WITH NEW WIRING AND CONNECTION TO NEW CONTROLS SYSTEM. HEAT PUMPS CONTROLLED BY EXISTING VAV T-STATS. VERIFY BMS CONTROL OF BOTH VAV AND HEAT PUMP DEVICES IS MAINTAINED IN REPLACEMENT.
6. SUPPLY DIFFUSERS SERVED BY GHP-7. OTHER HEAT PUMP DIFFUSERS AND DUCTWORK NOT SHOWN.
7. THERMOSTATS E1.23 AND 2.M RELOCATED WITH ARCHITECTURAL CHANGES. CONTRACTOR TO VERIFY VAV TO CORRECT VAV SERVING AREA CONTIGUOUS WITH THERMOSTAT



MECHANICAL LAYOUTS PROVIDED FROM OAK POINT ASSOCIATES RELATIVE TO CENTER AS-BUILT DRAWINGS DATED 9/1/2004

LAYOUTS SHOWN MAY NOT REFLECT CURRENT FIELD CONDITIONS

SAS ARCHITECTS

MECHANICAL/ ELECTRICAL

PROJECT

SMR
+
BUILDING 1
ALTERATIONS

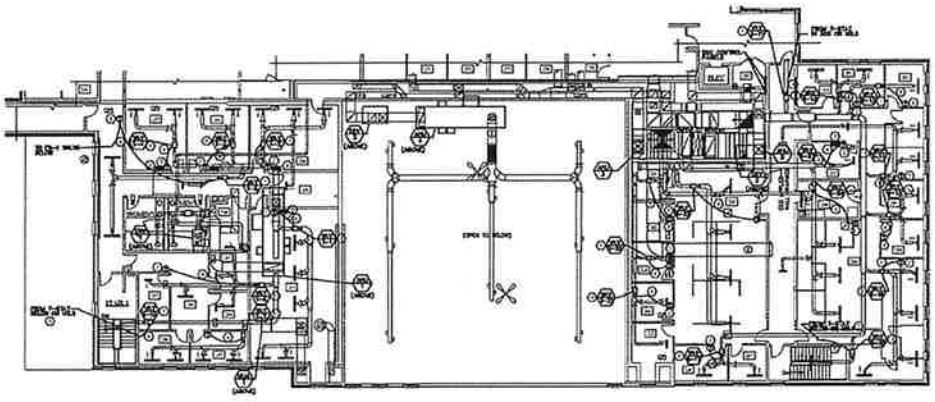
CONCORD, NH

DATE: JULY 16, 2014
SCALE: AS NOTED
DRAWN BY: SCB
CHECKED: TVD

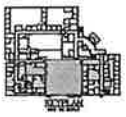
SMR B1
2ND FLOOR
NORTH

M2.2

9/14/26



SECOND FLOOR MECHANICAL PLAN - SOUTH



DRAWING KEYNOTES:

1. REPLACE VAV CONTROLLER. SEE CONTROLS SCHEMATIC FOR DEVICE INFORMATION.
2. REPLACE T-STAT. SEE CONTROLS SUBMITTAL FOR DEVICE INFORMATION
3. REPLACE CO2 DETECTOR. SEE CONTROLS SUBMITTAL FOR DEVICE INFORMATION.
4. MODIFY EXISTING LAN CABLE BETWEEN T-STAT & CONTROLLER. REMOVE 5-PIN CONNECTOR ON EACH END AND INSTALL 6-PIN CONNECTOR UTILIZING 4 CONDUCTORS CONSISTENTLY. TEST CONNECTORS FOR CONTINUITY PRIOR TO CONNECTION TO DEVICES.

SAS ARCHITECTS

CONSULTANTS

MECHANICAL/ ELECTRICAL

PROJECT

SMR
•
BUILDING 1
ALTERATIONS

CONCORD, NH
03301

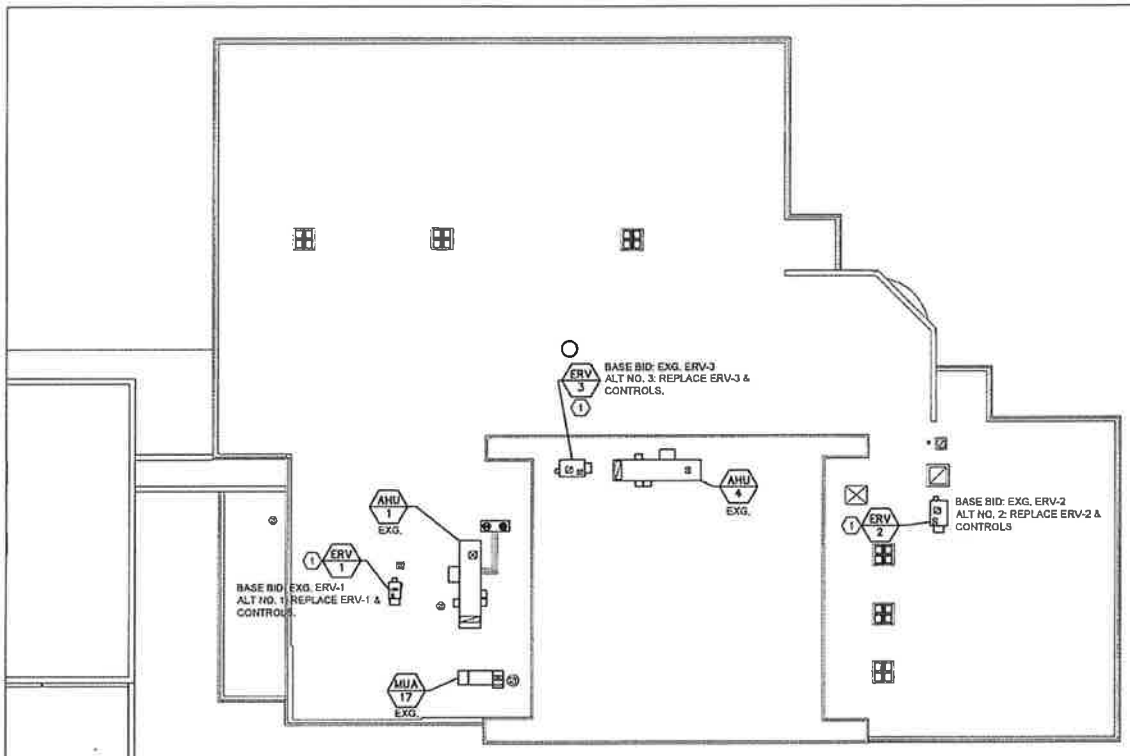
DATE: MAY 16, 2025
SCALE: AS NOTED
DRAWN BY: MJR
CHECKED: DVD

REVISIONS

SMR B1
2ND FLOOR
SOUTH

M2.3

9/4/26



DRAWING KEYNOTES:

1. BASE BID SCOPE IS EXISTING ERVS TO REMAIN. ADD-ALT 1, 2, & 3 SCOPE IS TO REPLACE ERVS 1, 2, & 3 RESPECTIVELY, INCLUDING CONTROLS.

   FOR ADD-ALT 1, 2, & 3: REMOVE EXISTING ERV AND ALL WIRING TO UNIT INCLUDING POWER AND CONTROLS. EXISTING ROOF CURB AND DUCTWORK TO REMAIN FOR CONNECTION TO NEW ERVS. PROVIDE ROOF CURB ADAPTER FOR NEW UNIT CONNECTIONS TO EXISTING CURB. PROVIDE UNIT POWER FROM EXISTING PANEL LOCATION. WIRE CONTROL POINTS TO EMS VIA NEW AHU CONTROLLERS. SEE POINTS LIST FOR REQUIRED CONTROL POINTS.

ROOF MECHANICAL PLAN

MECHANICAL LAYOUT PROVIDED FROM OAK POINT ASSOCIATES FOR RELIANCE CENTER <ADD-ALT DRAWINGS DATED 7/4/2024

LAYOUT SHOWN MAY NOT REFLECT CURRENT FIELD CONDITIONS

CONSULTANTS

MECHANICAL/ ELECTRICAL

PROJECT

SMR
+
BUILDING 1 ALTERATIONS

CONCORD, NH

DATE: JULY 16, 2024
SCALE: AS NOTED
DRAWN BY: SER
CHECKED: SVD

REVISIONS

SMR B1 ROOF PLAN

M2.4

9/16/26

LOCATE NEW BUILDING 2 JADE EX MECH 106 ON THIS WALL. CONNECT PER CONTROLS SCHEMATIC

BUILDING 2 FIRST FLOOR PARTIAL MECHANICAL PLAN

BUILDING 2
PARTIAL PLAN AREA

EXTENDED KEY PLAN
NOT TO SCALE

LAYOUT SHOWN MAY NOT REFLECT CURRENT FIELD CONDITIONS

SAS ARCHITECTS

CONSULTANTS

MECHANICAL/ ELECTRICAL

PROJECT

SMR
+
BUILDING 1
ALTERATIONS

CONCORD, NH
03301

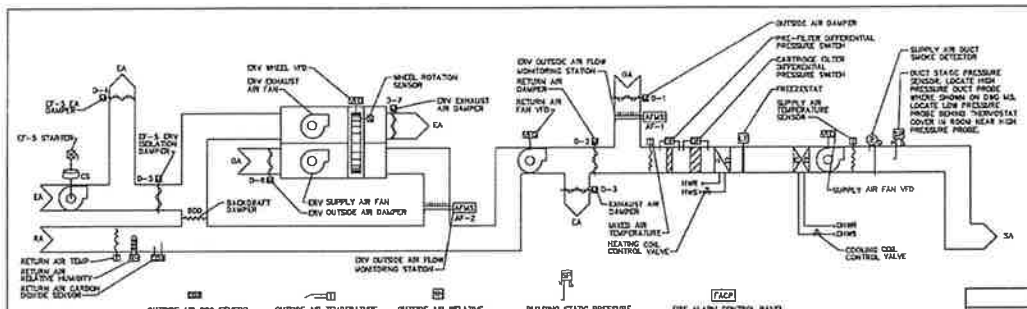
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SCALE: AS NOTED
DRAWN BY: SSR
CHECKED: SVD

REVISIONS

SMR B2
1ST FLOOR
PARTIAL PLAN
AND SCOPE
NOTES

M2.5

9/14/26



AHU-1 AND ERV-1 CONTROL DIAGRAM

AIR HANDLING UNIT 1 (AHU-1) / ERV-1 COMMISSIONING SCOPE OF WORK:

AHU-1

MIXED AIR TEMPERATURE SENSOR - MIXED AIR TEMPERATURE SENSOR PROBE LENGTH SHALL BE INCREASED TO PROVIDE A MORE-RELIABLE AVERAGE READING. SENSOR READING SHALL BE VERIFIED.

OA, MA, EA DAMPERS - AHU DAMPER ACTUATORS SHALL BE REPLACED TO PROVIDE OPERATION. DAMPER OPERATION SHALL BE VERIFIED.

OUTDOOR TEMPERATURE SENSOR - OUTDOOR AIR TEMPERATURE SENSOR SHALL BE REPLACED TO PROVIDE ACCURATE READING TO CONTROLLER. READINGS SHALL BE VERIFIED.

OUTDOOR AIRFLOW STATION - OUTDOOR AIRFLOW STATION SHALL BE REPLACED TO PROVIDE ACCURATE READING TO CONTROLLER. READINGS SHALL BE VERIFIED.

FILTER DIFFERENTIAL PRESSURE SENSOR - CARTRIDGE FILTER DIFFERENTIAL PRESSURE SENSOR SHALL BE REPLACED TO PROVIDE ACCURATE READING TO CONTROLLER. READINGS SHALL BE VERIFIED.

AHU CONTROLLER - AIR HANDLER CONTROLLER SHALL BE REPLACED AND PROVIDED WITH MODERN MODEL. ALL EXISTING FUNCTIONALITY SHALL BE MAINTAINED. FULL UNIT OPERATION SHALL BE VERIFIED.

ERV-1 REPLACEMENT (NEW ALT 15)

DEMO AND REPLACE ENTIRE UNIT, INCLUDING CONTROLS. NEW CONTROLS SHALL MAINTAIN FUNCTIONALITY OF EXISTING.

VFD POWER - DETERMINE EXISTING POWER FEED. PROVIDE NEW CIRCUIT FROM EXISTING PANEL SOURCE.

CONTROLS I/O - WIRE ALL EXISTING POINTS OR NEW CONTROLLER ADDRESSES PER POINTS LIST. MAINTAIN EXISTING SEQUENCES.

TAB SHALL BE PERFORMED ON ENTIRE SYSTEM TO VERIFY OVERALL EQUIPMENT AND SYSTEM PERFORMANCE IS MAINTAINED.

ALL I/O POINTS INCLUDING ERV-1 I/O POINTS ARE BASE BID TO BE INCLUDED IN NEW EMS SYSTEM.

AHU-1, ERV-1 POINTS LIST

SYSTEM POINT DESCRIPTION							NOTES
OUTSIDE AIR TEMPERATURE							
OUTSIDE AIR RELATIVE HUMIDITY							
OUTSIDE AIR CARBON DIOXIDE LEVEL							
SUPPLY AIR TEMPERATURE							1
MIXED AIR TEMPERATURE							2
RETURN AIR TEMPERATURE							
RETURN AIR CARBON DIOXIDE SENSOR							13
RETURN AIR RELATIVE HUMIDITY							
OUTSIDE AIR DAMPER (O-1)							
AHU OUTSIDE AIR FLOW (AF-1)							8
RETURN AIR DAMPER (O-2)							
EXHAUST AIR DAMPER (O-3)							
SUPPLY AIR FAN VFD ENABLE							
SUPPLY AIR FAN VFD SIGNAL							
SUPPLY AIR FAN VFD ALARM							3
SUPPLY AIR DUCT STATIC PRESSURE							5
SUPPLY AIR DUCT STATIC PRESSURE SET POINT							
RETURN AIR FAN VFD ENABLE							
RETURN AIR FAN VFD SIGNAL							
RETURN AIR FAN VFD ALARM							3
BUILDING STATIC PRESSURE							5
BUILDING STATIC PRESSURE SET POINT							
HEATING COIL VALVE (MODULATING)							
COOLING COIL VALVE (MODULATING)							11
DX COOLING STAGE 1							10
DX COOLING STAGE 2							10
LOW TEMPERATURE THERMOSTAT (FREEZE STAT)							6
SUPPLY AIR SETPOINT							
PRE-FILTER STATUS							9
FIRE ALARM CONTROL PANEL							
CARTRIDGE FILTER STATUS							7
OCCUPIED MODE							
EMERGENCY MODE							
SHUT-OFF MODE							
COOL-DOWN MODE							
EF-5 ENABLE							
EF-5 STATUS (CURRENT SENSOR)							4
EF-5 EXHAUST AIR DAMPER (O-3)							
EF-5 ERV ISOLATION DAMPER (O-5)							
ERV SUPPLY FAN ENABLE							
ERV SUPPLY AIR TEMPERATURE							
ERV WHEEL ROTATION SENSOR							12
ERV OUTSIDE AIR ISOLATION DAMPER (O-6)							
ERV EXHAUST FAN ENABLE							
ERV EXHAUST AIR ISOLATION DAMPER (O-7)							
ERV WHEEL VFD ENABLE							
ERV WHEEL VFD SIGNAL							
ERV WHEEL VFD ALARM							3
ERV OUTSIDE AIR FLOW (AF-2)							8

NOTES:
1. GENERATE ALARM IF NOT WITHIN 5°F OF SETPOINT.
2. GENERATE ALARM IF TEMPERATURE FALLS BELOW 42°F.
3. GENERATE ALARM IF VFD IS IN ALARM.
4. GENERATE ALARM IF CURRENT SENSOR INDICATES FAN BREAK-PROOF OF AIR-FLOW.
5. GENERATE ALARM IF NOT WITHIN ±0.2 IN H2O.
6. GENERATE ALARM IF BELOW 0.0 IN H2O.
7. GENERATE ALARM IF DIFFERENTIAL PRESSURE DROP IS GREATER THAN 0.75 IN H2O.
8. GENERATE ALARM IF THERE IS A PERSON DISCREPANCY.
9. GENERATE ALARM IF AIRFLOW FALLS BELOW MINIMUM SETPOINT.
10. GENERATE ALARM IF WHEEL ROTATION SENSOR IS IN ALARM.
11. GENERATE ALARM IF CO2 LEVEL RISES MORE THAN 600 PPM ABOVE OUTDOOR LEVEL.

DUCT SMOKE DETECTORS SHALL BE HARD-WIRED TO SHUT DOWN SUPPLY AND RETURN FANS AND ERV IN THE EVENT OF ANY SMOKE DETECTOR ACTIVATION.

ALL POINTS IN THE CURRENT BAS PROGRAMMING AND GRAPHICS SHALL BE MAINTAINED.

STATE OF NEW HAMPSHIRE
MICHAEL J. BLADEN
No. 11218
LICENSED PROFESSIONAL ENGINEER

SAS ARCHITECTS

CONSULTANTS
MECHANICAL
ELECTRICAL
CIVIL & LAND
STRUCTURAL
SPECIFICATIONS
TELEPHONE/FACSIMILE

PROJECT
SMR
+
BUILDING 1
ALTERATIONS
CONCORD, NH
03301

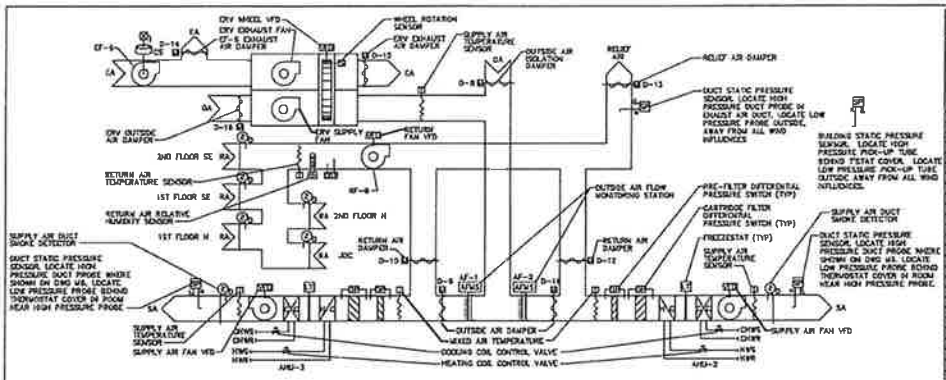
DATE: JULY 11, 2024
SCALE: AS NOTED
DRAWN BY: CSB
CHECKED: TAS

REVISIONS

SMR B1
AHU-1 / ERV-1
CONTROLS
DIAGRAM

M3.0

Date



AHU-2 / 3 AND ERV-2 CONTROL DIAGRAM

NOT TO SCALE

AIR HANDLING UNIT 2 & 3 (AHU-2 & 3) / ERV-2 CONVERSIONS SCOPE OF WORK:

AHU-2

ECONOMIZER MODE OPERATION - ECONOMIZER MODE CONTROLS SHALL BE REPLACED TO PROVIDE EXPECTED OPERATION. ECONOMIZER MODE OPERATION SHALL BE VERIFIED.

OUTDOOR AIRFLOW STATION - OUTDOOR AIRFLOW STATION SHALL BE REPLACED TO PROVIDE ACCURATE READING TO CONTROLLER. READINGS SHALL BE VERIFIED.

OUTDOOR AIR DAMPER SEALS - OUTDOOR AIR DAMPER SEALS SHALL BE PROVIDED TO PREVENT LEAKAGE. SEALS SHALL BE INSPECTED AFTER INSTALLATION.

CHILLED WATER VALVE - CHILLED WATER VALVE SHALL BE REPLACED TO PREVENT LEAKAGE. VALVE SHALL BE INSPECTED FOR NO LEAKAGE AFTER REPLACEMENT.

EXHAUST STATIC PRESSURE CONTROLS - EXHAUST STATIC CONTROLS SHALL BE REPLACED TO PROVIDE EXPECTED OPERATION. EXHAUST STATIC CONTROLLED OPERATION SHALL BE VERIFIED.

STATIC PRESSURE READINGS - BUILDING STATIC PRESSURE SENSORS SHALL BE REPLACED TO PROVIDE ACCURATE READINGS. READINGS SHALL BE VERIFIED FOR ACCURACY.

FILTER DIFFERENTIAL PRESSURE SENSORS - CARTRIDGE FILTER DIFFERENTIAL PRESSURE SENSOR SHALL BE REPLACED TO PROVIDE ACCURATE READING TO CONTROLLER. READINGS SHALL BE VERIFIED.

FREEZESTAT ALARM - FREEZESTAT SIGNAL AND BMS RESPONSE SHALL BE REVIEWED AND ADDRESSED TO TRIGGER EXPECTED ALARM CONDITIONS IN BMS. BMS RESPONSE SHALL BE VERIFIED.

AHU CONTROLLER - AIR HANDLER CONTROLLER SHALL BE REPLACED AND PROVIDED WITH MODERN MODEL. ALL EXISTING FUNCTIONALITY SHALL BE MAINTAINED. FULL UNIT OPERATION SHALL BE VERIFIED.

SUPPLY FAN VFD - SUPPLY FAN VFD SHALL BE REPLACED TO PROVIDE EXPECTED, RELIABLE OPERATION. VFD CONTROL AND PERFORMANCE SHALL BE VERIFIED.

AHU-3

ECONOMIZER MODE OPERATION - ECONOMIZER MODE CONTROLS SHALL BE REPLACED TO PROVIDE EXPECTED OPERATION. ECONOMIZER MODE OPERATION SHALL BE VERIFIED.

OUTDOOR AIRFLOW STATION - OUTDOOR AIRFLOW STATION SHALL BE REPLACED TO PROVIDE ACCURATE READING TO CONTROLLER. READINGS SHALL BE VERIFIED.

OUTDOOR AIR DAMPER ACTUATOR - OUTDOOR AIR DAMPER ACTUATOR SHALL BE REPLACED TO PROVIDE EXPECTED OPERATION. DAMPER ACTUATOR OPERATION SHALL BE VERIFIED.

OUTDOOR AIR DAMPER SEALS - OUTDOOR AIR DAMPER SEALS SHALL BE PROVIDED TO PREVENT LEAKAGE. SEALS SHALL BE INSPECTED AFTER INSTALLATION.

CHILLED WATER VALVE - CHILLED WATER VALVE SHALL BE REPLACED TO PREVENT LEAKAGE. VALVE SHALL BE INSPECTED FOR NO LEAKAGE AFTER STORAGE OR REPLACEMENT.

STATIC PRESSURE READINGS - BUILDING STATIC PRESSURE SENSORS SHALL BE REPLACED TO PROVIDE ACCURATE READINGS. READINGS SHALL BE VERIFIED FOR ACCURACY.

FILTER DIFFERENTIAL PRESSURE SENSOR - CARTRIDGE FILTER DIFFERENTIAL PRESSURE SENSOR SHALL BE REPLACED TO PROVIDE ACCURATE READING TO CONTROLLER. READINGS SHALL BE VERIFIED.

FREEZESTAT ALARM - FREEZESTAT SIGNAL AND BMS RESPONSE SHALL BE REVIEWED AND ADDRESSED TO TRIGGER EXPECTED ALARM CONDITIONS IN BMS. BMS RESPONSE SHALL BE VERIFIED.

AHU CONTROLLER - AIR HANDLER CONTROLLER SHALL BE REPLACED AND PROVIDED WITH MODERN MODEL. ALL EXISTING FUNCTIONALITY SHALL BE MAINTAINED. FULL UNIT OPERATION SHALL BE VERIFIED.

ERV-2 REPLACEMENT (INSTALL'D)

REPLACE ENTIRE UNIT, INCLUDING CONTROLS. NEW CONTROLS SHALL MAINTAIN FUNCTIONALITY OF EXISTING.

UNIT POWER - DETERM EXISTING POWER FEED. PROVIDE NEW CIRCUIT FROM EXISTING PANEL SOURCE.

CONTROLS I/O - MAKE ALL EMS I/O POINTS OR MAP CONTROLLER ADDRESSES PER POINTS LIST. MAINTAIN EXISTING SEQUENCES.

TAB SHALL BE PERFORMED ON ENTIRE SYSTEM TO VERIFY OVERALL EQUIPMENT AND SYSTEM PERFORMANCE IS MAINTAINED.

ALL I/O POINTS INCLUDING DRY I/O POINTS ARE BASE BID TO BE INCLUDED IN NEW EMS SYSTEM.

AHU-2, AHU-3, ERV-2 POINTS LIST

SYSTEM POINT DESCRIPTION	SUPPLY AIR TEMPERATURE	MIXED AIR TEMPERATURE	RETURN AIR TEMPERATURE	RETURN AIR RELATIVE HUMIDITY	RETURN AIR CARBON DIOXIDE SENSOR	OUTSIDE AIR ISOLATION DAMPER (O-9)	OUTSIDE AIR DAMPER (O-3 & O-11)	AHU OUTSIDE AIR FLOW (AF-1 & AF-2)	RETURN AIR DAMPER (O-10 & O-12)	RELIEF AIR DAMPER (O-13)	SUPPLY AIR FAN VFD ENABLE	SUPPLY AIR FAN VFD SIGNAL	SUPPLY AIR FAN VFD ALARM	SUPPLY AIR DUCT STATIC PRESSURE	SUPPLY AIR DUCT STATIC PRESSURE SET POINT	RETURN AIR FAN VFD ENABLE	RETURN AIR FAN VFD SIGNAL	RETURN AIR FAN VFD ALARM	BUILDING STATIC PRESSURE	BUILDING STATIC PRESSURE SET POINT	HEATING COIL VALVE (MODULATING)	COOLING COIL VALVE (MODULATING)	LOW TEMPERATURE THERMOSTAT (FREEZE STAT)	SUPPLY AIR SETPOINT	PRE-FILTER STATUS	CARTRIDGE FILTER STATUS	OCCUPIED MODE	ECONOMIZER MODE	WARM-UP MODE	COOL-DOWN MODE	EF-6 ENABLE	EF-6 STATUS (CURRENT SENSOR)	EF-6 EXHAUST AIR DAMPER (O-14)	ERV SUPPLY FAN ENABLE	ERV SUPPLY AIR TEMPERATURE	ERV EXHAUST FAN ENABLE	ERV OUTSIDE AIR ISOLATION DAMPER (O-15)	ERV EXHAUST AIR ISOLATION DAMPER (O-15)	ERV WHEEL VFD ENABLE	ERV WHEEL VFD SIGNAL	ERV WHEEL VFD ALARM	ERV WHEEL ROTATION SENSOR	NOTES
SUPPLY AIR TEMPERATURE	•	•																																									1,8
MIXED AIR TEMPERATURE	•	•																																										3,8
RETURN AIR TEMPERATURE	•	•																																										
RETURN AIR RELATIVE HUMIDITY	•	•																																										
RETURN AIR CARBON DIOXIDE SENSOR	•	•																																										12
OUTSIDE AIR ISOLATION DAMPER (O-9)	•						•																																				
OUTSIDE AIR DAMPER (O-3 & O-11)	•							•																																				9
AHU OUTSIDE AIR FLOW (AF-1 & AF-2)	•	•																																									9,10
RETURN AIR DAMPER (O-10 & O-12)	•	•																																									9
RELIEF AIR DAMPER (O-13)	•	•																																									
SUPPLY AIR FAN VFD ENABLE	•		•																																							9
SUPPLY AIR FAN VFD SIGNAL	•	•																																									9
SUPPLY AIR FAN VFD ALARM	•		•																																							3,9
SUPPLY AIR DUCT STATIC PRESSURE	•	•																																									5,9
SUPPLY AIR DUCT STATIC PRESSURE SET POINT	•																																									9
RETURN AIR FAN VFD ENABLE	•		•																																								
RETURN AIR FAN VFD SIGNAL	•	•																																									
RETURN AIR FAN VFD ALARM	•		•																																								3
BUILDING STATIC PRESSURE	•	•																																									4
BUILDING STATIC PRESSURE SET POINT	•																																										
HEATING COIL VALVE (MODULATING)	•	•																																									9
COOLING COIL VALVE (MODULATING)	•	•																																									9
LOW TEMPERATURE THERMOSTAT (FREEZE STAT)	•			•																																						8,9
SUPPLY AIR SETPOINT	•																																									9
PRE-FILTER STATUS	•			•																																						7,9
CARTRIDGE FILTER STATUS	•			•																																						7,9
OCCUPIED MODE	•																																									9
ECONOMIZER MODE	•																																									9
WARM-UP MODE	•																																									9
COOL-DOWN MODE	•																																									9
EF-6 ENABLE	•				•																																					
EF-6 STATUS (CURRENT SENSOR)	•	•																																									4
EF-6 EXHAUST AIR DAMPER (O-14)	•				•																																					
ERV SUPPLY FAN ENABLE	•				•																																					
ERV SUPPLY AIR TEMPERATURE	•	•			•																																					
ERV EXHAUST FAN ENABLE	•				•																																					
ERV OUTSIDE AIR ISOLATION DAMPER (O-15)	•				•																																					
ERV EXHAUST AIR ISOLATION DAMPER (O-15)	•				•																																					
ERV WHEEL VFD ENABLE	•				•																																					
ERV WHEEL VFD SIGNAL	•	•			•																																					
ERV WHEEL VFD ALARM	•				•																																					3
ERV WHEEL ROTATION SENSOR	•				•																																					11

NOTES:
1. GENERATE ALARM IF NOT WITHIN ±5°F OF SETPOINT.
2. GENERATE ALARM IF TEMPERATURE FALLS BELOW 45°F.
3. GENERATE ALARM IF VFD IS IN ALARM.
4. GENERATE ALARM IF FAN FAILS TO SHOW PROOF OF AIR-FLOW.
5. GENERATE ALARM IF NOT WITHIN ±0.2 IN H2O.
6. GENERATE ALARM IF BELOW 0.0 IN H2O.
7. GENERATE ALARM IF DIFFERENTIAL PRESSURE DROP IS GREATER THAN 0.75 IN H2O.
8. GENERATE ALARM IF THERE IS A FREEZE CONDITION.
9. PROVIDE 2 CONTROL POINTS, ONE FOR AHU-2 AND ONE FOR AHU-3.
10. GENERATE ALARM IF AIRFLOW FALLS BELOW MINIMUM SETPOINT.
11. GENERATE ALARM IF WHEEL ROTATION SENSOR IS IN ALARM.
12. GENERATE ALARM IF CO2 LEVEL RISES MORE THAN 600 PPM ABOVE OUTDOOR LEVEL.

DUCT SMOKE DETECTORS SHALL BE HARD-WIRED TO SHUT DOWN SUPPLY AND RETURN FANS AND DRY IN THE EVENT OF ANY SMOKE DETECTOR ACTIVATION.

ALL POINTS IN THE CURRENT BMS PROGRAMMING AND GRAPHICS SHALL BE MAINTAINED

SAS ARCHITECTS

CONSULTANTS

MECHANICAL/ ELECTRICAL

LAS PROJECT NUMBER: 1337

PROJECT

SMR
+
BUILDING 1 ALTERATIONS

CONCORD, NH
03301

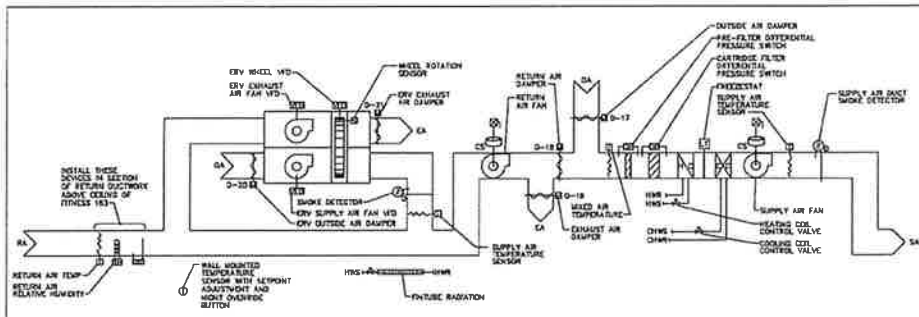
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DRAWN BY: LCB
CHECKED: SVD

REVISIONS

SMR B1
AHU-2&3 / ERV-2
CONTROLS DIAGRAM

M3.1

Date: 9/14/26



AHU-4 AND ERV-3 CONTROL DIAGRAM

AHU-4, ERV-3 POINTS LIST

SYSTEM POINT DESCRIPTION	DDC CONTROLLER	ANALOG INPUT	ANALOG OUTPUT	BINARY INPUT	BINARY OUTPUT	ANALOG VALUE	BINARY VALUE	NOTES
SUPPLY AIR TEMPERATURE	•	•			•	•		1
MIXED AIR TEMPERATURE	•	•			•	•		2
RETURN AIR TEMPERATURE	•	•			•	•		
RETURN AIR RELATIVE HUMIDITY	•	•			•	•		
OUTSIDE AIR DAMPER (D-17)	•		•			•		
RETURN AIR DAMPER (D-18)	•		•			•		
EXHAUST AIR DAMPER (D-19)	•		•			•		
SUPPLY AIR FAN ENABLE	•			•		•		
SUPPLY AIR FAN STATUS (CURRENT SENSING)	•	•			•	•		4
RETURN AIR FAN ENABLE	•			•		•		
RETURN AIR FAN STATUS (CURRENT SENSING)	•	•			•	•		4
ROOM TEMPERATURE	•	•				•		1
ROOM COOLING SET POINT	•					•	•	
ROOM HEATING SET POINT	•					•	•	
NIGHT OVERRIDE BUTTON	•			•			•	
FINTUBE VALVE (2-POSITION)	•			•			•	
COOLING COIL VALVE (MODULATING)	•	•					•	
HEATING COIL VALVE (MODULATING)	•	•					•	
LOW TEMPERATURE THERMOSTAT (FREEZE STAT)	•		•		•		•	3
SUPPLY AIR SETPOINT	•					•		
PRE-FILTER STATUS	•		•		•			5
CARTRIDGE FILTER STATUS	•		•		•			6
OCCUPIED MODE	•						•	
ECONOMIZER MODE	•						•	
WARM-UP MODE	•						•	
COOL-DOWN MODE	•						•	
ERV SUPPLY FAN VFD ENABLE	•			•		•		
ERV SUPPLY FAN VFD SIGNAL	•	•				•		
ERV SUPPLY FAN VFD ALARM	•		•		•	•		3
ERV SUPPLY AIR TEMPERATURE	•	•				•		
ERV OUTSIDE AIR ISOLATION DAMPER (D-20)	•		•			•		
ERV EXHAUST FAN VFD ENABLE	•			•		•		
ERV EXHAUST FAN VFD SIGNAL	•	•				•		
ERV EXHAUST FAN VFD ALARM	•		•		•	•		3
ERV EXHAUST AIR ISOLATION DAMPER (D-21)	•		•			•		
ERV WHEEL VFD ENABLE	•			•		•		
ERV WHEEL VFD SIGNAL	•	•				•		
ERV WHEEL VFD ALARM	•			•		•		3
ERV WHEEL ROTATION SENSOR	•			•		•		3
RETURN AIR CARBON DIOXIDE	•	•				•		3

NOTES:
1. GENERATE ALARM IF NOT WITHIN ±5°F OF SETPOINT.
2. GENERATE ALARM IF TEMPERATURE FALLS BELOW 45°F.
3. GENERATE ALARM IF VFD IS IN ALARM.
4. GENERATE ALARM IF FAN FAILS TO SWITCH PROOF OF AIR-FLOW.
5. GENERATE ALARM IF CO2 LEVEL RISES MORE THAN 800 PPM ABOVE OUTDOOR LEVEL.
6. GENERATE ALARM IF DIFFERENTIAL PRESSURE DROP IS GREATER THAN 0.75 IN H2O.
7. GENERATE ALARM IF THERE IS A FREEZE CONDITION.
8. GENERATE ALARM IF WHEEL FAILS TO SHOW ROTATION.

DUCT SMOKE DETECTORS SHALL BE HARD-WIRED TO SHUT DOWN SUPPLY AND RETURN FANS AND ERV IN THE EVENT OF ANY SMOKE DETECTOR ACTIVATION.

ALL POINTS IN THE CURRENT BMS PROGRAMMING AND GRAPHICS SHALL BE MAINTAINED.

AIR HANDLING UNIT 4 (AHU-4) / ERV-3 COMMISSIONING SCOPE OF WORK:

AHU-4

OUTDOOR AIR DAMPER ACTUATOR - OUTDOOR AIR DAMPER ACTUATOR FOR THE IDENTIFIED DAMPER SHALL BE REPLACED TO PROVIDE EXPECTED OPERATION. OA DAMPER ACTUATOR OPERATION SHALL BE VERIFIED.

ECONOMIZER MODE DAMPER OPERATION - ECONOMIZER MODE DAMPER CONTROLS SHALL BE REVIEWED AND ADJUSTED TO PROVIDE EXPECTED DAMPER OPERATION IN ECONOMIZER MODE. DAMPER OPERATION SHALL BE VERIFIED.

CHILLED WATER VALVE CONTROLS - COOLING VALVE CONTROLS SHALL BE REVIEWED AND ADJUSTED TO PROVIDE EXPECTED COOLING RESPONSE TO DEMAND. COOLING VALVE OPERATION SHALL BE VERIFIED.

CHILLED WATER VALVE - CHILLED WATER VALVE SHALL BE REPLACED TO ELIMINATE NOISY OPERATION AND FAILURE. VALVE SHALL BE INSPECTED AFTER REPLACEMENT.

EMERGENCY STOP - EMERGENCY STOP SHALL BE REPLACED OR WIRED TO PROVIDE EXPECTED EMERGENCY STOP FUNCTION. EMERGENCY STOP SHALL BE TESTED UPON INSTALLATION.

STATIC PRESSURE READINGS - BUILDING STATIC PRESSURE SENSORS SHALL BE REPLACED TO PROVIDE ACCURATE READINGS. READINGS SHALL BE VERIFIED FOR ACCURACY.

AHU CONTROLLER - AIR HANDLER CONTROLLER SHALL BE REPLACED AND PROVIDED WITH MODERN MODEL. ALL EXISTING FUNCTIONALITY SHALL BE MAINTAINED. FULL UNIT OPERATION SHALL BE VERIFIED.

ERV-3 REPLACEMENT (ALT-3)

REPLACE ENTIRE UNIT, INCLUDING CONTROLS. NEW CONTROLS SHALL MAINTAIN FUNCTIONALITY OF EXISTING.

UNIT POWER - DETERMINE EXISTING POWER FEED. PROVIDE NEW CIRCUIT FROM EXISTING PANEL SOURCE.

CONTROLS (DDC) - WIRE ALL BMS I/O POINTS OR MAP CONTROLLER ADDRESSES PER POINTS LIST. MAINTAIN EXISTING SEQUENCES.

TAB SHALL BE PERFORMED ON ENTIRE SYSTEM TO VERIFY OVERALL EQUIPMENT AND SYSTEM PERFORMANCE IS MAINTAINED.

ALL I/O POINTS INCLUDED IN I/O POINTS ARE REQUIRED TO BE INCLUDED IN NEW BMS SYSTEM.

ENERGY RECOVERY VENTILATOR SCHEDULE

TAG	MANUFACTURER	MODEL	LOCATION	SERVICE	SUPPLY FAN: AIRFLOW (CFM)	SUPPLY FAN: E.S.P. (IN. WG.)	SUPPLY FAN: FAN POWER (HP)	EXHAUST FAN: AIRFLOW (CFM)	EXHAUST FAN: E.S.P. (IN. WG.)	EXHAUST FAN: FAN POWER (HP)	TYPE	UNITS FOR DRAWING: SUPPLY AIR: DB (°F)	SUPPLY AIR: WB (°F)	OUTSIDE AIR: DB (°F)	OUTSIDE AIR: WB (°F)	EXHAUST AIR: DB (°F)	EXHAUST AIR: WB (°F)	ENTHALPY WHEEL (BTU/H)	EFFECTIVENESS (%)	ENERGY EQUIPMENT: SUPPLY AIR: DB (°F)	SUPPLY AIR: WB (°F)	SUPPLY AIR: DP (°F)	SUPPLY AIR: RH (%)	OUTSIDE AIR: DB (°F)	OUTSIDE AIR: WB (°F)	OUTSIDE AIR: DP (°F)	OUTSIDE AIR: RH (%)	EXHAUST AIR: DB (°F)	EXHAUST AIR: WB (°F)	EXHAUST AIR: DP (°F)	EXHAUST AIR: RH (%)	ENTHALPY WHEEL (BTU/H)	EFFECTIVENESS (%)	MIN. OA (%)	FILTERS: SA	FILTERS: EA	DIMENSIONS: LENGTH	DIMENSIONS: WIDTH	DIMENSIONS: HEIGHT	WEIGHT (LBS)	ELECTRICAL DATA: VOLTS	ELECTRICAL DATA: PHASE	ELECTRICAL DATA: HERTZ	ELECTRICAL DATA: MCA	ELECTRICAL DATA: MOCP	ELECTRICAL DATA: ETHERNET POWER (WATTS)	NOTES
ERV-3	GREENHECK	FSX105H	ROOF	WHEEL	1,800	0.50"	1.5	1,800	-0.5"	1.5	WHEEL	45	1	14.9	1	68	56	58,000	76.0%	52.0	51.1	50.2	97.1	14.9	1	-2.0	80.2	68	56	50.2	97.1	58,000	76.0%	25%	MERV 8	MERV 8	72"	48"	24"	1,150	480	1	60	15.2	20	1,000	1, 2, 10
ERV-3	GREENHECK	FSX105H	ROOF	WHEEL	1,800	0.50"	1.5	1,800	-0.5"	1.5	WHEEL	45	1	14.9	1	68	56	58,000	76.0%	52.0	51.1	50.2	97.1	14.9	1	-2.0	80.2	68	56	50.2	97.1	58,000	76.0%	25%	MERV 8	MERV 8	72"	48"	24"	1,150	480	1	60	15.2	20	1,000	1, 2, 10
ERV-3	GREENHECK	FSX105H	ROOF	WHEEL	1,800	0.50"	1.5	1,800	-0.5"	1.5	WHEEL	45	1	14.9	1	68	56	58,000	76.0%	52.0	51.1	50.2	97.1	14.9	1	-2.0	80.2	68	56	50.2	97.1	58,000	76.0%	25%	MERV 8	MERV 8	72"	48"	24"	1,150	480	1	60	15.2	20	1,000	1, 2, 10

NOTES
1. PROVIDE WITH DOUBLE WALL INSULATED CONSTRUCTION.
2. PROVIDE WITH FACTORY WIRED NON-FUSED DISCONNECT SWITCH.
3. PROVIDE WITH FACTORY MOUNTED, PRE-PIPED EMERGENCY MOTORS AND UNINTERRUPTIBLE POWER SUPPLY (UPS) TO RIDE THROUGH MOTOR.
4. PROVIDE WITH FACTORY MOUNTED, PRE-PIPED AIR STREAMS.
5. PROVIDE WITH GASKETED ULTRA LOW LEAKAGE DOUBLE BOX DAMPERS ON BOTH OUTSIDE & EXHAUST AIR STREAMS.
6. PROVIDE WITH FACTORY STAINLESS FROST CONTROL PACKAGE WITH SUMMIT MULTI-POINT ICE TO BMS. COORDINATE WITH BMS REQUIREMENTS WITH THE CONTROLS CONTRACTOR.
7. PROVIDE WITH 2" ALUMINUM MERV 8 FILTERS (PER MANUFACTURER'S RECOMMENDATION).
8. PROVIDE WITH DISCHARGE AIR TEMPERATURE PROBE LOCATED ON DISCHARGE DUCT TO BMS. PROVIDE ON DRAWINGS WITH I/O TERMINATIONS.
9. PROVIDE WITH SYSTEMS BOOST AMPLIFIER STATION, WIRE TO BMS. PROVIDE ON DRAWINGS WITH I/O TERMINATIONS.
10. EQUIPMENT CHARACTERISTIC DATA FROM MANUFACTURER'S CATALOG PER REFERENCE LOCATION NOTED ON DRAWINGS DATED 7/2024. CONTRACTOR TO PROVIDE IN SUBMITTAL INFORMATION BY BRAND OF UNIT COMPLIANCE WITH MINIMUM ECCC 2024 WINTER WET BULB DATA NOT PROVIDED FOR EXISTING ERVs.

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SAS ARCHITECTS
CONSULTANTS
MECHANICAL
ELECTRICAL

SMR
BUILDING 1
ALTERATIONS
CONCORD NH
03301

DATE: JULY 16 2024
SCALE: AS NOTED
DRAWN BY: MB
CHECKED BY: DMD

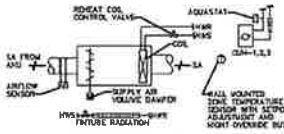
REVISIONS

SMR B1
AHU-4 / ERV-3
CONTROLS
DIAGRAM

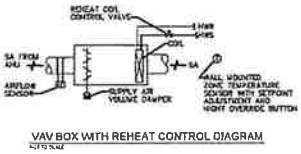
M3.2

Date _____

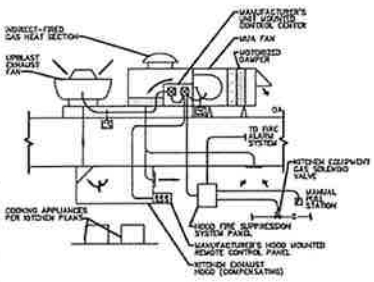
9/14/26



VAV BOX WITH REHEAT AND FINNED TUBE RADIATION OR CUH CONTROL DIAGRAM



VAV BOX WITH REHEAT CONTROL DIAGRAM



KITCHEN EXHAUST SYSTEM CONTROL DIAGRAM

VAV BOX WITH REHEAT AND FINTUBE RADIATION OR CUH

SYSTEM POINT DESCRIPTION	GRAPHIC	ZONE TEMP SENSOR	NIGHT OVERRIDE BUTTON	HEATING SETPOINT	COOLING SETPOINT	REHEAT VALVE (MODULATING)	AIR FLOW (CFM)	DAMPER POSITION	FINTUBE RADIATION VALVE (2-POSITION)	NIGHT HEATING SET-BACK	NIGHT COOLING SET-BACK	CUH FAN ENABLE	CUH AQUASTAT	NOTES
ZONE TEMPERATURE	•	•	•											1
NIGHT OVERRIDE BUTTON	•		•											
HEATING SETPOINT	•			•										
COOLING SETPOINT	•				•									
REHEAT VALVE (MODULATING)	•					•								
AIR FLOW (CFM)	•	•					•							2
DAMPER POSITION	•	•						•						
FINTUBE RADIATION VALVE (2-POSITION)	•								•					
NIGHT HEATING SET-BACK	•									•				
NIGHT COOLING SET-BACK	•										•			
CUH FAN ENABLE	•											•		3
CUH AQUASTAT	•												•	3

NOTES: 1. GENERATE ALARM IF ROOM TEMPERATURE IS GREATER THAN 6°F ABOVE THE COOLING SETPOINT OR LOWER THAN 6°F BELOW THE HEATING SETPOINT.
2. GENERATE ALARM IF AIRFLOW IS NOT BETWEEN MINIMUM AND THE MAXIMUM AIRFLOW SETTINGS.
3. PROVIDE AT STAIRWELL LOCATIONS.

VAV BOX WITH REHEAT

SYSTEM POINT DESCRIPTION	GRAPHIC	ZONE TEMP SENSOR	NIGHT OVERRIDE BUTTON	HEATING SETPOINT	COOLING SETPOINT	REHEAT VALVE (MODULATING)	AIR FLOW (CFM)	DAMPER POSITION	NIGHT HEATING SET-BACK	NIGHT COOLING SET-BACK	NOTES
ZONE TEMPERATURE	•	•	•								1
NIGHT OVERRIDE BUTTON	•		•								
HEATING SETPOINT	•			•							
COOLING SETPOINT	•				•						
REHEAT VALVE (MODULATING)	•					•					
AIR FLOW (CFM)	•	•					•				2
DAMPER POSITION	•	•						•			
NIGHT HEATING SET-BACK	•								•		
NIGHT COOLING SET-BACK	•									•	

NOTES: 1. GENERATE ALARM IF ROOM TEMPERATURE IS GREATER THAN 6°F ABOVE THE COOLING SETPOINT OR LOWER THAN 6°F BELOW THE HEATING SETPOINT.
2. GENERATE ALARM IF AIRFLOW IS NOT BETWEEN MINIMUM AND THE MAXIMUM AIRFLOW SETTINGS.

KITCHEN SYSTEMS POINTS LIST

SYSTEM POINT DESCRIPTION	GRAPHIC	STATUS (DIGITAL)	ALARM (DIGITAL)	MANUAL OVERRIDE (DIGITAL)	ANALOG (ANALOG)	ANALOG ALARM (ANALOG)	TREND (LOG)	NOTES
SYSTEM STATUS	•	•					•	
HEATING STATUS	•	•					•	
SUPPLY FAN STATUS	•	•					•	
EXHAUST FAN STATUS	•	•					•	

NOTES:

MISCELLANEOUS POINTS LIST

SYSTEM POINT DESCRIPTION	GRAPHIC	STATUS (DIGITAL)	ALARM (DIGITAL)	MANUAL OVERRIDE (DIGITAL)	ANALOG (ANALOG)	ANALOG ALARM (ANALOG)	TREND (LOG)	NOTES
12Z DOM HW RETURN PUMP (RP-1) ENABLE	•			•			•	2
12Z DOM HW RETURN PUMP (RP-1) STATUS	•		•				•	
12Z DOM HW OCCUPANCY MODE	•						•	1
14Z DOM HW RETURN PUMP (RP-2) ENABLE	•			•			•	2
14Z DOM HW RETURN PUMP (RP-2) STATUS	•		•				•	
14Z DOM HW OCCUPANCY MODE	•						•	1
SUMP PUMP (SP-1) STATUS	•		•				•	
SUMP PUMP (SP-2) ALARM	•					•	•	3
TELECOMMUNICATION ROOM SENSOR	•				•	•	•	4

NOTES: 1. OCCUPANCY SCHEDULE SHALL BE 7 DAY, 24 HOUR, ADJUSTABLE AND ACCESSIBLE TO THE BUILDING OPERATOR THROUGH THE GRAPHICAL USER INTERFACE. EACH DOM HW SYSTEM SHALL HAVE A DEDICATED OCCUPANCY SCHEDULE.
2. WHEN DOM HW SYSTEM IS IN OCCUPIED MODE, RETURN PUMP SHALL BE ENABLED AND CONTROLLED BY ELECTRIC AQUASTAT AS DEFINED IN SPECIFICATIONS.
3. GENERATE ALARM IF SUMP PUMP CONTROL PANEL IS IN ALARM.
4. GENERATE ALARM IF TEMPERATURE RISES ABOVE 78F (ADJUSTABLE).

ALL POINTS IN THE CURRENT BMS PROGRAMMING AND GRAPHICS SHALL BE MAINTAINED IN COORDINATION WITH OWNER. SEE "GRAPHICS" NOTE ON M3.1 .

ALL POINTS IN THE CURRENT BMS PROGRAMMING AND GRAPHICS SHALL BE MAINTAINED.

CONSULTANTS
MECHANICAL/ ELECTRICAL

PROJECT

SMR
+
BUILDING I ALTERATIONS

CONCORD, NH
03301

DATE: JULY 14, 2016
SCALE: AS NOTED
DRAWN BY: SEP
CHECKED: TVD

REVISIONS

SMR B1
VAV / EF & MUA CONTROLS DIAGRAM

M3.3

9/14/16

Bl pg. 1

GenFlex Roofing Systems

THERMOPLASTIC ROOFING SYSTEM WARRANTY

GenFlex Roofing Systems, LLC ("GenFlex"), warrants to the building owner ("Owner") named below, subject to the terms, conditions, and limitations set forth herein, that for the period in which this GenFlex Warranty is effective, GenFlex will repair any leak in the GenFlex RM or GenFlex TPO Roofing System ("System") installed by a GenFlex Authorized Contractor ("Contractor") on Owner's Building at the address shown below. The System consists of GenFlex RM or GenFlex TPO brand membrane, GenFlex brand insulation, fasteners, adhesives, sealants, flashings, fastener plates, metal bars and related GenFlex brand accessory items when used in accordance with GenFlex published written technical specifications.

TERMS, CONDITIONS AND LIMITATIONS

1. Installation of the System must be by the roofing contractor named below.
2. During the term of this warranty, GenFlex shall have access to the roof for inspection during normal business hours.
3. Owner shall obtain GenFlex's written approval before making any alterations of the roof or installing any structures, fixtures, or utilities on or through the roof.
4. Owner shall provide GenFlex with written notice of any leak in the roof and of any claim under this warranty within thirty (30) days of the discovery of the leak. Such notice shall be given by certified mail to GenFlex Roofing Systems LLC, 250 E 96TH St., Suite 200 Indianapolis, IN 46240 USA. If GenFlex's investigation of any claim under this warranty reveals that GenFlex is not responsible under the terms of this warranty for Owner's claim, Owner shall promptly reimburse the investigation and repair costs incurred by GenFlex.
5. If there is a leak during the period in which this warranty is in effect caused by a defect in GenFlex brand materials or workmanship within the scope of this warranty, GenFlex will repair the leak.
6. The remedy stated herein is the SOLE AND EXCLUSIVE REMEDY for failure of the System. GENFLEX SHALL UNDER NO CIRCUMSTANCES BE LIABLE FOR INCIDENTAL CONSEQUENTIAL DAMAGES INCLUDING BUT NOT LIMITED TO INJURY TO ANY PERSON OR DAMAGES TO THE BUILDING OR THE CONTENTS OF THE BUILDING, INCLUDING ANY SUCH DAMAGES RELATING TO THE PRESENCE OF MOLD, MILDEW OR ANY OTHER PATHOGENIC MICROBE.
7. THERE ARE NO EXPRESS WARRANTIES EXCEPT AS STATED HEREIN, AND GENFLEX HEREBY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE. NO REPRESENTATIVE HAS AUTHORITY TO MAKE ANY REPRESENTATIONS OTHER THAN THOSE STATED HEREIN.
8. This warranty shall not be applicable to damage or loss caused in whole or in part by:
a. natural disasters, including but not limited to lightning, wind gusts in excess of 54 mph, hail, hurricanes, or similar natural disasters;
b. vandalism, acts of war, or civil disturbances;
c. alteration of the roof or installation of structures, fixtures or utilities on or through the roof without the prior written approval of GenFlex;
d. overexposure to commercial/industrial solvents, acids, caustic fluids, oils, waxes, greases, absorbent clays, bleaches, plasticizers or other harmful chemicals;
e. failure by the Owner or lessee to use reasonable care in maintaining the roof, including but not limited to the requirements identified on the reverse side of this warranty;
f. traffic or storage of materials on the roof;
g. infiltration or condensation of moisture in, through, around or above the walls of the building;
h. acts of parties other than GenFlex or the roofing contractor named below;
i. failure of any materials not provided to Owner by GenFlex;
j. insects or animals;
k. deterioration or failure of any building component including, but not limited to, the roof substrate, walls or mortar; or condensation accumulation in the roof assembly due to incorrect design or due to a reduction in the vapor barrier's effectiveness;
l. discoloration or odors caused by algae, fungi, or lichens;
m. errors or omissions by architects or engineers not retained by GenFlex.
9. GenFlex reserves the right to suspend its obligations under this warranty if (a) all bills for installation of the GenFlex roofing have not been paid in full to the roofing contractor named below and to the material suppliers; (b) the prescribed warranty fee has not been paid to GenFlex; or (c) Owner fails to reimburse GenFlex for claim investigation cost as provided in paragraph 4 above. Notwithstanding the foregoing, the provisions of paragraph 6 and 7 shall remain in full force and effect.
10. This warranty may not be transferred upon change of ownership of the building shown below unless the Owner (a) notifies GenFlex in writing of its proposed change at least 45 days prior to the change; (b) pays GenFlex the warranty transfer fee then in effect on the date this warranty was issued and (c) completes all repairs required by GenFlex in order to correct failures to comply with Owner's obligations under this warranty.
11. Any claim or dispute between Owner and GenFlex arising out of this warranty or relating to any material supplied or specifically required by GenFlex shall be resolved by final and binding arbitration in accordance with the rules of the American Arbitration Association. Owner hereby releases GenFlex from all liability to Owner's insurance carrier or to anyone claiming under or through Owner by reason of subrogation or otherwise.

GenFlex Roofing Systems LLC, by _____ Date 08/28/2007
Gary Thompson, General Manager

Job #: 38070 A - Primary area

Square Footage: 31500

Specific Type: TPO Fully Adhered

Job Location
Readiness Center Add./Alt.
57 Regional Drive
Concord, NH 03301

Building Owner
N.H.DOT Bureau of Public Works
7 Hazen Drive, em.250, POB 483
Concord, NH 03302

Roofing Contractor
Skyline Roofing Company
861 Page St
Manchester, NH 03109

Effective from: 07/20/2007 to 07/20/2027

Initial: _____
Date: 9/14/26

State of New Hampshire
Department of State

CERTIFICATE

I, David M. Scanlan, Secretary of State of the State of New Hampshire, do hereby certify that TURNSTONE CORPORATION is a New Hampshire Profit Corporation registered to transact business in New Hampshire on April 17, 2002. I further certify that all fees and documents required by the Secretary of State's office have been received and is in good standing as far as this office is concerned.

Business ID: **403646**
Certificate Number: **0007909905**

IN TESTIMONY WHEREOF,
I hereto set my hand and cause to be affixed
the Seal of the State of New Hampshire,
this 16th day of April A.D. 2026.

David M. Scanlan
Secretary of State

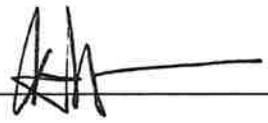
Certificate of Authority #1 *(Corporation)*

Corporate Resolution Certification of Authority

I, Tony DaCosta (Name of Attestor), **hereby certify** that I am duly elected Clerk/Secretary/Officer of Turnstone Corporation (Name of Corporation). I hereby certify the following is a true copy of a vote taken at a meeting of the Board of Directors/shareholders, duly called and held on September 14th, 2026, at which a quorum of the Directors/shareholders were present and voting.

VOTED: That Stacy J. Clark, President (Name and Title of Authorized Signatory) is duly authorized to enter into contracts or agreements on behalf of Turnstone Corporation (Name of Corporation) with the State of New Hampshire and any of its agencies or departments and further is authorized to execute any documents which may in his/her judgment be desirable or necessary to affect the purpose of this vote.

I hereby certify that said vote has not been amended or repealed and remains in full force and effect as of the date of the contract to which this certificate is attached. This authority **remains valid for thirty (30) days** from the date of this Corporate Resolution. I further certify that it is understood that the State of New Hampshire will rely on this certificate as evidence that the person(s) listed above currently occupy the position(s) indicated and that they have full authority to bind the corporation. To the extent that there are any limits on the authority of any listed individual to bind the corporation in contracts with the State of New Hampshire, all such limitations are expressly stated herein.

DATED: September 14, 2026 **ATTESTOR:** 

NAME: Tony DaCosta

TITLE: Vice President

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 09/14/2026

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME: Tracy Andriski, CISR
Cross Insurance-Laconia 155 Court Street Laconia NH 03246	PHONE (A/C, No, Ext): (603) 524-2425 FAX (A/C, No): (603) 524-3666 E-MAIL ADDRESS: tracy.andriski@crossagency.com
INSURED Turnstone Corporation 17 Armory Road Milford NH 03055	INSURER(S) AFFORDING COVERAGE — NAIC # INSURER A : Firemen's Ins. Co. of Washington D.C. — 21784 INSURER B : Acadia Ins Co. — 31325 INSURER C : Indian Harbor Insurance Co — 36940 INSURER D : INSURER E : INSURER F :

COVERAGES **CERTIFICATE NUMBER:** CL25123039832 **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	[X] COMMERCIAL GENERAL LIABILITY [ ] CLAIMS-MADE [X] OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: [ ] POLICY [X] PRO-JECT [X] LOC [ ] OTHER:			CPA0065107-36	12/31/2025	12/31/2026	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG	$ 1,000,000 $ 300,000 $ 10,000 $ 1,000,000 $ 2,000,000 $ 2,000,000
A	AUTOMOBILE LIABILITY [X] ANY AUTO [ ] OWNED AUTOS ONLY [ ] SCHEDULED AUTOS [X] HIRED AUTOS ONLY [X] NON-OWNED AUTOS ONLY			CAA0065120-37	12/31/2025	12/31/2026	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)	$ 1,000,000 $ $ $
B	[X] UMBRELLA LIAB [X] OCCUR [ ] EXCESS LIAB [ ] CLAIMS-MADE [ ] DED [ ] RETENTION $			CUA0065121-36	12/31/2025	12/31/2026	EACH OCCURRENCE AGGREGATE Products-Comp/Op Agg	$ 5,000,000 $ 5,000,000 $ 5,000,000
A	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) Y/N: N If yes, describe under DESCRIPTION OF OPERATIONS below	N/A		WPA0095615-34	12/31/2025	12/31/2026	[X] PER STATUTE [ ] OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	 $ 500,000 $ 500,000 $ 500,000
C	Professional Liability			PEC005574506	12/31/2025	12/31/2026	Limit - Professional Deductible - Each Claim	3,000,000 5,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

RE: RFB-DMAVS-2027-03 - NHANG Building 1 Alterations

The State of New Hampshire, its agencies, and its agents and employees are additional insureds for ongoing operations performed by or on behalf of Turnstone Corporation when required in a written contract.

30 day notice of cancellation, 10 days notice for non-payment of premium is included

CERTIFICATE HOLDER

State of New Hampshire Dept of Military Affairs and Veteran Services
4 Pembroke Road
Concord NH 03301

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

Tracy Andriski

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The ACORD name and logo are registered marks of ACORD

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 09/14/2026

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

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PRODUCER Cross Insurance-Laconia 155 Court Street Laconia NH 03246	CONTACT NAME: Tracy Andriski, CISR PHONE (A/C, No, Ext): (603) 524-2425 FAX (A/C, No): (603) 524-3666 E-MAIL ADDRESS: tracy.andriski@crossagency.com
INSURED The State of New Hampshire - Dept of Military Affairs and Veteran 4 Pembroke Road Concord NH 03301	INSURER(S) AFFORDING COVERAGE — NAIC # INSURER A : Acadia Ins Co. — 31325 INSURER B : INSURER C : INSURER D : INSURER E : INSURER F :

COVERAGES **CERTIFICATE NUMBER:** CL2691170263 **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	COMMERCIAL GENERAL LIABILITY ☐ CLAIMS-MADE ☒ OCCUR ☒ Owners & Contractors Protective GEN'L AGGREGATE LIMIT APPLIES PER: ☐ POLICY ☐ PRO-JECT ☐ LOC ☐ OTHER:			OCP5705764-10	09/14/2026	09/14/2027	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG	$ 2,000,000 $ $ $ $ 3,000,000 $
	AUTOMOBILE LIABILITY ☐ ANY AUTO ☐ OWNED AUTOS ONLY ☐ SCHEDULED AUTOS ☐ HIRED AUTOS ONLY ☐ NON-OWNED AUTOS ONLY						COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)	$ $ $ $
	☐ UMBRELLA LIAB ☐ OCCUR ☐ EXCESS LIAB ☐ CLAIMS-MADE ☐ DED ☐ RETENTION $						EACH OCCURRENCE AGGREGATE	$ $
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y / N ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? ☐ N / A (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below						☐ PER STATUTE ☐ OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	 $ $ $

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

RE: RFB-DMAVS-2027-03 - NHANG Building 1 Alterations

30 day notice of cancellation, 10 days notice for non-payment of premium is included

CERTIFICATE HOLDER

State of New Hampshire Dept of Military Affairs and Veteran Services
4 Pembroke Road
Concord NH 03301

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

Tracy Andriski

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EVIDENCE OF PROPERTY INSURANCE

DATE (MM/DD/YYYY): 09/14/2026

THIS EVIDENCE OF PROPERTY INSURANCE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE ADDITIONAL INTEREST NAMED BELOW. THIS EVIDENCE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS EVIDENCE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE ADDITIONAL INTEREST.

AGENCY	PHONE (A/C, No, Ext): (603) 524-2425
Cross Insurance-Laconia 155 Court Street Laconia NH 03246	FAX (A/C, No): (603) 524-3666 E-MAIL ADDRESS: tracy.andriski@crossagency.com CODE: SUB CODE: AGENCY CUSTOMER ID #: 00178165

COMPANY
Acadia Ins Co. One Acadia Commons P.O. Box 9010 Westbrook ME 04098-5010

INSURED	LOAN NUMBER	POLICY NUMBER
The State of New Hampshire - Dept of Military Affairs and Veteran Services Turnstone Corporation 17 Armory Road Milford NH 03055-0539		CIM5702856-10

EFFECTIVE DATE	EXPIRATION DATE	CONTINUED UNTIL TERMINATED IF CHECKED
09/14/2026	09/14/2027	☐

THIS REPLACES PRIOR EVIDENCE DATED:

PROPERTY INFORMATION

LOCATION/DESCRIPTION

1 Minuteman Way
Concord NH 03301

THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS EVIDENCE OF PROPERTY INSURANCE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

COVERAGE INFORMATION

PERILS INSURED ☐ BASIC ☐ BROAD ☐ SPECIAL ☐

COVERAGE / PERILS / FORMS	AMOUNT OF INSURANCE	DEDUCTIBLE
Builders Risks, RC, Special Form	897,630	1,000

REMARKS (Including Special Conditions)

RE: RFB-DMAVS-2027-03 - NHANG Building 1 Alterations

Any and all subcontractors, any other party that has a financial interest in the project and all others employed on the premises are included as named insureds.

Waiver of subrogation applies when required by contract. 30 day notice of cancellation, 10 days notice for non-payment of premium is included

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

ADDITIONAL INTEREST

NAME AND ADDRESS		
State of New Hampshire Dept of Military Affairs and Veteran Services 4 Pembroke Road Concord NH 03301	☐ ADDITIONAL INSURED ☐ LENDER'S LOSS PAYABLE ☐ LOSS PAYEE ☐ MORTGAGEE ☐	LOAN # AUTHORIZED REPRESENTATIVE Tracy Andriski

ACORD 27 (2016/03)

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3-28-2006 Rev. 7-19-2012

BOND NO. S064275

CONTRACT BOND
KNOW ALL MEN BY THESE PRESENTS

That we, TURNSTONE CORPORATION, 17 ARMORY ROAD, MILFORD, NH 03055 Contractor as Principal and EMPLOYERS MUTUAL CASUALTY COMPANY as Surety whose mailing is: 717 MULBERRY STREET, P.O. BOX 712, DES MOINES, IA 50309 are held and firmly bound unto the State of New Hampshire in the sum of EIGHT HUNDRED NINETY SEVEN THOUSAND SIX HUNDRED THIRTY AND 00/100 Dollars ($897,630.00), to be paid to the said State of New Hampshire or its certain attorney, its successors and assigns, for which payment, well and truly to be made, we bind ourselves, our heirs, executors and administrators, successors and assigns, jointly and severally, firmly by these presents.

The Conditions of this obligation are that whereas the said Principal has entered into a contract with the State of New Hampshire through its Commissioner of Department of Administrative Services for NHARNG SMR - BUILDING 1 ALTERATIONS, RFB-DMAVS-2027-03 In the Town/City of CONCORD.

Now the conditions of this obligation is such that if the said Principal and his subcontractors shall well and truly keep and perform all the agreements, terms and conditions in said contract set forth and specified to be by said Principal kept and performed and shall also pay all lawful taxes and shall also pay all labor performed or furnished, for all equipment hired, including trucks for all materials used and for fuels, lubricants, power tools, hardware and supplies purchased by said principal and used in carrying out said contract and for labor and parts furnished upon the order of said Principal for the repair of equipment used in carrying out said contract, this agreement to make such payment being in compliance with the requirements of Revised Statutes Annotated 447:16 to furnish security thereunder and being in fact such security, and if said Principal shall well and truly indemnify and save harmless said The State of New Hampshire against all claims and suits for damage to person or property arising from carelessness or want of due care, or any act or omission on the part of said Principal during the performance of said contract; then this obligation shall be void and of no effect; otherwise it shall remain in full force and virtue.

The Principal and Surety further understand and agree (1) that no modification or alteration of said contract shall in any way affect the obligation of the Surety hereunder; (2) that in case, liabilities not covered by said Revised Statutes Annotated 447:16 but covered by this bond, then the provisions of this bond shall control; (3) that Sect. 109.06 of the New Hampshire Standard Specifications as revised and as accepted by the Principal and Surety herein, provides in part as follows: "No moneys, payable under the contract or any part thereof, except the estimate for the first month or period, shall become due and payable, if the Commissioner so elects, until the Contractor shall satisfy the Commissioner that he has fully settled or paid for all labor performed or furnished, for all equipment hired, including trucks, for all materials used, and for fuels, lubricants, power tools, hardware and supplies purchased by the contractor and used in carrying out said contract and for labor and parts furnished upon the order of said Contractor for the repair of equipment used in carrying out said contract, and the Commissioner if he so elects, may pay any and all such bills, in whole or in part, and deduct the amount or amounts so paid from any monthly or final estimate, excepting the first estimate.

This bond shall become effective at the same time as the contract annexed hereto for the improvement hereinbefore mentioned.

Signed and sealed this 14th day of September, 2026.

Witness _____

Witness _____

TURNSTONE CORPORATION

By _____ President (SEAL)
Contractor

EMPLOYERS MUTUAL CASUALTY COMPANY

By _____ (SEAL)
Surety

SAMUEL M. GOULET, ATTORNEY-IN-FACT

emc INSURANCE

P.O. Box 712 • Des Moines, Iowa 50306-0712

POWER OF ATTORNEY APPOINTING INDIVIDUAL ATTORNEY-IN-FACT

KNOW ALL MEN BY THESE PRESENTS, that:

1. Employers Mutual Casualty Company, an Iowa Corporation
2. EMCASCO Insurance Company, an Iowa Corporation
3. Union Insurance Company of Providence, an Iowa Corporation
4. Illinois EMCASCO Insurance Company, an Iowa Corporation
5. Dakota Fire Insurance Company, a North Dakota Corporation
6. EMC Property & Casualty Company, an Iowa Corporation

hereinafter referred to severally as "Company" and collectively as "Companies", each does, by these presents, make, constitute and appoint:

Samuel M. Goulet

its true and lawful attorney-in-fact, with full power and authority conferred to sign, seal, and execute the following Surety Bond(s):

Surety Bond Number	Principal:	Obligee:
S064275	Turnstone Corporation	

and to bind each Company thereby as fully and to the same extent as if such instruments were signed by the duly authorized officers of each such Company, and all of the acts of said attorney pursuant to the authority hereby given are hereby ratified and confirmed.

AUTHORITY FOR POWER OF ATTORNEY

This Power-of-Attorney is made and executed pursuant to and by the authority of the following resolution of the Boards of Directors of each of the Companies at the first regularly scheduled meeting of each company duly called and held in 1999:

RESOLVED: The President and Chief Executive Officer, any Vice President, the Treasurer and the Secretary of Employers Mutual Casualty Company shall have power and authority to (1) appoint attorneys-in-fact and authorize them to execute on behalf of each Company and attach the seal of the Company thereto, bonds and undertakings, recognizances, contracts of indemnity and other writings obligatory in the nature thereof; and (2) to remove any such attorney-in-fact at any time and revoke the power and authority given to him or her. Attorneys-in-fact shall have power and authority, subject to the terms and limitations of the power-of-attorney issued to them, to execute and deliver on behalf of the Company, and to attach the seal of the Company thereto, bonds and undertakings, recognizances, contracts of indemnity and other writings obligatory in the nature thereof, and any such instrument executed by any such attorney-in-fact shall be fully and in all respects binding upon the Company. Certification as to the validity of any power-of-attorney authorized herein made by an officer of Employers Mutual Casualty Company shall be fully and in all respects binding upon this Company. The facsimile or mechanically reproduced signature of such officer, whether made heretofore or hereafter, wherever appearing upon a certified copy of any power-of-attorney of the Company, shall be valid and binding upon the Company with the same force and effect as though manually affixed.

IN WITNESS THEREOF, the Companies have caused these presents to be signed for each by their officers as shown, and the Corporate seals to be hereto affixed this 17th day of September, 2025.

Seals

SEAL — ILLINOIS EMCASCO INSURANCE COMPANY — CORPORATE — IOWA

1863 — UNION INSURANCE COMPANY OF PROVIDENCE — INCORPORATED — IOWA

1953 — EMC PROPERTY & CASUALTY CO. — INCORPORATED — IOWA

SEAL — EMCASCO INSURANCE COMPANY — CORPORATE — IOWA

SEAL — DAKOTA FIRE INSURANCE COMPANY — CORPORATE — NORTH DAKOTA

SEAL — EMPLOYERS MUTUAL CASUALTY CO. — CORPORATE — DES MOINES, IOWA

NOTARIAL SEAL — IOWA

AMY DANIEL
Commission Number 866839
My Commission Expires
August 13, 2028

Scott R. Jean, President & CEO
of Company 1; Chairman, President
& CEO of Companies 2, 3, 4, 5 & 6

Todd Strother, Executive Vice President
Chief Legal Officer & Secretary of
Companies 1, 2, 3, 4, 5 & 6

On this 17th day of September, 2025 before me a Notary Public in and for the State of Iowa, personally appeared Scott R. Jean and Todd Strother, who, being by me duly sworn, did say that they are, and are known to me to be the CEO, Chairman, President, Executive Vice President, Chief Legal Officer and/or Secretary, respectively, of each of the Companies above; that the seals affixed to this instrument are the seals of said corporations; that said instrument was signed and sealed on behalf of each of the Companies by authority of their respective Boards of Directors; and that the said Scott R. Jean and Todd Strother, as such officers, acknowledged the execution of said instrument to be their voluntary act and deed, and the voluntary act and deed of each of the Companies.

My Commission Expires August 13, 2028.

Amy Daniel
Notary Public in and for the State of Iowa

CERTIFICATE

I, Ryan J. Springer, Vice President of the Companies, do hereby certify that the foregoing resolution of the Boards of Directors by each of the Companies, and this Power of Attorney issued pursuant thereto on 17th day of September, 2025 are true and correct and are still in full force and effect.

In Testimony Whereof I have subscribed my name and affixed the facsimile seal of each Company this 14th day of September, 2026.

Ryan J. Springer
Vice President

An official website of the United States government Here's how you know

ISR Workspace: Increased Contract Volume
Show Details
Jun 26, 2026

Revolutionary FAR Overhaul Impacts to SAM.gov
Show Details
Aug 15, 2025

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e.g. 1606N020Q02

turnstone ×

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