TOWN OF CHESHIRE, CONNECTICUT

REQUEST
FOR PROPOSALS

Regenerator ERV Installation At CHS

BID #2223-12

LEGAL NOTICE

TOWN OF CHESHIRE, CONNECTICUT
REQUEST FOR PROPOSALS

Regenerator ERV Installation At CHS

November 8, 2022

The Town of Cheshire is seeking competitive proposals for ***Regenerator ERV Installation At CHS.*** Sealed proposals are due by 3:00 pm, on November 21, 2022 at the office of Department of Public Works, Cheshire Town Hall, 84 South Main Street, Cheshire, Connecticut 06410. At that time, proposals will be opened in public and read aloud.

The documents comprising the Request for Proposals ("RFP Documents") may be obtained on the Town's website, www.cheshirect.org, under "Proposals *&RFP's."*

The Town of Cheshire reserves the rights to amend or terminate this Request for Proposals, accept all or any part of a proposal, reject all proposals, waive any informalities or non-material deficiencies in a proposal, and award the proposal to the proposer that, in the Town's sole discretion and judgment, will be in the Town's best interests.

TOWN OF CHESHIRE, CONNECTICUT

REQUEST FOR PROPOSALS FOR
Regenerator ERV Installation At CHS

Proposal Number: 2223-12
Proposal Opening Date: 11-21-2022
Proposal Opening Time: 3:00 pm
Proposal Opening Place: Cheshire Town Hall, Room 207

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The Town of Cheshire is seeking proposals for the removal of old unit ventilators and provide rooftop air handling units to improve indoor air quality in the classrooms though ventilation heating and cooling and related construction.

One (1) original and 2 copies of sealed proposals accompanied by a digital copy on a removable thumb drive must be received in the Cheshire Town Hall, Department of Public Works and Engineering, Room *213,* 84 South Main Street, Cheshire, CT 06410 by the date and time noted above. The Town of Cheshire (the "Town") will not accept submissions by e- mail or fax. The Town will reject proposals received after the date and time noted above.

The documents comprising this Request for Proposals may be obtained on the Town's website, www.cheshirect.org, under "Proposals & *RFP's."* **Each proposer is responsible for checking the Town's website to determine if the Town has issued any addenda and, if so, to complete its proposal in accordance with the RFP as modified by the addenda.**

Proposals shall be held firm and cannot be withdrawn for sixty (60) calendar days after the opening date.

The Town reserves the rights to amend or terminate this Request for Proposals, accept all or any part of a proposal, reject all proposals, waive any informalities or non-material deficiencies in a proposal, and award the proposal to the proposer that, in the Town's sole discretion and judgment, will be in the Town's best interests.

This Request for Proposals ("RFP") includes:

- Standard Instructions to Proposers
- Specifications
- Insurance Requirements

- Proposal Form
- Proposer's Legal Status Disclosure
- Proposer's Certification Concerning Equal Employment Opportunities and Affirmative Action Policy
- Proposer's Non Collusion Affidavit
- Proposer's Statement of References
- Addenda, if any
- The Contract in the form attached

TOWN OF CHESHIRE, CONNECTICUT

STANDARD INSTRUCTIONS TO PROPOSERS

1. INTRODUCTION

The Town of Cheshire (the "Town") is soliciting proposals for ***Regenerator ERV Installation At CHS.*** This RFP is not a contract offer, and no contract will exist unless and until a written contract is signed by the Town and the successful proposer.

Interested parties should submit a proposal in accordance with the requirements and directions contained in this RFP. **Proposers are prohibited from contacting any Town employee, officer or official concerning this RFP, except as set forth in Section 6, below. A proposer's failure to comply with this requirement may result in disqualification.**

If there are any conflicts between the provisions or' these Standard Instructions to Proposers and any other documents comprising this RFP, these Standard Instructions to Proposers shall prevail.

2. RIGHT TO AMEND OR TERMINATE THE RFP OR CONTRACT

The Town may, before or after proposal opening and in its sole discretion, clarify, modify, amend or terminate this RFP if the Town determines it is in the Town's best interest. Any such action shall be effected by a posting on the Town's website, vvww.cheshirect.org, under "Proposals & RFP's." **Each proposer is responsible for checking the Town's website to determine if the Town has issued any addenda and,** if **so, to complete its proposal in accordance with the RFP as modified by the addenda.**

If this RFP provides for a multi-year agreement, the Town also reserves the right to terminate the Contract at the end of the last fiscal year for which funds have been appropriated, and the Town shall have no obligation or liability to the successful proposer for any unfunded year or years.

3. KEY DATES

Non-Mandatory Pre-Proposal Site Visit: **11-14-2022 @ 4:00 pm**

Proposal Opening: **11-21-2022 @ 3:00 pm**

Preliminary Notice of Award: **12-15-2022**

Contract Execution: **12-20-2022**

Substantial Completion: **August 23, 2023**

The Preliminary Notice of Award and Contract Execution dates are anticipated, not certain, dates. If awarded a contract, the successful respondent agrees, by the submission of its proposal, that it shall sign the contract provided by the Town without alteration or modification within five (5) days of receipt of notice of award.

4. OBTAINING THE RFP

All documents that are a part of this RFP may be obtained on the Town's website, www.cheshirect.org, under "Proposals & RFP's."]

5. PROPOSAL SUBMISSION INSTRUCTIONS

Proposals must be received in the **Cheshire Town Hall, Department of Public Works and Engineering, Room *213,* 84 South Main Street, Cheshire, CT 06410** prior to the date and time the proposals are scheduled to be opened publicly. Postmarks prior to the opening date and time do **NOT** satisfy this condition. The Town will not accept submissions by e-mail or fax. Proposers are solely responsible for ensuring timely delivery. The Town will **NOT** accept late proposals.

One (1) original and 2 copies of all proposal documents accompanied by a digital copy on a removable thumb drive must be submitted in sealed, opaque envelopes clearly labeled with the proposer's name, the proposer's address, the words **"PROPOSAL DOCUMENTS,"** and the **Proposal Title, Proposal Number and Proposal Opening Date.** The Town may decline to accept proposals submitted in unmarked envelopes that the Town opens in its normal course of business. The Town may, but shall not be required to, return such proposal documents and inform the proposer that the proposal documents may be resubmitted in a sealed envelope properly marked as described above.

Proposal prices must be submitted on the Proposal Form included in this RFP. All blank spaces for proposal prices must be completed in ink or be typewritten; proposal prices must be stated in both words and figures. The person signing the Proposal Form must initial any errors, alterations or corrections on that form. Ditto marks (“ “) or words such as "SAME" shall not be used in the Proposal Form.

Proposals may be withdrawn personally or in writing provided that the Town receives the withdrawal prior to the time and date the proposals are scheduled to be opened. Proposals are considered valid, and may not be withdrawn, cancelled, or modified, for sixty (60) days after opening. after the opening date, to give the Town sufficient time to review the proposals, investigate the proposers' qualifications, secure any required municipal approvals, and execute a binding contract with the successful proposer.

An authorized person representing the legal entity of the proposer must sign the Proposal Form and all other forms included in this RFP.

6. QUESTIONS AND AMENDMENTS

Respondents shall promptly notify the Town of any ambiguity, inconsistency or error which they may discover upon examination of the RFP and/or any documents provided or issued by the Town in conjunction with the RFP. Interpretations, corrections and changes made to the RFP Documents

will be made by written addenda. Addenda are written instruments issued by the Town prior to the proposal opening date, which modify or interpret the RFP Documents by addition, deletion, clarification or correction.

Questions concerning the process and procedures applicable to this RFP are to be submitted **in writing** (including by e-mail or fax) and directed **only to:**

Name:	Daniel Bombero
Department:	Public Works
E-mail:	dbombero@cheshirect.org
Fax:	203-271-6659

Questions concerning the RFP Documents are to be submitted **in writing** (including by e- mail or fax) and directed **only to:**

Name: Daniel Bombero
Department: Public Works
E-mail: dbombero@cheshirect.org
Fax: 203-271-6659

Proposers are prohibited from contacting any other Town employee, officer or official concerning this RFP. A proposer's failure to comply with this requirement may result in disqualification.

The appropriate Town representative listed above must receive any questions from proposers no later than seven (7) business days before the proposal opening date. That representative will confirm receipt of a proposer's questions by e-mail. The Town will answer all written questions by issuing one or more addenda, which shall be a part of this RFP and the resulting Contract, containing all questions received as provided for above and responses to same.

At least four (4) calendar days prior to proposal opening, the Town will post any addenda on the Town's website, www.cheshirect.org, under "Proposals & RFP's." **Each proposer is responsible for checking the website to determine if the Town has issued any addenda and, if so, to complete its proposal in accordance with the RFP as modified by the addenda.**

No oral statement of the Town, including oral statements by the Town representatives listed above, shall be effective to waive, change or otherwise modify any of the provisions of this RFP, and no proposer shall rely on any alleged oral statement.

7. ADDITIONAL INFORMATION/REQUIREMENTS

7.1 **Delivery/Time for Performance.** TIME IS OF THE ESSENCE with regard to the performance of the services procured through this RFP and the Contract to be entered into by the Town with the selected proposer, if any. Strict compliance with and adherence to the schedule for the services and the Contract is mandatory. If, in the sole opinion of the Town, the selected proposer is not adhering to the contract schedule, upon forty-eight (48) hours written notice from the Town to the selected proposer, the Town shall have the right to direct the proposer to increase its manpower to meet the established project schedule (including any milestones) without additional compensation. Any and all such additional labor or supervision shall be at proposer's sole cost and expense and may include, but shall not be limited to, the Town directing the selected proposer to work overtime, work weekends, or any combination thereof, without any additional compensation being due to proposer for such additional personnel. In addition, the Town shall have the right but not the obligation to supplement the proposer's forces with that of another vendor in order to achieve compliance with the project schedule. All costs attributable to the supplemental labor and supervision of same shall be the sole obligation and responsibility of the selected proposer. Failure to strictly adhere to the schedule (including any milestones) and the provisions of this paragraph 7.1 shall constitute a material default of proposer's contractual obligations and entitle the Town, in its discretion, to all remedies for default set forth in the contract.

7.2 **Termination of Contract**. Contracts shall remain in force for the period within which the selected proposer must perform as set forth in the proposal, unless an extension has been agreed upon as evidenced by a contract extension executed in writing by both the selected proposer and the Town.

7.3 **Assignment.** Proposer shall not assign, transfer or subcontract this contract or its obligations hereunder without the prior written consent of the Town, which consent may be withheld in the Town's sole discretion.

7.4 **Default.** The contract may be terminated by the Town by written notice of default to the upon non-performance or breach of the contract terms. The awarded proposer shall be obligated to pay the Town for all losses, damages, costs and expenses, including the cost of re-procurement, and attorney's fees incurred defending claims arising from such default and in seeking recovery of all such costs and expenses from proposer and/or its surety. Upon a termination for cause, the Town shall have no further obligation to issue payments to the proposer until resolution of the dispute.

7.5 **Conflict.** To the extent any of the contract terms set forth herein conflict with the terms of the form Contract entered into by the parties, the Contract terms shall control.

7.6 **COVID-19**: Proposers shall anticipate and incorporate into their proposals all potential costs and delays related to a public health emergency such as the COVID-19 coronavirus pandemic, including the cost of compliance with rules, regulations, guidelines and recommendations issued by public authorities. Potential costs may include but are not limited to, costs related to inefficiency, lost productivity, delays of performance, social distancing, manpower levels, project scheduling, coordination, material/product supply chain delays and disruptions, delivery delays, material escalation, and any other potential costs. In no event shall the Town be liable for any such costs and/or delays.

The Town reserves the right, either before or after the opening of proposals, to ask any proposer to clarify its proposal or to submit any additional information that the Town in its sole discretion deems desirable.

8. COSTS FOR PREPARING PROPOSAL

Each proposer's costs incurred in developing its proposal are its sole responsibility, and the Town shall have no liability for such costs.

9. OWNERSHIP OF PROPOSALS

All proposals submitted become the Town's property and will not be returned to proposers.

10. FREEDOM OF INFORMATION ACT

All information submitted in a proposal or in response to a request for additional information is subject to disclosure under the Connecticut Freedom of Information Act as amended and judicially interpreted. A proposer's responses may contain financial, trade secret or other data that it claims should not be public (the "Confidential Information"). A proposer must identify specifically the pages and portions of its proposal or additional information that contain the claimed Confidential Information by visibly marking all such pages and portions. Provided that the proposer cooperates with the Town as described in this section, the Town shall, to the extent permitted by law, protect

from unauthorized disclosure such Confidential Information.

If the Town receives a request for a proposer's Confidential Information, it will promptly notify the proposer in writing of such request and provide the proposer with a copy of any written disclosure request. The proposer may provide written consent to the disclosure, or may object to the disclosure by notifying the Town in writing to withhold disclosure of the information, identifying in the notice the basis for its objection, including the statutory exemption(s) from disclosure. The proposer shall be responsible for defending any complaint brought in connection with the nondisclosure, including but not only appearing before the Freedom of Information Commission, and providing witnesses and documents as appropriate.

11. REQUIRED DISCLOSURES

In its Proposal Form each proposer must disclose, if applicable:

- Its inability or unwillingness to meet any requirement of this RFP, including but not only any of the Contract Terms referenced herein and in the contract template provided by the Town as part of this RFP (if applicable);
- If it is listed on the State of Connecticut's Debarment List;
- If it is ineligible, pursuant to Conn. Gen. Stat.§ 31-57b, to be awarded the Contract because of occupational safety and health law violations;
- All resolved and pending arbitrations and litigation matters in which the proposer or any of its principals (regardless of place of employment) has been involved within the last ten (10) years;
- All criminal proceedings in which the proposer or any of its principals (regardless of place of employment) has ever been the subject; and
- Each instance in which it or any of its principals (regardless of place of employment) has ever been found to have violated any state or local ethics law, regulation, ordinance, code, policy or standard, or to have committed any other offense arising out of the submission of proposals or bids or the performance of work on public works projects or contracts.

A proposer's acceptability based on these disclosures lies solely in the Town's discretion.

12. REFERENCES

Each proposer must complete and submit the Proposer's Statement of References form included in this RFP.

13. LEGAL STATUS

If a proposer is a corporation, limited liability company, or other business entity that is required to register with the Connecticut Secretary of the State's Office, it must have a current registration on file with that office. The Town may, in its sole discretion, request acceptable evidence of any proposer's legal status.

14. PROPOSAL (BID) SECURITY

[Proposal (bid) security, whether in the form of a certified check or a proposal (bid) bond, guarantees the Town that, if the proposer is awarded the proposal, the proposer will deliver the insurance certificate, if required, the W-9 form and anything else required under the procurement, and will execute the contract at the proposal price. Security ensures the integrity of a proposal response. If the successful proposer refuses to enter into the contract, the security will be forfeited to the Town as liquidated damages not as a penalty.

Each proposal must be accompanied by a certified check of the proposer or a proposal (bid) bond with a surety acceptable to the Town in an amount equal to at least **TEN PERCENT (10%)** of the proposal amount. The proposal (bid) bond shall be written by a company or companies licensed to issue bonds in the State of Connecticut, which company or companies shall have at least an "A-" VIII policyholders rating as reported in the latest edition of Best Publication's Key Rating Guide. The successful proposer, upon its refusal or failure to execute and deliver the Contract, certificate(s) of insurance, W-9 form, performance security or other documents required by this RFP within **five (5) business days** of written notification of preliminary award, unless the Town otherwise agrees in writing, shall forfeit to the Town, as liquidated damages for such failure or refusal, the security submitted with its proposal.

Upon the successful proposer's execution of the Contract in the form provided with this RFP, the Town shall return the proposal security to the successful proposer and to all other proposers.

15. PRESUMPTION OF PROPOSER'S FULL KNOWLEDGE

Each proposer is responsible for having read and understood each document in this RFP and any addenda issued by the Town. A proposer's failure to have reviewed all information that is part of or applicable to this RFP, including but not limited to any addenda posted on the Town's website, shall in no way relieve it from any aspect of its proposal or the obligations related thereto.

Each proposer is deemed to be familiar with and is required to comply with all federal, state and local laws, regulations, ordinances, codes and orders that in any manner relate to this RFP or the performance of the work described herein.

By submitting a proposal, each proposer represents that it has thoroughly examined and become familiar with the scope of work outlined in this RFP, and it is capable of performing the work to achieve the Town's objectives. If applicable, each proposer shall visit the site, examine the areas and thoroughly familiarize itself with all conditions of the property before preparing its proposal.

16. SUBSTITUTION FOR NAME BRANDS

The proposer must attach detailed information concerning deviations from any name brands specified in the RFP and explain in detail how the substitution compares with the name brand's specifications. The Town in its sole discretion shall decide whether the substitution is acceptable.

17. TAX EXEMPTIONS

The Town is exempt from the payment of federal excise taxes and Connecticut sales and use taxes. Federal Tax Exempt #066-001971. Exemption from State sales tax per Conn. Gen. Stat. Chapter 219, § 12-412(1). No exemption certificates are required, and none will be issued.

18. INSURANCE

Vendor shall maintain in force at all times during which services are to be performed by vendor, or such longer period as provided by contract, the following coverages placed with company(ies) licensed by the State of Connecticut which have at least an "A-" VIII policyholders rating according to A.M. Bests latest edition Key Rating Guide. The stated policy limits are the minimum coverage amounts required.

		(Minimum Limits)
General Liability*	Each Occurrence	$1,000,000
	General Aggregate	$2,000,000
	Products/Completed Operations Aggregate	$2,000,000
Auto Liability*	Combined Single Limit Each Accident	$1,000,000
Umbrella* (Excess Liability)	Each Occurrence Aggregate	$1,000,000 $1,000,000

* The Town of Cheshire , and its Board of Education (if applicable) shall be named as "Additional Insured". Coverage is to be provided on a primary, noncontributory basis. Wavier ofsubrogation to be provided. Higher limits may be required, based on the scope and nature of the services to be provided. If higher limits are required, such limits shall be identified in the Request for Proposal of Invitation to Bid, as well as in the contract issued by the Town. The Town reserves the right to require additional coverages, including, without limitation, Builder's Risk insurance for construction projects and Owner's Protective Liability insurance, if desirable.

If any policy is written on a "Claims Made" basis, the policy must be continually renewed for a minimum of two (2) years from the completion date of this contract. If the policy is replaced and/or the retroactive date is changed, then the expiring policy must be endorsed to extend the reporting period for claims for the policy in effect during the contract for two (2) years from thecompletion date.

Workers' Compensation and	WC Statutory Limits	
Employers' Liability	EL Each Accident	$500,000
	EL Disease Each Employee	$500,000
	EL Disease Policy Limit	$500,000

Original, completed Certificates of Insurance must be presented to the Town's Purchasing Agent prior to purchase order issuance and contract execution. Vendor agrees to provide replacement/renewal certificates at least 60 days prior to the expiration of the policy. Should any of the above described policies be cancelled before the expiration date, written notice must be provided to the Town 30 days prior to cancellation. Failure to maintain required insurance coverage shall be a material default of vendor's contract with the Town.

The successful proposer shall, at its own expense and cost, obtain and keep in force at least the insurance listed in the Insurance Requirements that are a part of this RFP. The Town reserves the right to require from the successful proposer a complete, certified copy of any required insurance policy.

19. PERFORMANCE SECURITY

The successful proposer shall furnish security a performance bond covering the faithful performance of the Contract (the "Performance Security"). The Performance Security shall be *$,* and in a form reasonably acceptable to the Town. If the Performance Security is a performance bond, it shall be issued by a company licensed by the State of Connecticut that is a T List surety and has at least an "A-" VIII policyholders rating according to Best Publication's latest edition Key Rating Guide." The cost of the Performance Security shall be included in the proposal price.

In addition to the Performance Security, the successful proposer shall furnish a bond covering the successful proposer's payment to its subcontractors and suppliers of all obligations arising under the Contract (the "Payment Bond"). The Payment Bond shall be (a) in the full amount of the Contract price; (b) in a form reasonably acceptable to the Town; and (c) issued by a company licensed by the State of Connecticut that has at least an "A-" VIII policyholders rating according to Best Publication's latest edition Key Rating Guide and is on the T List. The cost of the Payment Bond shall be included in the proposal price.

20. DELIVERY ARRANGEMENTS

The successful proposer shall deliver the items that are the subject of the RFP, at its sole cost and expense, to the location(s) listed in the Specifications.

21. AWARD CRITERIA; SELECTION; CONTRACT EXECUTION

All proposals will be publicly opened and read aloud as received on the date, at the time, and at the place identified in this RFP. Proposers may be present at the opening, unless expressly prohibited by the Town.

The Town reserves the right to correct, after proposer verification, any mistake in a proposal that is a clerical error, such as a price extension, decimal point error or FOB terms. If an error exists in an extension of prices, the unit price shall prevail. In the event of a discrepancy between the price quoted in words and in figures, the words shall control.

The Town reserves the rights to accept all or any part of a proposal, reject all proposals, and waive any informalities or non-material deficiencies in a proposal. The Town also reserves the right, if applicable, to award the purchase of individual items under this RFP to any combination of separate proposals or proposers.

The Town will accept the proposal that, all things considered, the Town determines is in its best interests. Although price will be an important factor in most RFPs, it will not be the only basis for award. Due consideration may also be given to a proposer's experience, references, service, ability to respond promptly to requests, past performance, and other criteria relevant to the Town's interests, including compliance with the procedural requirements stated in this RFP.

The Town will not award the proposal to any business that or person who is in arrears or in default to the Town with regard to any tax, debt, charge, contract, security or any other obligation.

If the lowest proposer meets all specifications, is responsive, and, if applicable, qualified, but the proposal is not acceptable to the Town Manager or, if applicable, the Public Building Commission or the Board of Education, the matter must be referred to the Town Council for its decision on whether to reject all proposals, to accept a higher proposal, or to take such other action as may be in the Town's best interests.

The Town will select the proposal that it deems to be in the Town's best interest and issue a Preliminary Notice of Award to the successful proposer. The award may be subject to further discussions with the proposer. **The making of a preliminary award to a proposer does not provide the proposer with any rights and does not impose upon the Town any obligations. The Town is free to withdraw a preliminary award at any time and for any reason. A proposer has rights, and the Town has obligations, only if and when a Contract is fully executed by the Town and the proposer.**

If the proposer does not execute the Contract within five (5) business days of the date of the Preliminary Notice of Award, unless extended by the Town, the Town may call any proposal security provided by the proposer and may enter into discussions with another proposer.

The Preliminary Notice of Award and Contract Execution dates in Section 3's Key Dates are anticipated, not certain, dates.

22. AFFIRMATIVE ACTION, AND EQUAL OPPORTUNITY

Each proposer must submit a completed Proposer's Certification Concerning Equal Employment Opportunities and Affirmative Action Policy form included with this RFP. Proposers with fewer than ten (10) employees should indicate that fact on the form and return the form with their proposals

23. NONRESIDENT CONTRACTORS

If the successful proposer is a "nonresident contractor" as defined in Conn. Gen. Stat. § 12-430(7)(A) as amended, it shall comply fully with the provisions of § 12-430(7) and, prior to execution of the Contract, shall furnish the Town with a copy of the requisite certificate of compliance set forth in C.G.S. § 12-430(7)(E). The successful proposer agrees to defend, indemnify, and hold harmless the Town, its employees, officers, officials, agents, volunteers and independent contractors, including any of the foregoing sued as individuals (collectively, the "Town Indemnified Parties"), from any and all taxes, interest and penalties that the State of

Connecticut asserts are due with respect to the successful proposer's activities under the Contract.

The successful proposer shall also be required to pay any and all attorney's fees incurred by the Town Indemnified Parties in enforcing any of the successful proposer's obligations under this section, whether or not a lawsuit or other proceeding is commenced, which obligations shall survive the termination or expiration of the Contract.

24. COMPLIANCE WITH IMMIGRATION LAWS

By submitting a proposal, each proposer confirms that it has complied, and during the term of the Contract will comply, with the Immigration Reform and Control Act ("IRCA") and that each person it provides under the Contract will at all times be authorized for employment in the United States of America. Each proposer confirms that it has a properly completed Employment

Eligibility Verification, Form I-9, for each person who will be assigned under the Contract and that it will require each subcontractor, if any, to confirm that it has a properly completed Form I-9 for each person who will be assigned under the Contract.

The successful proposer shall defend, indemnify, and hold harmless the Town, its employees, officers, officials, agents, volunteers and independent contractors, including any of the foregoing sued as individuals (collectively, the "Town Indemnified Parties"), against any and all proceedings, suits, actions, claims, damages, injuries, awards, judgments, losses or expenses, including fines, penalties, punitive damages, attorney's fees and costs, brought or assessed against, or incurred by, the Town Indemnified Parties related to or arising from the obligations under IRCA imposed upon the successful proposer or its subcontractor. The successful proposer shall also be required to pay any and all attorney's fees and costs incurred by the Town Indemnified Parties in enforcing any of the successful proposer's obligations under this provision, whether or not a lawsuit or other proceeding is commenced, which obligations shall survive the termination or expiration of the Contract.

25. NON COLLUSION AFFIDAVIT

Each proposer shall submit a completed Proposer's Non Collusion Affidavit that is part of this RFP.

26. CONTRACT TERMS

The following provisions will be among the mandatory terms of the Town's Contract with the successful proposer. If a proposer is unwilling or unable to meet any of these Contract Terms, the proposer must disclose that inability or unwillingness in its Proposal Form (see Section 11 of these StandardInstructions to Proposers):

a. DEFENSE HOLD HARMLESS AND INDEMNIFICATION

The successful proposer agrees, to the fullest extent permitted by law, to defend, indemnify, and hold harmless the Town, its employees, officers, officials, agents, volunteers, boards, commissions, committees, and independent contractors, including any of the foregoing sued as individuals (collectively, the "Town Indemnified Parties"), from and against all proceedings, suits, actions, claims, damages, injuries, awards, judgments, losses or expenses, including attorney's fees, arising out of or relating, directly or indirectly, to the successful proposer's performance of the contract, including but not limited to proposer’s malfeasance, misconduct, negligence or failure to meet its obligations under the RFP or the Contract. The successful proposer's obligations under this section shall not be limited in any way by any limitation on the amount or type of the successful proposer's insurance. Nothing in this section shall obligate the successful proposer to indemnify the Town Indemnified Parties against liability for damage arising out of bodily injury to persons or damage to property caused by or resulting from the negligence of the Town Indemnified Parties.

In any and all claims against the Town Indemnified Parties made or brought by any employee of the successful proposer, or anyone directly or indirectly employed or contracted with by the successful proposer, or anyone for whose acts or omissions the successful proposer is or may be liable, the successful proposer's obligations under this section shall not be limited by any

limitation on the amount or type of damages, compensation or benefits payable by the successful proposer under workers' compensation acts, disability benefit acts, or other employee benefits acts.

The successful proposer shall also be required to pay any and all attorney's fees incurred by the Town Indemnified Parties in enforcing any of the successful proposer's obligations under this section, which obligations shall survive the termination or expiration of this RFP and the Contract.

As a municipal agency of the State of Connecticut, the Town will NOT defend, indemnify, or hold harmless the successful proposer.

b. ADVERTISING

The successful proposer shall not name the Town in any advertising, news releases, or promotional efforts without the Town's prior written approval.

If it chooses, the successful proposer may list the Town in a Statement of References or similar document required as part of its response to a public procurement. The Town's permission to the successful proposer to do so is not a statement about the quality of the successful proposer's work or the Town's endorsement of the successful proposer:

c. W-9 FORM

The successful proposer must provide the Town with a completed W-9 form before Contract execution.

d. PAYMENTS

Proposers are encouraged to offer discounts for early payment. All other payments are to be made 30 days after the appropriate Town employee receives and approves the invoice, unless otherwise specified in the Specifications or Contract.

In each of its contracts with subcontractors or materials suppliers, the successful proposer shall agree to pay any amounts due for labor performed or materials furnished not later than thirty (30) days after the date the successful proposer receives payment from the Town that encompasses the labor performed or materials furnished by such subcontractor or material supplier. The successful proposer shall also require in each of its contracts with subcontractors that such subcontractor shall, within thirty (30) days of receipt of payment from the successful proposer, pay any amounts due any sub-subcontractor or material supplier, whether for labor performed or materials furnished.

Each payment application or invoice shall be accompanied by a statement showing the status of all pending change orders, pending change directives and approved changes to the Contract. Such statement shall identify the pending change orders and pending change directives, and shall include the date such change orders and change directives were initiated, additional cost and/or time associated with their performance and a description of any work completed. The successful proposer shall require each of its subcontractors and suppliers to include a similar statement with each of their payment applications or invoices.

e. TOWN INSPECTION OF WORK

The Town may inspect the successful proposer's work at all reasonable times. This right of inspection is solely for the Town's benefit and does not transfer to the Town the responsibility for discovering patent or latent defects. The successful proposer has the sole and exclusive responsibility for performing in accordance with the Contract.

f. REJECTED WORK OR MATERIALS

The successful proposer, at its sole cost and expense, shall remove from the Town's property rejected items, commodities and/or work within 48 hours of the Town's notice of rejection. Immediate removal may be required when safety or health issues are present.

g. MAINTENANCE AND AVAILABILITY OF RECORDS

The successful proposer shall maintain all records related to the work described in the RFP for a period of five (5) years after final payment under the Contract or until all pending Town, state and federal audits are completed, whichever is later. Such records shall be available for examination and audit by Town, state and federal representatives during that time, at no cost to the Town.

h. SUBCONTRACTING

Prior to entering into any subcontract agreement(s) for the work described in the Contract, the successful proposer shall provide the Town with written notice of the identity (full legal name street address, mailing address (if different from street address), and telephone number) of each proposed subcontractor. The Town shall have the right to object to any proposed subcontractor by providing the successful proposer with written notice thereof within seven (7) business days of receipt of all required information about the proposed subcontractor. If the Town objects to a proposed subcontractor, the successful proposer shall not use that subcontractor for any portion of the work described in the Contract.

All permitted subcontracting shall be subject to the same terms and conditions as are applicable to the successful proposer. The successful proposer shall remain fully and solely liable and responsible to the Town for performance of the work described in the Contract. The successful proposer also agrees to promptly pay each of its subcontractors within thirty (30) days of receipt of payment from the Town or otherwise in accordance with law. The successful proposer shall assure compliance with all requirements of the Contract. The successful proposer shall also be fully and solely responsible to the Town for the acts and omissions of its subcontractors and of persons employed, whether directly or indirectly, by its subcontractor(s).

i. PREVAILING WAGES

State law may require that wages paid on an hourly basis to any person performing the work of any mechanic, laborer or worker under the Contract and the amount of payment or contribution paid or payable on behalf of each such person to any employee welfare fund, as defined in Conn. Gen. Stat. § 31-53, as amended, shall be at a rate equal to the rate customary or prevailing for the same work in the same trade or occupation in the Town. A successful proposer who is not obligated by agreement to make payment or contribution on behalf of such persons to any such employee welfare fund shall pay to each mechanic, laborer or worker as part of such person's wages the amount of payment or contribution for such person's classification on each pay day. Upon Contract award, the successful proposer must certify under oath to the State Labor Commissioner the pay scale to be used by the successful proposer and its subcontractors.

j. PREFERENCES

As required by statute, regulation or other applicable law, Respondent and any Subcontractor shall monitor and track MBE and WBE, local workforce and overall labor participation, including Set Aside documentation. If this Project is funded in whole or in part by funds from the State of Connecticut, Public Act 15-5 (§§58-71 and 88) requires that, effective with all contracts executed after October 1, 2015, all solicitations for municipal public works contracts funded in whole or in part with State funds

state in the notice of solicitation that the contract must comply with the set asides mandated by Public Act 15-5. The set aside requirements include a requirement that 25% of the total value of contracts in excess of $50,000.00 be set aside for exclusive bidding for "small contractors," as defined by Section 58 (a) (1), and 25% of such amount (that is, 6.25% of the total value), be set aside for "minority business enterprises," as defined by Section 58(a) (4). For contracts in excess of $50,000.00, Respondent must have obtained Commission approval of their Affirmative Action Plan prior to contract execution. Respondent is expressly directed to review Public act 15-5, sections 58-71 and 88, to familiarize itself with the requirements of such laws. The Town also directs Respondent's attention to sections 63 and 64 (non-discrimination requirements) and 66-68 (affirmative action requirements).

The Respondent agrees and warrants that in the performance of the Contract such Respondent will not discriminate or permit discrimination against any person or group of persons on the grounds of race, color, religious creed, age, marital status, national origin, ancestry, sex, gender identity or expression, sexual orientation, intellectual disability, mental disability or physical disability, including, but not limited to, blindness, unless it is shown by such Respondent that such disability prevents performance of the work involved, in any manner prohibited by the laws of the United States or of the state of Connecticut. The Respondent further agrees to take affirmative action to insure that applicants with job-related qualifications are employed and that employees are treated when employed without regard to of race, color, religious creed, age, marital status, national origin, ancestry, sex, gender identity or expression, intellectual disability, mental disability or physical disability, including, but not limited to, blindness, unless it is shown by such Respondent that such disability prevents performance of the work involved; (2) the Respondent agrees, in all solicitations or advertisements for employees placed by or on behalf of the Respondent, to state that it is an ."affirmative action-equal opportunity employer" in accordance with regulations adopted by the commission; (3) the Respondent agrees to provide each labor union or representative of workers with which such Respondent has a collective bargaining agreement or other contract or understanding and each vendor with which such Respondent has a contract or understanding, a notice to be provided by the commission advising the labor union or workers' representative of the Respondent's commitments under this section, and to post copies of the notice in conspicuous places available to employees and applicants for employment; (4) the Respondent agrees to comply with each provision of this section and sections 46a-68e and 46a-68f and with each regulation or relevant order issued by said commission pursuant to sections 46a-56, 46a-68e,46a-68f and 46a-86; (5) the Respondent agrees to provide the Commission on Human Rights and Opportunities with such information requested by the commission, and permit access to pertinent books, records and accounts, concerning the employment practices and procedures of the Respondent as relate to the provisions of this section and section 46a-56.

Any Respondent who is a party to a municipal public works contract or quasi-public agency project, where any such contract is valued at less than $50,000 for each year of the contract, shall provide the Commission on Human Rights and Opportunities with a written or electronic representation that complies with the nondiscrimination agreement and warranty under subsection (A)(1) above, provided if there is any change in such representation, the Respondent shall provide the updated representation to the Commission not later than 30 days after such change. Any Respondent who is a party to a municipal public works contract or a quasi-public agency project, where any such contract is valued at $50,000 or more for any year of the contract, shall provide the Commission with any one of the following: (1) Documentation in the form of a company or corporate police adopted by resolution of the board of directors, shareholder, managers, members or other governing body of such Respondent that complies with the nondiscrimination agreement and warranty under subsection (A)(1) of this section; (2) Documentation in the form of a company or corporate policy adopted by a prior resolution of the board of directors, shareholders, managers, members or other governing body of such Respondent if (a) the prior resolution is certified by a duly authorized corporate officer of such contractor to be in effect on the date the documentation is submitted, and the executive director of the Commission on Human Rights and Opportunities or designee certifies that the prior resolution

complies with the nondiscrimination agreement and warranty under subdivision (A)(1) of this section; or (3) Documentation in the form of an affidavit signed under penalty of false statement by a chief executive officer, president, chairperson or other corporate officer duly authorized to adopt company or corporate policy that certifies that the company or corporate policy of the contractor complies with the nondiscrimination agreement and warranty under subdivision (A)(1) of this section and is in effect on the date the affidavit is signed..

"Minority business enterprise" means any small contractor or supplier of materials fifty-one per cent or more of the capital stock, if any, or assets of which is owned by a person or persons: (1) Who are active in the daily affairs of the enterprise, (2) who have the power to direct the management and policies of the enterprise and (3) who are members of a minority, as such term is defined in subsection (a) of section 32-9n; and "good faith" means that degree of diligence which a reasonable person would exercise in the performance of legal duties and obligations. "Good faith efforts" shall include, but not be limited to, those reasonable initial efforts necessary to comply with statutory or regulatory requirements and additional or substituted efforts when it is determined that such initial efforts will not be sufficient to comply with such requirements. Determination of the Respondent's good faith efforts shall include, but shall not be eliminated to, the following factors: The Respondent's employment and subcontracting policies, patterns and practices; affirmative advertising recruitment and training; technical assistance activities and such other reasonable activities or efforts as the Commission on Human Rights and Opportunities may prescribe that are designed to ensure the participation of minority business enterprises in municipal public works contracts or quasi-public agency projects. "Municipal public works project" means that portion of an agreement entered into on or after October 1, 2015, between any individual, form or corporation and a municipality for the construction, rehabilitation, conversion, extension, demolition or repair of a public building, highway or other changes or improvements in real property, which is financed in whole or in part by the state, including, but not limited to, matching expenditures, grants, loans, insurance or guarantees but excluding any project of an alliance district, as defined in section 10-262u, finance by the state funding in an amount equal to fifty thousand dollars or less. "Quasi-public agency project" means the construction, rehabilitation, conversion, extension, demolition or repair of a building or other changes or improvements in real property pursuant to a contract entered into on or after October 1, 2015, which is financed in whole or in part by a quasi-public agency using state funds, including, but not limited to, matching expenditures, grants, loans, insurance or guarantees.

The successful proposer shall comply with the requirements of Conn. Gen. Stat. § 31-52(b), as amended. Specifically, the successful proposer agrees that in the employment of labor to perform the work under the Contract, preference shall be given to citizens of the United States who are, and have been continuously for at least three (3) months prior to the date of the Contract, residents of the labor market area (as established by the State of Connecticut Labor Commissioner) in which such work is to be done, and if no such qualified person is available, then to citizens who have continuously resided in New Haven County for at least three (3) months prior to the date hereof, and then to citizens of the State who have continuously resided in the State at least three (3) months prior to the date of the Contract.

k. WORKERS COMPENSATION

[Under Conn. Gen. Stat.§ 31-286a, a municipality may not enter into "any contract ... for the construction, remodeling, refinishing, refurbishing, rehabilitation, alteration or repair of any public works project before receiving from each of the other parties to such contract (1) sufficient evidence of compliance with the workers' compensation insurance and self-insurance requirements of subsection (b) of section 31-284, <u>and</u> (2) a current statement from the State

Treasurer that, to the best of his knowledge and belief, as of the date of the statement, the particular party was not liable to the state for any workers' compensation payments made pursuant to section 31-355"(emphasis added).

Ursula Tschinkel at the State Treasurer's office is the current contract for obtaining statements. Ursula.tschinkel@ct.gov (860) 702-3250.

Prior to Contract execution, the Town will require the tentative successful proposer to provide a current statement from the State Treasurer that, to the best of her knowledge and belief, as of the date of the statement, the tentative successful proposer was not liable to the State for any workers' compensation payments made pursuant to Conn. Gen. Stat. § 31-355.

l. SAFETY

The successful proposer and each of its permitted subcontractors shall furnish proof that each employee performing the work of a mechanic, laborer or worker under the Contract has completed a course of at least ten (10) hours in construction safety and health approved by the federal Occupational Safety and Health Administration or has completed a new miner training program approved by the Federal Mine Safety and Health Administration. Such proof shall be provided with the certified payroll submitted for the first week each such employee, mechanic, laborer, or worker begins work under the Contract.

m. COMPLIANCE WITH LAWS

The successful proposer shall comply with all applicable laws, regulations, ordinances, codes and orders of the United States, the State of Connecticut and the Town related to its proposal and the performance of the work described in the Contract, including but not limited to:

.1 **Non-Discrimination and Affirmative Action.** Proposer, in performing under this contract, shall not discriminate against any worker, employee or applicant, or any member of the public, because of race, creed, color, age, marital status, sexual orientation, national origin, ancestry, sex, mental retardation or physical disability, including but not limited to blindness, unless it is shown by the Proposer that such disability prevents performance of the work involved in any manner prohibited by the laws of the United States or the State of Connecticut, nor otherwise commit an unfair employment practice. Proposer further agrees that this article, (and any additional provisions required by law), will be incorporated by Proposer in all contracts entered into with suppliers of materials or services contractors and sub-contractors and all labor organizations, furnishing skilled, unskilled and craft union skilled labor or who may perform any such labor or services in connection with this contract. The following principles and requirements of Equal Opportunity and Affirmative Action, as incorporated herein, will be incorporated into "Equal Opportunity - Non-Discrimination Clause" are hereby deemed to be included in all Town bid documents, purchase orders, lease and contracts entered into with the Town. The principles of Affirmative Action are addressed in the 13th, 14th and 15th Amendments of the United States Constitution, Civil Rights Act of 1964, Equal Pay Act of 1963, Title VI and VII of the 1964 United States Civil Rights Act,

Presidential Executive Orders 11246, 11375, 11478 (nondiscrimination under federal contracts), Act 1, Section 1 and 20 of the Connecticut Constitution, Governor Grasso's Executive Order Number 11, Governor O'Neill's Executive Order Number 9, the Connecticut Fair Employment Practices Law (Sec. 46a-60-69) of the Connecticut General Statutes (CGS), Connecticut Code of Fair Practices (46a-70-81), Deprivation of Civil Rights (46a-58 (a)(d)), Public Accommodations Law (46a-63-64), Discrimination against Criminal Offenders (46a-80), definition of blind (46a-51(1)), definition of Physically Disabled (46a-51 (15)), definition of Mentally Retarded (46a-51-13), cooperation with the Commission on Human Rights and Opportunities (46a-77), Sexual Harassment (46a-60 (a)-8), Connecticut Credit Discrimination Law (360436 through 439), Title 1 of the State and the Local Fiscal Assistance Act 1 1972.

If a project is funded in whole or in part by State funds, CGS Sections 46a-68c through 46a-68k apply to contractors. These Sections trigger affirmative action plan requirements for contractors and the filing of compliance reports with the State by contractors.

.2 **Executive Orders.** The contract may be subject to the provisions of Executive Order No. Three of Governor Thomas J. Meskill, promulgate June 16, 1971, concerning labor employment practices, Executive Order No. Seventeen of Governor Thomas J. Meskill, promulgate February 15, 1973, concerning the listing of employment opening and Executive Order No. Sixteen of Governor John G. Rowland promulgated August 4, 1999, concerning violence in the workplace, all of which are incorporated into and are made a part of the contract as if they had been fully set forth in it. The contract may also be subject to Executive Order No. 7C of Governor M. Jodi Rell, promulgated July 13, 2006, concerning contracting reforms and Executive Order No. 14 of Governor M. Jodi Rell, promulgate April 17, 2006, concerning procurement of cleaning products and services, in accordance with their respective terms and conditions.

.3 **Connecticut's Prevailing Wage Law Provision.** If applicable, the Proposer must be in full compliance with CGS Section 31-53 and 31-53(a) which applies to each contract for the construction, remodeling, refinishing, refurbishing, rehabilitation, alteration, or repair of any public works project by the state or its agents, or by any political subdivision of the State, CGS Section 31-53 (g) provides monetary thresholds which must be met before the law is applicable. In accordance with CGS Section 31-53, projects are subject to the payment of minimum prevailing wages where the total cost of all work to be performed by all contractors and subcontractors in connection with new construction of any public works project is **$1,000,000** or more and where the total cost of all work to be performed by all contractors and subcontractors in connection with any remodeling, refinishing, refurbishing, rehabilitation, alteration or repair of any public works project is **$100,000** or more. For qualifying projects, all contractors and subcontractors shall submit to the Finance Department certified weekly payrolls for all contracts meeting the stated monetary limits. The certified payrolls shall be submitted to the Finance Department with the Proposer's monthly certificate for payment. The Proposers should familiarize

themselves with all aspects of the provisions under state law in order to ensure full compliance.

.4 **Occupational Safety and Health Administration Requirements.** According to CGS, Section 31-53b (a) each contract entered into on or after July 1, 2007, for the construction, remodeling, refinishing, refurbishing, rehabilitation, alteration or repair of any public building project by the state or any of its agents, or by a political subdivision of the state or any of its agents, where the total cost of all work to be performed by all contractors and subcontractors in connection with the contract is at least **$100,000** shall contain a provision requiring that, not later than thirty days after the date such contract is awarded, each contractor furnish proof to the Labor Commissioner that all employees performing manual labor on or in such public building , pursuant to such contract, have completed a course of at least ten hours in duration in construction safety and health approved by the federal Occupational Safety and Health Administration or, in the case of telecommunications employees, have completed at least ten hours of training in accordance with 29 CFR 1910.268. The aforesaid provisions shall be deemed to be incorporated into the Contract with the Town. The contractors should familiarize themselves with all aspects of state law and any applicable regulations pertaining to these requirements in order to ensure full compliance.

.5 **Payment Bond/Performance Bond State Law Requirements.** CGS Section 49-41, known as the Little Miller Act, requires that the Town ensure that payment bonds a/k/a labor and materials bond in the amount of the contract are provided for public works projects over **$100,000**. When a contract for construction, alteration, remodeling, repair or demolition of any public building is estimated to cost more than **$500,000** additional laws/requirements apply. The contractors should familiarize themselves with all aspects of state law and any applicable regulations pertaining to these requirements in order to ensure full compliance.

.6 **State of Connecticut Contractor Prequalification Program.** CGS Section 4b-91 requires all bidders for the construction, alteration, remodeling, repair or demolition of any public building or any other public work by a public agency (includes a municipality) that is paid for, in whole or in part, with state funds and that is estimated to cost more than **$500,000,** except a public highway or bridge project or any other construction project administered by DOT, shall be prequalified with the State pursuant to CGS Section 4a-100. Once a contractor is prequalified, it is issued a prequalification certificate by DAS, which certificate is in effect for one year. Subcontractors' work, the cost of which may exceed **$500,000**, are also required to be prequalified. Any bid for a project that requires prequalification must include a copy of the bidder's Prequalification Certificate showing the aggregate work capacity rating required under the contract and the Update (Bid) Statement showing renewal of certificate and/or change in aggregate work capacity. Bids which do not include a copy of the Prequalification Certificate and the Update (Bid) Statement are invalid. Contractors should contact the State Department of Administrative Services to familiarize themselves with these requirements.

.7 Non-Resident Contractor 5% Tax For Contracts.

CGS Section 12-430(7) requires non-resident contractors who perform services or furnish materials, or both, for the construction, alteration or improvement of any project in which the contract price is at least **$250,000**, to furnish the Department of Revenue Services (DRS) a Guarantee Bond for 5% of the total cost of the work, issued under a contract using Form AU-766, Guarantee Bond. This form is available on the State DRS website. Form AU-766 must be submitted for each additional change order or supplement issued against the contract. Non-resident contractors must have completed and submitted to the DRS Form REG-1, Business Tax Registration Application, to register with the DRS and have been issued a Connecticut Tax Registration Number. This form is available on the DRS website. Non-resident contractors have 120 days from the commencement of the contract to file the Guarantee Bond with the State. Commencement of the contract, as defined by law, "means the time when the non-resident contractor signs the contract, but, in any event, occurs no later than when the work under the contract actually starts." As soon as the guarantee bond is filed with the DRS, the non-resident contractor shall submit the copy of such Guarantee Bond together with the non-resident contractor's Connecticut Tax Registration Number to the Town department for whom the project is required. After the non-resident contractor receives its Certificate of Compliance from the DRS confirming that the Guarantee Bond requirement has been met, the non-resident contractor shall submit a copy of the same to the department, for whom the work is being performed, with a copy to the Purchasing Department.

.8 Equal Employment Opportunity (EEO); Minority Business Enterprises (MBE)

If a project is funded in whole or in part by state or federal funds, there may be a requirement that the contractor comply with CGS Section 4a-60 and applicable State regulations. On these projects it will depend upon which set-aside requirements are imposed by the funding agency. If no set-aside requirement is imposed, a statement that the Proposer is required to undertake good faith efforts to include subcontractors and suppliers who are minority business enterprises will suffice and shall be deemed to be incorporated into the Contract with the Town. If there is a set-aside goal, the Town and Proposer shall comply with the Small Contractors Set-Aside Program and the hiring goals identified by the State Commission on Human Rights and Opportunities (CHRO.)

.9 If a project or program is funded in whole or in part with federal funds, the Federal Uniform Guidance Procurement Standards, *2 CFR §§ 200.317-200.327*, shall apply and full compliance by Proposer with same shall be required.

6. LICENSES AND PERMITS

The successful proposer certifies that, throughout the Contract term, it shall have and provide proof of all approvals, permits and licenses required by the Town and/or any state or federal authority. The successful proposer shall immediately and in writing notify the Town of the loss or suspension of any such approval, permit or license.

7. AMENDMENTS

The Contract may not be altered or amended except by the written agreement of both parties.

8. ENTIRE AGREEMENT

It is expressly understood and agreed that the Contract contains the entire agreement between the parties, and that the parties are not, and shall not be, bound by any stipulations, representations, agreements or promises, oral or otherwise, not printed or inserted in the Contract or its attached exhibits.

9. VALIDITY

The invalidity of one or more of the phrases, sentences or clauses contained in the Contract shall not affect the remaining portions so long as the material purposes of the Contract can be determined and effectuated.

10. CONNECTICUT LAW AND COURTS

The Contract shall be governed by and construed in accordance with the internal laws (as opposed to the conflicts of law provisions) of the State of Connecticut, and the parties irrevocably submit in any suit, action or proceeding arising out of the Contract to the jurisdiction of the United States District Court for the District of Connecticut or of any court of the State of Connecticut, as applicable.

11. NON-EMPLOYMENT RELATIONSHIP

The Town and the successful proposer are independent parties. Nothing contained in the Contract shall create, or be construed or deemed as creating, the relationships of principal and agent, partnership, joint venture, employer and employee, and/or any relationship other than that of independent parties contracting with each other solely for the purpose of carrying out the terms and conditions of the Contract. The successful proposer understands and agrees that it is not entitled to employee benefits, including but not limited to workers compensation and employment insurance coverage, and disability. The successful proposer shall be solely responsible for any applicable taxes.

END OF STANDARD INSTRUCTIONS TO PROPOSERS

SPECIFICATIONS

Cheshire Regenerator – Jon D Petersen LLC
Mechanical & Electrical Specifications
DATE: 9/29/22

Specifications

Division 23 (Mechanical)

Section 23 00 00	General Requirements for Mechanical Work
Section 23 00 01	Heating, Ventilating and Air Conditioning (HVAC)
Section 23 05 00	Basic Materials and Methods
Section 23 05 93	Testing, Adjusting, and Balancing
Section 23 07 00	Mechanical Insulation
Section 23 30 00	Air Distribution

Division 26 (Electrical)

Section 26060	Grounding
Section 26120	Wiring (600v and under)
Section 26130	Junction & Pull Boxes
Section 26136	Raceways
Section 26500	Lighting

23 00 00 GENERAL REQUIREMENTS FOR MECHANICAL WORK

1. General:
   - A. References
     1. This Section covers the general requirements for plumbing, fire protection, and heating, ventilating and air conditioning work; examine all Contract Drawings and all other Sections of the Specifications for additional work related to the work of this Division.
     2. Refer to the GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS and applicable parts of DIVISION 01 for other general requirements.
     3. Refer to other Sections of this Division for detailed specifications on the Work of this Division.
   - B. Scope
     1. Provide labor, materials, services, equipment and transportation necessary for complete and operational mechanical systems as indicated on Contract Drawings.
   - C. Related Work Under Other Divisions
     1. Related work specified in other Divisions of the Specification includes, but is not limited to:
        - a. Temporary heat, water, sanitary system and electricity.
        - b. Installation of access panels furnished under this Section.
        - c. Finish painting.
        - d. Excavation, backfilling and grading.
        - e. Wood blocking and grounds.
        - f. Power wiring, control wiring, disconnect switches and electrical interlock wiring not specified herein: Division 26.
        - g. Electrical controls, disconnects and starters which are not integral with or specialized for mechanical equipment: Division 26.
        - h. Setting and flashing of roof drains furnished under this Division.
        - i. Exterior buried piping such as site water service, gas service, sanitary drainage and storm drainage, but not including fuel oil piping.
   - D. Shop Drawings Submittals
     1. Prepare and submit Shop Drawings through the Contractor to the Engineer for review. The Construction Manager must review and stamp all shop drawing submittals prior to submission for review by Engineer. Any shop drawings not reviewed prior to submission will be returned.
     2. The selection and intention to use a product specified by name shall NOT excuse the need for timely submission of shop drawings for that product.
     3. Prior to submitting shop drawings, submit for review preliminary list of intended or proposed manufacturers for all items for which shop drawings are required.
     4. Submission of shop drawings of unnamed manufacture or shop drawings at variance with the Contract Documents is NOT a proper request for substitution.

5. Upon completion of shop drawing review, shop drawings will be returned, marked with one of following notations: “Approved”, “Furnish as noted”, “Revise and Resubmit”, or “Rejected”. Only products whose shop drawings are marked "Furnish as noted" or "Approved" shall be used on the project.
6. Submittals shall include the following information:
    a. Descriptive and product data necessary to verify compliance with Contract Documents.
    b. Manufacturer's specifications including materials of construction, metal gauge, thickness and finish.
    c. Certified dimensional drawings including clearances required for maintenance or access.
    d. Performance data, ratings, operating characteristics, and operating limits.
    e. Electrical ratings and characteristics.
    f. Wiring and control diagrams, where applicable.
    g. Certifications requested, including UL label or listing.
    h. List of accessories which are required but are NOT being provided by the product manufacturer or are NOT being furnished under this Section. In the latter case, identify the Section(s) under which the accessories are being furnished.
7. In addition, submittals shall be clearly marked for the following:
    a. Specification Section and Paragraph under which equipment is specified.
    b. Equipment or fixture identification corresponding to that used in Contract Documents.
    c. Accessories and special or non-standard features and materials which are being furnished.
    d. Deletion of every reference to accessories, options, special features or materials which are NOT being furnished.

E. Product Selection
1. Contractor's options for selecting products are limited by Contract Document requirements and governing regulations and are NOT controlled by industry traditions or procedures experienced by Contractor on previous construction projects. Required procedures include, but are NOT necessarily limited to, following various methods of specifying:
2. Single Product Manufacturer Named: Provide product indicated. Advise Engineer, and obtain instructions before proceeding, when named product is known to be unacceptable or NOT feasible.
3. Two or More Manufacturers' Products Named: Provide one of the named products, at Contractor's option, but excluding products which do NOT comply with requirements. Do NOT provide, nor offer to provide, an unnamed product unless named products do NOT comply with requirements or are NOT feasible.

4. "Or Equal": Where named products are accompanied by the term "or equal" or words of similar effect, provide one of named products or propose substitute product according to paragraph on SUBSTITUTIONS.
5. Standards, Codes and Regulations: Where specification requires only compliance with a standard, code or regulation, Contractor may select any product which complies with requirements of that standard, code or regulation.
6. Performance Requirements: Provide products which comply with specific performances indicated and which are recommended by manufacturer (in published product literature or by individual certification) for application intended. Overall performance of product is implied where product is specified with only certain specific performance requirements.
7. Prescriptive Requirements: Provide products which have been produced in accordance with prescriptive requirements using specified materials and components, and complying with specified requirements for fabricating, finishing, testing and other manufacturing processes.
8. Visual Matching: Where matching with an established material is required, Engineer judgment of whether proposed product matches established material shall be final. Where product specified does NOT match established material, propose substitute product according to paragraph on SUBSTITUTIONS. Follow requirements for CHANGE ORDERS, also, if matching product within cost category of specified product is NOT available.
9. "Color as Selected by Architect": Unless otherwise noted, where specified product requirements include "color as selected by Architect" or words of similar effect, the selection of manufacturer and basic product complying with Contract Documents is Contractor's option and subsequent selection of color is Architect's option.
10. Inclusion by name, of more than one manufacturer or fabricator, does NOT necessarily imply acceptability of standard products of those named. All manufacturers, named or proposed, shall conform, with modification as necessary, to criteria established by Contract Documents for performance, efficiency, materials and special accessories.

F. Substitutions
1. Substitution requests from vendors, suppliers and manufacturers may be submitted during bid period only. Requests will NOT be considered unless requests are received at least 7 days prior to Bid Due date and supporting data is available in time for adequate review and for inclusion in Addendum, if acceptable. Requests from bidders will NOT be considered.
2. Contractor's request for substitution may be submitted only after award of Contract. Requests shall be in writing on Contractor's letterhead and shall include:
   a. Contractor's detailed comparison of significant qualities between specified item and proposed substitution.
   b. Statement of effect on construction time, coordination with other affected work, and cost information or proposal.

c. Contractor's statement to the effect that proposed substitution will result in overall work equal to, or better than, work originally intended.

3. Substitution requests will be considered if extensive revisions to Contract Documents are NOT required, if changes are in keeping with general intent of Contract Documents, if submitted in timely and proper manner, and if one or more of following conditions is satisfied all as judged by the Engineer:
   a. Where request is directly related to "or equal" clause or words of similar effect in Contract Documents.
   b. Where specified product, material or method can NOT be provided within Contract Time; but NOT as a result of Contractor's failure to pursue the work promptly or to coordinate various activities properly.
   c. Where specified product, material or method can NOT be provided in manner which is compatible with other materials of the work and where Contractor certifies that proposed substitution is compatible.
   d. Where specified product, material or method can NOT be properly coordinated with other materials of the work and where Contractor certifies that proposed substitution can be properly coordinated.
   e. Where specified product, material or method can NOT be warranted as required and where Contractor certifies that proposed substitution can be so warranted.
   f. Where specified product, material or method can NOT be used without adversely affecting Owner's insurance coverage on completed work and where Contractor certifies that proposed substitution can be so used.
   g. Where specified product, material or method will encounter other substantial non-compliances which are NOT possible to otherwise overcome except by using proposed substitution.
   h. Where specified product, material or method can NOT receive required approval by governing authority and proposed substitution can be so approved.
   i. Where substantial advantage is offered Owner; in terms of cost, time, energy conservation or other valuable considerations; after deducting offsetting responsibilities that Owner may be required to bear, including additional compensation to Engineer for redesign and evaluation services, increased cost of other work by Owner or separate contractors, and similar considerations.
4. The burden is upon the Contractor, supplier and manufacturer to satisfy the Engineer that:
   a. Proposed substitute is equal to, or superior to, the item specified.
   b. Intent of the Contract Documents, including required performance, capacity, efficiency, quality, durability, safety, function,

appearance, space clearances and delivery date, will be equaled or better.

5. Submission of shop drawings of unspecified manufacture or shop drawings at variance with the Contract Documents is NOT a proper request for substitution.
6. Changes in work of other trades, such as structural supports or wiring, which are required as a result of substitution and the associated costs for such changes shall be the complete responsibility of Contractor proposing substitution. Except as noted in subparagraph C(9) above, there shall be NO additional expense to the Owner.

G. Samples
1. Submit samples as requested by Engineer.

H. Record Drawings
1. Furnish and keep on the job at all times, one complete and separate set of blackline prints of the mechanical work. As work progresses, record changes, revisions and additions to Architectural and Mechanical work clearly, neatly, accurately and promptly.
2. Indicate daily progress on these prints by coloring in the various pipes, ducts, fixtures, apparatus and associated appurtenances as they are erected.
3. At the conclusion of work, prepare record drawings as required by GENERAL CONDITIONS and SUPPLEMENTARY GENERAL CONDITIONS.

I. Operating And Maintenance Instructions And Manuals
1. Furnish 48 hours of instruction in the proper operation and maintenance of mechanical systems and parts, to personnel designated by Owner. Instruction shall be made at times and places as convenient and designated by Owner, at least two weeks after acceptance of manuals. Instruction periods specified under other Sections of this Division shall be in addition to this general instruction period.
2. Submit for review operating and maintenance manuals for each system or piece of equipment, at least 2 weeks prior to request for acceptance of same. Upon acceptance, furnish 3 copies of each manual to Engineer for transmittal to Owner. Operating and maintenance manual shall include:
   a. Description of Unit (System) and Component Parts, including function, normal operating characteristics and limiting conditions, performance curves, engineering data and tests, and complete nomenclature and manufacturer's number for replaceable parts.
   b. Operating Procedures, including start-up, break-in, routing and normal operating instructions; regulation, control, stopping, shutdown and emergency instructions; summer and winter operating instructions; and any special operating instructions.
   c. Maintenance Procedures, including routine operations, guide to trouble-shooting; disassembly, repair and reassembly; alignment, adjusting and checking; servicing and lubrication schedule, and list

of lubricants; manufacturer's installation and maintenance bulletins and related information.

d. Sequence of Operation and Control Diagrams, corrected for as-built conditions.

e. Parts List, including illustrations, assembly drawings and diagrams required for maintenance, predicted life of parts subject to wear, and recommendations for stocking spare parts.

f. Valve Tag Charts, including number, location and function of each valve.

g. Copies of accepted shop drawings, charts and diagrams.

h. Names, addresses and telephone numbers of manufacturer's representative and service company.

i. Other data, as required under pertinent Sections of these Specifications.

J. Guarantee

1. Furnish standard manufacturers' guarantees for work under this Division. Such guarantees shall be in addition to, and not in lieu of, other liabilities under the law or by other provisions of the Contract Documents.
2. Materials, equipment and workmanship shall carry the standard warranty against defects in material and workmanship. Failure which may develop due to defective or improper material, equipment, workmanship or design shall be made good, forthwith, by and at the expense of the Contractor, including damage done to areas, materials and other systems resulting from this failure.
3. Guarantee that all elements of the systems are of sufficient capacity to meet the specified performance requirements as set forth in Contract Documents.
4. Upon receipt of notice from Owner of a failure of system(s) or component(s) during the guarantee period, replace affected components within reasonable time period at no additional cost.
5. Contractor's guarantee period shall extend for minimum of one year from Date of Acceptance of the project by Owner and shall include all associated incurred costs without exception.
6. Before final request for payment, furnish written guarantee covering above requirements.

K. Examination Of Site And Contract Documents

1. Before submitting prices or beginning work, thoroughly examine the site and the Contract Documents.
2. No claim for extra compensation will be recognized if difficulties are encountered which would have been revealed by examination of site conditions and Contract Documents prior to executing Contract.
3. Where discrepancies occur within Contract Documents, notify Architect, in writing, of discrepancy and request clarification. Until notified of Architect's decision, include item or arrangement of better quality, greater quantity or higher cost in Contract price.

4. Notify the Engineer, in writing, of materials and apparatus believed to be omitted, inadequate or unsuitable, or in violation of laws, ordinances, rules or regulations of authorities having jurisdiction. In absence of such written notice, it is mutually agreed that bid price for work under each Section has included the cost of items required for acceptable satisfactory functioning of entire system.

L. Definitions

1. The following terms are used in this Division and are defined as follows:
   a. "Provide": To furnish and install, ready for safe and regular operation the item, material or service indicated.
   b. "Furnish": To purchase, acquire and deliver to the site, complete with related accessories.
   c. "Install": To erect, mount and mechanically connect, complete, by acceptable methods.
   d. "Work": Labor, materials, equipment, apparatus, controls and accessories required for proper and complete installation.
   e. "Concealed": Embedded in masonry or other construction; or installed in furred spaces, trenches or crawl spaces; or installed within double partitions or hung ceilings; or in enclosures.
   f. "Exposed": Visible to building occupants, excluding mechanical room and utility tunnel locations.
   g. "Equal": of weight, size, design, capacity and efficiency to meet requirements specified and shown, and of acceptable manufacture, as determined in the opinion of the Engineer.
   h. "Acceptable": Acceptable, as determined in the opinion of the Engineer.
   i. "Contractor": General or Prime Contractor, hired by the owner to perform the work. (References to "Contractor" in connection with specific trade's work shall be interpreted to mean the applicable trade subcontractor acting through the Prime Contractor.)
   j. "Motor Controllers": Manual or magnetic starter, individual pushbutton or Hand-Off-Automatic (HOA) switch controlling operation of equipment.
   k. "Named" Product: Manufacturer's name for product, as recorded in published documents of latest issue as of date of Contract Documents. Obtain Engineer's permission before using products of later or earlier model.
2. Standards, specifications and tests of following technical societies, organizations and governmental bodies, as referenced in Contract Documents, are hereby made part of Contract Documents.

   a. AGA: American Gas Association.
   b. AMCA: Air Movement and Control Association.
   c. ANSI: American National Standards Institute.
   d. ARI: American Refrigeration Institute.

e.	ASA:	American Standards Association.
f.	ASHRAE:	American Society of Heating, Refrigeration and Air Conditioning Engineers.
g.	ASME:	American Society of Mechanical Engineers.
h.	AWWA:	American Water Works Association.
i.	EPA:	Environmental Protection Agency.
j.	FM:	Factory Mutual Engineering Division.
k.	NEC:	National Electrical Code.
l.	NEMA:	National Electrical Manufacturers Association.
m.	NFPA:	National Fire Protection Association.
n.	SMACNA:	Sheet Metal and Air Conditioning Contractors National Association.
o.	OSHA:	Occupational Safety and Health Administration.
p.	UL:	Underwriters Laboratories.
q.	Code:	Codes and regulations of the Federal, State and local governments and of utility companies having jurisdiction, as appropriate.

3. Use of singular or plural reference form in these Specifications shall not be construed to limit number of units required. Specifications are intended to define quality and performance characteristics; quantity of units supplied shall be as needed to meet requirements as specified and as shown on Contract Documents.

M. Permits, Laws, Ordinances, Codes And Standards
1. Obtain and pay for permits, inspections, licenses and certificates required for work under this Division.
2. Comply with laws, ordinances, rules and regulations of Local, State and Federal authorities having jurisdiction; rules and regulations of National Board of Fire Underwriters, National Electrical Code and local utility companies.
3. Contract Documents shall govern whenever they are more stringent than Code requirements.
4. All work of this Division shall conform to following standards:
   a. NEMA Standards.
   b. ANSI Standard CI: National Electrical Code (NFPA 70), current edition.
   c. ANSI Standard C52.1: Motors and generators (NEMA MGI).

N. Underwriters Laboratories Labels
1. Equipment, materials and components, for which there are listings in UL Product Directories, shall bear UL labels.

2. Products:
A. General Product Requirements
1. Products shall be undamaged and unused at time of installation and shall be complete with accessories, trim, finish, safety guards and other devices and details needed for complete installation and for intended use.

2. Where available, products shall be standard products of types which have been produced and used previously and successfully on other projects and in similar applications.
3. Where products by their nature and their use are likely to need replacement parts on a future date, for maintenance and repair or replacement work, products shall be standard domestically produced products likely to have such parts available to Owner in future.
4. Labels and stamps which are required for observation after installation shall be located on accessible surfaces which, in occupied spaces, are NOT conspicuous. Other labels and stamps shall be located on concealed surfaces.

3. Execution:
   A. Arrangement Of Work
      1. Contract Drawings are diagrammatic and indicate general arrangement of the work. Consult Engineering Contract Drawings for exact equipment locations. If exact location is not given, obtain information from Architect. Verify measurements in field. Base measurements on Architect's established benchmarks.
      2. Install work as closely as possible to layouts shown on Contract Drawings. Modify work as necessary to:
         a. Provide maximum possible headroom and space clearance on each side.
         b. Provide adequate clearance and ready access to all parts of the work, for inspection, operation, safe maintenance and repair, and code conformance.
         c. Coordinate and arrange work to avoid conflicts with work of other trades and as needed for satisfactory space conditions shown on coordination drawing submittals.
         d. Where space appears inadequate, consult the Engineer before proceeding with installation.

      3. Work shall present a neat coordinated appearance.
   B. Coordination
      1. Examine Contract Documents and coordinate with Contractor and other trades as necessary to facilitate the progress of the work.
      2. Each trade shall keep Contractor and other trades fully informed as to shape, size, and locations of openings, chases, equipment and panels required, with sufficient advance notice so that coordination may be completed in advance. If information is not furnished in proper and timely fashion, the trade involved shall do own cutting and patching or have same done by Contractor, without additional cost to Owner.
      3. Furnish services of experienced mechanical Superintendent who shall be constantly in charge of mechanical work, together with skilled laborers required to unload, transfer, erect, connect, adjust, start, operate and test each system.

4. Particular emphasis is placed on timely installation of major apparatus and furnishing of other trades and Contractor with relevant information.
5. Do NOT install a system until critical components of system and related systems have been coordinated and applicable shop drawings have been accepted.

C. Workmanship
1. Work covered under this Division shall be constructed and finished in every respect in a workmanlike and substantial manner.
2. Equipment and materials shall be new, of first quality, selected and arranged to fit properly into spaces indicated.
3. It is not intended that Contract Drawings show every pipe, fitting and appurtenance; however, such parts as may be necessary to complete the systems in accordance with best trade practice and Code requirements and to Architect's satisfaction shall be deemed to be included.
4. Obtain detailed information from manufacturer as to proper methods for installation and connections. This includes such tests as equipment manufacturer recommends.
   a. Unless specifically indicated otherwise on Contract Documents, equipment and materials shall be installed in accordance with manufacturer's recommendations.
   b. Notify Engineer of conflicts between manufacturer's recommendations and Contract Documents requirements, and request clarification before proceeding with installation.
5. Where equipment, piping, ductwork, etc. is exposed, color of finish or paint shall be as selected by the Engineer.

D. Operation Of Services And Utilities
1. During the construction period and until finally inspected, tested and accepted, maintain new services and utilities.
2. Shutdown of existing services and utilities shall, without exception, be coordinated with the proper utility and with the Owner as to date, time of day, and duration.
   a. Notify the Engineer and Owner of estimated duration of shutdown period at least ten days in advance of date when shutdown is proposed. Approval of shutdown shall be obtained from proper utility and Owner, before any service is interrupted.
   b. Work during shutdown period shall be arranged for continuous performance, including overtime if required, to ensure that existing operating services will be shut down only for time actually necessary to complete connections.

E. Protection
1. Be responsible for work and equipment until fully inspected, tested and accepted. Carefully store materials and equipment which are not immediately installed after delivery to site. Close open ends of work with temporary covers or plug during construction to prevent entry of obstructing material or damaging water.

2. Protect work and material of other trades from damage that might be caused by mechanical work and make good damage thus caused.

F. Lubrication
1. Equipment shall be furnished and installed so that lubrication points are conveniently and readily accessible for maintenance. Make these provisions by whatever means is appropriate: extended fittings, access doors, equipment location, etc.
2. No equipment shall be operated for temporary service or for testing purposes without proper lubrication. Items requiring lubrication shall be left freshly and fully lubricated at time of substantial completion.
3. Printed adhesive type equipment labels are unacceptable.

G. Identification
1. Permanent nameplates shall be provided on each piece of service-connected or power-operated equipment, on easily accessible surface. Nameplates shall be engraved Lamicoid with white letters on black background, unless otherwise specified or requested. Letters and numbers shall 1/2" high.
   a. Manufacturer's nameplate, name, trademark and address shall be attached permanently to equipment and material furnished under this Division. Nameplate showing distributor or Contractor will NOT be permitted.
   b. Nameplate shall include product name, model number, serial number, capacity, speed, ratings, and similar essential operating data.
   c. Attach nameplates with screws or rivets. Wherever covers of adjacent units are interchangeable, attach nameplates to wall or backboard rather than covers.
2. Number equipment according to designations used in Contract Documents. Furnish directory indicating number, location and use of each item.
3. After finish painting is completed, apply identification stencils and labels.
   a. Equipment labels shall be stenciled letters and numbers 1-1/2" high, corresponding to equipment numbers shown on Contract Drawings. Place label where it will be readily visible from normal operating position on floor.
   b. Valves, piping and ducts shall be labeled as specified under other Sections.

H. Access
1. Locate equipment which must be serviced, including valves, traps, vents, cleanouts, water hammer arresters, drains, dampers, controls and strainers, in accessible locations if at all possible. For other locations, furnish access panels compatible with surrounding construction and finishes.
2. Access doors shall be located to conveniently serve intended purpose and shall be installed so that adjacent piping, equipment and structures do not render doors unusable.

3. Coordinate locations and sizes of access panels with the appropriate trades through the Contractor; submit coordinated location and sizes for review, prior to installation of panels by the appropriate trade.
4. Access doors are not required in removable panel ceilings if suitable identifying markers are provided to indicate access locations.

I. Painting
1. Unless otherwise specified, materials furnished under this Division shall have prime coat and standard manufacturer's finish.
2. Paint mechanical equipment and appurtenances in concealed and unfinished areas with one coat of rust-inhibiting paint or with an appropriate bitumastic protective product designed for the intended application. Items to be painted shall include, but not be limited to: non-insulated hangers, supports, piping, tanks and other ferrous metal work, which are concealed or inaccessible but not galvanized.
3. Special care shall be taken to avoid painting or splattering equipment nameplates.
4. Cooperate in identifying systems for painters. Identification and labeling are described under another paragraph in this Division.
5. All exposed steel piping not insulated shall be painted with prime coat plus two finish coats in a color selected by the Engineer.
6. Exposed equipment and bases that are furnished with prime coat only shall receive 2 coats of finish enamel in a color selected by the Engineer.
7. Refer to Drawings and to DIVISION 09 for any additional requirements pertaining to painting of mechanical work.

J. Waterproofing
1. Where any work pierces waterproofing, including waterproof concrete, submit method of installation for review prior to start of work.
2. Provide necessary sleeves, caulking and flashing required to make openings waterproof.

K. Bases And Supports
1. Unless noted otherwise, provide necessary supports, pads, bases and piers required for equipment furnished or installed under this Division.
2. Equipment shall be securely attached to building structure in acceptable manner. Attachments shall be of strong and durable nature, as determined by Architect.
3. Attachment of supports to roof decking is NOT permitted. Pipes, ducts, boxes, etc. must be supported from bar joists or steel construction or additional members spanning roof steel as determined by structural engineer.
4. Structural steel members required for bracing and supporting mechanical equipment must be requested through Contractor in sufficient time to permit checking by Architect prior to installation.

L. Tests
1. Furnish labor, materials, instruments, supplies and services necessary for testing required under this Division. Correct all defects appearing during

tests, and repeat tests until no defects are disclosed. Final tests shall be made in Engineer's presence.

2. Each piece of mechanical equipment, including motors and controls, shall be operated continuously for minimum test period of one hour.
3. Perform tests required by legal authorities and by agencies having jurisdiction over this Work.

M. Demolition: Impact On Existing Systems

1. Major changes to existing building spaces have been shown on Contract Drawings; minor changes have NOT been shown. Contractor shall anticipate that there will be numerous minor changes including:
   a. Relocation of control piping and control wiring.
   b. Relocation of thermostats, due to architectural revisions.
   c. Relocation of diffusers and registers.
2. Electrical connections to existing equipment which are to be removed or relocated, including motors, shall be disconnected under DIVISION 26, ELECTRICAL WORK.
3. Electrical system equipment shall be relocated or removed under DIVISION 26, ELECTRICAL WORK.
4. Remove, store and relocate mechanical equipment designated to be relocated and reused.
5. Existing piping, ductwork, controls, and mechanical system equipment which are located in areas designated for demolitions and which are not designated to remain shall be removed. Material which is removed and is not designated for reuse shall, at the Owner's option, either:
   a. Be delivered to Owner's storage location, OR
   b. Become Contractor's property and be removed from the site.
6. Existing piping, ductwork, controls, or equipment which are to remain and which are disturbed or damaged during construction shall be replaced with appropriate new materials, equipment or components at no extra cost to Owner.

END OF SECTION 23 00 00

23 00 01 HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

1. General:
   A. General Requirements
      1. This Section covers the specification of heating, ventilating and air conditioning (HVAC) equipment not covered under BASIC MATERIALS AND METHODS, AIR DISTRIBUTION or CONTROLS SECTIONS. Refer to other Sections of this Division for specifications on temperature controls, piping, air distribution, insulation, and balancing requirements relating to this work.
      2. Refer to SECTION 23 00 00, GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS and applicable parts of DIVISION 01 for other general requirements.
   B. Scope
      1. Provide labor, materials, equipment, services and transportation necessary for complete and operational HVAC systems as indicated on the Contract Drawings.
   C. Shop Drawings And Other Submittals
      1. Submit for review shop drawings for all H.V.A.C. equipment scheduled on the Contract Drawings.
      2. Submit complete pump operating curves with shop drawings, showing single pump operating curves, parallel pump operating curves, and system curves based on pump design capacities scheduled.
         a. Curves shall be of sufficient size and scale for use with field test data. Heads and flows shall be easily read to nearest 5%.
         b. Show pump curve for impeller size actually furnished.
         c. Curve submitted for substitute pump, if any, shall closely follow pattern and slope of curve of specified pump.
      3. Shop drawings shall include manufacturer's name and data for each control component.
      4. Submit complete piping and wiring diagrams for condenser water treatment system.
      5. Obtain from manufacturers and submit certified sound power levels of air-moving devices at specified operating conditions, in accordance with AMCA Standard 300 or ASHRAE Guide for noise measurement and procedures.
      6. Submit to Engineer three copies of test reports for each test required under PART 3. Submit record of static deflection as designed and as measured in the field for fans, pumps and other mechanical equipment.
2. Products:
   A. Motors
      1. Motors shall be by quality manufacturer with nationwide distribution and service organization. Motors shall be furnished and installed under this Division and shall be wired under DIVISION 26, ELECTRICAL WORK.

2. Unless otherwise required: Motors 1/2HP and smaller shall be single phase, 115-volt, 60 hertz, 1750 rpm. Motors over 1/2 HP shall be 3-phase, either 460 or 230/208 volt, 60 hertz, 1750 rpm. Motors shall have service factor of 1.15 with premium efficiency rating. Unless noted otherwise motors shall be NEMA design B.
3. Fractional horsepower motors shall be split phase or capacitor type. Larger motors shall be standard torque, induction motors, drip-proof construction, Class B, insulated, 40 degrees C rise, with permanently sealed grease lubricated ball bearings; when specified as two-speed motors: 1800/900 rpm, single winding, consequent pole.
4. Motors used on V-belt drives shall have adjustable slide rail bases or other positive means of adjustment.
5. All motors shown to be operated via a VFD are to be rated for *true inverter duty*, meeting NEMA MG-1 Part 31.40.4.2. Such motors shall be warranteed for use with a speed turndown ratio of up to 10:1.
6. All motors shall meet the following efficiency schedule. Values are minimum full load nominal efficiency, as tested in accordance with IEEE Standard 112 Method B and stamped on the nameplate by the manufacturer.

OPEN DRIP PROOF

HP	3600 (RPM)	1800 (RPM)	1200 (RPM)
1.0	84.0	82.5	82.5
1.5	82.5	84.0	84.0
2.0	84.0	84.0	85.5
3.0	84.0	87.5	86.6
5.0	87.5	88.5	88.5
7.5	87.5	90.2	89.5
10	88.5	90.2	90.2
15	89.5	91.7	91.0
20	90.2	92.4	91.0
25	91.0	93.0	93.0
30	91.7	93.0	93.0
40	92.4	94.1	94.1
50	93.0	94.1	94.1

TOTALLY ENCLOSED

HP	3600 (RPM)	1800 (RPM)	1200 (RPM)
1.0	84.0	82.5	84.0
1.5	82.5	84.0	85.5
2.0	84.0	84.0	88.5
5.0	88.5	88.5	89.5
7.5	90.2	90.2	90.2
10	91.0	90.2	91.0
15	91.7	91.7	91.0
20	91.7	92.4	91.7

25	92.4	93.0	92.4
30	92.4	93.0	93.0
40	93.0	94.1	93.6
50	93.0	94.1	93.6

B. V-Belt Drives

1. Drives shall have minimum horsepower ratings of 150% of motor horsepower and shall be of sufficient size to start and bring equipment up to speed without slipping or squealing. Drives for motors 1-1/2 HP and larger shall have minimum of two belts. Furnish spare belt for each belt drive, tagged with unit number.
2. Sheaves shall be cast iron and dynamically balanced. Motor sheaves shall be adjustable pitch type, with wide range of adjustment, selected to that design fan speed is at midpoint of adjustment range. Sheaves for motor and fan shafts on drives of 3 HP and larger shall have forged steel or cast iron shaft bushings. Provide for any drive sheave changes as recommended by the testing and balancing company.
3. Multi-belt drives shall have matched sets of belts to ensure equal tension and equal wear on all belts.
4. Drives not enclosed within equipment cabinets or casings shall have belt guards, easily removable, supported to prevent rattling or other noise. Guard shall have holes opposite all shafts, for checking speeds without removing guard.

C. Variable Speed Drives (VFD)

1. This specification is to cover a complete Variable Frequency Motor Drive (VFD) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor. The drive manufacturer shall be ABB, Inc.
   a. Sales representative exclusively for VFD products, Flow Tech 860-242-6832 x15.
2. The drive manufacturer shall supply the drive and all necessary controls as herein specified. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of twenty years.
3. Referenced Standards:
   a. Institute of Electrical and Electronic Engineers (IEEE)
   b. Standard 519-1992, IEEE Guide for Harmonic Content and Control.
   c. Underwriters laboratories
   d. UL508C
   e. National Electrical Manufacturer's Association (NEMA)
   f. ICS 7.0, AC Adjustable Speed Drives
   g. IEC 16800 Parts 1 and 2
4. Qualifications:
   a. VFDs and options shall be UL listed as a complete assembly. VFDs that require the customer to supply external fuses for the VFD to be UL listed are not acceptable. VFDs with requiring additional branch

circuit protection are not acceptable. The base VFD shall be UL listed for 100 KAIC without the need for input fusing.

b. CE Mark – The VFD shall conform to the European Union ElectroMagnetic Compatibility directive, a requirement for CE marking. The VFD shall meet product standard EN 61800-3 for the First Environment restricted level.

c. Acceptable Manufactures:
   i. ABB ACH Series.

5. Submittals
   a. Submittals shall include the following information:
      i. Outline dimensions, conduit entry locations and weight.
      ii. Customer connection and power wiring diagrams.
      iii. Complete technical product description include a complete list of options provided. Any portions of the specifications not complied with must be clearly indicated or the supplier and contractor shall be liable to provide all components required to meet the specification.

6. The VFD package as specified herein shall be enclosed in a UL Listed Type enclosure, (NEMA rated enclosures are not acceptable) completely assembled and tested by the manufacturer in an ISO9001 facility. The VFD tolerated voltage window shall allow the VFD to operate from a line of +30% nominal, and -35% nominal voltage as a minimum.
   a. Environmental operating conditions: $0 – 40^0$ C continuous. Altitude 0 to 3300 feet above sea level, up to 95% humidity, non-condensing. All circuit boards shall have conformal coating.
   b. Enclosure shall be rated UL type 1 and shall be UL listed as a plenum rated VFD.

7. All VFDs shall have the following features:
   a. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
   b. The keypad shall include Hand-Off-Auto selections and manual speed control. There shall be fault reset and “Help” buttons on the keypad. The Help button shall include “on-line” assistance for programming and troubleshooting.
   c. There shall be a built-in time clock in the VFD keypad. The clock shall have a battery back up with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. If the battery fails, the VFD shall automatically revert to hours of operation since initial power up. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output

relays. The VFD shall have a digital input that allows an override to the time clock (when in the off mode) for a programmable time frame. There shall be four (4) separate, independent timer functions that have both weekday and weekend settings. Capacitor backup is not acceptable.

d. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to setpoint without safety tripping or component damage (flying start).

e. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430-150 for 4-pole motors.

f. The VFD shall have 5% equivalent impedance internal reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% equivalent impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. VFDs with only one DC reactor shall add an AC line reactor.

g. The VFD shall include a coordinated AC transient protection system consisting of 4-120 joule rated MOV's (phase to phase and phase to ground), a capacitor clamp, and 5% equivalent impedance internal reactors.

h. The VFD shall provide a programmable proof of flow Form-C relay output (broken belt / broken coupling). The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay outputs shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.

8. All VFDs to have the following adjustments:

a. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed.

b. Two (2) PID Setpoint controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed loop control. The VFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. There shall be two parameter sets for the first PID that allow the sets to be switched via a digital input, serial communications or from the keypad for night setback, summer/winter setpoints, etc. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain setpoint of an independent process (ie. valves, dampers,

etc.). All setpoints, process variables, etc. to be accessible from the serial communication network.

c. Two (2) programmable analog inputs shall accept current or voltage signals.

d. Two (2) programmable analog outputs (0-20ma or 4-20 ma). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data.

e. Six (6) programmable digital inputs.

f. Three (3) programmable digital Form-C relay outputs. The relays shall include programmable on and off delay times and adjustable hysteresis. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating 2 amps RMS. Outputs shall be true Form-C type contacts; open collector outputs are not acceptable.

g. Run permissive circuit - There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, time-clock control, or serial communications) the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD digital input and allows motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close. Two independently adjustable accel and decel ramps with 1 – 1800 seconds adjustable time ramps.

h. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and audible motor noise.

i. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows higher carrier frequency without derating the VFD or operating at high carrier frequency only at low speeds.

j. The VFD shall include password protection against parameter changes.

9. The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (LED and alpha-numeric codes are not acceptable). All VFD faults shall be displayed in English words.

10. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list

below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):

Output Frequency
Motor Speed (RPM, %, or Engineering units)
Motor Current
Drive Temperature
DC Bus Voltage
Output Voltage

11. The VFD shall include a fireman's override input. Upon receipt of a contact closure from the fireman's control station, the VFD shall operate in one of two modes: 1) Operate at a programmed predetermined fixed speed or operate in a specific fireman's override PID algorithm that automatically adjusts motor speed based on override set point and feedback . The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands), except customer defined safety run interlock, and force the motor to run in one of the two modes above. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation.
12. Serial Communications
    a. The VFD shall have an RS-485 port as standard. The standard protocols shall be Modbus, BACnet, Johnson Controls N2 bus, and Siemens Building Technologies FLN. Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority (i.e. BTL Listing for BACnet). Use of non-certified protocols is not allowed.
    b. The BACnet connection shall be an RS485, MS/TP interface operating at 9.6, 19.2, 38.4, or 76.8 Kbps. The connection shall be tested by the BACnet Testing Labs (BTL) and be BTL Listed. The BACnet interface shall conform to the BACnet standard device type of an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:
        i. Data Sharing – Read Property – B.
        ii. Data Sharing – Write Property – B.
        iii. Device Management – Dynamic Device Binding (Who-Is; I-AM).
        iv. Device Management – Dynamic Object Binding (Who-Has; I-Have).
        v. Device Management – Communication Control – B.
    c. Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock the

keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible.

13. EMI / RFI filters. All VFDs shall include EMI/RFI filters. The VFD shall comply with standard EN 61800-3 for the First Environment, restricted level with up to 100' of motor cables. No Exceptions. Certified test lab test reports shall be provided with the submittals.
14. All VFDs through 60HP shall be protected from input and output power mis-wiring. The VFD shall sense this condition and display an alarm on the keypad. The VFD shall not be damaged by this condition.
15. ADDITIONAL FEATURES – Additional features shall be furnished and mounted by the drive manufacturer. All additional features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label. The bypass enclosure door and VFD enclosure must be interlocked such that input power is turned off before either enclosure can be opened. The VFD and Bypass as a package shall have a UL listed short circuit rating of 100,000 amps and shall be indicated on the data label.
    a. A complete factory wired and tested bypass system consisting of an output contactor and bypass contactor, service (isolation) switch and VFD input fuses are required. Bypass designs, which have no VFD only fuses, or that incorporate fuses common to both the VFD and the bypass will not be accepted.
    b. Door interlocked padlockable circuit breaker that will disconnect all input power from the drive and all internally mounted options.
16. The following operators shall be provided:
    Bypass Hand-Off-Auto
    Drive mode selector and light
    Bypass mode selector and light
    Bypass fault reset
    Bypass LDC display, 2 lines, for programming and status / fault / warning indications
    a. Motor protection from single phase power conditions - The Bypass system must be able to detect a single phase input power condition while running in bypass, disengage the motor in a controlled fashion, and give a single phase input power indication. Bypass systems not incorporating single phase protection in Bypass mode are not acceptable.

b. The system (VFD and Bypass) tolerated voltage window shall allow the system to operate from a line of +30%, -35% nominal voltage as a minimum. The system shall incorporate circuitry that will allow the drive or bypass contactor to remain "sealed in" over this voltage tolerance at a minimum.

c. The Bypass system shall NOT depend on the VFD for bypass operation. The bypass shall be completely functional in both Hand and Automatic modes even if the VFD has been removed from the enclosure for repair / replacement.

d. Serial communications – the bypass and VFD shall be capable of being monitored and or controlled via serial communications. Provide communications protocols for ModBus; Johnson Controls N2; Siemens Building Technologies FLN (P1) and BACnet in the bypass controller.

e. BACnet Serial communication bypass capabilities shall include, but not be limited to; bypass run-stop control; the ability to force the unit to bypass; and the ability to lock and unlock the keypad. The bypass shall have the capability of allowing the DDC to monitor feedback such as, bypass current (in amps), bypass kilowatt hours (resettable), bypass operating hours (resettable), and bypass logic board temperature. The DDC shall also be capable of monitoring the bypass relays output status, and all digital input status. All bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible. The following additional bypass status indications and settings shall be transmitted over the serial communications bus – keypad "Hand" or "Auto" selected, and bypass selected. The DDC system shall also be able to monitor if the motor is running under load in both VFD and bypass (proof of flow) in the VFD mode over serial communications or Form-C relay output. A minimum of 40 field parameters shall be capable of being monitored in the bypass mode.

f. Run permissive circuit - there shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, time-clock control, or serial communications) the VFD and bypass shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD system input and allows motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close.

g. The bypass control shall monitor the status of the VFD and bypass contactors and indicate when there is a welded contactor contact or open contactor coil. This failed contactor operation shall be indicated on the Bypass LCD display as well as over the serial communications protocol.

h. The bypass control shall include a programmable time delay for bypass start and keypad indication that this time delay is in process. This will allow VAV boxes to be driven open before the motor operates at full speed in the bypass mode. The time delay shall be field programmable from 0 – 120 seconds.

i. The bypass control shall be programmable for manual or automatic transfer to bypass. The user shall be able to select via keypad programming which drive faults will generate an automatic transfer to bypass and which faults require a manual transfer to bypass.

j. There shall be an adjustable motor current sensing circuit for the bypass and VFD mode to provide proof of flow indication. The condition shall be indicated on the keypad display, transmitted over the building automation protocol and on a relay output contact closure.

k. The bypass controller shall have six programmable digital inputs, and five programmable Form-C relay outputs.

l. The relay outputs from the bypass shall programmable for any of the following indications.
    i. System started
    ii. System running
    iii. Bypass override enabled
    iv. Drive fault
    v. Bypass fault
    vi. Bypass H-O-A position
    vii. Motor proof of flow (broken belt)
    viii. Overload
    ix. Bypass selected
    x. Bypass run
    xi. System started (damper opening)
    xii. Bypass alarm
    xiii. Over temperature

m. The digital inputs for the system shall accept 24VAC or 24VDC. The bypass shall incorporate internally sourced power supply and not require an external control power source. The bypass power board shall supply 250 ma of 24 VDC for use by others to power external devices.

n. Customer Interlock Terminal Strip – provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully

functional whether the system is in VFD or Bypass mode. The remote start/stop contact shall operate in VFD and bypass modes. The terminal strip shall allow for independent connection of up to four (4) unique safety inputs.

o. The user shall be able to select the text to be displayed on the keypad when the safety opens. Example text display indications include “Firestat”, “Freezestat”, “Over pressure” and “Low pressure”. The user shall also be able to determine which of the four (4) safety contacts is open over the serial communications connection.

p. Class 10, 20, or 30 (selectable) electronic motor overload protection shall be included.

q. Individual motor overload protection shall be provided in VFD’s serving two motors.

D. Fans

1. All fans shall be as specified on the Contract Drawings and shall be manufactured by Greenheck, Cook or Acme.
2. Fan motor B.H.P. shall not exceed 80% of the nameplate motor H.P. rating.
3. Provide belt guards, vibration isolators and grease lubricated bearings.

3. Execution:

A. General Installation Requirements

1. Furnish wiring diagrams for field wiring under DIVISION 26, ELECTRICAL WORK.
2. Pumps: Mount and align motor and pump assemblies according to manufacturer's instructions. Pump shall be serviceable without removal of piping. Piping shall NOT be supported from pump or pump base.
3. Install heaters with maximum headroom and clearance, suspended from overhead construction with hanger rods.

B. Noise And Vibration Isolation

1. Locate vibration isolation devices for ease of inspection and adjustment as well as for proper operation.
2. Position vibration isolation hangers so that hanger housing may rotate 360 degrees without contacting any object.
3. Fans and other rotating mechanical equipment shall NOT operate at speeds above 80% of critical speed.
4. Rotating equipment shall be dynamically balanced. Measure vibration levels with equipment and vibration isolators installed. Where unacceptable vibration or noise occurs, re-balance or re-align equipment (e.g., pumps and fans) to increase efficiency and reduce noise; take other corrective steps necessary to obtain acceptable results.
5. For each pump under 20 HP, bases shall be securely bolted to concrete housekeeping pad and shall be grouted according to manufacturer's instructions. Grout shall be high quality, non-shrink type by Chem-Comp or equal.

6. With concrete base, provide supports for pipe elbows at suction and discharge connections. Where concrete base in non-rectangular, "T" shaped, or "L" shaped, locate mountings under projections and main body of concrete base, to eliminate cantilevering of projections.
7. Condensing unit isolators shall be located between equipment base and roof or dunnage steel support system.

C. Identification
1. Radiation and equipment with furnished enclosures which are located in finished rooms do not require identification.
2. Other equipment shall be identified with stencilled label or nameplate, as required; refer to SECTION 23 00 00, GENERAL REQUIREMENTS FOR MECHANICAL WORK.

D. Startup And Adjustment
1. Startup of equipment shall be performed according to manufacturer's recommendations. Startup and adjustment shall include services required to check out, test and balance all devices to ensure proper sequencing of operation, prior to instruction of the Owner's maintenance personnel.
2. Prior to startup, equipment shall be checked for physical damage, loose connections, loose parts, leaks and other defects, and defects shall be corrected.
3. Furnish startup/adjustment services by manufacturer, for following equipment. Manufacturer shall be responsible for supervising and inspecting equipment installation and for equipment startup and adjustment.
   a. CRAC units and Dx condensing unit.
   b. Pumps. Before starting pumps, manufacturer shall inspect and properly align pumps and motors. All bearings are to be greased. Manufacturer shall furnish certified readings of pump head, pump gpm, motor amperage and motor voltage under full load conditions. Pumps 15 H.P. and larger are to have their bases filled with grout after proper alignment.
   c. Chiller. Manufacturer shall supervise leak testing, evacuation and dehydration using high vacuum pump furnished by manufacturer, charging and start-up. Provide sufficient refrigerant and/or dry nitrogen for pressure testing and charging.
   d. Condenser water treatment system. Manufacturer shall furnish written report and basic water test kit upon completion of start-up/adjustment procedure.
   e. Cooling Towers. Manufacturer shall confirm proper installation and perform start-up services.

E. Testing
1. Tests shall be performed in presence of Engineer and Owner.
2. Fans shall be given running test, with motor and drive in place.
3. Pumps shall be given running test, to confirm proper alignment, installation, rotation and performance.

4. Heat exchangers shall be given operating test to verify performance, measuring inlet and outlet temperatures, flow gpm, and pressure drops.

END OF SECTION 23 00 01

23 05 00 BASIC MATERIALS AND METHODS - MECHANICAL

1. General:
   - A. General Requirements
     1. This Section covers the specification of basic materials for plumbing, heating, cooling, and fire protection systems.
     2. Refer to SECTION 23 00 00, GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS and applicable parts of DIVISION 01 for other general requirements.
   - B. Scope
     1. Provide labor, materials, equipment, services and transportation for piping systems as indicated on Contract Drawings.
   - C. Shop Drawings And Other Submittals
     1. Submit for review shop drawings for all products listed on the Contract Drawings.
     2. Shop drawings shall identify system and intended use of pipe, valve, etc.
     3. Shop drawings on noise and vibration isolators shall include (1) schedule of device locations, design load, and minimum static deflection at design load and (2) evidence that suppliers have designed and manufactured equipment similar to that specified for past 3 years.
     4. For each piping system, furnish two valve charts framed under glass or in laminated plastic; furnish one unframed copy for record files. Charts shall be typewritten and shall include:
        a. System designation.
        b. Valve numbers, in consecutive order, corresponding to numbers shown on Contract and Record Drawings.
        c. Service and location of each valve.
        d. Information on normal valve position, and opening and closing sequence of interrelated valves.
        e. Legend for piping stencils.
     5. Furnish system diagrams showing essential features. Valve numbers shall correspond to valve tag numbers.
2. Products:
   - A. Steel Piping
     1. Every length of pipe shall be marked with manufacturer's name or trademark and ASME or ASTM type and grade. Pipe shall have beveled ends for welding and grooved ends for grooved joint fittings. All pipe and fittings shall pass applicable ASTM or ASME requirements. The Contractor shall provide proof of origin and compliance with test requirements on request.
     2. For ordinary use (steam supply, chilled water, heating hot water, condenser water, glycol; 125 psig maximum at 350 degrees F, 175 psig maximum at 100 degrees F):
        a. Unless otherwise specified, pipe shall be standard weight, Schedule 40, black steel meeting ASTM A53, grade B.
        b. Pipe 14" and larger shall be Schedule 30.

c. Steam condensate shall be Schedule 80.
d. Unless otherwise specified, fittings shall be:
i. Threaded, 2" and smaller: Class 125 lb. cast iron, meeting ASME B16.4.
ii. Threaded, 2-1/2" and larger: Class 150 lb. malleable iron, meeting ASME B16.3.
iii. Grooved joint, full flow fittings with malleable iron couplings, 3" and smaller: Victaulic Style 77 with Grade E-EPDM-230 degrees F molded gaskets for hot water systems: Victaulic Style 77 with Grade E-EPDM gaskets for chilled water and condenser water systems; or equal. Grooved joint fittings are not allowed for steam service. Cut groove joints Schedule 40 only; roll groove Schedule 10 only. Note: Grooved joint piping systems shall be used only where specifically permitted by the contract documents.
iv. Welded, all sizes: Standard weight black steel welding pattern, meeting ASME B16.5, B16.9 and B16.25.

3. Joints:
a. All threaded pipe and fittings shall have threads cut to ASME B1.20.1
b. Flanged joints shall be made up with non-asbestos gaskets. Refer to paragraph UNIONS, FLANGES AND COUPLINGS.
c. Grooved pipe shall be joined by a listed combination of fittings, gaskets and grooves conforming to ANSI/AWWA C606-81. Victaulic Style 75, 005, or 77 with grade E gaskets or approved equal. Grooved fittings including gaskets used on dry pipe automatic sprinkler systems shall be listed for dry pipe service. Victaulic flush seal, type L, silicone gasket or approved equal.
d. Welded joints may be used on piping 4" and larger where and as approved by Code and authorities having jurisdiction. Welding methods shall comply with the applicable requirements of AWS B2.1.

B. Copper Tube
1. Every length of pipe shall be marked with manufacturer's name or trademark and ANSI or ASTM type and grade.
2. For potable water systems, general heating systems and general cooling systems, interior:
a. Pipe shall be Type L, hard drawn copper, meeting ASTM B88.
b. Fittings shall be copper or copper alloy, meeting ASME B16.22, B16.18, B16.15, B16.23, B16.26, B16.29 or B16.32.
c. Joint shall be soldered with silver bearing solder (non-lead) using non-corrosive flux conforming to ASTM B813. The joining of potable water supply piping shall be made with lead-free (less than 0.2% lead) solders and fluxes.

3. For above-grade clear water waste and vents, 2-1/2" and smaller, (other than heating service drainage):
   a. Pipe shall be Type L, hard drawn copper, meeting ASTM B88.
   b. Fittings shall be wrought copper meeting ASME B16.29 or cast bronze meeting ASME B16.23.
   c. Joints shall be soldered with silver bearing solder (non-lead) with non-corrosive flux.
4. For above-grade clear water, heating service drainage: Pipe and fittings shall match materials used for heating service.
5. For refrigerant piping:
   a. Pipe shall be Type L or Type ACR, refrigeration service copper tubing:
      i. 3/4" outside diameter or smaller: Soft drawn, meeting ASTM B280.
      ii. Any size: Hard drawn, meeting ASTM B88.62 ACR.
   b. Fittings shall be wrought or forged copper solder pattern for hard drawn tube; and brass flared compression fittings for soft tube, meeting ASME B16.26 SAE.
   c. Joints shall be brazed with filler material conforming to AWS A5.8, Bag-5 45% silver brazing alloy.
   a.

C. Unions, Flanges And Couplings
1. Unions, flanges and couplings shall be of same class and material as pipe and fittings. For bolted flanged joints, bolts and nuts shall meet ASTM B31.1.
2. Unless otherwise specified, unions in black steel piping systems shall be 300 lb. black malleable iron with brass-to-brass ground joint.
   a. For fire protection piping, unions shall be 300 lb. malleable iron with ground-joint copper alloy seat type. Unions should be manufactured to ANSI B16.39 “malleable iron threaded pipe unions”.
   b. For galvanized drainage piping, unions shall be 135 lb. galvanized iron with brass-to-iron ground joint.
3. In brass or copper piping, unions shall be 125 lb. bronze or brass with ground joint. Unions in copper piping shall be of same manufacture as copper tube and fitting.
4. Flanged unions
   a. For welded pipe, unions shall be weld neck, raised face, 150 lb, meeting ANSI B16.5.
   b. For fire protection piping, unions shall be bolted type with ASA 250# flanges.
5. Flanged union gaskets

a. Gasket material should be suitable for the fluid & pressure to be contained, ASME B16.21. For general use, gaskets shall be 1/16" thick, compressed non-asbestos sheet gaskets, inside bolt circle, with graphite applied to both faces: Durabla, "Durlon", Klinger, Aramid, or equal.
b. For fire protection systems, gaskets shall be type and material approved for fire protection. Gaskets shall be placed inside bolt circle.
c. For steam systems, gaskets shall be Flexitallic "Type CG" spiral wound compression type.

6. Grooved end couplings shall be used only where specifically permitted by the Contract Documents; they shall be Victaulic Style, or equal, malleable iron couplings used with grooved end pipe and fittings. Use grade E EPDM molded gaskets for heating and cooling systems; use grade E for potable water and fire protection systems.
7. Steel couplings for threaded steel pipe systems shall be one grade heavier than pipe.
8. Couplings for high pressure, high temperature threaded steel pipe systems shall be 300 lb. extra heavy malleable iron.
9. Dielectric unions shall be by Watts or, for grooved joint, liquid-carrying systems, may be Victaulic "Clear-Flow" Dielectric.

D. Pipe Nipples
1. Pipe nipples shall be Schedule 80 and of the same quality and material as pipe system. Close nipples are NOT permitted in pressure systems and fire protection systems.

E. Escutcheons
1. Escutcheons shall be chrome plated. Provide high pattern escutcheons where sleeves are extended above floor:
2. Escutcheons in ceilings shall have set screws or other positive means of holding units firmly in place.

F. Pipe Sleeves And Seals
1. Sleeves shall be one of the following:
a. Galvanized steel pipe; Schedule 40, Schedule 30 or Schedule 20.
b. In new concrete: removable plastic forms.
c. Within enclosed vertical pipe chases: 24 gauge round galvanized sheet steel.
d. For any system except hot water, steam or condensate: Schedule 40 PVC.
2. In lieu of preset sleeves, concrete or masonry may be core drilled.
3. Seals for pipe penetrations through mechanical room walls and floors, areaway walls, and walls below grade shall be standard service insulating type: Thunderline Link-Seal Type C. Link-Seal model and number of links in assembly shall be as recommended by manufacturer. Where Link-Seals are used, penetrations must be accurately formed by core drilling,

removable plastic forms or permanent sleeves with water stop and anchor flanges.

4. Seal non-fire-rated interior wall penetrations with silicone foam, Dow-Corning #734 RTV or equal, or with acoustical sealant as follows:
   a. For concealed applications, acoustical sealant shall be non-shrinking, non-migrating, non-staining sealant of either non-drying or permanently elastic type: Tremco Acoustical Sealant, JM Clipper "Duxseal" or equal.
   b. For exposed applications on surfaces to be painted, sealant shall be permanently elastic paintable acoustical sealant: latex, acrylic or acrylic-latex type, Pecora AC-20 FTR or equal.
   c. For exposed applications on finished surfaces, sealant shall be silicone or butyl sealant by General Electric, Dow Chemical, or Tremco.

   d. Seal penetrations through floors and through fire-rated walls with appropriately rated fire barrier sealant meeting ASTM E-814, UL 2079, and applicable AT&T standards.

G. General Service Valves
   1. General service valves of similar type shall be by one manufacturer. Acceptable manufacturers include following:
      a. Gate, globe and check valves shall be by Crane, Jenkins, or Stockham.
      b. Ball valves shall be by Crane, Jamesbury, Jenkins, Stockham or Milwaukee.
      c. Butterfly valves shall be by Alfa Laval Flow – Saunders or Norris. Butterfly valves by Grinnell, Center Line, Bray, Jenkins, Crane, or Stockham are also acceptable for this project, subject to specifications.
      d. Plug valves shall be by DeZurik or Homestead.
      e. Emergency fuel shut-off valves shall be by Preferred Utilities or Jamesbury.
      f. Valves on fire protection systems shall by UL listed or FM approved. Exterior valves on water and fire protection systems shall be by ITT Grinnell (Kennedy Division), Mueller or Stockham.
   2. For valves 4" and larger located more than 7 feet above floor, provide chain wheel operators with mounting hardware and galvanized steel chain.
   3. HVAC Hydronic Systems - Gate Valves 2-1/2" and larger: 125# class, iron body, OS&Y, bronze trim, rising stem and flanged ends; Jenkins #454J or Crane #465-1/2.
   4. HVAC Hydronic Systems - Ball Valves 1/2" to 2": 150# WSP and 400# WOG, full port, bronze two-piece or three-piece body; with TFE Teflon seats and seals, insulated steel lever handle, and Type 316 stainless steel ball and trim: Jamesbury Series 300.

5. HVAC Hydronic Systems - Globe Valves 2-1/2" and larger: 125# class, iron body, bronze mounted, flanged ends; Jenkins #2342J or Crane #351.
6. HVAC Hydronic Systems - Check Valves
   a. Check valves 2" and smaller: Bronze body, screw-in cap, screwed ends: Jenkins #4092J or Crane #37.
   b. Check valves 2-1/2" and larger: 125# class, 200# WOG, iron body, regrinding swing check, bronze disc, bolted cover, flanged ends: Jenkins #477LJ or Crane #383.
7. HVAC Hydronic Systems - Plug Valves: Nickel alloy seat, cast iron or semi-steel body, with stainless steel or bronze top and bottom bushings, "Hy-Car" or E.P.T. faced plug, non-lubricating, gear operated, 150 psig working pressure, 125 lb. ASA flanges; DeZurik Series PEC with operator Model GS adjustable open position stop.
8. T.HVAC Low Pressure Steam Systems - Gate Valves
   a. Gate valves 1" and smaller, for condensate trap assemblies: 125# WSP, 200# WOG, bronze body, threaded, non-rising stem; Jenkins #992AJ, Crane 1701 or equal.
   b. Gate valves 2" and smaller: 150# WSP, 200# WOG, bronze body, threaded ends, non-rising stem, Jenkins #2310J, Crane 437 or equal.
   c. Gate valves 2-1/2" and larger: 125# class, iron body, OS&Y, bronze trim, rising stem and flanged ends; Jenkins #454J or Crane #465-1/2.
9. HVAC Low Pressure Steam Systems - Ball Valves 2" and smaller: 150# WSP, 400# WOG, bronze two-piece or three piece body; with TFE Teflon seats and seals, insulated steel lever handle, and Type 361 stainless steel ball and trim: Jamesbury Series 300.
10. HVAC Low Pressure Steam Systems - Globe Valves
    a. Globe valves 2" and smaller: 150# class, bronze body, threaded ends; Jenkins #106BJ or Crane #14 1/2P.
    b. Globe valves 2-1/2" and larger: 125# class, iron body, bronze mounted, flanged ends; Jenkins #2342J or Crane #351.
11. HVAC Low Pressure Steam Systems - Check Valves
    a. Check valves 2" and smaller: Bronze body, screw-in cap, threaded ends: Jenkins #4092J or Crane #37 for steam; Jenkins #4475TJ or Crane #141TF for condensate.
    b. Check valves 2-1/2" and larger: 125# class, 200# WOG, iron body, regrinding swing check, bronze disc, bolted cover, flanged ends: Jenkins #477LJ.
12. Special Use Valves

1. Acceptable manufacturers include following:
   a. Pump discharge check valves shall be by Crane, Streamflow, Armstrong or Bell & Gossett.
   b. Balance valves shall be by Bell & Gossett, DeZurik, or Armstrong.

c. Specialty valves for HVAC hydronic and steam systems shall be by McDonnell & Miller, Consolidated, Watts or Bell & Gossett.

2. For valves 4" and larger located more than 7 feet above floor, provide chain wheel operators with mounting hardware and galvanized steel chain.
3. HVAC Hydronic Systems - Pump Discharge Check Valves
   a. Valves 1-1/2" and smaller: 250# bronze body, screw end; with Teflon gaskets, stainless steel springs, and bronze or stainless steel trim;
      i. Valves 2" to 6": 125# semi-steel body, 304 stainless steel trim, flanged ends; Crane Fig. 147 or Streamflow Model CT-125.
      ii. Valves 8" to 14": 125# semi-steel body, 304 stainless steel trim, flanged ends; Crane Fig. 147, Streamflow Model CT-125.
4. HVAC Hydronic Systems - Low Pressure Relief Valves: side outlet, lever handle, bronze construction, ASME labeled, Bell & Gossett Model 790.
5. Vent Valves, Drain Valves, Gauge Cocks
   a. Ball valves: Bronze, full port, TFE Teflon seat and seal; Jamesbury "Style A" or Crane #9303.
   b. Drain valves shall have a 3/4" hose thread adapter on outlet.

H. Special Service Valves
1. Special service valves shall be by one manufacturer. Acceptable manufacturers include following:
   a. Valves used in refrigeration piping shall be by Henry, Kerotest, Mueller or Superior.

2. For valves 4" and larger located more than 7 feet above floor, provide chain wheel operators with mounting hardware and galvanized steel chain.
3. Refrigeration Valves: Valves shall be backseating, packless diaphragm valves with flared or solder ends as required.
   a. Shutoff, purging & charging valves: Parker 80-01G
   b. Check valves: Parker CK1 or CK4A
   c. Relief valves: Parker H2, H3, H4 or H5.

I. Strainers
   1. Unless otherwise specified, strainers shall be by Armstrong, Barnes & Jones, or Sarco.
   2. Strainers 2" and smaller: 250#, screwed, iron body "Y" pattern, 1/2" plugged blow-off outlet;
      a. For steam systems, provide 30-mesh screen stainless steel or Monel basket.
      b. For water systems, provide 20-mesh screen stainless steel basket.

J. Vents & Vacuum Breakers
   1. Vacuum breakers for steam coils and steam equipment shall be Barnes & Jones Model VB or equal.
   2. Air vents on hydronic piping system main lines shall be air chambers not less than 4" or more than 8" high, full pipe size of main up to 2" maximum. Provide 1/4" vent and drain piping with accessible 3/8" ball valve.
   3. Air vents on hydronic system branch piping, radiation heaters and radiation coils shall be Bell & Gossett #4V 1/8" key operated vents, Jamesbury 1/4" Series 300 ball valves.

K. Refrigeration Specialties
   1. Sight glasses for installation in liquid lines adjacent to compressors shall be 500 psig, UL listed, moisture-liquid indicators.
   2. Filter driers shall be UL listed, 500 psig, steel shell with desiccant ceramic molded cores.

L. Thermometers
   1. Thermometers shall be by Taylor, Weiss or Weksler.
   2. Thermometers shall be adjustable angle type with accurate fast response; including:
      a. Thermometers shall have aluminum case, industrial glass, 9" scale length or 5”diameter round dial and 2 degree F subdivisions.
      b. Stem length shall be minimum of 3-1/2" and at least one-third as long as pipe diameter. Provide brass, monel or stainless steel separable socket of matching length. Provide lagging extensions when installed in insulated pipe.

      For thermometers up to 300 degrees F, clear acrylic plastic window.
      For thermometers over 300 degrees F, double strength glass window.
   3. Range shall be manufacturer's standard closest to following:
      a. Hot water heating: 25 to 300 degrees F.
      b. Chilled water: 0 to 100 degrees F.
      c. Condenser water: 0 to 160 degrees F.
      d. Potable hot water: 30 to 300 degrees F.
      e. Potable cold water: 0 to 100 degrees F.
      f. Condensate: 0 to 250 degrees F.

M. Pressure Gauges

1. Gauges shall be Grade 2A, ½% accuracy, with brass lever handle gauge cock: Ashcroft "Duragauge" #1279 for HVAC water systems and steam or equal by Marsh, U.S. Gauge, Trerice or ENFM.
2. Gauges shall be liquid filled to provide damping of pointer movement.
3. Gauges for HVAC water systems shall have 4½" dial, and following scale:
   a. Heating Hot Water scale range: 0-60 psig, 0-140 ft.
   b. Chilled Water scale range: 0-100 psig, 0-230 ft.
   c. Condenser Water scale range: 0-100 psig, 0-230 ft.
4. Gauges for steam systems shall have 4½" dial and following scale range: 0-30 psig for low pressure; 0-100 psig for medium pressure, 0-200 psig for high-pressure systems.
5. Gauges for plumbing water systems shall have 4-1/2" dial and scale range of 0-200 psig.
6. Gauges for fire protection systems shall be UL and FM approved sprinkler service gauge, with 4-1/2" dial and scale range of 0-300 psig.

N. Steam Traps
1. Traps in low-pressure steam systems (15# and less) shall be float and thermostatic type: Sarco #FT-15 or equal by Armstrong, Barnes & Jones or Strong.
2. Traps in medium pressure steam systems (16-100#) shall be inverted bucket type, with integral internal check valve and thermostat air vent: Armstrong Series 200 or equal by Sarco or Strong.
3. Traps in high pressure steam systems (101-200#) shall be inverted bucket type, 250 psig forged steel, with top and bottom connections and integral internal check valve: Armstrong Types 312-316 or equal by K-Master, Sarco or Webster. Provide thermostatic vents at end of main drips at trap locations.

O. Cleanouts

P. Hangers And Supports
1. Acceptable manufacturers include: ITT Grinnell, Carpenter & Patterson, or Tolco.
2. All pipe hangers shall have electro galvanized plated finish.
3. Hangers and attachments for pipe 8" and smaller shall be UL or FM approved for application. Support components shall meet "Manufacturers Standardization Society of the Valve and Fitting Industry" (MSS) Specification SP-58. Hangers and supports for insulated pipe shall be sized to permit insulation to pass uninterrupted through hanger.
4. Pipe attachments shall be as follows:
   a. For 2" and smaller insulated pipe, HVAC and plumbing systems: Grinnell #300, #260 or #65 adjustable clevis type.
   b. For 2" and smaller uninsulated steel, cast iron and plastic pipe, HVAC and plumbing systems: Grinnell #65 or #260 adjustable clevis type, or Grinnell #97 ,#97c, or #69 adjustable ring type.

c. For 2" and smaller uninsulated copper, HVAC and plumbing systems: Grinnell #CT-99c, #97c or #CT-69 adjustable ring type, or Grinnell #CT-65 adjustable clevis type.
d. For 4" and smaller fire protection pipe: Grinnell #69, #97 or #69G adjustable ring type, or Grinnell #260 adjustable clevis type.
e. For 2-1/2" to 6" uninsulated steel or plastic pipe, HVAC and plumbing systems: Grinnell #260 adjustable clevis type, or Grinnell #171, #177 or #181 adjustable pipe rolls.
f. For 2-1/2" to 6" uninsulated copper, HVAC and plumbing systems: Grinnell #97c or #CT-69 adjustable ring type.
g. For 2-1/2" to 12" uninsulated cast iron drainage pipe, plumbing systems: Grinnell #260 adjustable clevis, or Grinnell #171, #177 or #181 adjustable pipe roll type.
h. For 2-1/2" to 12" insulated pipe, HVAC and plumbing systems: Grinnell #260 or #300 adjustable clevis type, or Grinnell #171, #274 or #177 adjustable pipe rolls.
i. For 4-1/2" to 8" fire protection pipe: Grinnell #69 adjustable ring type, or Grinnell #260 adjustable clevis type.
j. For 8" and larger, uninsulated steel and plastic pipe, HVAC and plumbing systems: Grinnell #260 adjustable clevis type, or Grinnell #171, #274 or #177 adjustable roll type.
k. For pipe installed on rack supports: Grinnell #175, #271 or #274 pipe roll chairs or stands.

5. Piping run near floor shall be supported by:
   a. For pipe 2" and smaller: Supported from floor on legs of galvanized angle iron, on galvanized channels or on galvanized pipe legs.
   b. For pipe 2-1/2" to 4": Adjustable pipe saddles, Grinnell #264, supported from floor on pipe legs.
   c. For pipe 4" and larger:
      i. Grinnell #277 pipe roll and plate, supported on masonry piers and shimmed to provide proper pitch as required, or
      ii. Grinnell #257 slide assemblies with adequate pipe attachments, or
      iii. Grinnell #274 adjustable pipe roll stands supported on masonry piers, welded steel channels or I-beams.
   d. Where longitudinal pipe movement must be restricted, use anchor chairs or acceptable pipe clamps.
6. Piping run along walls shall be supported by:
   a. For single pipes run along walls: hanger rods which are supported from welded steel brackets: for 4" and smaller pipe, Grinnell #194 brackets; for 5" to 8" pipe, Grinnell #195 brackets.

b. For pipe 10" and larger and for all sizes of multiple pipes grouped along walls: Channel erector framing system as follows, by Kindorf, Power-Strut, Carpenter & Paterson, Unistrut or equal.
   i. Vertical members may be cast in concrete walls.
   ii. Framing members and fittings shall be galvanized 12 gauge steel, 1-5/8" x 1-5/8" x 3" double-slotted channel sections.
   iii. For sections cast in concrete, provide welded anchor straps on 12" centers.
   iv. Provide additional fittings and attachments required.

c. For concealed vertical piping, other than copper pipe: Grinnell #261 riser clamps.

d. For concealed vertical copper pipe: Grinnell #CT-121C or #261C riser clamps.

e. Where longitudinal pipe movement must be restricted, use anchor chairs or acceptable pipe clamps.

f. Wall hangers shall be used where hanger rods attached to overhead steel structure exceed four-foot length.

7. Contact between dissimilar metals is NOT permitted. Pipe attachments in metal-to-metal contact with copper and brass pipe shall be copper-plated or PVC-coated.

8. With hangers and supports for insulated piping, provide pipe-covering protection, as follows:
   a. For pipe 3" and smaller and for copper pipe: Grinnell #167 shields.
   b. For steel pipe 4" and larger: Grinnell #160, #161 or #162 saddles attached to pipe.
   c. High-density rigid insulation sections or suitable factory-fabricated units, in lieu of pipe saddles.

9. Support rods for hangers shall be adjustable, threaded, complete with locknuts. Hanger rods shall be secured to building by one of following acceptable structural attachments:
   a. To structural steel beams:
      i. For pipes smaller than 2": Grinnell #87 malleable iron C-type beam clamps with retaining clip; or Grinnell #93 or #94 top beam clamps.
      ii. For pipes 2" and 3": Grinnell #87 malleable iron C-type beam clamps with retaining clip; or Grinnell #61, #62 or #227 top beam clamps with Grinnell #89 retaining clip; or Grinnell #218, #225 or #226 beam clamps.
      iii. For pipes 3-1/2" to 8": Grinnell #218, #225 or #226 beam clamps.
      iv. For pipes 10" and larger: Grinnell #66 bolted and welded beam attachments, or Grinnell #228 or #292 beam clamps.
   b. To poured-in-place concrete structures:
      i. For pipe 3" and smaller: Grinnell #281 galvanized steel preset inserts.

ii. For pipe 4" to 8": Grinnell #282 galvanized malleable iron preset inserts.

c. In completed concrete work or other solid masonry:

iii. For pipe 3" and smaller: Phillips "Red Head" self-drilling inserts, or Tolco electro-galvanized anchors #209 or #210.

iv. For pipe 4" and larger: Grinnell #47, #49 or #52 concrete attachment plates.

10. Wall brackets and supports for piping outside of mechanical equipment spaces may be secured by:

a. In steel stud wall construction, for pipe 2" and smaller: Suitable angle iron or channel reinforcing as needed to distribute load over two or more studs.

b. In hollow masonry, for pipe 2" and smaller: Zinc-coated spring head toggle bolts Tolco Fig. 124.

c. In completed concrete work or other solid masonry:

i. For pipe 4" and smaller: Phillips "Red Head" self-drilling inserts, or Tolco electro-galvanized #209 or #210 expansion shield anchors.

ii. For pipe 5" to 8": Grinnell #281 galvanized steel preset inserts.

3. Execution:

A. Identification

1. Refer to Section 23 00 00, GENERAL CONDITIONS FOR MECHANICAL WORK.

2. Valve tags shall be 1-1/2" or 2" brass tags with black filled legend. Minimum size of legends on tags shall be 1/4" high letters above 1/2" high numbers. Secure tags to valve stems with #16 brass jack chain or brass S-hooks.

a. Provide square tags for HVAC systems: Seton Nameplate Style M4502 or equal.

b. Provide round tags for plumbing systems: Seton Nameplate Style M4507 or equal.

c. Provide hexagonal or octagonal tags for fire protection systems: Seton nameplate Style M4500, M4505 or equal.

3. Visible and accessible piping shall be identified with pipe markers and arrows, which contrast with background color.

a. Pipe markers shall be preprinted, color-coded, wrap-around semi-rigid, snap-on labels: Seton Nameplate "Setmark" or Brady "Snap-On".

4. Label shall be located for maximum visibility, close to valves and equipment, at each change of direction, at each access door or panel, at each side of wall penetrations, and at intervals of approximately 20 feet.

5. Label color-coding and sizes shall conform to ANSI A13.1 and OSHA. Use the following legend:

LPS	- Low pressure steam supply
LPCR	- Low-pressure steam condensate return

6. Whenever Owner's standards differ from above, observe and follow Owner's standard labeling.

B. Pipe Installation - General

1. Piping shall be installed with proper provisions to allow expansion and contraction of lines without placing undue strain on pipes, fittings and equipment.
2. Piping shall be installed to provide proper pitch, complete drainage, venting and filling, and without trapping plumbing lines. Where pipe is run through beams, locate openings so that pipe pitches properly and can move freely between 1/4" and 3/4" in all directions.
3. Horizontal piping shall run concealed above ceilings in areas with hung ceilings. Vertical piping shall run concealed; if possible, throughout finished spaces either in furred spaces, shafts, chases or wall cavities.
4. Whenever work is not in progress, open ends of piping shall be capped or plugged, watertight.
5. Provide drain pan under pipe(s) which pass overhead and within 2'-0" of any switchboard, motor or controller. Drain pan shall be 20 oz. copper pan at least 4" wider than the outside edge of the pipe(s). Pan shall be properly stiffened and braced with brass angles; supported to prevent sagging; with 2" turned-up edge, rolled over stiff brass wire, on each side. Seams shall be soldered and watertight. Provide 1" drip pipe, from pan, down to nearest drain.
6. Reductions in pipe sizes shall be made at fittings or through reducing fittings. Bushings are permitted ONLY in vent piping.
7. Remove burrs, ream or file pipe ends to full size bore of pipe, and remove chips.
8. Joints and connections
    a. In welded piping, use long radius elbows except where space limitations require short or standard radius elbows. Branch connections shall be made with standard weld tees only.
    b. Steel piping 1-1/4" and smaller shall be made up with threaded joint; steel piping 1-1/2" to 2-1/2" may be threaded or welded. In general, piping 3" and larger shall be welded.
    c. Threaded joints shall be made up using Teflon pipe tape, Teflon liquid or other acceptable non-hardening joint compound applied to male thread only.
    d. Grooved end couplings and fittings are permitted only where accessible. These may be used in place of flanged or screwed unions.
    e. Unions on pressure piping systems shall be installed only in accessible locations.

f. Connections to pipe headers, fixtures and equipment shall be made with unions or flanges to permit replacement, removal and servicing of equipment. Unions shall be located between shut-off valve and equipment.

g. Pipe branch connections at every piece of equipment shall be arranged with proper drops and offsets to permit access to equipment and to allow some movement of main pipe.

h. Provide flexible pipe connections to isolate movement of equipment and piping from each other and to isolate movement of main piping from branch piping installed at an angle to main. Anchor any branch piping adjacent to flexible connectors to ensure that movement and vibration is absorbed in flexible connection.

i. Joints between pipes of dissimilar metals and joints between pipes and equipment of dissimilar metals shall be made with dielectric insulating fittings or unions.

9. Welding Procedures

a. Welding shall be done by experienced ASME-certified welders, qualified under ASME "Boiler & Pressure Vessel Code" Section IX and acceptable to Owner. Furnish welding certificates if requested by Owner or Engineer.

b. Take precautions against fire and other damage when welding or cutting. Procedures shall comply with ANSI Z49.1 "Safety in Welding and Cutting".

c. Welding of pipe joints shall conform to ANSI B31.1 "Power Piping". Oxyacetylene or electric arc process shall be used, using coated rods.

d. In existing facilities, obtain Owner's permission as to time and location of welding, before proceeding.

e. For welding in areas near occupied spaces: provide air cleaning/ventilating devices (e.g., exhaust fans, recirculating type electrostatic air cleaners, activated charcoal air cleaners) as necessary to control welding fumes and to keep air clean within occupied spaces, to Owner's and Architect's/Engineer's satisfaction. Provide temporary enclosures if required for this purpose.

f. For welding in tunnels and confined spaces, provide adequate ventilating and air cleaning equipment to maintain healthy environment for workers. Air cleaning/ventilation methods and systems shall be acceptable to Owner and Engineer.

C. Sealing

1. Void space between pipe or insulation and sleeve shall be packed for full length of sleeve. Pipe shall be installed so that pipe does not bear or rub on sleeves and so that limited movement along pipe axis does not destroy packing integrity. All penetrations through fire-rated walls or floors shall be sealed pursuant to AT&T standards (see Architectural specifications).

Apply caulk per manufacturer's recommendation to maintain the fire rating of the penetrated assembly.

D. Piping Supports

1. Horizontal piping shall be supported throughout entire run. Provide hangers or supports within 2'-0" of elbows, as required to support heavy groups of fittings and valves, and as practical and necessary for attachment to building structure.
2. Hanger rod sizes and maximum spacing of hangers and supports shall be as follows. Where double rod hangers are used, rod sizes for pipe over 2" may be reduced one size. For steel and copper pipe, 1-1/2" and larger, which is used in plumbing and HVAC systems that carry only gas or vapor, hanger support spacing may be increased by 15%.

HVAC System Pipe/Size	Spacing	Rod Size
Steel pipe, 1-1/4" & smaller	6'-0"	3/8"
Steel pipe, 1-1/2"	8'-0"	3/8"
Steel pipe, 2"	10'-0"	3/8"
Steel pipe, 2-1/2"	10'-0"	1/2"
Steel pipe, 3"	12'-0"	1/2"
Steel pipe, 4"	12'-0"	5/8"

3. Vertical piping supports:
   a. Vertical steel and copper piping over 20 feet high shall be supported at upper floor level, at every other floor, at 20 foot intervals, and as necessary to prevent "whipping" of small pipe risers.
   b. Vertical cast iron; plastic and non-metallic pipe shall be supported at every floor.
   c. For vertical lengths less than 20 feet in height, support pipe at top and bottom of riser.
4. Where longitudinal pipe movement must be restricted, provide welded anchor chairs or acceptable pipe clamps.
5. Wood plugs, fiber plugs, cold bent hanger loops, chains, wires, perforated metal bands and horizontal pieces of pipe are NOT permitted.
6. Building attachments and rods shall be sized for total load of all pipes.
7. Provide independent support for relief valve discharge pipes. Do NOT use valve body for support. Wrenches shall NOT be applied to valve body; levers shall NOT be inserted in valve outlet.
8. Install pipe guides on each side of every expansion compensator and expansion joint. In long runs of finned tube radiation, install guides at first radiation support on each side of compensator. Provide two guides on each side of expansion joint and one guide on each 50 feet of straight piping. Follow recommendations of expansion joint manufacturer for proper spacing and location of guides.
9. Attach anchors for finned tube pipes having compensator, to pipe and to reinforced fin tube supports or building structure.

10. Install expansion compensators and expansion joints with proper cold pre-set compression. Make sure guides and anchors are secured before any pressure test is undertaken. Install temporary restraining rods at expansion joint to restrict movement and prevent damage during pressure tests. Remove temporary restraints upon completion and acceptance of tests and before system is filled or charged for normal operation.

E. Installation Of Steam And Condensate Systems
1. Provide complete and proper drainage and venting of air and non-condensate gases from system.
2. Horizontal piping shall be run at uniform pitch of not less than 1" in 40' and not greater than 1" in 20', downward in direction of flow.
3. Branch connections to steam and condensate lines shall be made only from above centerline of main piping.
4. Reducing fittings in horizontal steam piping shall be eccentric pattern, installed flush on bottom. Reducing fittings in vertical piping shall be concentric pattern.
5. Valve stems shall be above horizontal.
6. Trap sizes shall be based on 2-1/2 time maximum condensate discharge rate of equipment at 1/2 psig trap inlet pressure.

F. Installation Of Refrigerant Systems
1. "ACR" pipe shall be kept sealed until assembly work commences. Pipe contaminated during installation shall be thoroughly cleaned prior to assembly.
2. Piping shall be run and pitched to prevent trapping oil outside of compressor, to prevent flashing in liquid lines, to prevent slugging, and to prevent excessive noise or vibration.
3. "Bull head" tees in direction of flow are NOT permitted.
4. Provide charging, purging, system pump down, etc. necessary for completion of system.

G. Equipment Furnished By Others
1. Install automatic control valves, sensor wells, and other pipeline devices furnished under SECTION 25 00 00, CONTROLS.

H. Testing - General
1. Perform specified tests and tests required by authorities having jurisdiction. Tests will NOT be accepted unless witnessed by the Engineer and Owner.
2. Unless otherwise noted, perform pressure tests and obtain approval of test results before starting cleaning or concealing of pipe under insulation or other finish.
3. Tests are satisfactory only when joints show no visible leaks and test pressure remains constant after continuous test period. Repair leaks, and remove and replace defective pipe, fittings and joints with new material, until accepted by Engineer and inspecting authority. Wicking, caulking, compounding, peening, or other makeshift type of repairs are NOT permitted.

4. Repeat tests after repairs until systems are proven tight.

I. Testing Of Steam, Water And Fuel System Piping
   1. Tests shall be maintained as long as necessary to completely inspect piping and for following minimum period:
      a. Potable water systems: 4 hours.
      b. HVAC water systems: 2 hours.
      c. Steam systems: 2 hours.
      d. Fuel systems: 2 hours.
      e. Fire protection systems: 2 hours.
   2. Following precautions shall be taken during pressure tests:
      a. Steam traps shall be disconnected or isolated.
      b. Hot water system relief valve shall be removed.
      c. System pressure gauges with scale ranges lower than test pressure shall be removed or isolated.
      d. Water and steam control valves shall be removed, where not rated for test pressure.
      e. Fuel burners shall be disconnected.
      f. Limit rods on expansion joints shall be made hand-tight and even, to limit travel and expansion. Joints without permanent limit rods shall have temporary straps and rods installed to limit travel.
   3. Maximum test pressure shall NOT exceed 125% of design or rated working pressures of system components such as valves and shall NOT exceed 125% of following minimum test pressures except where required by code and approved by engineer:
      a. HVAC water systems: 125 psig
      b. Condensate systems: 125 psig
      c. Low pressure steam systems: 125 psig
   4. Steam piping shall be subjected to second test with steam at operating pressure. During this test, check anchor, expansion joints, hanger and supports to ensure that each item is performing as intended, without distortion, with uniform loading and with proper freedom of movement.

J. Testing Of Refrigerant Piping
   1. Test for leaks by filling system with dry nitrogen. Compressor suction and discharge valves shall be closed. Expansion valves shall be plugged. Use separate pump or available gas cylinder pressure to pressurize system.
   2. Maximum test pressure shall NOT exceed 120% of following minimum test pressure:
      a. Refrigerant high side piping: 250 psig
      b. Refrigerant low side piping: 150 psig
   3. Using commercially produced liquid leak detector solution OR a soap & water solution, check pipe joints, valve packings and bonnets, flanges, sight glasses, fitting and equipment for leakage. After pressure tests have been completed and accepted, evacuate systems to atmosphere and proceed with evacuation tests.

4. Evacuate system by external vacuum pump designed for this purpose. System compressors shall NOT be used, under any circumstances. Evacuate system to 250 microns of mercury vacuum or lower, and maintain vacuum for minimum of 4 hours, with system at minimum ambient temperature of 65 degrees F.
5. Purge system with dry nitrogen and repeat evacuation test, to 250 microns or lower, two times, holding vacuum for at least 2 hours each time, to ensure that piping systems are free of moisture before charging with refrigerant.
6. Charge system with liquid refrigerant, using dehydrator in charging line. Start compressors and add refrigerant until liquid-line sight glass shows clear liquid flow under operating conditions. Top off system with 10% to 15% additional refrigerant, or adjust for sub cooling per manufacturer's instructions. Under no circumstances is refrigerant gas or liquid to be vented to the atmosphere.
7. All persons handling refrigerants shall be properly certified in accordance with Federal and State requirements for service technicians to work on the type of systems involved, as well as for the type of refrigerant to be used.
8. All refrigerant used shall be new, virgin product certified by the manufacturer as new product. Reclaimed or recycled refrigerant shall NOT be used, unless explicitly allowed elsewhere in Contract Documents.
9. Pump out of refrigerants shall be done using approved systems designed for the safe transfer of refrigerant from a system to a reclaim container. Containers used for removed refrigerants shall meet applicable Federal standards. All removed or reclaimed refrigerant shall be removed from the site and delivered to a Federally approved refrigerant reclaim processing facility, except where Owner specifically takes responsibility for refrigerant.

K. Cleaning Piping Systems
1. Before operating piping systems: Blow out system with compressed air and/or water. Flush and drain systems until all traces of dirt, construction debris, weld, scale, slag, corrosion material, oil, grease, etc., are removed from piping systems. Flush and clean plumbing piping systems before decontamination.
2. Provide necessary drain and fill connections, temporary piping connections, and equipment required for flushing and cleaning. Install spool pieces in place of automatic control valves for duration of flushing; install control valves before system is chemically cleaned.

3. HVAC cleaning and treatment program, chemicals and supervision shall be provided by firm specializing in water treatment. Labor shall be by trade which installed piping. Water treatment firm shall:
   a. Be recognized specialist, whose major business is in industrial water treatment.

b. Have regional water analysis laboratories, development facilities, service department and full-time service personnel conveniently located near job site.
c. Determine volume of each system, type of chemicals and amount of chemicals required for cleaning.
d. Instruct and supervise Contractor's personnel in adding chemicals, circulating treated water through system, filling and draining system and taking samples.
e. Test water samples.
f. Determine when system has been properly cleaned.

5. Provide chemical cleaning and treatment of HVAC water piping systems as follows:
a. Flush with compressed air or cold water to remove chips and scale.
b. In hot water system, bring up to temperature of 200 degrees F and circulate water through piping and heating elements for minimum of two hours; completely drain and flush out system, while water is still hot (minimum of 170 degrees F). In chilled water system, circulate water at ambient temperature for minimum of two hours.
c. Repeat step 2, and take a water sample before draining.
d. Check water sample for oil, sediment and pH. Cleaning procedure shall be repeated until water sample shows oil and sediment is reduced to trace acceptable to Engineer. Then, if pH is 7 or lower, water shall be treated with sufficient trisodium phosphate to bring water to alkalinity between 8 and 10 pH.
e. Immediately before final acceptance by Owner, inspect and clean water system strainers and low point drains, check that system vents properly, and ensure that system is free of air and expansion tanks are properly charged.

6. Provide suction line strainers and acid-absorbing suction line filters, at beginning of cleaning period and according to following schedule:
a. Two days after startup.
b. One week after startup.
c. Two weeks after startup.

L. Renovation And Alteration Work
1. Where existing piping systems are altered, abandoned or removed in part, work shall be compatible with existing construction and shall be done so as to leave work in safe condition that will not adversely affect operation of remaining portions of existing systems.
2. Pipe stubs, openings, etc., shall NOT be left in unsightly condition or in condition causing safety hazard. Deactivated piping shall be removed back to active piping so as to leave no dead ends.

END OF SECTION 15050

23 05 93 TESTING, ADJUSTING, AND BALANCING

1. General:
   - A. Related Documents
     1. Drawings and related documents including the General and Supplementary Conditions and Division 01 Specifications Section and Division 23 Specifications.
   - B. Description
     1. The Testing and Balancing Agency shall specialize in testing, adjusting, and balancing of heating, ventilating, air-moving equipment, air-conditioning systems and hydronic systems. The testing agency shall have successfully completed at least five projects of similar size and scope, and shall be a certified member of the Testing Adjusting and Balancing Bureau (TABB).
     2. The TAB Contractor shall furnish all labor, equipment, and services necessary to test and balance all air and hydronic systems on the project.
     3. Testing and balancing shall not begin until the mechanical systems have been completed and are in full working order.
     4. Testing and Balancing work shall be performed by: Wing's Testing and Balancing Co., Branford, CT, 203-481-4988.
   - C. Scope Of Work
     1. The required testing, adjusting, and balancing includes:
        a. All air conditioning equipment including air distribution devices, supply ducts, air handling units, condensing units, fans, coils, and related equipment.
        b. All hydronic systems including pumps, water distribution systems, chillers, boilers, heat exchangers, coils, and related equipment.
        c. For renovation work where existing air distribution systems are being reused, see Contract Drawing for the extent of air balancing.
   - D. References
     1. ASHRAE 111 – Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
     2. SMACNA – HVAC Systems Testing, Adjusting, and Balancing.
     3. TABB – International Standards for Environmental Systems Balance.
   - E. Submittals
     1. Within 30 days after award of Contract, submit name of testing, adjusting, and balancing agency for approval.
     2. Field reports must be submitted indicating deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
     3. Submit six (6) TAB report in soft cover, letter size, binder manuals, complete with index page and indexing tabs.
     4. The Mechanical Contractor shall provide a copy of the TAB Report within each operating and maintenance manual.
   - F. Quality Assurance

1. Perform total system balance in accordance with Testing Adjusting and Balancing Bureau (TABB) – Quality Assurance Program for Environmental Systems Balance. (The AABC National Standards for Field Measurement and Instrumentation, or Total System Balance or NEBB Standards – Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems may be added if desired).

G. Project Conditions
1. System shall not be balanced until the HVAC system is complete and in full working order, and all areas of general construction are complete (walls, doors, ceilings).

H. Warranty/Guarantee
1. The TAB Contractor shall include an extended warranty of 90 days after submission of a completed balancing report, during which time the Owner may request a recheck of no more than 10% of total number of terminals, or resetting of any outlet, coil, or device listed in the test report, and;
2. Warranty/Guarantee must meet one of the following programs: TABB International Quality Assurance program, AABC national project performance guarantee, NEBB's Conformance Certification.

2. Products:

A. Instruments/Tools
1. Provide all necessary TAB instruments as per instrument schedules from Testing, Adjusting, and Balancing Bureau (TABB), NEBB, or AABC. Instruments shall be used and applied that are best suited to the system function being tested.

3. Execution:

A. Examination
1. The general, electrical, mechanical, controls, and sheet metal contractor(s) will verify that systems are complete and operable before commencing work. Responsible installing contractors shall ensure the following conditions:
a. Systems are started and operating in a safe and normal condition.
b. Temperature control systems are installed, complete, and operable.
c. All automatic and manual dampers are operable and fully open.

d. Proper thermal overload protection is in place for all fans, pumps, chillers, etc.
e. Final filters are clean and in place.
f. Duct and fan systems are clean of debris.
g. Fans are rotating correctly
h. Fire and volume dampers are in place and open.
i. Air coil fins are cleaned and combined straightened.
j. Access doors are closed, and duct end caps are in place
k. Air outlets are installed and connected.
l. Hydronic systems are pressure tested, flushed, filled, and properly vented.
m. Pumps are rotating correctly.
n. Start up or construction strainers have been removed and all other strainers are clean and in place.
o. Gauges and/or test ports are properly located for balancing.
p. Service and balance valves are open.

2. A construction deviation field report must be submitted noting deviation, or deficiencies in the above 3.1a, that would preclude or prevent system balance.

B. Balancing Tolerances
1. Air Handling Systems: Adjust to within plus 10 percent of outlet total plus allowable leakage rate. If this is not achievable, contact designing engineer on how to proceed.
2. Air Outlets and Inlets: Adjust total to within plus 10 percent or minus 10 percent of design for the space, or revised design quantities determined value obtained in A.
3. Hydronic System: Adjust to within plus 10 percent of outlet total minus 0 percent. If this is not achievable, contact designing engineer on how to proceed.
4. Hydronic terminal devices: Adjust total to within plus 10 percent or minus 10 percent of design for the space, or revised design quantities determined value obtained in A.

C. Adjusting - General
1. Recorded data shall represent actual measured or observed condition.
2. Permanently mark setting of valves, dampers, and other adjustment devices allowing for settings to be restored. Set and lock memory stops.
3. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

D. Air Systems Procedure
1. Adhere to one of the following procedures:
a. TABB & SMACNA's HVAC Testing, Adjusting, and Balancing International Standards.
i. Chapters on preliminary TAB procedures.
ii. Chapters on General air systems TAB procedures

iii. Chapters on TAB procedures for specific air systems VAV, CAV, Multizone, duel duct, etc.

b. NEBB procedural standards to TAB of environmental systems.

c. AABC National standards for total system balance.

2. Minimum air procedures should include the following:

a. Test and adjust fan RPM to design requirements.

b. Test and record motor full load nameplate rating and actual ampere draw.

c. Test and record system static pressures, fan suction, and discharge.

d. Adjust all main supply and return air duct to proper design CFM.

e. Test and adjust each diffuser, grille, and register. Reading and tests of diffusers, grilles, and registers shall include design velocity (FPM) and adjusted velocity, design CFM and adjusted CFM.

f. Test and record outside, mixed air, and discharge temperatures (D.B. for heating cycle, D.B. and W.B. for cooling cycle).

g. In coordination with the ATC contractor, set adjustments of automatically operated dampers to operate as specified, indicated and/or noted.

h. Test and adjust air handling and distribution systems to provide required or design supply, return, outside, and exhaust air quantities.

i. Make air quantity measurements in ducts by Pitot tube traverse entire cross sectional area of duct.

j. Measure air quantities at air inlets and outlets.

k. Use volume control devices to regulate air quantities only to the extend (?) that adjustments do not create objectionable air motion or sound levels.

l. Vary total system air quantities by adjustment of fan speeds. Provide drive changes recommendations to installing contractor. Vary branch air quantities by damper regulation.

m. Measure static air pressure conditions on air supply units, including filter and coil pressure drops and total pressure across the fan. Make allowances for loading of filters.

n. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

o. Measure temperature conditions across air, return air, and exhaust dampers to check leakage.

p. Where modulating dampers or economizers are provided, take measurement at full return air, minimum outside air, and 100 percent outside air mode of operation.

E. Hydronic System Procedure

1. Adhere to one of the following procedures:

a. SMACNA's HVAC Testing, Adjusting, and Balancing standards

i. Chapters on hydronic TAB procedures

b. NEBB procedural standards for TAB of environmental systems.

c. AABC National standards for total system balance.

F. Required Reports To Be Submitted
1. Submitted reports shall be on TABB/SMACNA, NEBB or AABC, or forms that contain the previous minimum data and the following information:
2. Reports shall include the following minimum information:
   a. Title page
      i. Project name and location
      ii. Project architect and location
      iii. Project Engineer and location
      iv. Project contractors (general, mechanical, balancing) and location
      v. Page index for all sections of the report
      vi. Report date
   b. Section A. Summary and Certifications
      i. Deficiency noted where design criteria could not be obtained within specified tolerance
      ii. Design versus final performance
      iii. Quality assurance statement and balancing certification
      iv. Name and address of Certifying Testing, Adjusting, and Balancing Agency
      v. TAB Supervisor name and certification number
      vi. TAB technician name and certification number
   c. Section B. Air Outlet Test Report: Supply, Return, and Exhaust Air
      i. Drawing or sketch number
      ii. Air terminal number / air handling unit
      iii. Area served (room number / location if available)
      iv. Terminal type
      v. Terminal size
      vi. Ak factor if applicable
      vii. Design air flow and velocity if applicable
      viii. Final air flow of velocity if applicable
      ix. Percent of design air flow
   d. Section C. Fan Test Data
      i. Designation
      ii. Service
      iii. Location
      iv. Manufacturer
      v. Model/size
      vi. Serial number
      vii. Design RPM/actual RPM
      viii. Fan sheave size and bore
      ix. Motor sheave size and bore
      x. Belts quantity number and size
      xi. Bore center to center distance
      xii. Sheave type fixed adjustable (percent open)

xiii. Motor manufacturer
xiv. Nameplate horsepower
xv. Motor RPM
xvi. Nameplate and actual voltage
xvii. Nameplate and actual amperage
xviii. Design brake horsepower/actual brake horsepower
xix. Phase
xx. 60 Hertz or variable frequency drive
xxi. Service factor
xxii. Frame size
xxiii. Starter size
xxiv. Heater size
xxv. Design air flow/actual airflow
xxvi. Design total static pressure/actual static pressure
xxvii. Actual discharge static pressure
xxviii. Actual suction pressure
xxix. Design CFM/actual CFM

e. Section D. Air handling unit test data additional required data (all readings for Section C to be included):
   i. Filter (quality and size)
   ii. Outside air flow (specified / actual)
   iii. Return air flow (specified / actual)
   iv. Relief or spill air (specified and actual)
   v. State pressure profile for all component parts filters, coils, humidifiers, sound attenuators (traps), etc., and inlet static pressure

f. Section F. Duct Traverse Data:
   i. Designation (system zone/branch)
   ii. Duct size and area
   iii. Test readings and calculations
   iv. Design and actual duct static pressure
   v. Design and actual air flow (CFM)
   vi. Correction factor for altitude density ad temperature if applicable
   vii. Method used

END OF SECTION 23 05 93

23 07 00 MECHANICAL INSULATION

1. General:
   - A. General Requirements
     1. This Section covers the specification of insulation for plumbing, heating, cooling, and ventilating systems.
     2. Refer to SECTION 23 00 00, GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS and applicable parts of DIVISION 01 for other general requirements.
   - B. Scope
     1. Provide labor, materials, equipment, services and transportation for insulating of systems, as indicated on Contract Drawings and specified herein, including but not limited to insulating following systems:
        a. Steam and condensate piping
        b. Refrigerant piping
        c. Pipe fittings, pipe flanges, valve bodies, strainers and accessories
        d. Equipment
        e. Ductwork and plenums
   - C. Shop Drawings And Other Submittals
     1. Before ordering materials, submit for review shop drawings, schedules and samples for following:
        a. Insulation
        b. Insulation fittings
        c. Insulation jackets
        d. Sealants and adhesives
2. Products:
   - A. General Insulation Requirements
     1. Insulation and components such as jackets, adhesives, sealants and finishes shall be fire-resistant and fire-retardant; shall comply with NFPA 255, NFPA 90A and UL 723; and shall meet following:
        a. Flame-spread rating not exceeding 25
        b. Smoke-developed rating not exceeding 50
        c. Fuel-contributed rating not exceeding 50
     2. Use of any material not meeting these requirements is prohibited.
   - B. Low Temperature Pipe Insulation (Schedule Type FG)
     1. Insulation shall be rigid preformed, glass fiber insulation with minimum density of 3-1/2 pcf and maximum K value of 0.25 at 75 degrees F: Manville "Micro-Lok", Owens-Corning "Pipe Insulation SSL-2", Knauf "Pipe Insulation", or equal.
     2. Insulation shall have white, foil kraft laminate, factory-applied vapor-barrier jacket, commonly called "All Service Jacket" (ASJ).
     3. Insulation shall be held in place by vapor barrier mastic applied to sealing laps, or by self-sealing laps secured by outward clinch staples spaced 3" on center. Punctures caused by stapling shall be sealed with acceptable vapor-barrier sealer.

C. Low Temperature Pipe Insulation (Schedule Type FF)
   1. For exterior and mechanical room applications only, insulation may be Armstrong "AP Armaflex" or Manville "Aerotube II", with insulation jacketing.
   2. Apply U.V. protective coating for exterior applications.

D. Insulation For Pipeline Accessories
   1. Fittings, valves, valve bodies including valve bonnet, strainer bodies and flanges shall be insulated to same thickness and with same material as specified for adjoining pipe insulation. Insulation shall be:
      a. Premold fittings and covers, by same manufacturer: Zeston or equal; or
      b. Mitered sections of the proper thickness; or
      c. Where piping is concealed: lightly wrapped layers of insulation blanket built up to thickness of adjacent pipe covering and held in place with wrappings of vapor barrier tape.

   2. Provide jacket as specified for piping or with glass cloth and lagging adhesive.
   3. Field-formed fittings and covers shall be neat.

E. Duct Insulation - Rigid Board Type – Exposed Applications
   1. Low temperature insulation Type D-FG-E shall be glass fiber duct insulation with minimum density of 3 pcf and maximum K value of 0.25 at 75 degrees F; with factory-applied glass cloth facing: Manville "Spin-Glas 815" with FSK facing, Knauf "Insulation Board", or equal.

F. Duct Insulation - Wrap Type – Concealed Applications
   1. Low temperature insulation Type D-FG-C shall be flexible glass fiber insulation, with minimum density of 3/4 pcf and maximum K value of 0.31 at 75 degrees F; with aluminum-foil facing: Manville "Microlite R-Series" with FSKL facing, Knauf "Duct Wrap", Owens-Corning "All Service Ductwrap", or equal.
   2. Adhesive shall be vapor barrier mastic: Benjamin-Foster #85-20 or equal.

G. Aluminum Jacketing
   1. Where called for, aluminum jacketing shall be corrugated, of 0.020” thickness, complete with fastening straps. Jacketing shall be by Childers, or equal.

3. Execution:

A. General Installation Requirements
   1. Covering shall not be applied until work has been tested, both individually and as complete system, and has been accepted by Engineer.
   2. Vapor barrier jackets shall be installed according to manufacturer's instructions so as to maintain vapor barrier without breaks.
   3. Expansion joints in insulated piping or ductwork shall be "bagged" with removable sections of insulation, neatly enclosed in canvas. Free movement of joint shall NOT be hindered.

4. Pipe insulation installed exterior to building shall be covered with aluminum jacketing. Joints of jacketing shall be lapped minimum of 2" and shall be sealed to prevent moisture penetration. Jacketing shall be secured by minimum 0.020" aluminum straps at joints and spaced 12" o.c.
5. For any conditions or situations not covered by this Specification, follow manufacturer's instructions.

B. Installation Of Insulation On Pipe And Fittings
1. General
   a. On exposed pipe, longitudinal seams on insulation shall be kept at top of pipe on horizontal runs and at back of pipe on vertical runs; circumferential joints shall be kept to minimum. Raw ends of insulation shall be concealed by neatly finishing and sealing ends.
   b. Note that oversized pipe hangers and sleeves are required on insulated piping with normal operating temperatures below 70 degrees F; refer to SECTION 23 05 00, BASIC MATERIALS AND METHODS. Pipe insulation shall be continuous along pipe, passing inside hanger or sleeve. Sheet metal saddles, provided with hanger system, shall be placed between pipe hangers and insulation.
   c. Pipe insulation Type FF shall be secured with adhesive and tape as recommended by manufacturer.
2. Heating Systems Pipe
   a. Insulate steam and condensate piping. Do NOT insulate trap bodies or cooling legs.
   b. Insulate hot water supply and return piping, except for piping located within enclosures of heat utilization equipment, such as radiation, convectors and fan-coil units.
   c. Insulate piping located within accessible plenums and wherever injurious accidental contact between hot piping and maintenance personnel can occur.
   d. Insulate flanges with sectional pipe insulation extending minimum of 1" beyond bolt ends. Finish with open weave glass fiber smoothly adhered and coated with lagging adhesive. Lap glass fabric at least 1" on itself and 2" on adjoining pipe insulation. If fiber glass blanket is used, apply smoothing coat of cement before finish is applied.
3. Pipe Insulation Schedule:

Piping	Fluid Temp. Range (ºF)	Pipe Size	Insulation Thickness	Type
Low Pressure Steam (0-15 psig)	201-250	2" & smaller	1-1/2"	FG
		2-1/2" & larger	2"	FG
Steam Condensate	Any	1" & smaller	1"	CS/FG
		1-1/4" to 2"	1-1/2"	CS/FG
		2-1/2" to 4"	2"	CS/FG
		5" & larger	2-1/2"	CS/FG
Drains	Any	All sizes	1/2"	FG
Interior Refrigerant	Any	All sizes	1"	FG
Outdoor Refrigerant w/ Alum. Jacket	Any	All sizes	1"	FG
Refrigerant in Mech. Rooms	Any	All sizes	1"	FG

C. Installation Of Duct Insulation

1. Coordinate sheet metal insulation work with other sheet metal work to avoid duplication of insulation on internal and external sides of ductwork.
2. Duct Insulation Schedule:

Ductwork	Minimum Insulation Thickness	Insul-ation Type
Exposed ductwork and plenums	1"	D-FG-E
Concealed ductwork and plenums	2"	D-FG-C

3. Insulate air supply ducts and plenums from supply fan discharge to each air outlet, except where ducts are exposed in rooms which they serve or where ducts are internally insulated. Provide overlap of 6" to 12" externally, where internal insulation begins and external insulation ends.
4. Insulate air return ducts, except where ducts are exposed in rooms which they serve or where ducts are internally insulated. Provide overlap of 6" to 12" externally, where internal insulation begins and external insulation ends.
5. Plenums and main ducts from outside air louver to return air mixing plenum shall be insulated by external insulation, unless noted otherwise.
6. Installation of low temperature insulation on exposed ducts:
   a. Secure insulation and jacket to duct with adhesive, stick pins and speed clip washers. Pins shall have pre-attached caps or caps that leave no protruding points.

b. Joints, clips and breaks in insulation shall be sealed with pressure sensitive tape. Use 3" wide tape along sides and 5" wide tape on corners.

7. Installation of low temperature insulation on concealed ducts:
   a. Insulation shall be firmly butted at joints, with maximum allowable compression of 25%. Seams shall overlap 2" minimum and shall be finished with acceptable pressure-sensitive tape or glass fabric and vapor barrier mastic. Tape or glass fabric shall be minimum 3" wide.
   b. When duct is 18" wide or wider, secure insulation to bottom of duct with mechanical fasteners on 18" centers. Washers shall be applied without compressing insulation.
   c. Seams, joints, penetrations and damage to facing shall be sealed with vapor barrier mastic.

D. Renovation Work In Existing Building
1. Where piping and ductwork in the existing building systems is replaced, altered, removed or otherwise destroyed by renovation work, repair or replace existing insulation with new insulation of similar type.
2. Cost of repair or replacement of insulation damaged by other trades shall be borne by those trades or as determined by Architect.
3. New insulation material shall be neatly matched and blended to existing material wherever such junctions occur.

END OF SECTION 23 07 00.

23 30 00 AIR DISTRIBUTION

1. General:
   - A. General Requirements
     1. This Section covers the specification of sheet metal work and associated air distribution devices.
     2. Refer to SECTION 23 00 00, SECTION 23 07 00, SECTION 25 00 00, GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS and applicable parts of DIVISION 01 for other general requirements.
   - B. Scope
     1. Provide labor, materials, services, equipment and transportation necessary for complete and operational air distribution systems, as indicated on Contract Drawings and specified herein, including but not limited to following:
        a. Low pressure ductwork
        b. Diffusers, registers and grilles
        c. Flexible connections
        d. Meters and gauges
        e. Dampers
     2. Related Work In Other Sections:
        a. Insulation: SECTION 23 07 00.
        b. Air handling equipment SECTION 23 00 01.
   - C. Shop Drawings And Other Submittals
     1. Design of duct system is critical with regard to pressure losses and total fan pressure requirements. No changes in duct size, type or quantity of fittings or components, or any other variance from Contract Documents will be permitted without prior approval of Architect/Engineer.
     2. Submit for review shop drawings for following:
        a. Ductwork, including plenums and casings
        b. Access doors
        c. Dampers
        d. Diffusers, grilles and registers
        e. Thermometers
        f. Pressure gauges
        g. Sound attenuators
        h. Noise and vibration isolators
     3. Shop drawings on fire dampers shall include mounting details conforming to method or test under which damper received UL label.
     4. Shop drawings on plenums shall include structural supports, joining and flashing details, duct openings, pipe sleeves, and damper and equipment locations.
     5. Ductwork shop drawings shall NOT be submitted to Engineer until ductwork has been coordinated with other trades. Each sheet of shop drawings shall be signed by Electrical, Fire Protection, Plumbing and Piping

trades and by Contractor, signifying that each has reviewed duct layout and has coordinated said layout with his work.

6. Shop drawings on noise and vibration isolation equipment shall include (1) schedule of device locations, design load and minimum static deflection at design load.
7. Obtain from manufacturers and submit sound power levels generated by grilles and diffusers at airflow and pressure drops indicated, in accordance with ASHRAE 36B-63 Procedure. Data shall be derived from tests performed in approved laboratory and, when specifically requested, for configurations shown on Contract Drawings.
8. Obtain from manufacturers and submit acoustical performance data for duct silencers, including dynamic insertion loss, self-noise and pressure drop ratings, obtained from independent laboratories for operating conditions indicated.

D. Standards
1. Work shall meet following standards, as applicable, unless otherwise specified:
a. SMACNA HVAC Duct Construction Standards, Metal and Flexible, 3rd edition, 2005, hereinafter referred to as SMACNA DCS.
b. SMACNA Fire, Smoke & Radiation Damper Installation Guide for HVAC Systems.
c. SMACNA Duct Liner Application Standard.
d. ASHRAE Equipment Handbook, Duct Construction Tables.

2. Products:
A. Sheet Metal Materials
1. Fittings, dampers and accessories installed in duct systems shall be made of same material as ductwork.

2. Ducts which handle moist air; ducts which are subject to intrusion of moisture; and joints between ducts and building construction, louvers or plenums shall be made watertight to prevent leakage.
3. Applications:
a. General service ducts shall be constructed from G-60 coated galvanized sheet steel of lock-forming quality meeting ASTM A653 and A924 standards. Minimum yield strength for steel sheet and reinforcements is 30,000 psi.
4. Flat oval and round ducts shall be prefabricated, galvanized steel or aluminum, machine formed spiral lock-seam ducts with matching machine-formed welded seam fittings: United Sheet Metal "UNISEAL" or "UNI-RIB" ducts or equal by Spiromatic or SEMCo. Exception: round ducts in constant volume systems classified at 2” w.g. or below may be longitudinal seam type, conforming to SMACNA DCS Chapter 3.
a. Fittings shall be of same material and manufacture as duct. Elbows shall be smooth radius type; mitered elbows are not acceptable.

b. Joints shall be flanged, sleeve or slip joints, as recommended by SMACNA DCS. Drawband joints are not acceptable at joints between rigid duct sections and/or fittings, unless specifically permitted by Contract Drawings.
c. Ducts in low pressure systems shall meet low pressure requirements for 2" w.g. operating pressure.
d. Ducts in high pressure systems shall meet high pressure requirements for 6" w.g. operating pressure.

B. Duct Sealant
1. Duct sealant shall be non-hardening sealing mastic: United Sheet Metal "Duct Sealer", Hardcast "Duct Sealant 601", Precision Adhesives #PA-2084 "Duct Sealant", or 3M #EC-800.
2. Alternately, Contractor may submit a sealing system using mastic with embedded woven fabric for approval by Architect/Engineer.

C. Volume Dampers
1. Damper shall be made of same material as duct.
2. Damper blades shall be 18 gauge minimum. For ducts 14" deep or less, use single-blade dampers; for ducts over 14" deep, use multi-blade dampers. Dampers in round ducts shall be butterfly type.
3. For 2” w.g. class ducts, damper design and construction shall comply with SMACNA DCS Figure 2-12 or 2-13. Splitter dampers shall NOT be used.
4. Dampers shall be equipped with self-locking quadrants: Ventlok #641 or equal for uninsulated ducts and Ventlok #644 or equal for insulated ducts. Provide end bearings: Ventlok #607 or #609 or equal.
5. Dampers 24" wide and wider shall have damper bearings on each end of shaft. Bearings shall extend through ducts; bearings opposite quadrant shall be mounted on 2" x 3" x 1/8" plate attached to duct by sheet metal screws.

D. Fire Dampers
1. Fire dampers shall be dynamically-rated curtain blade style meeting the requirements of the latest edition of UL Standard 555, suitable for application in dynamic or static HVAC systems. Fire dampers shall be B style, rectangular connection, blades out of airstream, high free area. Fire dampers shall have a rating of 1½ hours in accordance with UL 555. Dampers shall be classified for dynamic closure to 2000 fpm and 4 inches w.g. (1 kPa) static pressure.
2. Construction requirements:
Frame: Maximum 5 inch (127 mm) roll formed, galvanized steel channel.
Blades: Galvanized curtain type.
Closure Springs: Type 301 stainless steel, constant force or spring clip type.
Temperature Release Device: 165 degrees F (74 degrees C) fusible link, or 212 degrees F (100 degrees C) fusible link.
3. Fire Dampers shall be Ruskin Model DIBD2 or equal by Greenheck or Prefco.

E. Flexible Connections

1. Flexible connections shall comply with NFPA 90A and 90B and UL 214. Material and connection shall be air-tight.
2. Flexible connections shall be Neoprene coated 30 oz. woven glass fiber fabric with operating range of -20 degrees F to 200 degrees F: Ventfabrics "Ventglas" or Duro-Dyne MF6N.

F. Flexible Duct
1. Flexible duct shall consist of air-tight aluminum or polyester core on galvanized or plastic-coated spring steel helix, with minimum 1" fiberglass insulation and exterior vapor barrier jacket of polyester or polyolefin.
2. Flexible duct shall have minimum pressure ratings of 6" w.g. positive and 2" w.g. negative. Flexible duct shall meet UL #181 Class 1 connector or air duct requirements.
3. Duct shall be Wiremold "Type WG", Clevaflex "Type KQ", or accepted equivalent by Thermaflex or United Flex.
4. Flexible duct shall not be used upstream of VAV boxes.

G. Thermometers
1. Duct-mounted thermometers shall be solid liquid-filled dial type, with 5 feet of bronze-armored capillary and 8 foot averaging bulb sensor: Trerice #L80025 with #8-19LL-1 plain connection or equal by Jay, Moeller, Palmer, Taylor, Weksler or Weiss. Capillary shall be sealed and protected by rubber bushings at sheet metal penetrations.
2. Dial Ranges shall be standard size closest to following:
   a. For measuring outdoor, return or mixed air temperature: -40 degrees F to 120 degrees F.
   b. For measuring supply fan or coil discharge temperature: 0 degrees F to 180 degrees F.

H. Pressure Gauges
1. Duct-mounted differential static pressure gauges shall have necessary probes, vent valves, tubing, supports and mounting brackets (including externally adjustable red signal flag) and shall be ad follows:
   a. For low pressure return, exhaust and supply fans: Dwyer Magnahelic Series 2000, with 0" to 3.0" w.g. range.
   b. For medium pressure supply fans: Dwyer Magnahelic Series 2000, with 0" to 5" w.g. range.
   c. For high pressure supply fans: Dwyer Magnahelic Series 2000, with 0" to 10" w.g. range.
   d. For low efficiency, low velocity filters: Dwyer Magnahelic Series 2000, with 0" to 1" w.g. range.
   e. For high efficiency filters: Dwyer Magnahelic Series 2000, with 0" to 2" w.g. range.
   f. For mixed air plenums: Dwyer Magnahelic Series 2000, with 0" to 0.5" w.g. range, negative.
   g. For exhaust air discharge duct: Dwyer Magnahelic Series 2000, with 0" to 0.5" w.g. range.

I. Air Filters - General
1. All filters shall be by same manufacturer: American Air Filter, Cambridge, Continental, Farr or air handling unit manufacturer.
2. Unitary type, fixed position filters shall have filter-holding frames for duct or plenum mounting, for each filter unit. Frames shall be 16 gauge galvanized steel, with gaskets and spring-action latches or spring-action retaining clips.
3. Filter bank shall be assembled for replacement of filters from upstream side of filters. Provide access doors located on both sides of filter casings.
4. Refer to other paragraph in this Section for specification on pressure gauges required for each filter bank.
5. Furnish one complete set of replacement filter media to Owner for maintenance purposes.
6. Filter unit shall be integrated part of air handling unit furnished by unit manufacturer.
7. When filters are not an integral part of air handling unit casing assembly, the separate filter casings shall be galvanized steel. supported and reinforced with angle iron, provide with hinged access doors on both sides for servicing filters.

J. Disposable Media Air Filters, Panel Type
1. Filter assembly for each air supply system shall be single stage, disposable type.
2. Filter media shall be UL approved, 2" thick, disposable, non-fiberglass pleated media type with a minimum ASHRAE minimum efficiency of 30%: American Air Filter Type Am /Air 300X or approved equal by Farr.

K. Instrument Test Holes
1. Provide openings in ductwork for test instruments as required for testing and adjustment of the work and for permanent instrument ports. Holes shall be smooth-edged and properly plugged against leakage.

3. Execution:

A. General Ductwork Installation Requirements
1. All duct runs shall be checked for clearances before installation of any ductwork. Coordinate with other trades to avoid conflicts with piping, conduit, light fixtures, equipment and building structure. Duct locations and elevations in following areas are considered critical and shall require coordination drawings:
a. Areas above ceilings
b. Areas above telephone switching equipment or D.C. power plants.
c. Equipment rooms
2. Ducts shall be offset as required to clear structural members, major piping and large conduits.
a. Major offsets shall be made with radius elbows or right angle elbows with turning vanes, and duct dimensions shall NOT be altered.

b. To clear minor obstacles, duct depth may be reduced up to a maximum of 30%, top or bottom, with approach angle NOT exceeding 30 degrees and with duct width remaining constant.
c. Otherwise, no changes in duct shape or dimensions will be permitted without Architect/Engineer's approval. Any change proposed to exposed ductwork shall be submitted for approval first.

3. Exposed ductwork shall provide neat, smooth and finished appearance. Use only cadmium-plated sheet metal screws on exposed ductwork.
4. Ducts shall be free from vibration, buckling, thumping or rattling when fans are started, stopped and operated. In occupied areas, systems shall be free from noise created by air leakage or turbulence.
5. Dimensions of sheet metal duct shown on Contract Drawings shall be understood to mean dimensions without duct lining and inside dimensions of double wall duct. Where acoustical duct lining is installed, duct size shall be increased accordingly to maintain cross-section area.
6. Sealing
   a. Duct openings shall be kept sealed during construction to prevent entry of dirt, dust, moisture and foreign material.
   b. Locate seams on top side of ducts. Transverse and longitudinal seams shall be sealed and taped. Ducts serving "wet" exhausts shall have water tight seams and joints.
   c. Seal openings around ducts passing through fire walls. External insulation shall NOT pass through fire walls. Internal insulation shall be interrupted at fire dampers.
   d. Weld seams on stainless steel and black iron ducts. On exposed ducts, welds shall be ground smooth and finished to match duct material.
7. Wherever ducts penetrate structure, space around penetrating members should be 1/2" to 1".
   a. Space in excess of 1" shall be closed in, to satisfy the above limits, with materials providing at least the same surface weight as structure being penetrated.
   b. Remaining space between duct and building construction shall be tightly packed with acoustical filler, to full depth of penetration. Both sides of penetration shall be sealed with acoustical sealant.
8. Provide flexible connections in every connection between fans or air handling units and adjoining ducts or plenums. Clear opening between equipment and adjoining duct, where flexible connection is installed, shall be NOT less than 3” nor more than 5" and shall have good alignment. Emergency generator radiators shall have a 10" flexible connection.
9. Flexible duct
   a. Flexible duct connections to diffusers shall NOT exceed 6 feet in length, shall NOT contain more than one 90 degree bend, and shall NOT be used as substitute for 90 degree metal elbows.
   b. Provide flexible connections between ducts and terminal boxes.

c. Flexible duct shall be secured to duct and equipment collars with stainless steel clamps.
d. Flexible duct shall NOT pass through fire rated walls or other fire barriers.

10. Work of this Section shall include duct connections to louvers, plenum connections to louvers, and blanking off of unused portions of louvers. Ensure that duct, louver and plenum connections are water- and air-tight.

B. Installation Of Duct And Plenums

1. All SBC ductwork shall conform to SMACNA DCS 2" pressure classification, construction details and installation details. Construct plenums and casing for supply, return and exhaust air systems according to SMACNA DCS Figures 6-1 through 6-11.
2. Sealing of 2" pressure systems shall be SMACNA DCS Class C.
3. Rectangular duct construction shall conform to SMACNA DCS Table 1-5. Longitudinal seams for rectangular ducts shall conform to SMACNA DCS Figure 1-5.
4. Transverse joints in rectangular ducts shall be S slip joints, or factory-fabricated companion joints with recommended gaskets or sealants and bolted flange corner closures. Corner clips or other boltless corner closures will not be accepted in lieu of bolted corner closures at transverse flanged joints. Notching of corners is allowed only on small (inner) end of duct; other end of duct may have dimple for reference in breaking. Round and flat oval duct joints shall be either beaded sleeve or companion flange, meeting SMACNA DCS. After assembly, paint duct sealer into joints, at corners and wherever excessive leakage occurs.
5. When necessary to stiffen ducts against excessive deflection thumping, provide crossbreaking, beading and additional reinforcement, per SMACNA DCS Figures 1-8, 1-9 and 1-10. Crossbreaking and beading shall NOT substitute for any other specified reinforcement.
6. Wherever square elbows are shown on Contract Drawings and whenever field conditions will not permit standard radius elbows, use square elbows conforming to SMACNA DCS Figures 2-3 and 2-4. Otherwise, use standard radius duct elbows, conforming to SMACNA DCS Figure 2-2. Turning vanes up to 36" length shall be single thickness; turning vanes 36" and longer shall be double thickness.
7. Other construction and installation details shall be as shown in SMACNA DCS Figures 2-7 through 2-10, 2-16, 2-17 and 2-18.
   a. Extractors shall NOT be used at branch duct takeoffs.
   b. Straight taps shall NOT be used.
   c. Splitter dampers shall NOT be used.
   d. Button punch snap lock seams shall NOT be used in aluminum duct.

C. Hangers And Supports

1. Duct hangers and attachments shall conform to SMACNA DCS Figures 4-1 through 4-7, Table 4-1 and Table 4-2. Trapeze hangers shall use threaded rods and locknuts. Strap hangers shall NOT be used for ducts over 30" wide.
2. Ducts of size such that one person can crawl on or in duct shall be constructed and supported to hold 200 pound person at any point.
3. Provide structural supports and bracing for plenums to withstand the respective fan maximum operating pressure differential without buckling, warping, leaking, or binding of access doors. Structural supports shall be securely attached building structure. Allowable deflection shall NOT exceed limits specified in Part II of this Section.
4. Provide appropriate duct supports adjacent to access doors, fire dampers and reheat coils, at point of entry and exit to each room, and at junction. Supports shall be outside external insulation.

D. Access
1. Provide access doors in ductwork where required for inspecting, servicing, adjusting, cleaning, and observation of items installed inside ducts and plenums, including following locations:
   a. At each control device location
   b. At each fire damper location
   c. At each coil location, on each side of duct
   d. At each filter location
   e. At each location where equipment is installed in duct

E. Installation Of Thermometers And Gauges
1. Provide duct and plenum-mounted thermometers for measuring air temperature at following points in each air system. Locate thermometer and adjust viewing angle to facilitate reading by operators.
   a. Supply fan discharge
   b. Return air fan discharge
   c. Outside air intake
2. For each supply fan, each return air fan and each filter bank, provide Dwyer pressure gauge to measure total differential static pressures.

F. Installation Of Dampers And Baffles
1. In every supply, return and exhaust duct system, provide volume dampers to control and adjust total air volume of each system, each zone, each branch, each outlet and each intake.
2. Install automatic control dampers and other duct-mounted devices furnished under SECTION 25 00 00, CONTROLS.
3. Provide fire and smoke dampers as required by Code and as shown on Contract Drawings. Installation shall be according to NFPA 90A and SMACNA Fire And Smoke Installation Guide, with sleeves and with retaining angles on both sides of wall or floor. Sleeves shall be as per UL test under which damper fire rating was obtained. Angles shall be 1-1/2" by 1-1/2" by 1/8", shall completely close wall opening and shall provide independent anchorage for damper. Provide plastic breakaway clips and bolts at duct connections to fire/smoke damper sleeves.

4. Ensure that dampers are correctly installed, that frames are neither racked nor twisted, and that blades and linkages operate freely and close tightly. Provide blank-off plates when control application requires dampers smaller than duct size.
5. Assemble multiple section dampers with required interconnecting linkages. Extend shafts through ducts for externally mounted damper motors.

G. Cleaning Of Air System
1. Upon completion of construction, vacuum clean interior of air handling units and plenums to remove dirt, dust and other foreign materials.
2. Fans and air handling units shall NOT be operated for testing, balancing, temporary heat, temporary ventilation, or any other purpose, until they are cleaned and filters are installed.
3. Provide replaceable filter media and maintain filters until system is turned over to Owner. At that time, install new clean permanent filter media.
4. When fans are first operated, purge system as follows:
   a. Open access doors in supply ducts and blow out dirt and foreign matter.
   b. Close access doors and continue to blow out through supply air openings (covered with filtering media) until system is cleaned of all loose dirt and dust.
   c. If dirt and foreign matter remain after reasonable period of air purging, clean system further by whatever means are necessary to remove dirt and foreign matter.

H. Identification
1. Refer to SECTION 23 00 00 for general requirements on equipment identification.
2. Duct identification shall include function (supply, exhaust, return, outside air), identification of system or fan serving duct, and direction of air flow. Such labeling shall be adjacent to access doors, fire dampers, volume dampers, control instruments, and reheat coils; at points of entry and exit to each room; at junctions; and repeated at intervals not exceeding 25 feet in mechanical rooms and above ceilings.
3. Duct identification shall be Seton Nameplate "Ventmark" or equal.
4. Fan identification shall include direction of rotation.
5. Damper identification shall include open and closed positions.
6. Provide 1-1/2" square brass tag with black-filled legend, for each damper motor. Minimum size of legend shall be 1/4" high letters above 1/2" high numbers. Secure tags with brass jack chain or S-hooks.
7. Nameplate on air measuring station shall show model number, size, area and design air flow capacity.
8. Terminal air unit and mixing box identification shall include unit type, unit number corresponding to Contract Drawings, factory setting in cfm, unit minimum and maximum cfm. Provide permanent label adjacent to pressure balancing taps on unit exterior, giving design cfm (corresponding to Contract Drawings) and pressure differential reading at that design condition.

I. Renovation Work

1. Existing systems shall be retained and remain operable except when removed or altered as shown on Contract Drawings. Where unforeseen field conditions would render such intent impractical or impossible, request instructions from Architect/Engineer before continuing work on such systems.
2. Where existing systems are altered, abandoned or removed in part, undertake such work so as not to adversely affect operation of remaining portions of systems.
3. Finish stubs, openings, etc. as needed to prevent unsightly conditions and safety hazards. Deactivated ducts shall be removed back to active ducts so as to leave no dead ends.

END OF SECTION 23 30 00

SECTION26060
GROUNDING

PART1 -GENERAL

1.01 SCOPE

A. Designandfurnishmaterials,equipmentandlaborto install,testandcommission agroundingsystemandgroundingcircuitrytoallelementsoftheelectricalsystem installedorotherwiseconnectedtointhisContract.Allequipmentenclosuresand theraceway system,whichincludes metalconduit,liquidtightflexiblemetal conduit,expansionjoints,pullboxesandjunctionboxes, shallbebondedtoform acontinuous,conductingpermanentgroundcircuit.

1.02 RELATEDSECTIONS

A. Section26120– Wiring(600VoltsandUnder) B.

Section26130– JunctionandPullBoxes

C. Section26136–Raceways

1.03 REFERENCES

ThepublicationslistedbelowformapartofthisSpecificationtotheextentreferenced. Thepublicationsarereferredtowithinthetextbythebasicdesignationonly.

A. ASTMInternational(ASTM)

B. NationalFireProtectionAssociation(NFPA)

NFPA70(2014) NationalElectricalCodeArticle250

C. UnderwritersLaboratories,Inc.(UL)

UL467(2004) StandardforGroundingandBondingEquipment

D. InstituteofElectricalandElectronicsEngineers(IEEE)

IEEEStd.142RecommendedPracticeforGroundingofIndustrialand CommercialPowerSystems

1.04 SUBMITTALS

Submittalsshallincludethefollowing: A.

ProductDataSheets:

1. Manufacturer'scatalogproductdatasheetsshallbesubmittedforthe followingitems:
   a. GroundandBondWires
   b. BondingStrapsandJumpers
   c. GroundingandBondingConnectors d. GroundingandBondingFasteners
   e. FusionWeldKits

B. ShopDrawings:

1. InstallationdrawingsshallbesubmittedforGroundingSystemincluding completedetailsofequipmentlayoutanddesign.

C. DetailedWiringDiagrams

D. FieldTestProcedures

E. FieldTestReports

F. As-BuiltDrawings

1.05 QUALITYASSURANCE

A. TestReports:

1. TestReportsshallbesubmittedfortheGroundingSystemsinaccordance withtheNECCode.Thereportshallinclude acertified recordofground-resistance, isolationandcontinuitytestsoneachcircuit.Recordshall includethenumberandtypeofequipmentinstalledateachlocationtomeet therequiredresistance-to-groundmeasurementsspecified.

B. GroundingSystemTests:

1. ThefollowingtestsshallbeperformedbytheContractorinthepresenceof theEngineer:

a. GroundResistanceTest:

i. Groundingsystemsshallbetestedforgroundresistance.The totalresistancetogroundfromanyequipmentshallmeasurein therangeof1-5ohms.

b. ContinuityTests:

i. Continuitytestsshallbeperformedonallpowerequipmentto ensurethatthegroundterminals areproperlygrounded tothe existinggroundsystem.

PART2 -PRODUCTS

2.01 GROUNDINGANDBOND CONDUCTORS

A. GroundingandbondwiresshallbeinaccordancewithSection16120– Wiring (600VoltsandUnder)andtheContractDrawings.

2.02 GROUNDINGANDBONDINGBUSHINGS,CLAMPS,LUGSANDSTRAPS

A. Groundingandbondingconnectorsshallconformtotherequirementsof UL467. B.

Furnishgroundingbushingsmadeofsiliconbronzealloys(EverdurorDurium). Screws,partofgroundingbushingsshallbe316stainlesssteel.

C. Furnishtin-platedhigh-copperalloy,castormachined,two-hole,longbarrel compressiontypelugs.

D. Furnishtwo-hole,tin-platedcoppergroundstraps.

2.03 GROUNDINGANDBONDING FASTENERS

A. Allbolts,nuts,washers,lockwashersandassociatedfastenersusedforgrounding andbondingconnections shallbestainlesssteel.Allconnectors andfasteners suppliedshallbeofsimilarmaterial.

PART3 -EXECUTION

3.01 GROUNDING-GENERAL

A. Groundwiresinconduitandexposedoutdoorsshallbeinsulated.Allother equipmentgroundingconductors usedingroundingbushingsonconduits connectingtoequipmentenclosuresshallbebarecopper.

B. Groundwiresshallberuninalllowvoltageraceways,liquidtightflexiblemetal conduits,inaccordancewiththeContractDrawings.

C. Installcablesandstrapswithenoughslacktopreventbreakingstresses. D.

Protectgroundingconductorssubjecttomechanicaldamagebyrigidsteel conduitorothersuitablesteelguards.

E. Whererigidsteelprotectsgroundcable,permanentlygroundsteelconduitto enclosuresateachendofitslength.

F. Splicesinwireorcablegroundingconductorsareprohibited.

G. Where conduitenters or leaves any electrical enclosure with removable coverplates, provideconduitgroundingbushingsandbondingjumpersbetween thegroundingbushingsandtheenclosureframeorgroundbus.

H. Terminationofrigidconduitatallboxes,cabinetsandenclosuresshallbemade withadoublelocknutarrangementandabushing.

3.02 BONDING

A. TypeofBonds:

1. Unlessotherwisespecifiedherein,bondingofmetalsurfacesshallbe accomplishedbyclampingorstructuraljoining methods,oracombination thereof.

B. Clamping:

1. Inexternallocations,clampingshallbeusedonlywhereadisconnecttype ofconnectionisrequired.The connectiondevicemay utilizeeitherspring-loadedjawsorthreadedfasteners.

C. CleaningofBondingSurfaces:

1. Allsurfaceswhichcomprisethebondshallbethoroughlycleanedbefore joining toremovepaint,oxidesandotherresistancefilmsfromthemating surfaces.

D. BondingStrapsandJumpers:

1. Unlessotherwisespecified,bondingstrapsandjumpersshallbecopper andshallhaveacross-sectional areanotlessthanthatofaNo.6AWG copperwire.

a. Bondsshallbeaccomplishedbyclampingwithbolts.Foreachbolt, atooth-type lockwashershallbeinsertedbetweenthestrapand metallicmember.

E. BondResistance:

1. Resistanceof anybondshallbetestedin accordancewithSubpart1.05B, GroundingSystemTests.Bondsthatfailtosuccessfully complytotest parametersshallbereworkedbytheContractoratnoadditionalcosttothe Authority.

F. EnclosureBonding:

1. Allboxesandcabinetsshallbebondedtoground.Atleastonecopper connection shallbemadefromthesystemgroundpointtooneormore enclosures inthearea suchthatallenclosures andequipment,when properlybondedtogether,providea lowimpedancepathtoground.

G. BondingofConduitandRacewaySystems:

1. Metalconduit,fittings,junctionboxes,outletboxes,armoredandmetal-sheathedcable,andotherracewaysshallbebonded.Careshallbetaken toensureadequateelectricalcontactatthejointsandterminations.

H. ProtectionofFinishedBonds:

1. Finishedbondsshallbeprotectedbypaintingtomatchtheoriginalfinish afterabondismade.

PART4 -MEASUREMENTANDPAYMENT

A. TheworkofthisSectionwillnotbemeasuredforpayment.

B. Noseparatepaymentwillbemadefortheworkofthis Section.Allcostsofalllabor, materialsandequipmentnecessarytocomplete thisworkinaccordancewiththe Contractdocuments.

ENDOFSECTION

SECTION26120
WIRING(600VOLTSANDUNDER)

PART1 -GENERAL

1.01 SCOPE

A. SectionIncludes:

1. Cables
2. Splices
3. Terminations

1.02 RELATEDSECTIONS

A. Section26060–Grounding

B. Section26130– JunctionandPullBoxes

C. Section26136–Raceways

D. Section26500– Lighting

1.03 REFERENCES

Thefollowingisalistingofthepublicationsreferencedinthis Section:

A. AmericanSocietyforTestingandMaterials(ASTM)

ASTMB 1 Hard-DrawnCopperWire
ASTMB 2 Medium-Hard-DrawnCopperWire
ASTMB 3 SoftorAnnealedCopperWire
ASTMB33 TinnedSoftorAnnealedCopperWireforElectricalPurposes
ASTMB174Bunch-StrandedCooperConductorsforElectricalConductors

B. InsulatedCableEngineersAssociation(ICEA) C.

NationalFireProtectionAssociation(NFPA)

NFPA70 NationalElectricalCode(NEC) D.

NationalElectricalTestingAssociation(NETA)

AcceptanceTestingSpecificationsforElectricalPowerDistributionEquipment andSystems

E. UnderwritersLaboratories,Inc.(UL)

UL62 FlexibleCordandFixtureWire
UL467 GroundandBondingEquipment
UL854 Service-EntranceCables
UL1581 ReferenceStandardforElectricalWires,CablesandFlexible Cords

1.04 SUBMITTALS

A. ProductData:Catalogsheets,specificationsandinstallationinstructions. B.

Samples:

1. One12”min.sampleofeachproduct

C. Certificatesas required

PART2 -PRODUCTS

2.01 INSULATEDCONDUCTORS

A. DateofManufacture:Noinsulatedconductormorethanoneyearold,when deliveredtothesite,willbeacceptable.

B. AcceptableManufacturers:

1. GeneralCable
2. Kerite
3. Okonite
4. AIWC
5. OrEngineerapprovedequal.

C. Conductors: Annealed uncoated copper or annealed coated copper in conformance withtheapplicablestandardsforthetypeofinsulationshallbe appliedontheconductor.ConductorSizesNo.8andlargershallbestranded.

D. Types:

1. TypeRHH,RHW-2/USE-2,VW-1–Composite600Vcopperconductor consistingofethylenepropolylene rubberinsulationwithajacketof thermosettingchlorosulfanated polyethyleneorHypalon®meeting ICEA/NEMAS-95-659/NEMA WC670andlistedtoUL-44andUL-854; Rating90ºCdryorwet.

2.02 CONNECTORS

A. General:Connectorsspecifiedarepartofasystem.Furnishconnectorsand components,andusespecifictoolsandmethods asrecommendedbyconnector manufacturertoformcompleteconnectorsystem.

B. Splices:

1. SpringType,Rating105DegreesCand600V:Amerace Corp.ElastimoldDiv.’sBuchananBCapElectricalProductsDi v./3M’sScotchlokTypeY,R,GorBIdealIndustriesInc.’sWing Nuts
   Thomas&BettsCorp.’sPiggies
   KingSafety60000Series,orEngineerapprovedequal.
2. IndentTypewithInsulatingJacket,Rating105DegreesCand600V:

AmeraceCorp.ElastimoldDiv.'sBuchananPressureConnectors
IdealIndustriesInc.'sCrimpConnectors
Thomas&BettsCorp.'sSTAKON.

C. Terminals:Nyloninsulatedpressureterminalconnectorsasmanufacturedby:

1. AmpSpecialIndustries,BurndyCorp.
IdealIndustriesInc.
PanduitCorp.
Thomas&BettsCorp.
WiremoldCo.,orEngineerapprovedequal. D.

Lug:

1. SingleCable(CompressionTypeLugs):Copper,oneortwoholestyle (#2andlarger),longbarrel
BurndyCorp.'sHylugYA
IdealIndustriesInc.'sCCBorCCBL
OrApprovedEqual

Thomas&BettsCorp.'sLocktiteSeries,orEngineerapprovedequal.
2. SingleCable(#2andlarger).Copper,twoholestyle(tosuitconditions);
BurndyCorp.'sQuicklugSeries
Thomas&BettsCorp.'sLocktiteSeries,orEngineerapprovedequal.
OrApprovedEqual

2.03 TAGS

A. Stainlesssteeltags.

PART3 -EXECUTION

3.01 INSTALLATION

A. Installconductorsinracewaysaftertheracewaysystemiscompletedinspecific workareas.

B. Installconductorsinoutsideandunderground racewaysafterracewaysystemis completed.

C. Allconduitsshallbecleanedwithamandrel(1/2"lessthandiameterofconduit) priortoinstallingnewcables.Usepolyethylene lineormanilaropeaspullwires wheninstallingconductorsinconduits.

D. Innocaseshallthebendingradius ofanywireexceedeight(8)timestheoverall diameter,perNEC.

3.02 CIRCUITING

A. Donot change,grouporcombinecircuitsotherthan asindicatedontheContract Drawings.

B. PhaseRelationship:Connectfeederstomaintainphaserelationshipanddirection ofrotation through system.Phaselegsoffeeders shallmatchbusarrangements inequipment towhichthefeederareconnected. TheContractor shallbe responsible totestexistingphasesequencewithphasesequencemeterand record.

3.03 COMMONNEUTRALCONDUCTOR

A. Acommonneutralconductormaybeusedforbranchcircuitswherethecircuits areindicatedontheContractDrawingstobeenclosedwithinthesameraceway.

3.04 CONDUCTORSIZE

A. InstallconductorsofsizeshownonContractDrawings.Wheresizeisnotindicated forbranchcircuitwiring,theminimumsize allowedisNo.12AWG.Wheresizeis notindicatedforcontrolwiring,theminimumsizeallowedisNo.14AWG.

B. Terminations:

1. ForConductorsNo.10AWGorsmaller:Useterminals for:
   a. Connectingcontrolandsignalwiringtoterminalstrips.
   b. Connectingwiringtoequipmentdesignedforusewith terminals.

2. ForConductorsNo.8AWGorlarger:Usecompressionormechanical typelugsfor:
   a. Connectingcablestoflatbusbars.
   b. Connectingcablestoequipmentdesignedforusewithlugs.

3.05 CABLEINSULATIONTEST(600VOLTSORLESS)

A. Allfeedersshallbetestedforproperphasingafterinstallationandshallbemegger testedwitha1000voltmeggerbeforebeingplacedinservice.Testsshallindicate aninsulationresistancesatisfactorytotheEngineer.Insulationtestsoneachcable withrespecttogroundandadjacentcables.

B. Such testing maynotbestarteduntilallintermediatespliceshave been made up andtestedandallservicefeedersarecompletely installed.Uponsuccessful completionofthesetests,thecableterminationsmaybemade.

C. Allsecondarycablesshallbetestedforproperphasing.

D. Allcablesinconduitshallberuncontinuouslywithoutsplices. E.

Performcontinuityteststoinsurepropercableconnections.

F. VisualandMechanicalInspection:

1. Cablestobeinspectedforphysicaldamageandproperconnectionin accordancewithsinglelinediagram.
2. Cableconnectionshallbetorquetestedtomanufacturer'srecommended values.

G. ElectricalTests:

1. Performinsulationresistancetestoneachcablewithrespecttoground andadjacentcables.
2. Performcontinuitytesttoinsurepropercableconnection. H.

TestValues:

1. Insulationresistancetestsshallbeperformedat1000voltsD.C.forone minute.TestproceduretoconformtoNETAinspectionandtestprocedures 7.3.Insulationresistance readingshouldbemadeandinterpreted byan experienced testingspecialisttodeterminethe conditionofthecable's insulation.

I. Submitwrittenstatementoftheprocedurebeforeperformingeachoftheabove tests.Insulation resistance reporttobesimilarinformattoBiddleInsulation Resistance TestingReportCardforeachcircuitandindicatetheresultsofeach test,applied voltageandtestduration. Afterthetestshavebeenmade,submit completecertifiedwrittenresults.

PART4 -MEASUREMENTANDPAYMENT

A. TheworkofthisSectionwillnotbemeasuredforpayment.

B. Noseparatepaymentwillbemadefortheworkofthis Section.Allcostsofalllabor, materialsandequipmentnecessarytocomplete thisworkinaccordancewiththe Contractdocuments.

ENDOFSECTION

SECTION26130
JUNCTIONANDPULLBOXES

PART1 -GENERAL

1.01 SCOPE

A. BoxescoveredinthisSectionInclude:

1. PullBoxes
2. JunctionBoxes

B. Conduitbodies,exceptforsmallsizes,arenotcoveredinthisSection.Conduit bodiesareotherwise treatedas“fittings”andarecoveredunder“RACEWAYS”, Section16136.

1.02 RELATEDSECTIONS

A. Section26060–Grounding

B. Section26120– Wiring(600VoltsandUnder) C.

Section26136– Raceways

1.03 REFERENCES

Thefollowingisalistingofthepublicationsreferencedinthis Section: A.

NationalElectricalManufacturersAssociation(NEMA)

B. NationalFireProtectionAssociation(NFPA)

NFPA70NationalElectricalCode(NEC)

C. UnderwritersLaboratories,Inc.(UL)

1.04 SUBMITTALS

A. ProductData:Catalogsheets,specificationsandinstallationinstructions.

B. Samples:oneforeachproductifdifferentfromcompanyorcatalognumber specified.

PART2 -PRODUCTS

2.01 JUNCTIONANDPULLBOXES

A. GalvanizedSteelJunctionandPullBoxes:Codegauge,steel,screwcoverboxes asmanufactured byGrayMetalProducts,Inc.,HoffmanEngineeringCo., KeystoneColumbia,Inc.,QueenProductsCo.,Inc.,orEngineerapprovalequal.

B. ThreadedTypeBoxes:MalleableironwithPVCcoatedfinishforusewithPVC coatedsteelconduit,asmanufactured byAppletonElectricCo.,Hubbell-Killark, OZ/GedneyCo.Type‘FD’orapprovedequal.

C. Castironpullboxes/junctionboxesshallbewatertightandrain-tight.Boxesshall be hopdip galvanizedprovided with cover and stainless steel screws and neoprene gasket.BoxesshallbeULcertifiedtype4E-18095andE-24824and shallconformtoUL514A,50,NEMA4.Minimumwallthicknessshallbe¼-inch.

PART3 -EXECUTION

3.01 PREPARATION

A. Beforeproceedingwiththeinstallationofjunctionandpullboxes,checkthe locationswiththeEngineerforapproval.

3.02 INSTALLATION

A. BoxesforConduitSystem:

1. Usethreadedtypeboxeswithexternalmountinglugs.
2. Providestructuralsteelsupports,railings,etc.requiredtoinstallpull boxes.
3. Installpullboxwithgroundedconduitbushings,identificationsignage,all hardware,etc.

PART4 -MEASUREMENTANDPAYMENT

A. TheworkofthisSectionwillnotbemeasuredforpayment.

B. NoseparatepaymentwillbemadefortheworkofthisSection.Allcostsofalllabor, materialsandequipmentnecessarytocompletethisworkinaccordancewiththe Contractdocuments.

ENDOFSECTION

SECTION26136
RACEWAYS

PART1 -GENERAL

1.01 SCOPE

A. SectionIncludes:

1. Raceways:
   a. Immediate Metalconduit(IMC)
   b. Liquidtightflexiblemetalconduit(LFMC)

1.02 RELATEDSECTION

A. Section26060– Grounding

B. Section26120– Wiring(600VoltsandUnder)

1.03 REFERENCES

A. AmericanNationalStandardsInstitute(ANSI)

B. NationalElectricalManufacturersAssociation(NEMA) C.

NationalFireProtectionAssociation(NFPA)

NFPA70 NationalElectricalCode(NEC) D.

UnderwritersLaboratories,Inc.(UL)

E. NationalElectricalContractorsAssociation– NECA101-2001

1.04 SUBMITTALS

A. ProductData:Catalogsheets,specificationsandinstallationinstructions.

B. Samples: Oneforeachproductifdifferentfromcompanyorcatalognumber specified.

C. Certificatesper requirement.

1.05 QUALITYASSURANCE

A. Itemsprovidedunderthissectionshallbelistedorlabeledby ULorother NationallyRecognizedTestingLaboratory(NRTL). B.

RegulatoryRequirements:

1. NationalElectricalCode(2020Edition) with CT Amendments: Componentsandinstallation shallcomplywithNFPA70.

C. ComplywithNECA“StandardofInstallation.”

PART2 -PRODUCTS

2.01 METALCONDUITANDTUBING

A. Intermediate MetalConduit:UL6andNEMARN1.

B. LiquidtightFlexibleSteelConduit,NECTypeLFMC:UL360,with105ºC.rating.

2.02 FITTINGS

A. Fittingsformetalconduits:

1. Castaluminumormalleableironwithgalvanizedfinish.
2. Syntheticinsertsforsealingorinsulationasrequired.

B. Conduitbodies:

1. Malleableironwithgalvanizedfinish. C.

Fittingsforliquidtightflexiblemetal conduit:

1. Insulatedthroattype.
2. Onepiecesealing“O”ringswithconnectorswhenenteringboxesor enclosures.

2.03 RACEWAYSMANUFACTURERS

A. Intermediate MetalConduit:Steelhotdippedgalvanizedontheoutsideand inside,asmanufacturedbyAlliedTube&ConduitCorp.,WheatlandTubeCo.or Engineerapprovedequal.

B. Liquid-tightFlexibleMetalConduit:ULcategorizedasliquid-tightflexiblemetal conduit(identified onULListingMarkasLiquid-TightFlexible Metalconduit,also specificallymarkedwithtemperature andenvironment applicationdata),byAFC CableSystems,Inc.,AnametEletrical,Inc.,Electri-Flex Co.,orUniversalMetal HoseCo.

2.04 FITTINGSANDACCESSORIESMANUFACTURERS

A. InsulatedBushings:

AppletonElectricCo.’sBU501Series
MidwestElectricMfg.Corp.’s1031Series
OZ/GedneyCo.’sIBCSeries
RacoInc.’s1132Series
Thomas&BettsCorp.’s1222Series
orEngineerapprovedequal.

B. PlasticBushingsfor¾-InchConduit:

AppletonElectricCo.’sBBU50,BBU75

MidwestElectricMfg.Corp.'s931,932
OZ/GedneyCo.'sIB-75
RacoInc.'s1402,1403
Thomas&BettsCorp.'s222,223
orEngineerapprovedequal.

C. InsulatedGroundingBushings:

AppletonElectricCo.'sGIB-50Series
MidwestElectricMfg.Corp.'sGLLSeries
OZ/GedneyCo.'sIBC-L-BCSeries
RacoInc.'s1212Series
Thomas&BettsCorp.'s3870Series
orEngineerapprovedequal.

D. ConnectorsandCouplings:

1. Locknuts:

AppletonElectricCo.'sBL-50Series
MidwestElectricMfg.Corp.'s10Series
OZ/GedneyCo.'s1-50SSeries
RacoInc.'s1002Series
Thomas&BettsCorp.'s141Series
orEngineerapprovedequal.

2. GroundingWedge:

Thomas&BettsCorp.'s3650Series
orEngineerapprovedequal.

E. ConduitBodies(Threaded):

1. MalleableIron/ZincElectroplate:Zincelectroplatemalleableironbodies withzincelectroplatesteelcovers:

AppletonElectricCo.'sUnilets
Crouse-HindsCo.'sCondulets
OZ/GedneyCo.'sConduitBodies
orEngineerapprovedequal.

F. ExpansionFittings:

1. HotDippedGalvanizedwithPolyurethaneCoatedFinish:

AppletonElectricCo.'sXJG
Crouse-HindsCo.'sXJG
MidwestElec.Mfg.Corp.'sXJG
OZ/GedneyCo.'sAX
orEngineerapprovedequal.

2. HotDippedGalvanizedFinish:

OZ/GedneyCo.'sAX
orEngineerapprovedequal.

PART3 -EXECUTION

3.01 EXAMINATION

A. Examinesurfaces toreceiveraceways,wirewaysandfittingsforcompliancewith installationtolerancesandotherconditionsaffectingperformance ofraceway system.

B. Coordinatelayoutandinstallationofracewayandboxeswithotherconstruction elementstoensureadequateheadroom,workingclearanceandaccess.

3.02 WIRINGMETHODS

A. Outdoors,DamporWetLocations: Usethefollowingwiringmethodsunless otherwisenotedontheContractDrawings:

1. Exposed:PlasticCoatedgalvanizedrigidsteel.
2. Concealed:Galvanizedrigid steel.

B. UnlessspecificallyindicatedotherwiseontheContractDrawings,usegalvanized rigidsteel.

3.03 INSTALLATION

A. Providewatertightconduitsystemwhereinstalledinwetplaces,undergroundor whereburiedinmasonryorconcrete.

1. Usethreadedhubswhenenteringtopofenclosures.
2. Usesealingtypelocknutswhenenteringsidesorbottomofenclosures.

B. Installracewayslevelandsquareandatproperelevations.Provideadequate headroom.

C. Completeracewayinstallationbeforestartingconductorinstallation. D.

Supportracewayasrequired.

E. Joinracewayswithfittingsdesignedandapprovedforpurposeandmakejoints tight.

1. Useinsulatingbushingstoprotect conductors.

F. Terminations:Whereracewaysareterminatedwithlocknutsandbushings,align racewaytoentersquarelyandinstalllocknuts withdishedpartagainstbox.Use twolocknuts,one(1)insideandone(1)outsidebox.Useinsulating bushings. Provideinsulatedgroundingbushingstoterminategroundwire.

G. Whereterminatinginthreadedhubs,screwracewayorfittingtightintothehubso endbearsagainstwireprotection shoulder. Wherechasenipplesareused,align raceway socouplingissquaretoboxandtightenchasenipplesonothreadsare exposed.

H. Installpullwiresinemptyraceways.Usemonofilamentplasticlinehavingnotless than 200 pound(90 kg)tensilestrength.Leavenotless than 12inches(300 mm) ofslackateachendofpullwire.

I. ConduitInstalledExposed:

1. Installverticalrunsperpendiculartothefloor.
2. Installhorizontalrunsparalleltothefloor.
3. Installconduittighttothesurfaceofthebuilding construction.

J. ConduitBends:For¾-inchconduits,bendsmaybemadewithmanualbenders. Forallconduitsizeslargerthan¾-inch,manufacturedorfieldfabricatedoffsetsor bends,shallbeused.Makefieldfabricated offsetsorbendswithanapproved hydraulicbender.

K. RacewaysExposedtoDifferentTemperatures:Whereportionsofaninterior raceway systemareexposedtowidelydifferenttemperatures,sealracewaywith expanding siliconefoamtopreventcirculation ofairfromawarmertoacolder sectionthroughtheraceway.

L. MaterialsinConduitRuns:Allconduitsandfittingsinaconduitrunshallbeofthe samematerial.Acombinationofferrousandnon-ferrousconduitorfittingswillnot be permitted.

3.04 CONDUITSTUB-UPS

A. Protectstub-upsfromdamagewhereconduitspenetratetunnelliner.

B. Stub-UpConnections:Extendconductorstoequipmentwithrigidsteelconduit; flexiblemetalconduit maybeusedstarting at6inches(150mm)fromfaceof tunnelliner.

3.05 CONDUITBENDS

A. Makebendsandoffsetssoinsidediameterisnotreduced.Unlessotherwise indicated,keeplegsofbendinsameplaneandstraightlegsofoffsetsparallel.

B. Providelargeradiuselbowsforall conduitbendsunlessotherwisenoted.

3.06 FLEXIBLECONNECTIONS

A. Usemaximumof6feet(1830mm)offlexibleconduitforlowvoltagetransformers. B.

Useliquidtightflexibleconduitinwetordamp locations.

C. Installseparategroundconductorinsideflexibleconduitconnections.

3.07 FITTINGS

A. Installracewaysealingfittingsaccordingtomanufacturer'swritteninstructions. B.

Useracewayfittingscompatiblewithracewayandsuitableforuseandlocation.

C. Install automaticbreather drain fittings according to manufacturer's written instructions.

3.08 GROUNDING

A. GroundinaccordancewithNECCode.

B. Providegroundingconnectionsforraceways,boxesandcomponentsasindicated and instructedby manufacturer.Tightenconnectorsand terminals,including screws and bolts, according to equipment manufacturer'spublished torque-tighteningvaluesforequipmentconnectors.

PART4 -MEASUREMENTANDPAYMENT

A. TheworkofthisSectionwillnotbemeasuredforpayment.

B. NoseparatepaymentwillbemadefortheworkofthisSection.Allcostsofalllabor, materialsandequipmentnecessarytocompletethisworkinaccordancewiththe Contractdocuments.

ENDOFSECTION

SECTION26500
LIGHTING

PART1 -GENERAL

1.01 SCOPE

DesigningandInstallationofratedluminaries,asshowninthecontract documentsanddescribedherein.

1.02 RELATEDSECTIONS

A. Section26120– Wiring(600VoltsandUnder) B.

Section26130– JunctionandPullboxes

C. Section26136-Raceways

1.03 REFERENCES

A. AmericanNationalStandardsInstitute(ANSI)

B. EN60.529/IEC529EnclosureDegreesofProtection C.

IESNAClassificationSystemforIndoorLuminaries.

UL486Aand486BWireConnectors

1.04 QUALITYASSURANCE

A. Allfixturessubmittedshallbemanufacturedforthelamptype,sizeandpurpose withoutmajormodification.

1.05 SUBMITTALS

A. ProductPhotometricData,CatalogCuts,SpecificationsandInstallation

Instructions:

1. ShopDrawingsarerequiredforall luminaries,mountinghardware, ballastsandfuses.

B. Samples:Oneofeachproduct,ifdifferentfromcompanyorcatalognumber specified,istobedeliveredtotheEngineer’s officeandpickedupwhenthe EngineerhascompletedhisevaluationatnoadditionalcosttotheAuthority.

1.06 PERMITS

A. TheContractorshallberesponsibletoobtainpermitsrequired.

PART2 -PRODUCTS

2.01 GENERAL

A. Theuseofmanufacturernamesandcatalognumbersaretobeusedasaguide toestablishtype,qualityandperformancerequirementsdesired.Samplesofany luminary shallbefurnishedwhenrequested bytheEngineer.Fixturesshallbe installedwithlampsby theContractor.

B. The Engineerhas the right to reject any submittalsof lighting fixtures and components thatareincomplete forathoroughreview.Thetunnellightfixtures shallbeweatherprotectedsuitableforinstallationinwetlocations,durable,energy efficientandeasilymaintained.Protectivelensesandsafetyguardsshallbe used foralllluminaries.Allfixturesshallbesuitableforoperationatinterior temperatures.

2.02 LUMINARIES

A. Lightingshallcomplywith:

1. Lithonia 1'X 4' LED wrap around Model LBL4 LP840 4600LM 4000K with pendant ceiling mount kit for eachorequalfixture asapproved by the school facilities manager

2. NECcompliant:Section410.4CorrosionControland410.15Luminaries supports.

PART3 -EXECUTION

3.01 INSTALLATION

A. B. LuminaryMounting:

1. Furnish,mountandwireluminariescompletewithlampsas indicatedontheContractDrawingsandasspecifiedherein.

C. Grounding:

1. Provideaninsulatedcopperequipmentgroundingconductor(samesize asphaseconductors)installedwithintheconduit.
2. Bondsteelconduittotheequipmentgroundingconductor.

3.02 TESTINGANDMEASUREMENTS

A. Providenecessarypersonnelandmaterialtodemonstratetotheengineerthatthe properluminanceandillumination levelsaremetinaccordancewithIESNA LightingMeasurementsLM-50-99 PhotometricMeasurementsofTunnelLighting Installations.

END OF SPECIFICATIONS

TOWN OF CHESHIRE, CONNECTICUT

INSURANCE REQUIREMENTS FOR
Regenerator ERV Installation At CHS

PROPOSAL#2223-12

Vendor shall maintain in force at all times during which services are to be performed by vendor, or such longer period as provided by contract, the following coverages placed with company(ies) licensed by the State of Connecticut which have at least an "A-" VIII policyholders rating according to A.M. Bests latest edition Key Rating Guide. The stated policy limits are the minimum coverage amounts required.

		Minimum Limits
General Liability*	Each Occurrence	$1,000,000
	General Aggregate	$2,000,000
	Products/Completed Operations Aggregate	$2,000,000
Auto Liability*	Combined Single Limit Each Accident	$1,000,000
Umbrella* (Excess Liability)	Each Occurrence Aggregate	$1,000,000 $1,000,000

* The Town of Cheshire, and its Board of Education shall be named as "Additional Insured".

Coverage is to be provided on a primary, noncontributory basis. Wavier ofsubrogation to be provided. Higher limits may be required, based on the scope and nature of the services to be provided. If higher limits are required, such limits shall be identified in the Request for Proposal of Invitation to Bid, as well as in the contract issued by the Town. The Town reserves the right to require additional coverages, including, without limitation, Builder's Risk insurance for construction projects and Owner's Protective Liability insurance, if desirable.

If any policy is written on a "Claims Made" basis, the policy must be continually renewed for a minimum of two (2) years from the completion date of this contract. If the policy is replaced and/or the retroactive date is changed, then the expiring policy must be endorsed to extend the reporting period for claims for the policy in effect during the contract for two (2) years from the completion date.

Workers' Compensation and	WC Statutory Limits	
Employers' Liability	EL Each Accident	$500,000
	EL Disease Each Employee	$500,000
	EL Disease Policy Limit	$500,000

Original, completed Certificates of Insurance must be presented to the Town's Purchasing Agent prior to purchase order issuance and contract execution. Vendor agrees to provide replacement/renewal certificates at least 60 days prior to the expiration of the policy. Should any of the above described policies be cancelled before the expiration date, written notice must be provided to the Town 30 days prior to cancellation. Failure to maintain required insurance coverage shall be a material default of vendor's contract with the Town.

END OF INSURANCE REQUIREMENTS

TOWN OF CHESHIRE, CONNECTICUT

PROPOSAL FORM
Regenerator ERV Installation At CHS

PROPOSAL#2223-12

PROPOSER'S FULL LEGAL NAME: .....

Pursuant to and in full compliance with the RFP, the undersigned proposer, having visited the site or property if applicable, and having thoroughly examined each and every document comprising the *RFP,* including any addenda, hereby offers and agrees as follows:

To provide the products and/or services specified in, and upon the terms and conditions of, the RFP for the total sum of_____
---------'--"/100 Dollars (write out in words) ($_____),

ACKNOWLEDGEMENT

In submitting this Proposal Form, the undersigned proposer acknowledges that the price(s) include all labor, materials, transportation, hauling, overhead, fees and insurances, bonds or letters of credit, profit, security, permits and licenses, and all other costs to cover the completed work called for in the RFP. Except as otherwise expressly stated in the RFP, no additional payment of any kind will be made for work accomplished under the price(s) as proposed.

REQUIRED DISCLOSURES

a. Exceptions to the RFP

_____This proposal does not take exception to any requirement of the RFP, including but not only any of the Contract Terms set forth in Section 26 of the Standard Instructions to Proposers.

b. State Debarment List

Is the proposer on the State of Connecticut's Debarment List?

___ YES
____ NO

c. Occupational Safety and Health Law Violations

Has the proposer or any firm, corporation, partnership or association in which i.t has an interest (1) been cited for three (3) or more willful or serious violations of any occupational safety and health act or of any standard, order or regulation promulgated pursuant to such act, during the three-year period preceding the proposal (provided such violations were cited in accordance with the provisions of any state occupational safety and health act or the Occupational Safety and Health Act of 1970, and not abated within the time fixed by the citation and such citation has not been set aside following appeal to the appropriate agency or court having jurisdiction) or (2) received one or more criminal convictions related to the injury or death of any employee in the three-year period preceding the proposal?

--- Yes
--- No

If "yes," attach a sheet fully describing each such matter.

d. Arbitration/Litigation

Has either the proposer or any of its principals (regardless of place of employment) been involved for the most recent ten (10) years in any resolved or pending arbitration or litigation?

--- Yes
--- No

If "yes," attach a sheet fully describing each such matter.

e. Criminal Proceedings

Has the proposer or any of its principals (regardless of place of employment) ever been the subject of any criminal proceedings?

--- Yes
--- No

If "yes," attach a sheet fully describing each such matter.

f. Has the proposer failed to complete work awarded to it or been declared in default in the past 5 years?

g. Ethics and Offenses in Public Projects or Contracts

Has either the proposer or any of its principals (regardless of place of employment) ever been found to have violated any state or local ethics law, regulation, ordinance, code, policy or standard, or to have committed any other offense arising out of the submission of proposals or bids or the performance of work on public works projects or contracts?

--- Yes
--- No

If "yes," attach a sheet fully describing each such matter.

NOTE: THIS DOCUMENT, IN ORDER TO BE CONSIDERED A VALID PROPOSAL, MUST BE SIGNED BY A PRINCIPAL OFFICER OR OWNER OF THE BUSINESS ENTITY THAT IS SUBMITTING THE PROPOSAL. SUCH SIGNATURE CONSTITUTES THE PROPOSER'S REPRESENTATIONS THAT IT HAS READ, UNDERSTOOD AND FULLY ACCEPTED EACH AND EVERY PROVISION OF EACH DOCUMENT COMPROMISING THE RFP, UNLESS AN EXCEPTION IS DESCRIBED ABOVE. PROPOSER AGREES THAT IT WILL SIGN CONTRACT PROVIDED BY THE TOWN, WITHOUT MODIFICATIONS OR ALTERATIONS, WITHIN FIVE (5) DAYS OF AWARD.

BY..... TITLE:.....
(PRINT NAME)

DATE:.....

(SIGNATURE)

END OF PROPOSAL FORM

TOWN OF CHESHIRE, CONNECTICUT

PROPOSER'S LEGAL STATUS DISCLOSURE

Please fully complete the applicable section below, attaching a separate sheet if you need additional space.

For purposes of this disclosure, "permanent place of business" means an office continuously maintained, occupied and used by the proposer's regular employees regularly in attendance to carry on the proposer's business in the proposer's own name. An office maintained, occupied and used by a proposer only for the duration of a contract will not be considered a permanent place of business. An office maintained, occupied and used by a person affiliated with a proposer will not be considered a permanent place of business of the proposer.

IF A SOLELY OWNED BUSINESS:

Proposer's Full Legal Name _____

Street Address

Mailing Address (if different from Street Address)_____

Owner's Full Legal Name _____

Number of years engaged in business under sole proprietor or trade name_____

Does the proposer have a "permanent place of business" in Connecticut, as defined above?

Yes ____ No

If yes, please state the full street address (not a post office box) of that "permanent place of business."

IF A CORPORATION:

Proposer's Full Legal Name _____

Street Address _____

Mailing Address (if different from Street Address)_____

Owner's Full Legal Name _____

Number of years engaged in business _____

Names of Current Officers

President Secretary Chief Financial Officer

Does the proposer have a "permanent place of business" in Connecticut, as defined above?

Yes No

If yes, please state the full street address (not a post office box) of that "permanent place of business."

IF A LIMITED LIABILITY COMPANY:

Proposer's Full Legal Name _____

Street Address _____

Mailing Address (if different from Street Address)_____

Owner's Full Legal Name _____

Number of years engaged in business _____

Names of Current Manager(s) and Member(s) ·

Name & Title (if any)	Residential Address (street only)
Name & Title (if any)	Residential Address (street only)
Name & Title (if any)	Residential Address (street only)
Name & Title (if any)	Residential Address (street only)
Name & Title (if any)	Residential Address (street only)

Does the proposer have a "permanent place of business" in Connecticut, as defined above?

Yes _____ No _____

If yes, please state the full street address (not a post office box) of that "permanent place of business."

IF A PARTNERSHIP:

Proposer's Full Legal Name _____

Street Address _____

Mailing Address (if different from Street Address)_____

Owner's Full Legal Name _____

Number of years engaged in business_____

Names of Current Partners

Name & Title (if any)	Residential Address (street only)
Name & Title (if any)	Residential Address (street only)
Name & Title (if any)	Residential Address (street only)
Name & Title (if any)	Residential Address (street only)

Does the proposer have a "permanent place of business" in Connecticut, as defined above?

Yes ____ No

If yes, please state the full street address (not a post office box) of that "permanent place of business."

****

Sign on the next page

Proposer's Full Legal Name

(print)
Name and Title of Proposer's Authorized Representative

(signature)
Proposer's Representative, Duly Authorized

Date

END OF LEGAL STATUS DISCLOSURE FORM

TOWN OF CHESHIRE, CONNECTICUT

PROPOSAL #2223-12
Regenerator ERV Installation At CHS

PROPOSER'S CERTIFICATION
Concerning Equal Employment Opportunities
And Affirmative Action Policy

I/we, the proposer, certify that:

1) I/we are in compliance with the equal opportunity clause as set forth in Connecticut state law (Executive Order No. Three, http://www.cslib.org/exeorder3.htm).

2) I/we do not maintain segregated facilities.

3) I/we have filed all required employer's information reports.

4) I/we have developed and maintain written affirmative action programs.

5) I/we list job openings with federal and state employment services.

6) I/we attempt to employ and advance in employment qualified handicapped individuals.

7) I/we are in compliance with the Americans with Disabilities Act.

8) I/we (check one):
have an Affirmative Action Program, or

employ 10 people or fewer.

9) I/we have read and understand the RFP Documents and all addenda and our proposal has been made on the basis thereof.

Legal Name of Proposer

(signature)
Proposer's Representative, Duly Authorized

Name of Proposer's Authorized Representative

Title of Proposer's Authorized Representative

Date

TOWN OF CHESHIRE, CONNECTICUT

PROPOSER'S NON COLLUSION AFFIDAVIT

PROPOSAL FOR:

PROPOSAL NUMBER:

The undersigned proposer, having fully informed himself/herself/itself regarding the accuracy of the statements made herein, certifies that:

(1) the proposal is genuine; it is not a collusive or sham proposal;
(2) the proposer developed the proposal independently and submitted it without collusion with, and without any agreement, understanding, communication or planned common course of action with, any other person or entity designed to limit independent competition;
(3) the proposer, its employees and agents have not communicated the contents of the proposal to any person not an employee or agent of the proposer and will not communicate the proposal to any such person prior to the official opening of the proposal; and
(4) no elected or appointed official or other officer or employee of the Town of Cheshire is directly or indirectly interested in the proposer's proposal, or in the supplies, materials, equipment, work or labor to which it relates, or in any of the profits thereof.

The undersigned proposer further certifies that this affidavit is executed for the purpose of inducing the Town of Cheshire to consider its proposal and make an award in accordance therewith.

Legal Name of Proposer

(signature)
Proposer's Representative, Duly Authorized

Name of Proposer's Authorized Representative

Title of Proposer's Authorized Representative

Date

Subscribed and sworn to before me this ____ day of_____, 20___.

Notary Public
My Commission Expires:

TOWN OF CHESHIRE, CONNECTICUT

PROPOSAL #2223-12

Regenerator ERV Installation At CHS

PROPOSER'S STATEMENT OF REFERENCES

Provide at least three (3) references:

1. BUSINESS NAME.....

   ADDRESS.....

   CITY, STATE

   TELEPHONE:

   INDIVIDUAL CONTACT NAME AND POSITION _ _ _ _ _ _ _ _ _ _

2. BUSINESS NAME.....

   ADDRESS_____

   CITY, STATE_____

   TELEPHONE:

   INDIVIDUAL CONTACT NAME AND POSITION _ _ _ _ _ _ _ _ _ _

3. BUSINESS NAME.....

   ADDRESS_____

   CITY, STATE

   TELEPHONE:

   INDIVIDUAL CONTACT NAME AND POSITION _ _ _ _ _ _ _ _ _ _

END OF STATEMENT OF REFERENCES

CONTRACT FOR *Regenerator ERV Installation At CHS*

This Contract is made as of the____ day of _____, 20___ (the "Effective Date"), by and between the Town of Cheshire, 84 South Main Street, Cheshire, Connecticut, a municipal corporation organized and existing under the laws of the State of Connecticut (the "Town"), and ***[name and address of successful proposer/*** (the "Contracting Party")-

RECITALS:

WHEREAS, the Town has issued a Request for Proposals for ***the removal of old unit ventilators and provide rooftop air handling units to improve indoor air quality in the classrooms though ventilation heating and cooling and related construction.***

(the "RFP"), a copy of which, along with any addenda, is attached as Exhibit A;

WHEREAS, the Contracting Party submitted a proposal to the Town dated _____ (the "Proposal"), a copy of which is attached as Exhibit B;

WHEREAS, the Town has selected the Contracting Party to perform the Work (as defined in Section 1 below); and

WHEREAS, the Town and the Contracting Party desire to enter into a formal contract for the performance of the Work.

NOW THEREFORE, in consideration of the recitals set forth above and the parties' mutual promises and obligations contained below, the parties agree as follows:

1. Work: The Contracting Party agrees to perform the Work described more fully in the attached Exhibits A
2. (collectively, the "Work").

The Contracting Party also agrees to comply with all of the terms and conditions set forth herein and in the RFP, including but not only **all of the terms set forth in Section 26 (the "Contract Terms") of the Standard Instructions to Bidders.**

3. Term: ***[placeholder - will vary from contract to contract]***

4. Contract Includes Exhibits; Order of Construction: The Contract includes the RFP (Exhibit A) and the Proposal (Exhibit B), which are made a part hereof. In the event of a conflict or inconsistency between or among this document, the RFP, and the Proposal, this document shall have the highest priority, the RFP the second priority, and the Proposal the third priority.

5. Price and Payment: ***{placeholder - will vary from contract to contract. If contract extends beyond current fiscal year, be sure to include non-appropriation language.]***

6. Right to Terminate - If the Contracting Party's fails to comply with any of the terms, provisions or conditions of the Contract, including the exhibits, the Town shall have the right, in addition to all other available remedies, to declare the Contract in default and, therefore, to terminate it and to resubmit the subject matter of the Contract to further public procurement. In that event, the Contracting Party shall pay the Town, as liquidated damages, the amount of any excess of the price of the new contract over the Contract price provided for herein, plus any legal or other costs or expenses incurred by the Town in terminating this Contract and securing a new contracting party.

7. No Waiver or Estoppel - Either party's failure to insist upon the strict performance by the other of any of the terms, provisions and conditions of the Contract shall not be a waiver or create an estoppel. Notwithstanding any such failure, each party shall have the right thereafter to insist upon the other party's strict performance, and neither party shall be relieved of such obligation because of the other party's failure to comply with or otherwise to enforce or to seek to enforce any of the terms, provisions and conditions hereof.

8. Notice - Any notices provided for hereunder shall be given to the parties in writing (which may be hardcopy, facsimile, or e-mail) at their respective addresses set forth below:

Daniel Bombero
Department of Public Works
Dbombero@cheshirect.org
Fax:203-271-6659

9. Execution - This Contract may be executed in one or more counterparts, each of which shall be considered an original instrument, but all of which shall be considered one and the same agreement, and shall become binding when one or more counterparts have been signed by each of the parties hereto and delivered (including delivery by facsimile) to each of the parties.

IN WITNESS THEREOF, the parties have executed this contract as of the last date signed below.

TOWN OF CHESHIRE

By_____
Sean M. Kimball
Its Town Manager, Duly Authorized
Date:_____

[CONTRACTING PARTY LEGAL NAME]

By_____

Its_____, Duly Authorized
Date:.....

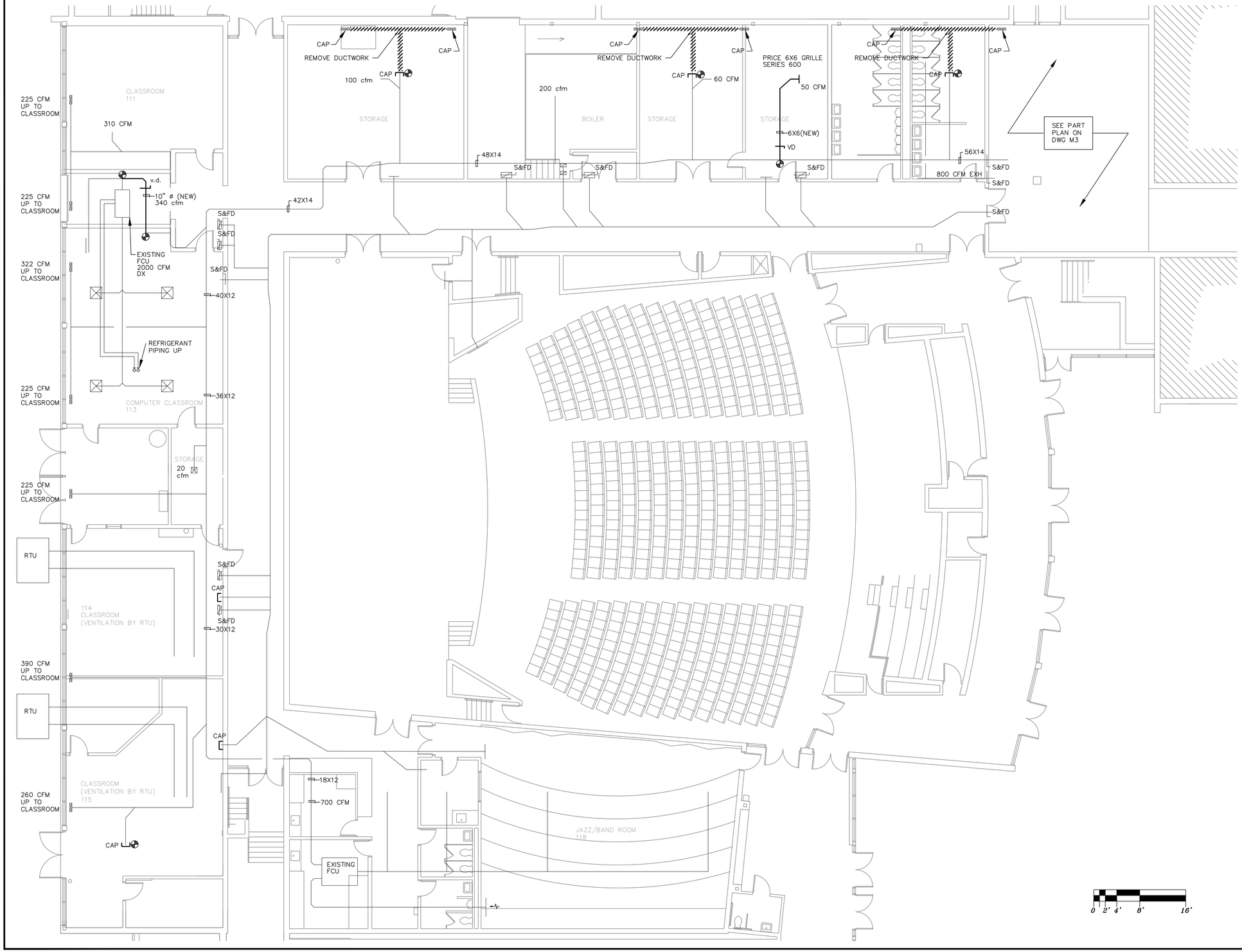
CHESHIRE HIGH SCHOOL REGENERATOR VENTILATION UPGRADE PROJECT

DATE: 10/3/2022

DRAWING LIST

M1 - MECHANICAL 1ST FLOOR PLAN
M2A - MECHANICAL 2ND FLOOR PLAN EAST
M2B - MECHANICAL 2ND FLOOR PLAN WEST
M3 - MECHANICAL PART PLAN & DETAILS
M4 - MECHANICAL SCHEDULES & DETAILS
M5 - DOA UNIT SCHEDULE AND SPEC

E1 - ELECTRICAL DEMOLITION
E2 - ELECTRICAL PART PLAN & DETAILS
E3 - ELECTRICAL LIGHTING & SCHEDULES



Jon D Petersen LLC
846 Ridgewood Rd
Middletown CT 06457
860-788-3548
Email: JonPetersen@sbcglobal.net

REVISIONS / AUTHORIZATIONS

NO.	REVISIONS / AUTHORIZATIONS	DATE

STATE OF CONNECTICUT · JON D PETERSEN · 19718 · LICENSED PROFESSIONAL ENGINEER

PROJECT TITLE:

Cheshire High School

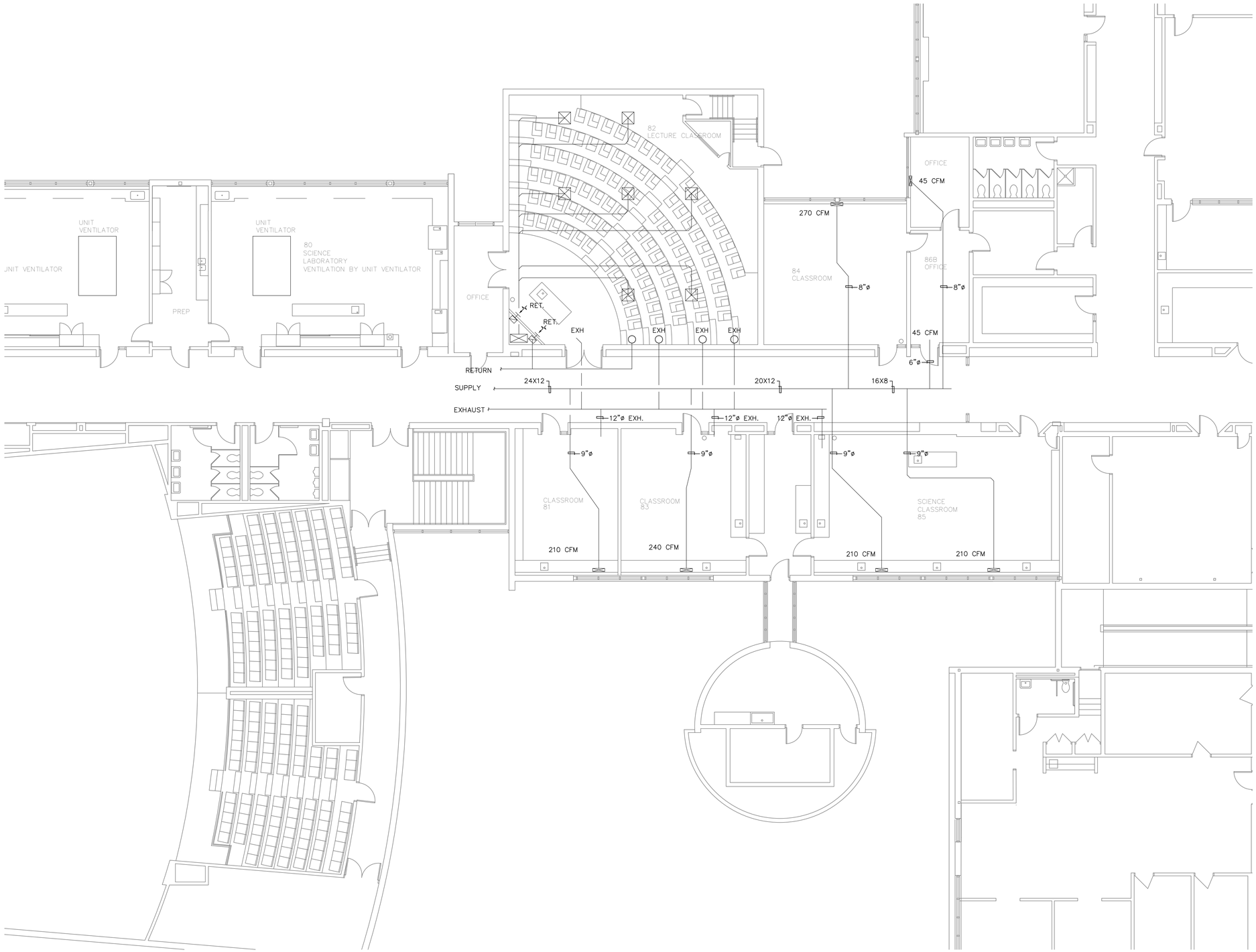
525 S Main Street, Cheshire, CT 06410

REGENERATOR PROJECT

SHEET TITLE:

MECHANICAL 1ST FLOOR PLAN

PROJECT NUMBER:	DATE: 10/3/22	SCALE: AS NOTED
—	DRAWN BY: JDP JDP	CHECKED BY: JDP -
	SHEET: # OF: XX SHEETS	SHEET NO.
	AT&T DRAWING NO.:	M1



Jon D Petersen LLC
846 Ridgewood Rd
Middletown CT 06457
860-788-3548
Email: JonPetersen@sbcglobal.net

REVISIONS / AUTHORIZATIONS

NO.	REVISIONS / AUTHORIZATIONS	DATE

STATE OF CONNECTICUT
JON D PETERSEN
19718
LICENSED
PROFESSIONAL ENGINEER

PROJECT TITLE:

Cheshire High School

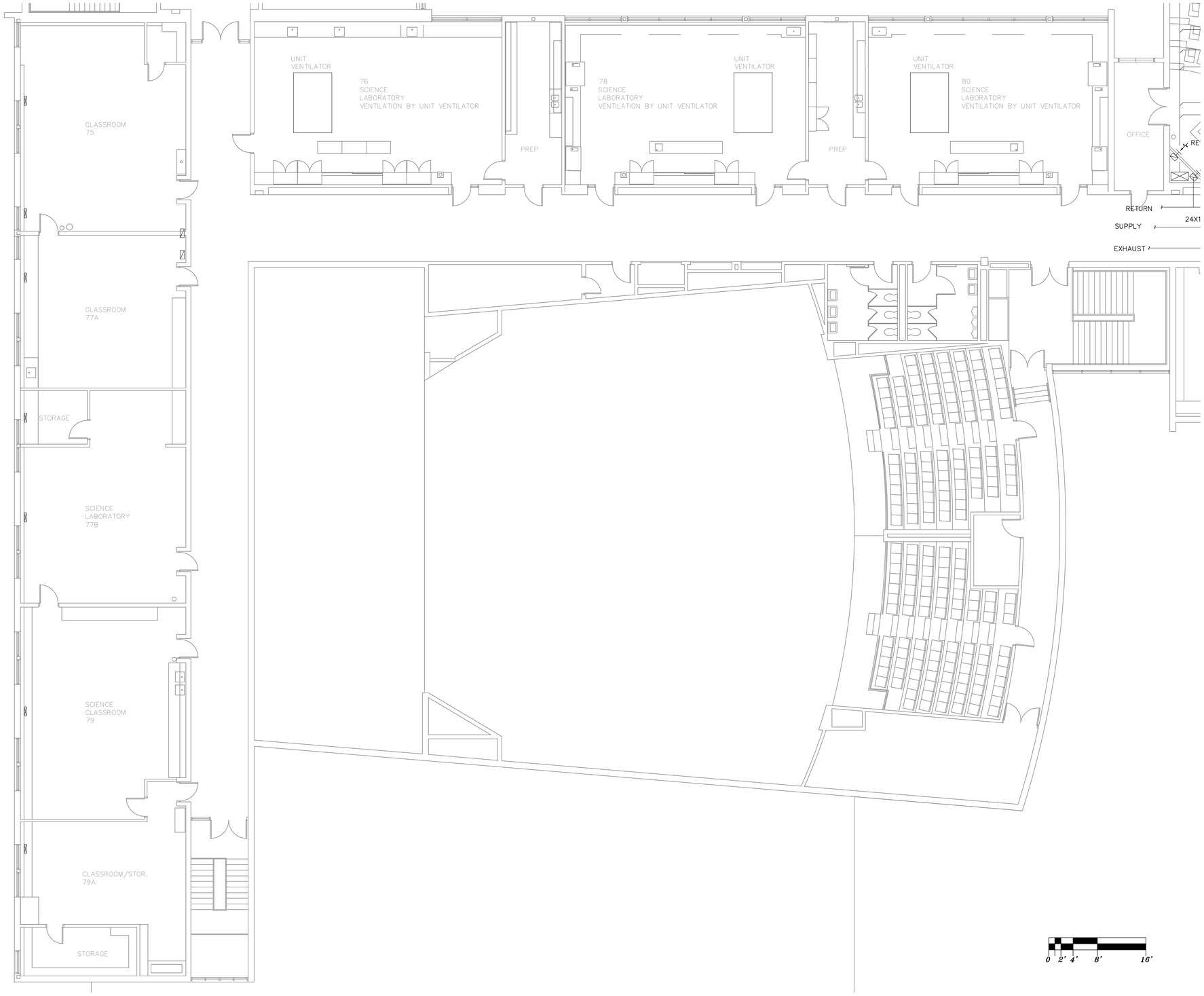
525 S Main Street, Cheshire, CT 06410

REGENERATOR PROJECT

SHEET TITLE:

MECHANICAL 2ND FLOOR PLAN EAST

PROJECT NUMBER: ___	DATE: **10/3/22**	SCALE: AS NOTED	
	DRAWN BY: JDP JDP	CHECKED BY: JDP -	
	SHEET: # OF: XX SHEETS	SHEET NO.	
	AT&T DRAWING NO.:	M2A	



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846 Ridgewood Rd
Middletown CT 06457
860-788-3548
Email: JonPetersen@sbcglobal.net

REVISIONS / AUTHORIZATIONS

NO.	REVISIONS / AUTHORIZATIONS	DATE

STATE OF CONNECTICUT
JON D. PETERSEN
19718
LICENSED
PROFESSIONAL ENGINEER

PROJECT TITLE:

Cheshire High School

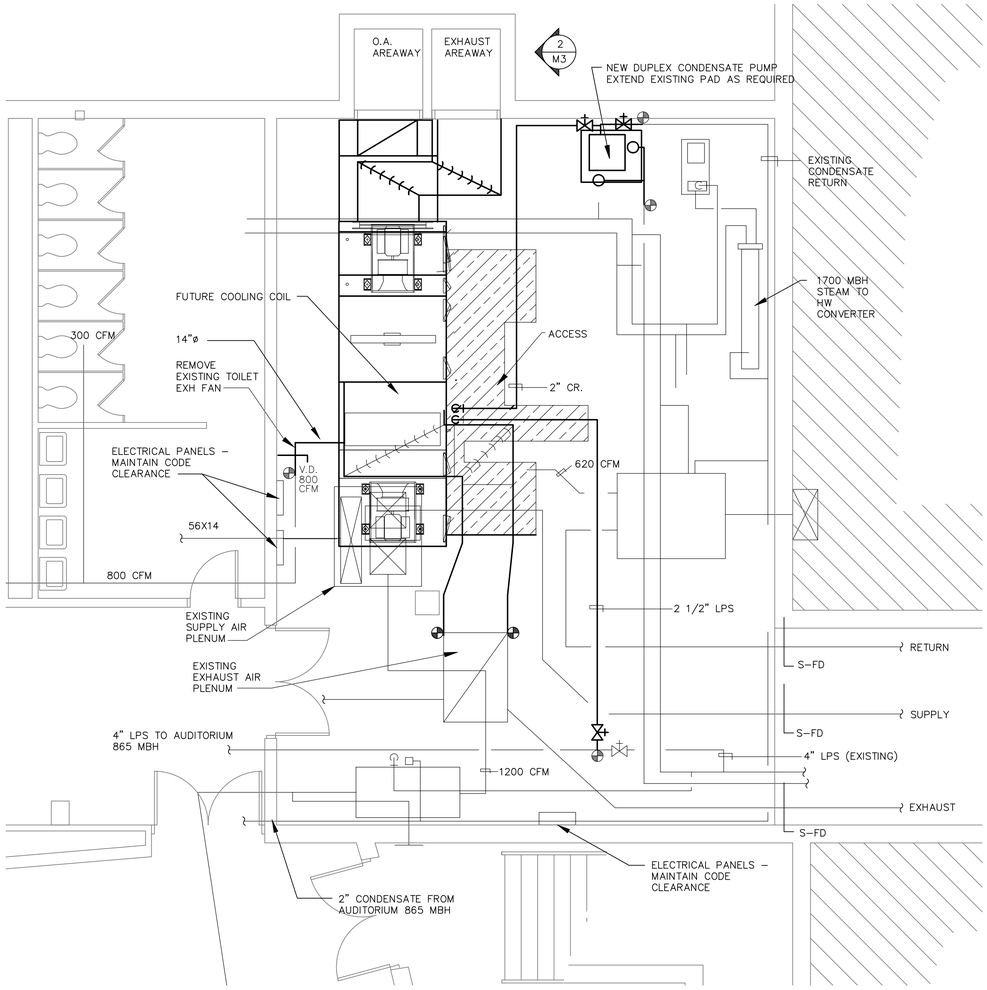
525 S Main Street, Cheshire, CT 06410

REGENERATOR PROJECT

SHEET TITLE:

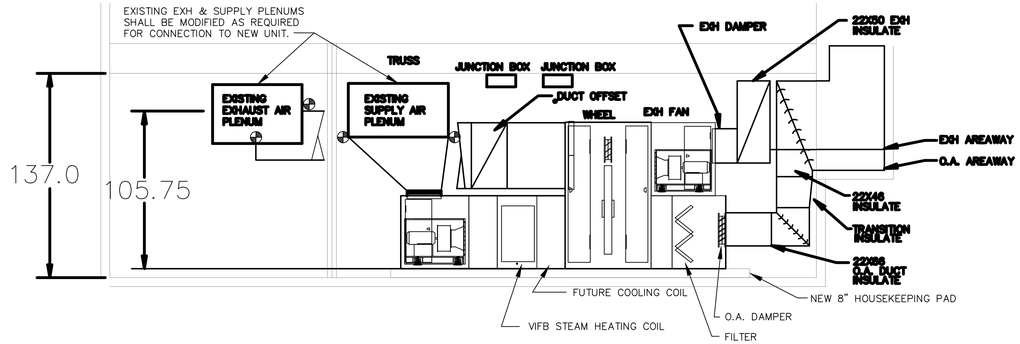
MECHANICAL 2ND FLOOR PLAN WEST

PROJECT NUMBER: —	DATE: **10/3/22**	SCALE: AS NOTED
	DRAWN BY: JDP JDP	CHECKED BY: JDP -
	SHEET: # OF: XX SHEETS	SHEET NO. M2B
	AT&T DRAWING NO.:	



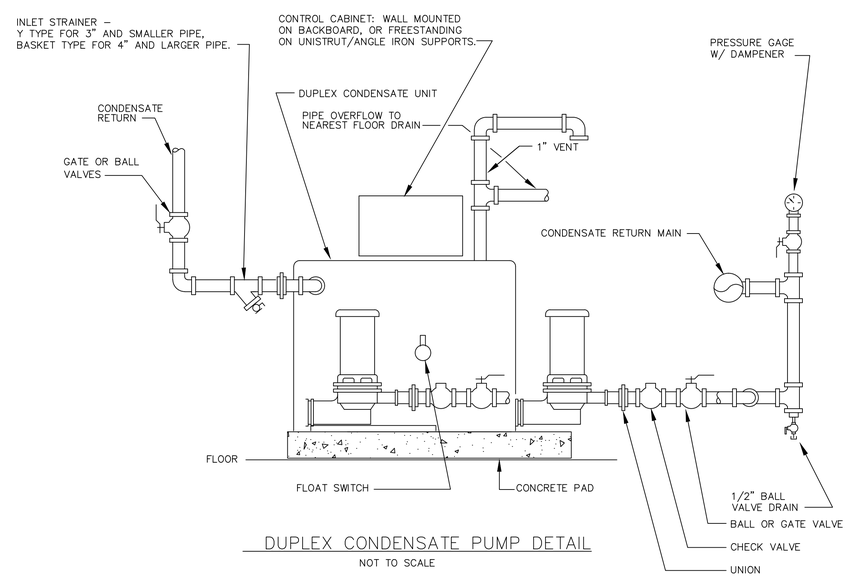
1/M3 MECHANICAL ROOM PART PLAN

0 1' 2' 4' 8'



2/M3 MECHANICAL ROOM SECTION

0 1' 2' 4' 8'



DUPLEX CONDENSATE PUMP DETAIL

NOT TO SCALE

NOTES:

1. DIAGRAMATIC ONLY. FOR FLANGED INSTALLATIONS OMIT UNIONS DO NOT OBSTRUCT ADJACENT EQUIPMENT

3/M3 CONDENSATE PUMP DETAIL

NOT TO SCALE

Jon D Petersen LLC
846 Ridgewood Rd
Middletown CT 06457
860-788-3548
Email: JonPetersen@sbcglobal.net

REVISIONS / AUTHORIZATIONS

NO.	REVISIONS / AUTHORIZATIONS	DATE

STATE OF CONNECTICUT JON D PETERSEN 19718 LICENSED PROFESSIONAL ENGINEER

PROJECT TITLE:

Cheshire High School

525 S Main Street, Cheshire, CT 06410

REGENERATOR PROJECT

SHEET TITLE:

MECHANICAL PART PLAN & DETAILS

PROJECT NUMBER:	DATE: 10/3/22	SCALE: AS NOTED
—	DRAWN BY: JDP JDP	CHECKED BY: JDP -
	SHEET: # OF: XX SHEETS	SHEET NO.
	AT&T DRAWING NO.:	M3

Outdoor Air Requirements:

Room	Room #	Room Type	Required CFM/Person	Required CFM/SF	Occupant Density/SF	Area SF	Occupant # PEOPLE	CFM PEOPLE	CFM SF	Total CFM
1ST FLOOR										
		Storage Room	0	0.12	0	377.00	0	0	46	46
		Storage Room	0	0.12	0	481.00	0	0	58	58
		Boiler Room	0	0.00	0		0	0	0	200
		Storage Room	0	0.12	0	821.00	0	0	99	99
	111	CLASSROOM	10	0.12	35	647.00	23	230	78	308
	113	COMPUTER	10	0.12	25	890.00	23	230	107	337
		Storage Room	0	0.12	0	146.00	0	0	18	18
	118	JAZZ BAND ROOM	10	0.06	35	1466.00	52	520	88	608
2ND FLOOR			0	0.12	0	234.00	0	0	29	29
	79A	CLASSROOM	10	0.12	35	530.00	19	190	64	254
	79	SCIENCE LAB	10	0.18	25	886.00	23	230	160	390
	77B	CLASSROOM	10	0.12	35	933.00	33	330	112	442
	77A	CLASSROOM	10	0.12	35	681.00	24	240	82	322
	75	CLASSROOM	10	0.12	35	921.00	33	330	111	441
	82	LECTURE CLASSROOM	5	0.06	65	1590.00	104	520	96	616
	84	CLASSROOM	10	0.12	35	547.00	20	200	66	266
	86B	OFFICE	5	0.06	5	494.00	3	15	30	45
	86B	OFFICE	5	0.06	5	494.00	3	15	30	45
	81	CLASSROOM	10	0.12	35	425.00	15	150	51	201
	83	CLASSROOM	10	0.12	35	500.00	18	180	60	240
	85	SCIENCE LAB	10	0.18	25	960.00	24	240	173	413
		LOBBY	5	0.06	150	1400.00	210	1050	84	1134

DUPLEX CONDENSATE PUMP SCHEDULE

UNIT No.	SERVING	MANUFACTURER – MODEL	SIZE	GPM	HEAD PSIG	MOTOR				REMARKS
						HP	PH	VOLTS	RPM	
CR–1	HX&ERV	B&G SERIES CC 23 GALLON DUPLEX	23 GALLON	22 GPM	20	1/2	1	208	3500	–

NOTES: PROVIDE MECHANICAL ALTERNATOR FOR PUMP SEQUENCING AND STAND–BY OF SECOND PUMP ON HIGH LEVEL.

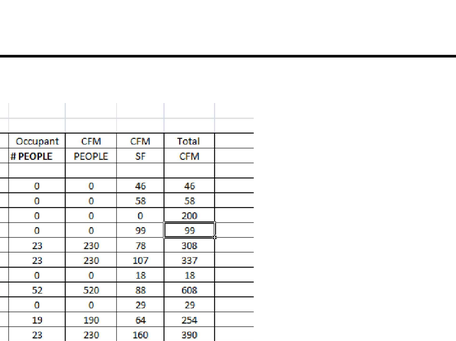
VERIFY ELECTRICAL PRIOR TO ORDERING
INSTALL PER MFG IOM MANUAL

DEMOLITION NOTES:

1. THIS JOB IS A RENOVATION. BEFORE SUBMITTING BIDS, THE MECHANICAL CONTRACTOR SHALL VISIT THE SITE AND BECOME THOROUGHLY FAMILIAR WITH ALL EXISTING CONDITIONS UNDER WHICH HIS WORK WILL BE PERFORMED. THIS CONTRACT INCLUDES ALL MODIFICATIONS OF EXISTING SYSTEMS AS REQUIRED TO COMPLETE WORK. THIS CONTRACT INCLUDES ALL MODIFICATIONS REQUIRED TO INSTALL EXISTING AND/OR NEW EQUIPMENT IN EXISTING AND/OR NEW SPACES. COORDINATE ALL WORK WITH OTHER TRADES AND OWNER. THIS CONTRACTOR SHALL BE HELD RESPONSIBLE FOR ANY ASSUMPTIONS, OMISSIONS, OR ERRORS AS A RESULT OF HIS FAILURE TO BECOME FULLY FAMILIAR WITH EXISTING FIELD CONDITIONS AND THE CONTRACT DOCUMENTS OF ALL OTHER TRADES.
2. LOCATIONS OF ALL EXISTING EQUIPMENT, DUCTWORK, AND PIPING SHOWN ARE BASED ON EXISTING DRAWINGS. THE CONTRACTOR SHALL VERIFY LOCATIONS OF EXISTING PIPING, DUCTWORK, AND EQUIPMENT IN THE FIELD AND ADJUST THE WORK AS NECESSARY BASED ON FIELD–MEASURED DIMENSIONS AT NO ADDITIONAL COST TO THE OWNER.
3. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING SERVICES AND UTILITIES TO EXISTING EQUIPMENT, SYSTEMS, AND FIXTURES NOT REMOVED AS PART OF DEMOLITION WORK. CONTRACTOR SHALL COORDINATE ANY RELOCATIONS AND/OR MODIFICATIONS NECESSARY TO ALLOW FOR NEW CONSTRUCTION AND PHASING.

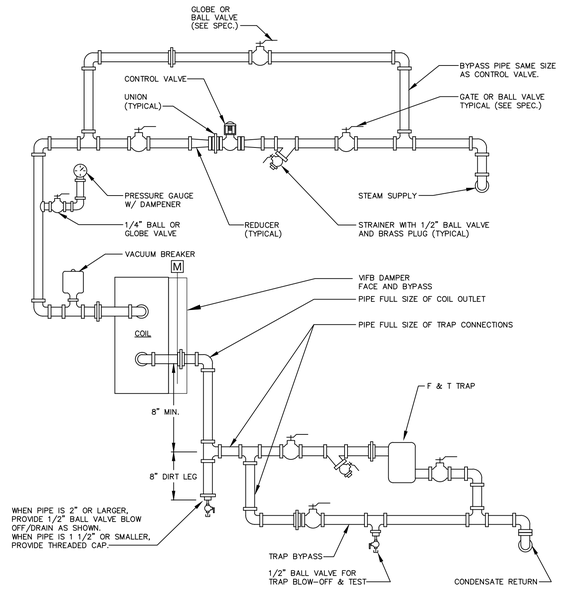
GENERAL NOTES FOR NEW WORK

1. INSTALL ACCESS DOORS AT ALL COILS, DAMPERS & CONTROL DEVICES.
2. THIS PLAN IS GENERALLY SCHEMATIC IN NATURE. EVERY ELBOW, FITTING, ETC. IS NOT SHOWN. PROVIDE SUCH COMPONENTS AS REQUIRED FOR COMPLETED INSTALLATION, PROPERLY COORDINATED WITH ALL TRADES.
3. ALL MATERIALS, METHODS AND EQUIPMENT INSTALLED UNDER THIS CONTRACT SHALL BE IN COMPLIANCE WITH ALL APPLICABLE CODES AND REGULATIONS.
4. MISCELLANEOUS RELOCATIONS OF EXISTING SMALL PIPE SERVICES MAY BE REQUIRED TO ACCOMPLISH THE WORK INDICATED. CAREFULLY REVIEW THE SPACE PRIOR TO BIDDING AND INCLUDE THE COST OF WORK IN THE BASE CONTRACT.
5. MECHANICAL CONTRACTOR SHALL HIRE GENERAL SUB–CONTRACTOR FOR ALL ARCHITECTURAL/SITE NEW WORK AND DEMOLITION ITEMS.
6. MECHANICAL CONTRACTOR SHALL COORDINATE WITH CONTROLS VENDOR FOR BMS MONITORING AND CONTROL OF THE NEW UNIT.
7. DOA UNIT MUST BE BROKEN DOWN INTO SECTIONS FOR RIGGING INTO SPACE. ALL RIGGING SHALL BE BY MECHANICAL CONTRACTOR.
8. PROVIDE AIR BALANCING FOR DOA UNIT AND ALL REGISTERS / DIFFUSERS CONNECTED TO UNIT. 15% LEAKAGE WAS INCLUDED IN UNIT SIZING. IF LEAKAGE EXCEEDS THIS AMOUNT BALANCING CONTRACTOR SHALL WORK WITH MECHANICAL CONTRACTOR TO IDENTIFY LOCATION OF LEAKAGE. MECHANICAL CONTRACTOR SHALL INCLUDE A PRICE FOR SEALING DUCTWORK ON LINEAR FOOT BASIS AS AN ALTERNATE. SUPPLY AND EXHAUST FAN VFD'S SHALL BE USED TO ADJUST FAN VOLUME. VFD OPERATION TO BE COORDINATED WITH CONTROLS VENDOR.



SEQUENCE OF OPERATION

1. UNIT SHALL BE ENALBED BY BMS BASED ON TIME SCHEDULE FOR SCHOOL OCCUPANCY. O.A. DAMPER AND EXH. DAMPER SHALL OPEN AND BE VERIFIED BY END SWITCH PRIOR TO FAN ENABLE. SUPPLY AND RETURN FANS SHALL SOFT START WITH VFD AND RAMP TO DESIRED SPEED.
2. STEAM COIL CONTROL VAVLE SHALL OPEN WHEN OUTSIDE AIR TEMPS ARE BELOW 40°F (ADJUSTABLE) FOR FREEZE PROTECTION.
3. STEAM COIL VIFD DAMPER SHALL MODULATE TO MAINTAIN SUPPLY AIR TEMPERATURE SETPOINT (68°F ADJ.)
4. ENERGY WHEEL BYPASS DAMPER SHALL OPEN DURING DEFROST CYCLE AS DETERMINED BY OUTSIDE AIR CONDITIONS. CONSULT ERV MANUAL FOR FULL SEQUENCE.
5. ALARMS
   - A – DIRTY FILTER
   - B – DAMPER FAILURE (O.A. & EXH.)
   - C – STEAM COIL VALVE FAILURE AS SENSED BY POSITION INDICATOR
   - D – VIFB DAMPER FAILURE AS SENSED BY POSITION INDICATOR
   - E – WHEEL PRESSURE DROP HIGH
6. PROVIDE ADDITIONAL 6 FUTURE POINTS IN CONTROLLER FOR FUTURE COOLING COIL & CONDENSING UNIT.



PREHEAT STEAM COIL PIPING DIAGRAM
NOT TO SCALE

NOTES:

1. FOR MULTIPLE COIL BANK, EACH COIL SHALL BE INDIVIDUALLY TRAPPED AND INDIVIDUAL STEAM LINES TO COILS SHALL BE TAKEN OFF THE TOP OF A DRIPPED HEADER.
2. THIS DETAIL IS DIAGRAMMATIC ONLY. ARRANGE PIPING TO FACILITATE COIL REMOVAL AND SO AS NOT TO OBSTRUCT ADJACENT EQUIPMENT. FOR FLANGED INSTALLATION OMIT UNIONS.

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REVISIONS / AUTHORIZATIONS

NO.	REVISIONS / AUTHORIZATIONS	DATE

STATE OF CONNECTICUT · JON D. PETERSEN · 19718 · LICENSED PROFESSIONAL ENGINEER

PROJECT TITLE:

Cheshire High School

525 S Main Street, Cheshire, CT 06410

REGENERATOR PROJECT

SHEET TITLE:

MECHANICAL SCHEDULES & DETAILS

PROJECT NUMBER:	DATE: 10/3/22	SCALE: AS NOTED
—	DRAWN BY: JDP JDP	CHECKED BY: JDP -
	SHEET: # OF: XX SHEETS	SHEET NO.
	AT&T DRAWING NO.:	M4

Unit Construction
All unit panels shall be 2" solid, double-wall construction to facilitate cleaning of unit interior. Unit panels shall be provided with a mid-span, no-through-metal, internal thermal break. Casing thermal performance shall be such that under 55°F supply air temperature and design conditions on the exterior of the unit of 81°F dry bulb and 73°F wet bulb, condensation shall not form on the casing exterior.
All exterior and interior indoor AHU panels will be made of galvanized steel.
Unit Paint
Unit to ship unpainted from factory. If required, unit to be painted by 3rd party finisher, or by painting contractor at job site.

Casing Deflection
The casing shall not exceed 0.0042 inch deflection per inch of panel span at 1.50 times design static pressure. Total maximum static shall not exceed +8 inches w.g. in all positive pressure sections and −8 inches w.g. in all negative pressure sections.
Floor Construction
The unit floor shall be of sufficient strength to support a 300.0 lb load during maintenance activities and shall deflect no more than 0.0042 inch per inch of panel span.

Unit base
Manufacturer to provide a full perimeter integral base frame for either ceiling suspension of units or to support and raise all sections of the unit for proper trapping. Indoor unit base frame will either be bolted construction or welded construction. All outdoor unit base frames shall be welded construction. For indoor units, refer to schedule for base height and construction type. Contractor will be responsible for providing a housekeeping pad when unit base frame is not of sufficient height to properly trap unit. Unit base frames not constructed of galvanized steel shall be chemically cleaned and coated with both a rust-inhibiting primer and finished coat of rust-inhibiting enamel. Unit base height to be included in total height required for proper trap height.

Insulation
Panel insulation shall provide a minimum thermal resistance (R) value of 13 ft²-h-°F/Btu throughout the entire unit. Insulation shall completely fill the panel cavities in all directions so that no voids exist and settling of insulation is prevented. Panel insulation shall comply with NFPA 90A.

Drain Pan
In sections provided with a drain pan, the drain pan shall be designed in accordance with ASHRAE 62.1. To address indoor air quality (IAQ) the drain pan shall be sloped in two planes promoting positive drainage to eliminate stagnant water conditions. Drain pan shall be insulated, and of double wall construction. The outlet shall be the lowest point on the pan, and shall be of sufficient diameter to preclude drain pan overflow under normally expected operating conditions. All drain pans connections shall have a threaded connection, extending a minimum of 2-1/2" beyond the unit base, and shall be made from the same material as the drain pan. Drain pan located under a cooling coil shall be of sufficient size to collect all condensate produced from the coil.
Refer to Product Data for specific information on which sections are supplied with a drain pan, the drain pan material and connection location.

Access Door Construction
Access doors shall be 2" double wall construction. Interior and exterior door panels shall be of the same construction as the interior and exterior wall panels respectively. All doors shall be provided with a thermal break construction of door panel and door frame. Gasketing shall be provided around the full perimeter of the doors to prevent air leakage. Surface mounted handles shall be provided to allow quick access to the interior of the functional section and to prevent through cabinet penetrations that could likely weaken the casing leakage and thermal performance. Handle hardware shall be designed to prevent unintended closure. Access doors shall be hinged and removable for quick easy access. Hinges shall be interchangeable with the door handle hardware to allow for alternating door swing in the field to minimize access interference due to unforeseen job site obstructions. Door handle hardware shall be adjustable and visually indicate locking position of door latch external to the section. Door hinges shall be galvanized.
All doors shall be a minimum of 60" high when sufficient height is available or the maximum height allowed by the unit height.
Door handles shall be provided for each latching point of the door necessary to maintain the specified air leakage integrity of the unit. Optionally for indoor AHUs and as standard on outdoor AHUs, outward swing doors are provided with a single handle linked to multiple latching points. An optional shatterproof window shall be provided in access doors where indicated on the plans. Window shall either be single pane, or thermal dual pane, as defined on schedule. Window shall be capable of withstanding unit operating pressures and shall be safe for viewing UV-C lamps.
Refer to Product Data for specific information on which sections are supplied with an access door, the door location, a single handle and a window.

MIXING SECTION
A mixing section shall be provided to support the damper assembly for outdoor, return, and/or exhaust air.
Dampers

Dampers shall modulate the volume of outdoor, return, or exhaust air. The dampers shall be of double skin airfoil design with metal, compressible jamb seals and flexible blade-edge seals on all blades. The
blades shall rotate on stainless-steel sleeve bearings. The dampers shall be rated for a maximum leakage rate of 3 cfm/ft² at 1 in. w.g. complying with ASHRAE 90.1 maximum damper leakage. All leakage testing and pressure ratings shall be based on AMCA Standard 500-D. Dampers may be arranged in a parallel or opposed-blade configuration.
Title 24
The following specifications apply only to units with outside air and return air dampers, with actuators. The 5 year warranty applies only to these items.
This unit contains Economizer that meets or exceeds all mandatory requirements prescribed by Title 24, including but not limited to:
- 5 yr parts only warranty
- Successfully tested to 60,000 Actuations
- Less than 10 cfm/sq.ft. of damper leakage at 1" WG per AMCA 500L

Filters
Mixing sections shall be provided with a filter rack as indicated in the Product Data and As-Built sections of the submittal.
4 inch high efficiency filters constructed with a fine fiber media made into closely spaced pleats shall be provided. The filters shall be capable of operating up to 625 fpm face velocity without loss of filter efficiency and holding capacity. The filter media shall be sealed into a frame assembled in a rigid manner. The manufacturer shall supply a side access filter rack capable of holding 4 inch high efficiency filters.
The 4 inch high efficiency filters shall have a MERV 13 rating when tested in accordance with the ANSI/ASHRAE Standard 52.2.

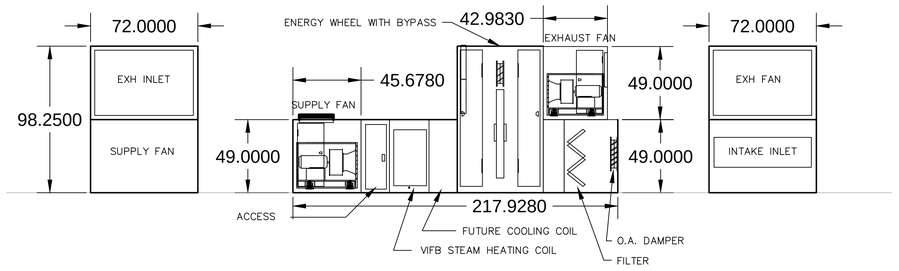
COIL SECTION WITH FACTORY INSTALLED COIL
The coil section shall be provided complete with coil and coil holding frame. The coils shall be installed such that headers and return bends are enclosed by unit casings. If two or more cooling coils are stacked in the unit, an intermediate drain pan shall be installed between each coil and be of the same material as the primary drain pan. Like the primary drain pan, the intermediate drain pan shall be designed being of sufficient size to collect all condensation produced from the coil and sloped to promote positive drainage to eliminate stagnant water conditions. The intermediate pan shall begin at the leading face of the water-producing device and be of sufficient length extending downstream to prevent condensate from passing through the air stream of the lower coil. Intermediate drain pan shall include downspouts to direct condensate to the primary drain pan. The outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition.

COIL SECTION WITHOUT FACTORY INSTALLED COIL
The coil section shall be provided complete with coil holding frame. Blockoffs around perimeter of field installed coil shall be responsibility of the installing contractor. Contractor shall field install coil(s) such that headers and return bends are enclosed by unit casings. If two or more cooling coils are stacked in the unit, contractor shall fabricate an intermediate drain pan which shall be installed between each coil and be of the same material as the primary drain pan. Like the primary drain pan, the intermediate drain pan shall be designed being of sufficient size to collect all condensation produced from the coil and sloped to promote positive drainage to eliminate stagnant water conditions. The intermediate pan shall begin at the leading face of the water-producing device and be of sufficient length extending downstream to prevent condensate from passing through the air stream of the lower coil. Intermediate drain pan shall include downspouts to direct condensate to the primary drain pan. The outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition.

ERV – INDOOR AIR HANDLING UNIT SCHEDULE

AIR HANDLING UNIT DATA									FUTURE COOLING COIL	STEAM COIL DATA (PREHEAT) VIFB						SUPPLY FAN MOTOR						EXHAUST FAN MOTOR						
UNIT NO.	MANUFACTURER	MODEL & SIZE	WEIGHT	TOTAL CFM	MIN. O.A. CFM	E.S.P.	FAN T.S.P.	FAN RPM		COILS HIGH/ ROWS/F.P.I.	E.A.T. °F	L.A.T. °F	MBH	FACE VEL.	A.P.D.	STEAM PRESS.	VFD	BHP	HP	PH	VOLTS	RPM	VFD	BHP	HP	PH	VOLTS	RPM	REMARKS
DOA-1	TRANE	CSA-017	4392 LBS	9000	9000	1	4.07	–		–	42	91	490.2	742	.443	5 PSI	YES	11.6	15	3	208	–	YES	9.8	10	3	208	–	

OPTIONS / NOTES
1. VFD RATED PREMIUM EFF. FAN MOTORS
2. VIFB STEAM COIL
3. O.A. & EXH DAMPER
4. SEE PLANS FOR CONNECTIONS
5. PROVIDE SECTION FOR FUTURE COOLING COIL
6. SUPPLY FAN SHALL BE SIZED FOR FUTURE DX COOLING COIL STATIC.
7. ENERGY WHEEL MOTOR IS 208 3 PHASE FLA 2.6 MCA 3.25.
8. VFD BY OTHERS (SEE DIV 16 DWGS & SPECS)



WHEEL PERFORMANCE

SUMMER ENTERING	SUMMER LEAVING	WINTER ENTERING	WINTER LEAVING
95/78	82/69	0/0	42/39.6

VERIFY SIZE PRIOR TO ORDERING FOR RIGGING DETAILS
VERIFY ELECTRICAL PRIOR TO ORDERING
INSTALL PER MFG IOM MANUAL

ACCESS/INSPECTION / TURNING SECTION
A section shall be provided to allow additional access/inspection of unit components and space for field-installed components as needed. An access door shall be provided for easy access. All access sections shall be complete with a double-wall, removable door downstream for inspection, cleaning, and maintenance. Interior and exterior door panels shall be of the same construction as the interior and exterior wall panels, respectively. All doors downstream of cooling coils shall be provided with a thermal break construction of door panel and door frame.

DIRECT-DRIVE PLENUM FAN SECTION
The fan type shall be provided as required for stable operation and optimum energy efficiency. The fan shall be a single-width, single-inlet, multiblade-type direct-drive plenum fan. Motor bearing life of the direct-drive plenum fan shall be not less than L-10 250,000 hrs. Refer to the Product Data section for fan quantity and number of blades selected within each unit. Central Station Air Handling Unit Supply Fans are "Certified by the AHRI Central Station Air-Handling Unit (AHU) Certification Program, based on AHRI Standard 430/431. AHRI certified units are subject to rigorous and continuous testing, have performance ratings independently measured and are third-party verified. Certified units may be found in the AHRI Directory at www.ahridirectory.org" Central Station Air Handling Unit Supply Fans shall be tested and rated in-accordance with AHRI Standard 260 for sound performance.
Fans that are selected with inverter balancing shall first be dynamically balanced at design RPM. The fans then will be checked in the factory from 25% to 100% of design RPM to insure they are operating within vibration tolerance specifications, and that there are no resonant frequency issues throughout this operating range. Inverter balancing that requires lockout frequencies inputted into a variable frequency drive to in order to bypass resonant frequencies shall not be acceptable. If supplied in this manner by the unit manufacturer, the contractor will be responsible for rebalancing in the field after unit installation. Fans selected with inverter balancing shall have a maintenance free grounding assembly installed on the fan motor to discharge both static and induced shaft currents to ground.
On units supplied with plenum or motorized impeller fans, door guard(s) shall be supplied on the access door(s) to the fan and those downstream access door(s) where unintended access to the plenum or motorized impeller fan could occur. Door guard is intended to deter unauthorized entry and incidental contact with rotating components. Refer to the Product Data section for fans with access door guard(s).

Motor Frame
The motor shall be mounted integral to the isolated fan assembly and furnished by the unit manufacturer. The motor is mounted inside the unit casing on an adjustable base to permit adjustment of drive belt tension (not applicable for direct drive plenum fans). The motor shall meet or exceed all NEMA Standards Publication MG 1 requirements and comply with NEMA Premium efficiency levels when applicable except for fractional horsepower motors which are not covered by the NEMA classification. The motor shall be T-frame, squirrel cage with size, type, and electrical characteristics as shown on the equipment schedule. Refer to the Product Data section for selected fan motors within each unit.
Two-Inch Spring Isolators
Direct-drive fan and motor assemblies shall be internally isolated from the unit casing with 2-inch (50.8 mm) deflection spring isolators. The isolation system shall be designed to resist loads produced by external forces, such as earthquakes, and conform to the current IBC seismic requirements.

ENERGY WHEEL SECTION
The air-handling unit shall have an AHRI 1060-certified total energy recovery wheel sized per the ventilation requirement of the unit. The air-handling unit nameplate shall bear the AHRI 1060 certification label. The energy recovery cassette shall be an Underwriters Laboratories (UL) Recognized Component certified for mechanical, electrical, and fire safety in accordance with UL Standard 1812.
The energy recovery wheel cassette frame shall be insulated and incorporate a rotary wheel with all necessary seals, drive motor, and drive belts. The total energy recovery wheel shall incorporate a desiccant without the use of binders or adhesives. Coated segments shall be washable using standard detergent or alkaline-based coil cleaners. The desiccant shall not dissolve in the presence of water or high humidity. The rim shall be of continuous rolled stainless steel and forms an even concentric circle, preventing leakage around the rim and minimizing the wear of components. All diameter and perimeter seals shall be provided as part of the cassette assembly. Perimeter seals shall be self-adjusting; diameter seals are adjustable. The wheel drive motor shall be thermally protected and UL Component Recognized. Drive belts shall not require belt tensioners. Wheel bearings shall be permanently sealed and lubricated and have a minimum L-10 life of 400,000 hours.
The energy recovery wheel shall be provided in the form of removable segments. The segments shall be removable without the use of tools to facilitate maintenance and cleaning as required. The cassette shall be removable through the energy recovery section side panel. Access doors shall be provided immediately upstream and downstream of the energy recovery wheel cassette. Adequate space shall be provided for cleaning, service, and maintenance of the wheel, motor, bearing, and belt.
Mixed Airflow Wheel
The air-handling unit shall be constructed with internal bypass dampers to bypass air around the wheel during economizing. The pressure drop across the wheel does not increase during economizing.

Wheel Control
The energy recovery wheel section shall incorporate a variable effectiveness / exhaust air bypass damper to control the energy wheel recovery capacity. The variable effectiveness control shall have the ability to modulate the total energy recovery effectiveness to 40 percent of the initial total recovery capacity.

Frost Control
Frost control prevention shall be achieved by either outside air bypass, or return air preheat. Frost setpoint temperatures based on scheduled design air conditions shall be provided by the air handling manufacturer. Winter design supply and exhaust air conditions leaving the energy wheel provided by the unit manufacturer shall include any derate in performance due to frost protection measures.
Wheel Warranty
In conjunction with the Trane standard unit warranty, the energy recovery wheel shall be warranted for a period of five years. Warranty applies to all parts and components of the energy recovery cassette with the exception of the motor. Applying a VFD to an energy wheel motor can cause premature motor failure and could void the warranty.

Primary Filters
2 inch pleated media filters made with 100% synthetic fibers that are continuously laminated to a supported steel wire grid with water repellent adhesive shall be provided. Filters shall be capable of operating up to 625 fpm face velocity without loss of filter efficiency and holding capacity. The filters shall have a MERV 13 rating when tested in accordance with the ANSI/ASHRAE Standard 52.2.

Lifting Instructions
The air handling units must be rigged, lifted, and installed in strict accordance with the Installation, Operation, and Maintenance manual (CLCH-SVX07G-EN). The units are also to be installed in strict accordance with the specifications. Units may be shipped fully assembled or disassembled to the minimum functional section size in accordance with shipping and job site requirements.
Indoor units shall be shipped on an integral base frame (variable from the standard 2.5" to 8" height) for the purpose of mounting units to a housekeeping pad and providing additional height to properly trap condensate from the unit. The integral base frame may be used for ceiling suspension, external isolation, or as a housekeeping pad. Indoor sizes 3 to 30 will also be shipped with a shipping skid designed for forklift transport. Refer to the unit As-Built or Product Data section of the submittal for the base frame height of each unit.
All units will be shipped with an integral base frame designed with the necessary number of lift points for safe installation. All lifting lugs are to be utilized during lift. The lift points will be designed to accept standard rigging devices and be removable after installation. Units shipped in sections will have a minimum of four points of lift.

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REVISIONS / AUTHORIZATIONS

NO.	REVISIONS / AUTHORIZATIONS	DATE

STATE OF CONNECTICUT · JON D PETERSEN · 19718 · LICENSED PROFESSIONAL ENGINEER

PROJECT TITLE:

Cheshire High School

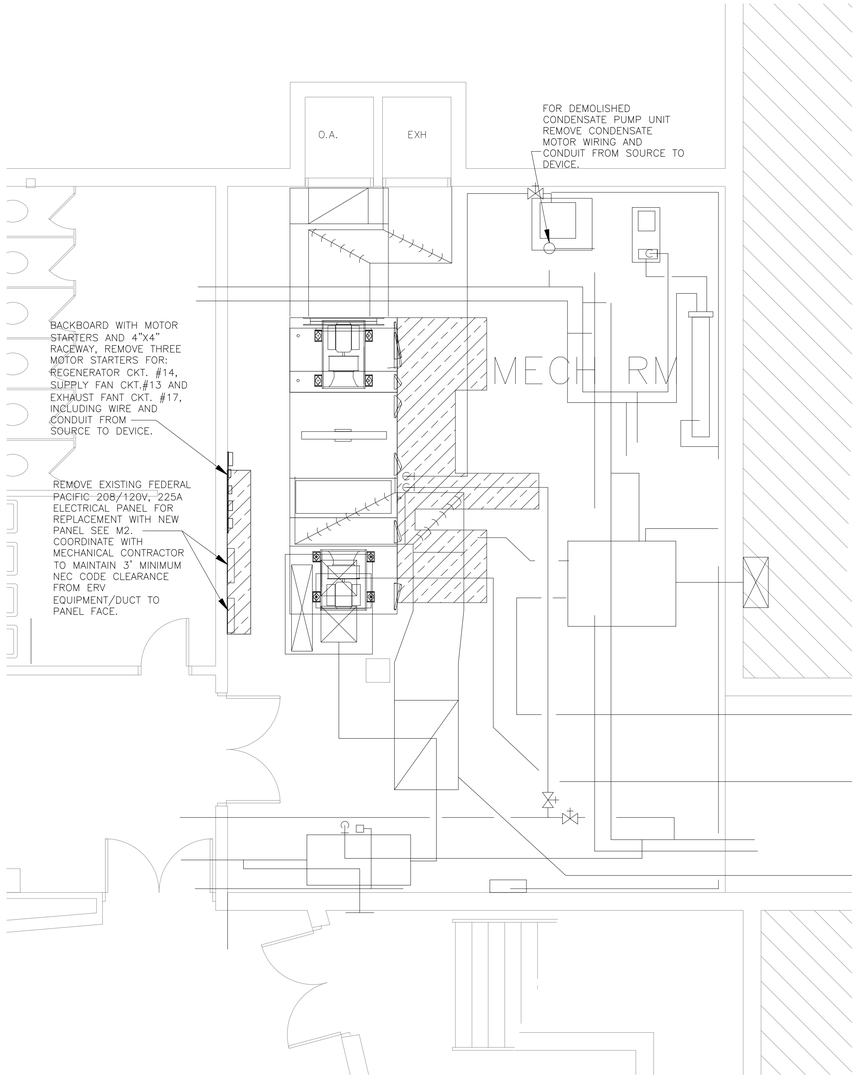
525 S Main Street, Cheshire, CT 06410

REGENERATOR PROJECT

SHEET TITLE:

DOA UNIT SCHEDULE & SPEC.

PROJECT NUMBER:	DATE: 10/3/22	SCALE: AS NOTED
—	DRAWN BY: JDP JDP	CHECKED BY: JDP -
	SHEET: # OF: XX SHEETS	SHEET NO.
	AT&T DRAWING NO.:	M5



1 / M3 MECHANICAL ROOM ELECTRICAL DEMOLITION

0 1' 2' 4' 8'

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REVISIONS / AUTHORIZATIONS

NO.	REVISIONS / AUTHORIZATIONS	DATE

STATE OF CONNECTICUT
JON D PETERSEN
19718
LICENSED
PROFESSIONAL ENGINEER

PROJECT TITLE:

Cheshire High School

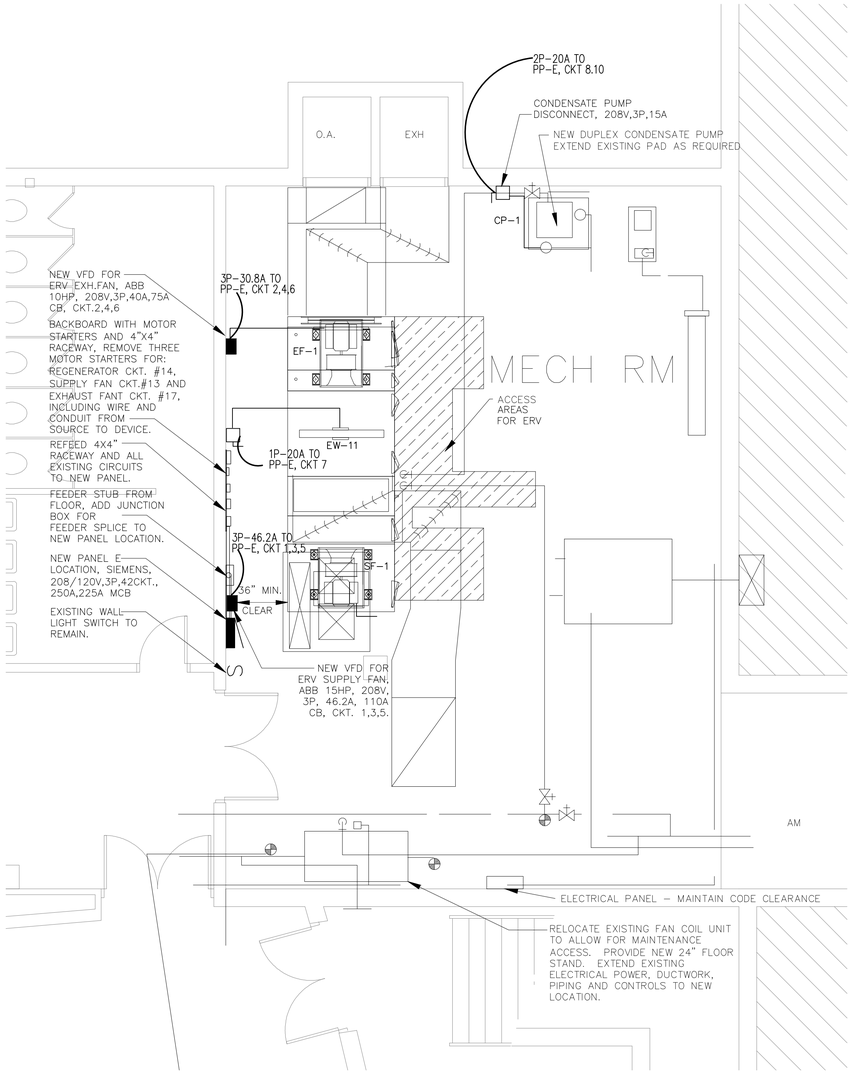
525 S Main Street, Cheshire, CT 06410

REGENERATOR PROJECT

SHEET TITLE:

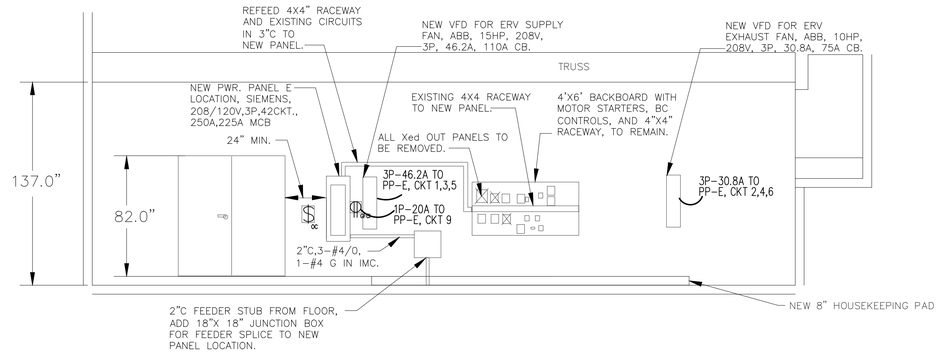
ELECTRICAL DEMOLITION

PROJECT NUMBER:	DATE: **10/3/22**	SCALE: **AS NOTED**
—	DRAWN BY: **JDP**	CHECKED BY: **JDP**
	SHEET: OF: XX SHEETS	SHEET NO.
	AT&T DRAWING NO.:	E1



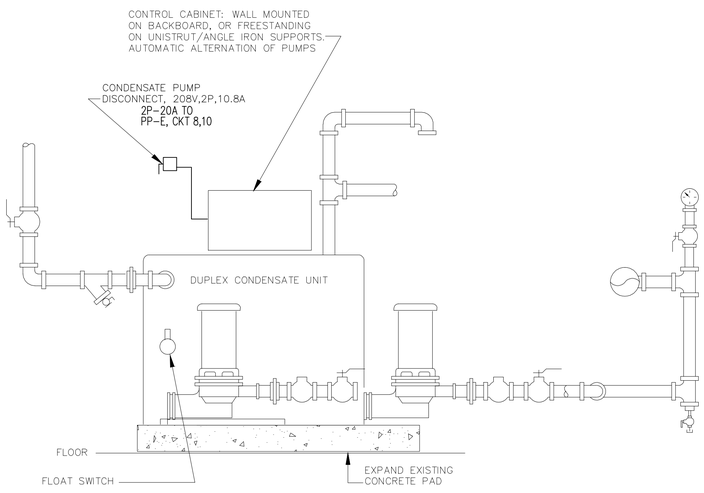
1 / M3 MECHANICAL ROOM–ELECTRICAL PART PLAN

0 1' 2' 4' 8'



2 / M3 MECHANICAL ROOM–ELECTRICAL WALL SECTION.

0 1' 2' 4' 8'



NOTES:

3 / M3 DUPLEX CONDENSATE PUMP–ELECTRICAL DETAIL

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REVISIONS / AUTHORIZATIONS

NO.	REVISIONS / AUTHORIZATIONS	DATE

STATE OF CONNECTICUT · JOHN PETERSEN · 19718 · LICENSED PROFESSIONAL ENGINEER

PROJECT TITLE:

Cheshire High School

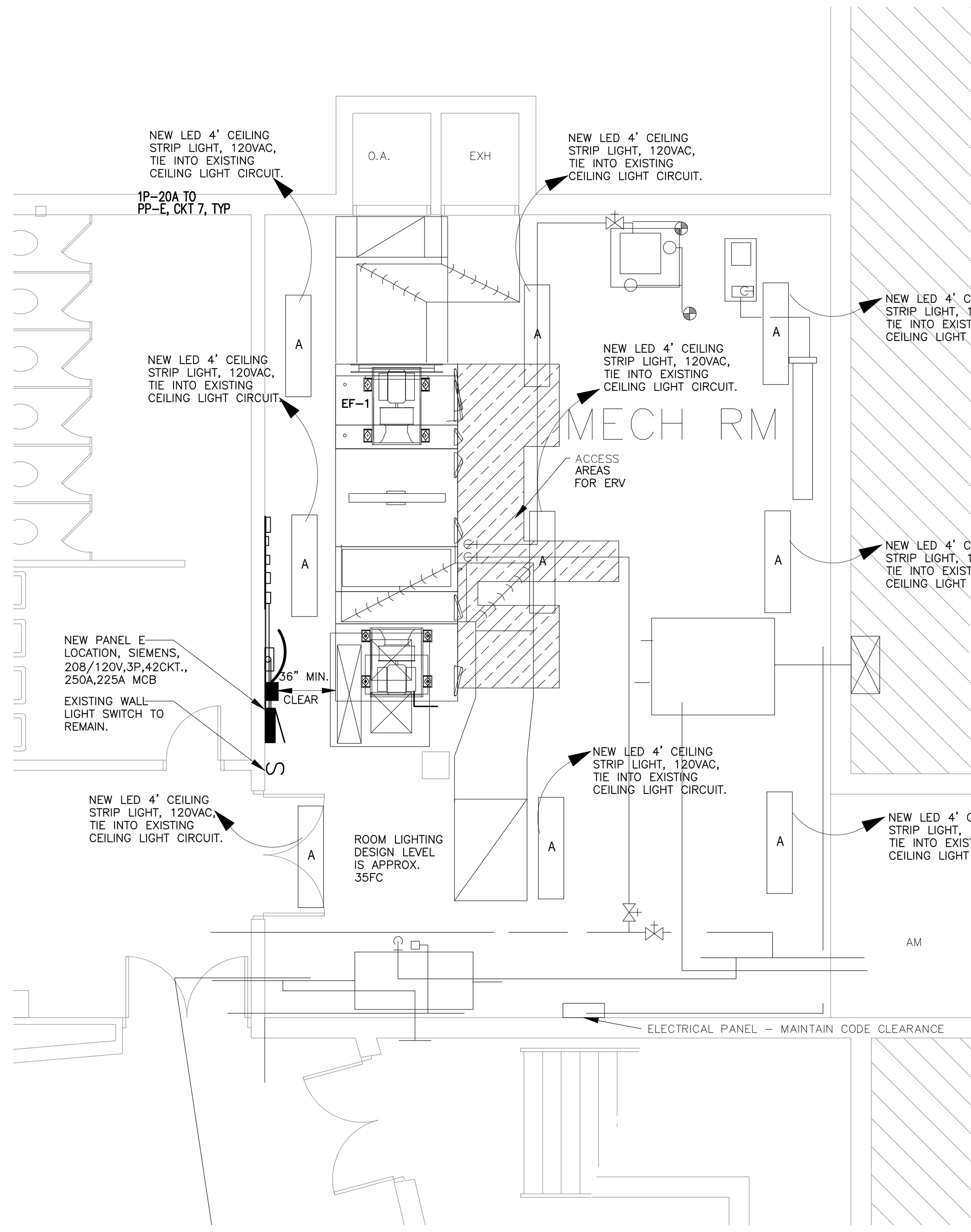
525 S Main Street, Cheshire, CT 06410

REGENERATOR PROJECT

SHEET TITLE:

ELECTRICAL PART PLAN & DETAILS

PROJECT NUMBER:	DATE: 10/3/22	SCALE: AS NOTED
—	DRAWN BY: JDP	CHECKED BY: JDP
	SHEET: OF: XX SHEETS	SHEET NO. E2
	AT&T DRAWING NO.:	



1 / E1 MECHANICAL ROOM–ELECTRICAL LIGHTING PLAN

0 1' 2' 4' 8'

LIGHTING LEGEND

A	1' X 4' LED LITHONIA WRAP AROUND LBL4 LP840 4600LM 4000K, W/PENDANT CEILING MT. KIT. OR EQUAL FIXTURE AS ACCEPTABLE TO THE SCHOOL FAC. MGR.

GENERAL LIGHTING NOTES:

1. ALL EXISTING MECHANICAL ROOM LIGHTS ARE TO BE REMOVED AND REPLACED WITH NEW FIXTURES AS SPECIFIED AND WIRED INTO THE EXISTING LIGHTING CIRCUIT, PP–E, CKT 7.
2. ALL NEW MECHANICAL ROOM LIGHT FIXTURES ARE TO BE OCCUPANCY CONTROLLED FROM THE EXISTING WALL LIGHTING SWITCH LOCATION.
3. INSTALL ALL NEW LIGHT FIXTURES AT 8'AFF OR AS CLOSE AS POSSIBLE ACCOUNTING FOR CEILING INTERFERENCES, WIRE INTO EXISTING LIGHTING CIRCUIT LOOP AND CHANGE EXISTING LIGHTING TOGGLE SWITCH TO LEVITON PIR OCCUPANCY WITH ON–OFF BUTTON, SET TIMER FOR 30MIN. ON INTERVAL OR AS OCCUPIED.

ELECTRICAL EQUIPMENT SCHEDULE

SYMBOL	SERVING	VOLTAGE	PHASE	MCA	FLA	MOTOR HP	FEEDER SIZE	CONDUIT	CIRCUIT BREAKER	DISC SIZE	FED FROM PANEL	CIRCUIT NUMBER	REMARKS
SF–1	ERV SUPPLY FAN	208	3	36.88A	29.5A		3#6, 1#8G	3/4"C	110A3P		"E"	#1,3,5	USE VFD–ABB #ACH580–01–VCR046A–04 46.2A FOR 15HP, W/INTEGRAL,DISC.SWITCH
EF–1	ERV EXHAUST FAN	208	3	51.25A	41.0A		3#8, 1#10G	3/4"C	75A3P		"E"	#2,4,6	USE VFD–ABB #ACH580–01–VCR031A–04 30.8A FOR 10HP, W/INTEGRAL,DISC.SWITCH
EW–11	ERV ENERGY WHEEL	208	3	3.25A	2.6A		2#12, 1#12G	3/4"C	20A1P		"E"	#7	PROVIDE LOCAL DISC. SAFETY SWITCH
CP–1	CONDENSATE PUMP	208	1	13.5A	10.8A		2#12, 1#12G	3/4"C	20A2P		"E"	#8,10	EQUIP. HAS 2–1/2HP MOTORS DUPLEXED PROVIDE LOCAL DISC.SWITCH&FUSES

NOTES:

1. NEW FEEDERS FROM THE PANEL TO THE NEW EQUIPMENT. PROVIDE NEW FITTINGS, COUPLINGS AND WIRING DEVICES AS NEEDED.
2. NEW PANEL WITH NEW CIRCUIT BREAKERS SIZED FOR THE NEW EQUIPMENT. MATCH THE CIRCUIT BREAKERS FOR THE EXISTING EQUIPMENT FROM THE REPLACED PANEL WITH THE SAME SIZE BREAKERS.
3. VFDs ARE AS SPECIFIED OR EQUAL PRODUCT AS ACCEPTABLE TO THE SCHOOL'S FACILITIES MANAGER.
4. ALL VFDs PROVIDED SHALL HAVE AN INTEGRATED BUILT IN BY–PASS.

PANEL PP–E

MCB ☒ MLO ☐ — LOCATION SEE PLANS

MAIN CB SIZE 225 AMPS — PHASE THREE

PANEL SIZE 250 AMPS — VOLTS 208V/120V — MTG SURFACE — TYPE BOLT–ON — WIRE FOUR

	CKT. NO.	DESCRIPTION	WIRE SIZE	TRIP AMP	POLE	KVA	CONN. LOAD KVA A	B	C	KVA	POLE	TRIP AMP	WIRE SIZE	DESCRIPTION	CKT. NO.	
	1			110	3	16.6	27.7			11.1	3	75			2	
* NEW	3	ERV SUPPLY FAN VFD	3#6	110	3	16.6		27.7		11.1	3	75	3#8	ERV EXHAUST FAN VFD	4	* NEW
	5			110	3	16.6			27.7	11.1	3	75			6	
* NEW	7	ROOM LIGHTING	2#12	20	1	.7	1.6			.9	1	20	2#12	NEW CONDENSATE PUMP	8	
* NEW	9	PANEL GFCI RECEPTACLE	2#12	20	1	.6		1.5		.9	1	20			10	* NEW
* REWIRE	11	BARBER–COLEMAN PWR SPLY	2#12	20	1	.6			1.5	.9	1	20	2#12	EXISTING CONDENSTE PUMP	12	* REWIRE
* REWIRE	13	STARTER	2#12	20	1	.6	.6				3	–	–	SPACE	14	
	15		2#12	20	1	.9		.9							16	
* NEW	17	ERV ENERGY WHEEL MOTOR	2#12	20	1	.9			.9						18	
	19		2#12	20	1	.9	.9				1	–	–	SPACE	20	
	21	SPACE	–	–	1			XXX			1	–	–	SPACE	22	
	23	SPACE	–	–	1				XXX		1	–	–	SPACE	24	
	25	SPACE	–	–	1		XXX				1	–	–	SPACE	26	
	27	SPACE	–	–	1			XXX			2	–	–	SPACE	28	
	29	SPACE	–	–	1				XXX						30	
	31	SPACE		–	1		XXX				1	–	–	SPACE	32	
	33	SPACE		–	1			XXX			1	–	–	SPACE	34	
	35	SPACE		–	1				XXX		1	–	–	SPACE	36	
	37						XXX								38	
	39	SPACE	–	–	3			XXX			3	–	–	SPACE	40	
	41								XXX						42	
			CONN. VA/PHASE				30.8	30.1	30.1							
			TOTAL CONN. KVA					91.0								

NOTES:

1. PROVIDE PANEL WITH COPPER BUSSING.
2. PROVIDE PANEL WITH EQUIPMENT GROUND BAR.
3. PANEL PANEL RATINGS DESIGNED AT 90 DEG. C.

GENERAL NOTES–ELECTRICAL

1. REFER TO MECHANICAL DRAWINGS FOR THE EXACT REQUIREMENTS AND LOCATION OF THE EQUIPMENT TO BE POWERED, MAINTAIN MIN.36" CLEARANCE FROM PANEL FACE TO ERV EQUIPMENT..
2. ALL CIRCUIT NUMBERS ARE FOR REFERENCE ONLY. ELECTRICAL CONTRACTOR CAN CHANGE THE CIRCUIT NUMBERS BUT SHALL PROVIDE THE SHOWN CIRCUITS AND CIRCUIT BREAKERS IN THE PANELS. PROVIDE CIRCUIT BREAKERS AS REQUIRED
3. PROVIDE LAMICOID LABELS AND PRINTED PANEL SCHEDULE FOR ALL PANELS.

GENERAL NOTES:

1. INSTALLATIONS SHALL COMPLY WITH FEDERAL, STATE, AND LOCAL, 2022 BUILDING CODE WITH CT AMENDMENTS..
2. ALL WIRING SHALL COMPLY WITH APPLICABLE SECTIONS OF THE NATIONAL ELECTRICAL CODE 2020 WITH CT AMENDMENTS.
3. CONTRACTOR SHALL REFER TO SCHOOLS FIRE PROTECTION DRAWINGS AND FIELD VERIFY FOR EXACT COUNT OF SMOKE DETECTORS AND BE RESPONSIBLE FOR ALL REQUIRED UNITS.
4. NO SMOKE DETECTOR SHALL BE LOCATED WITHIN 3 FEET OF A SUPPLY AIR OUTLET, REFER SHALL NFPA 72 FOR MORE GUIDELINES.
5. NO PARALLEL BRANCHING OR "T" SPLICES ARE PERMITTED ON SIGNALING CIRCUITS.
6. ALL ENCLOSURES AND CONDUITS SHALL BE PROPERLY GROUNDED IN ACCORDANCE WITH APPLICABLE EDITION OF THE NATIONAL ELECTRICAL CODES.
7. ALL WIRING SHALL BE IN ELECTRICAL METAL CONDUIT UNLESS OTHERWISE INDICATED ON FLOOR PLANS OR SPECIFICATIONS.
8. INSTALLATION SHALL BE COMPLETED IN A PROFESSIONAL, WORKMANLIKE MANNER.
9. THE DEVICES SHOWN ON THE RISER DO NOT REPRESENT THE ACTUAL COUNT. ELECTRICAL CONTRACTOR SHALL REFER TO ELECTRICAL AND MECHANICAL DRAWINGS FOR EXACT COUNTS OF DEVICES, AND BE RESPONSIBLE FOR ALL REQUIRED UNITS.

ELECTRICAL SYMBOL LEGEND

SYMBOL	DESCRIPTION	ABBREV.	DESCRIPTION
S	SINGLE POLE SWITCH	AFF	ABOVE FINISHED FLOOR
S_2	DOUBLE POLE SWITCH	A	AMPS OR AMPERAGE
S_3	THREE WAY SWITCH	C/B	CIRCUIT BREAKER
S_{OC}	OCCUPANCY SWITCH	C	CONDUIT
S_T	PROGRAMMABLE TIMER SWITCH	CTR	COUNTERTOP
	DUPLEX RECEPTACLE	DN	DOWN
	DUPLEX RECEPTACLE TOP SWITCHED	EMT	ELECTRICAL METALLIC TUBING
GFCI	GFCI DUPLEX RECEPTACLE	ER	EXISTING TO REMAIN
CTR GFCI	GFCI DUPLEX RECEPTACLE ABOVE COUNTERTOP	EX	EXHAUST
WP GFCI	WEATHERPROOF GFCI DUPLEX RECEPTACLE	FL	FAN LIGHT
	DOUBLE DUPLEX RECEPTACLE	GFCI	GROUND FAULT CIRCUIT INTERRUPTER
	220 VOLT RECEPTACLE	GM	GAS METER
AFI	ARC FAULT INTERRUPTED DUPLEX RECEPTACLE	G	GROUND
	208/120V CIRCUIT BREAKER PANEL	IMC	INTERMEDIATE METAL CONDUIT
	ELECTRIC METER	KVA	KILOVOLTAMPERES
	DISCONNECT	KW	KILOWATTS
	FUSED DISCONNECT	N	NEW
J	JUNCTION BOX	P	POLE
T	TRANSFORMER	RE	REMOVE EXISTING
	CEILING MOUNTED FLUORESCENT LIGHT FIXTURE	RGS	RIGID GALVANIZED STEEL
	WALL MOUNTED LIGHT FIXTURE	RLE	RELOCATE EXISTING
	CEILING MOUNTED LIGHT FIXTURE	RNC	RIGID NONMETALLIC CONDUIT
	WALL MOUNTED WEATHERPROOF LIGHT FIXTURE	RPL	REPLACE EXISTING WITH NEW
T	WALL MOUNTED THERMOSTAT	TYP	TYPICAL
	CONDENSATE PUMP	W	WALL MOUNTED
	EXHAUST FAN	WH	WATER HEATER
S	SMOKE DETECTOR – CEILING MOUNTED	WP	WEATHERPROOF
S_W	SMOKE DETECTOR – WALL MOUNTED	V	VOLTS OR VOLTAGE
S_{CO}	COMBINATION SMOKE/CO DETECTOR	X	LIGHT TYPE FIXTURE DESIGNATION
CO	CARBON MONOXIDE DETECTOR	(#)	CIRCUIT NUMBER
TV	CABLE TV OUTLET	#	PLAN NOTE CALL OUT NUMBER
W	TELEPHONE OUTLET, WALL MOUNTED AT 48"AFF		CONDUIT DOWN
	TELEPHONE OUTLET, WALL MOUNTED AT 18"AFF		CONDUIT UP
	TELE/DATA OUTLET, WALL MOUNTED AT 18"AFF W/3/4"EMT TO ABOVE CEILING, WIRING BY OTHERS		
	DOORBELL/CHIME BUTTON		
	DOORBELL/CHIME		
(#)	HOME RUN AND CIRCUIT NUMBER		

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REVISIONS / AUTHORIZATIONS

NO.	REVISIONS / AUTHORIZATIONS	DATE

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