



City of Meriden, Connecticut

Purchasing Department

Invitation to Bid

For

Lincoln Middle School Chiller

Meriden, CT

B024-29

**Proposals Due: December 28, 2023 @
11:30 AM**

*Purchasing Department
142 East Main Street, Room 210
Meriden, CT 06450
(203) 630-4115*

LEGAL NOTICE INVITATION TO BID

THE CITY OF MERIDEN IS ACCEPTING SEALED BIDS FOR:

B024-29 Supply and Install Chiller at Lincoln Middle School

Bids shall be submitted on forms and in the manner specified. Bids will be accepted in Purchasing, Room 210, 142 East Main Street, Meriden, CT 06450, until **11:30 A.M. on December 28, 2023** at which time they will be publicly opened and read. Bid documents/Forms and specifications may be obtained from the Purchasing Department, on the City of Meriden website (www.meridenct.gov/business/bids-rfps/), and on the State of Connecticut Department of Administrative Services website (<https://webprocure.proactiscloud.com>).

A Non-MANDATORY Pre-Bid Conference will be held on the project site. Please meet at **10:00 AM on December 12, 2023** at Lincoln Middle School 164 Centennial Avenue, Meriden, CT 06451.

The right is reserved to reject any and all bids, in whole or in part, to award any item, group of items, or total bid, and to waive informality or technical defects, if it is deemed to be the best interest of the City of Meriden. No bidder may withdraw sixty (60) days of the date of the bid opening.

Each bid shall be accompanied by a Certified Check or Bid Bond in the amount of Ten (10%) percent of the amount proposal.

The attention of bidders is called to the requirement for minimum wage rates to be paid under the contract.

The City of Meriden is an Affirmative Action/Equal Opportunity Employer. Disadvantaged, minority, small, and woman business enterprises are encouraged to respond.

Rawle Dummett
Purchasing Officer,
City of Meriden
Dated: November 30, 2023

CITY OF MERIDEN, CONNECTICUT

B024-29 – Lincoln Middle School Chiller

INFORMATION TO BIDDERS

1. **BIDDING PROCEDURES**

Sealed Bids shall be submitted on the forms designated by the attached proposal bid forms. Bids will be received by the City of Meriden’s Purchasing Department, Room 210, City Hall, 142 East Main Street, Meriden, Connecticut, 06450-8022 until **11:00 AM on December 28, 2023** and thereafter immediately read in public (the “bid opening”).

2. **BIDS**

Bids are to be submitted on the attached proposal forms. Please submit two copies of the proposal forms and Bidder’s Qualification Statement. One shall be an original and one can be a copy. **Please submit one complete copy of your bid on a flash drive.**

BID WILL BE AUTOMATICALLY REJECTED FOR ANYONE SUBMITTING A SURETY OTHER THAN THOSE SPECIFIED.

- a. Bids must be made out and signed in the corporate, or other, name of Bidder, and must be fully and properly executed by an authorized person.
- b. The sealed envelope must denote the Bidder’s name and address in the upper left hand corner and the words “**BID DOCUMENT – B024-29 – Lincoln Middle School Chiller to be opened at 11:00 AM**” in the lower left hand corner.
- c. Bids received later than the time and date specified will not be considered.
- d. Amendments to or withdrawal of bids received later than the date and time set forth in the bid opening will not be considered.
- e. All prices must be in ink or typewritten. In the event of a bidder’s mathematical error in tabulating any bid prices, ***the written unit prices shall govern.***

3. **BIDDER QUALIFICATIONS**

Bidders will be required to fill out, and include as part of its bid, any attached Bidder’s Qualification Statement.

In determining the qualifications of a bidder, the City of Meriden will consider the bidder’s record of performance in any prior contracts for construction work. The City of Meriden expressly reserves the right to reject a bid if the bidder’s historical performance, in the sole opinion of the City of Meriden, has been unsatisfactory in any manner or if the bidder has habitually and without just cause neglected the payment of bills or has otherwise disregarded its obligations to subcontractors, suppliers, or employees.

4. EXAMINATION OF BIDDING DOCUMENTS

Bidders are to examine all documents and visit the site in order to make a thorough examination of the conditions so that the bidder may familiarize itself with all of the existing requirements, conditions, and difficulties that will affect the execution of the work in order to determine the amount of work necessary to carry out the true intent of the specifications and work shown on the drawings.

The City of Meriden and its agents do not have any responsibility for the accuracy, completeness, or sufficiency of any bid document obtained from any other source other than from the City of Meriden. Obtaining documents from any other source(s) may result in obtaining incomplete and inaccurate information. Obtaining documents from any other source may also result in failure to receive any addenda, corrections, or other revisions to the documents that may be issued.

No request shall be honored if such request is made less than seven (7) calendar days prior to the date fixed for the opening of bids. Any and all such interpretations, and any supplementary instructions, will be in the form of a written addenda to the specifications which, if issued, will be made available on the City of Meriden website (www.meridenct.gov) unless it is to change the date fixed for the opening of bids, not later than three (3) days prior to the date fixed for the opening of bids. Bidders are encouraged to check the website regularly for addenda. Failure of any bidder to receive any such addenda shall not relieve any bidder from any obligations under its bid as submitted.

Any questions about the bid document must be submitted in writing via email to meridenpurchasing@meridenct.gov. Any other format of question will not be answered.

5. BIDS TO REMAIN OPEN

No bidder may withdraw its bid within ninety (90) days of the date of the bid opening.

Should there be reason why the contract cannot be awarded within the specified period, the time may be extended by mutual agreement between the City of Meriden and the successful bidder.

6. AWARD OF CONTRACT

The Purchasing Officer reserves the right to make an award on the bid which, by the Purchasing Officer's judgment and recommendation from the Meriden Public Schools/Bemis Associates following bid evaluations, best meets the specifications and is deemed to be in the best interest of the City of Meriden.

The contract will not be awarded to any corporation, firm, or individual which/who is in arrears to the City of Meriden by debt or contract, or who is in default as security or otherwise by any obligation to the City of Meriden.

The right is reserved to reject any or all bids, in whole or in part, to award any item, group of items, or total bid, and to waive informality or technical defects, if it is deemed to be in the best interest of the City of Meriden.

7. BID PROTEST PROCEDURE

In the event that any bidder wishes to protest the potential award of a bid, or any procedure of act in the advertising or soliciting of the bids, said bidder must make said protest in writing, which shall state the reason therefore and request a conference with respect thereto. Said protest must be received in the City Purchasing Office within **FIVE (5)** business days after the delivery of bid results or decisions. A conference with respect to said protest shall be scheduled by the Purchasing Officer forthwith and shall be attended by him or his designee and such other persons as the Purchasing Officer and the City Manager shall require to attend. The subject matter of said conference shall be limited to the reasons for the protest specified in the written request for said conference. Said conference shall also include a discussion of all possibilities for a resolution of dispute. The City shall make a decision in writing within three (3) business days after said conference and forward the same to the protesting bidder forthwith. In the event that any protesting bidder wishes to take legal action against the City, they must fully comply with all of these instructions to bidders.

8. CITY OF MERIDEN, LOCAL PREFERENCE

In determining the lowest responsible bidder, the Purchasing Department shall also consider Local Preference.

This section shall not apply in those instances where the bid requested involves a cooperative purchasing arrangement between the City of Meriden and other municipalities or the State of Connecticut.

Bidders are specifically advised that the City of Meriden has adopted Section 3-14 of the Code of the City of Meriden which requires, but is not limited to, a local preference requiring, in part, that a "City-based business" shall mean a business with its principal place of business located within the boundaries of the City of Meriden. A business shall not be considered a "City-based business" unless evidence has been submitted, satisfactory to the Purchasing Department, with each bid (forms included in bidding documents) to establish that the bidder has a bona fide principal place of business, operates out of, or pays property taxes on personal property in the City of Meriden.

Any City-based business bidder which has submitted a bid not more than ten (10) percent higher than the low bid provided such City-based business bidder agrees to accept the award of the bid at the amount of the low bid. The acceptance shall be submitted in writing to the Purchasing Department no later than next business day following the opening of the bid. For example, a bid opened at 11:00 a.m. on a Monday must be accepted by the City-based bidder no later than 11:00 a.m. on Tuesday. If more than one City-based business bidder has submitted bids not more than ten (10) percent higher than the low bid and has agreed to

accept the award of the bid at the amount of the low bid, the lowest responsible bidder shall be one of the City-based business bidders which has submitted the lowest bid.

Bidders claiming status under the local preference are hereby required to submit with its bid an additional form, titled "Request for Status as a Meriden Based Business."

****The City of Meriden Local Preference may be withdrawn as the Meriden Public Schools are in the process of apply for a State of Connecticut Grant to defer the costs of the project.****

9. EXTENSION OF AGREEMENT – N/A

10. TIME

Inasmuch as the contract concerns a public improvement, the provisions of the contract relating to the time of performance and completion of the work are of the essence of the contract. Accordingly, the successful bidder/contractor ("Contractor") shall begin work on the day specified in paragraph 2.04 of the General Conditions and shall perform the work diligently so as to permit full use not later than the first day following the construction period established in the Contract. See paragraph 10 entitled "Liquidated Damages" of the Agreement between City of Meriden, as owner, and the Contractor.

11. SCHEDULE OF WORK

The Contractor shall schedule all work in a manner that will not disrupt City of Meriden operations. Once the work has begun, the Contractor shall work full-time until completion of the Contract.

12. TAXES

The City of Meriden is exempt under Connecticut General Statutes from the payment of the excise taxes imposed by the federal government and the Sales and Use Tax of the State of Connecticut; such taxes should not be included in the bid price. Upon request, exemption certificates will be furnished to the successful bidder.

13. FAIR EMPLOYMENT PRACTICES

The Contractor shall agree that neither it or its subcontractors, except in the case of a bona fide occupational qualification or need, to refuse to hire or employ or to bar or to discharge from employment any individual or to discriminate against such individual in compensation or in terms, conditions or privileges of employment because of the individual's race, color, religious creed, age, sex, gender identity or expression, marital status, national origin, ancestry, present or past history of mental disability, intellectual disability, learning disability, physical disability, including, but not limited to, blindness or status as a veteran. The aforementioned terms are obtained from Connecticut General Statutes Section 46a-60, *et seq.*, entitled "Discriminatory employment practices prohibited," as amended.

14. FORM OF AGREEMENT BETWEEN CITY OF MERIDEN AND CONTRACTOR

The Agreement for the work will be written on the Agreement between City of Meriden and Contractor, wherein the basis of payment is a stipulated sum.

15. LOCAL SUBCONTRACTORS, SUPPLIERS, etc.

Local subcontractors, material suppliers, and labor in the City of Meriden should be considered and sought out insofar as it is practical in the performance of this project.

16. CITY OF MERIDEN CODE OF ETHICS

The City of Meriden has adopted a Code of Ethics located in Chapter 21 of the Code of the City of Meriden, sections 21-1 through 21-15, inclusive, which are expressly incorporated herein by reference. The terms of the Code of Ethics shall constitute a part of any contract or agreement entered into by the City of Meriden as a result of this bid as if those terms were fully set forth in such contract or agreement.

Bidders are specifically advised that the Code of Ethics prohibits public officers and employees, as well as their immediate families and businesses, with which they are associated from participating in any transaction which is incompatible with the proper discharge of official duties or responsibilities. Bidders are also advised that the Code of Ethics contain provisions with respect to paid contractors and former employees and officials.

BIDDERS SHOULD NOTE THAT BIDS, CONTRACTS, AND AGREEMENTS ENTERED INTO OR AWARDED IN VIOLATION OF THE CODE OF ETHICS ARE VOIDABLE BY RESOLUTION OF THE CITY COUNCIL OF THE CITY OF MERIDEN.

Copies of the Code of Ethics may be obtained from the office of the City Clerk or may be found online on the City of Meriden's website.

17. NON-COLLUSION BID STATEMENT

Each bidder submitting a bid to the City of Meriden for any portion of the work contemplated by the documents on which bidding is based shall execute and attach thereto the sworn Non-Collusive Bid Statement, to the effect that the bidder has not colluded with any other person, firm, or corporation in the submission of the bid.

18. SOIL CONDITIONS

The City of Meriden does not guarantee the accuracy of any information which it may have obtained as to the kind or condition of the soil that may be encountered in the performance of the proposed work; neither does the City of Meriden represent that the plans and specifications drawn are based upon any soil data so obtained. The City of Meriden does not

make any representations as to the soil data so obtained. The City of Meriden does not make any representations as to the soil conditions to be encountered or as to foundation materials.

19. AWARD IN CASE OF A TIE

In the event there are two or more responsive bidders, the decision to award will be based by the following criteria and in the following order:

- a. The incumbent will be awarded the bid over that of another bidder.
- b. In the case of a multi-item bid, if one bidder has been awarded other items from the same bid and the other bidder has not, the bidder with the multiple awards will be awarded the bid over that of another bidder.
- c. The bidder located in the State of Connecticut will be awarded the bid over that of another bidder.
- d. The winner of a coin toss will be awarded the bid over that of another bidder.

The above-referenced provisions do not apply to those situations in which more than one City-based business responsible bidder has submitted bids not more than ten (10) percent higher than the lowest bid and has agreed to accept the award of the bid at the amount of the lowest bid. Under such circumstances, the provisions of the Code of the City of Meriden, section 3-14, are controlling, as set forth under Section 8 of this 'Information to Bidders.'

20. ASSIGNMENT OF CONTRACT

No contract may be assigned without the written consent of the Purchasing Officer or designee.

21. PERMITS

The Contractor shall be responsible for obtaining any and all necessary permits required by the City of Meriden prior to the commencement of work. The Contractor may contact the City of Meriden Building Department for permit information at (203) 630-4091. For all other required permits, contact the City of Meriden Engineering Department at (203) 630-4018.

22. BID PRICE AND PAYMENT

The City of Meriden is exempt from the payment of the excise taxes imposed by the Federal government and the Sales and Use Tax of the State of Connecticut under Connecticut General Statutes; accordingly, such taxes shall not be included in the bid price.

The City of Meriden, unless stated otherwise in the bidding documents or Contract, will make payment to the Contractor not less than thirty (30) days following completion of services.

23. QUALITY

All materials, equipment, supplies, and services shall be subject to rigid inspection. If defective material, equipment, supplies, or services are discovered, the Contractor shall remove or make good such material, equipment, or supplies without extra compensation. It is expressly understood and agreed that any inspection by the City of Meriden will in no way lessen the responsibility of the Contractor or release Contractor from the obligation to perform and deliver to the City sound and satisfactory materials, equipment, supplies, or allow the cost to be deducted from any monies due it from the City of Meriden. All services will be performed in a workmanlike manner.

24. INSURANCE

The successful bidder shall be required to provide a Certificate of Insurance denoting general liability, automobile liability, workers compensation liability, and other coverage required by the City's Risk Manager.

25. CITY HALL CLOSING

If Meriden City Hall is closed due to inclement weather, or any other unforeseen event, bids will be due at the same time on the next business day that City Hall is open.

26. PAYMENT REQUISITIONS & CERTIFIED PAYROLL

Progress payment requisitions are due monthly on last day of the month for work completed during the contract period. Requisitions are to be sent to the Architect/Engineer and/or City of Meriden Department responsible for management/administration of the contracted work.

Certified Payroll for construction contracts that require State of Connecticut Prevailing Wage Determinations are required for each week of work by the Contractor and any or all the Contractor's Subcontractors and are due monthly with each requisition. One hard copy and one electronic copy shall be sent to the Architect/Engineer and the City of Meriden Purchasing Department. No progress payments will be issued to the Contractor without accompanying Certified Payroll.

For federally funded construction contracts with Davis Bacon Wage Determinations, Certified Payroll for all employees of the Contractor and any or all of the Contractor's Subcontractors are required to be submitted weekly to the Architect/Engineer and to the City of Meriden Purchasing Department. One hard copy and one electronic copy shall be sent to the Architect/Engineer and the City of Meriden Purchasing Department. Employees on the construction site will be interviewed by City of Meriden Staff and/or City of Meriden subcontracted Project Management/Clerk-of-the-Works/Owner's Representatives for Davis Bacon compliance. No progress payments will be issued to the Contractor without accompanying Certified Payroll.

CITY OF MERIDEN, CONNECTICUT

**B024-29 – Lincoln Middle School Chiller NON-COLLUSIVE BID
STATEMENT/AFFIDAVIT**

The undersigned bidder, having been duly sworn, does hereby depose and says:

- 1. The bid has been arrived at by the bidder independently and has been submitted without collusion and without any agreement, understanding, or planned common course of action with any other vendor of materials, supplies, equipment, or services described in the Invitation to Bid.

- 2. The contents of the bid have not been communicated by the bidder or its employees or agents to any person not an employee or agent of the bidder or its surety on any bond furnished with the bid, and will not be communicated to any such person prior to the official opening of the bid.

- 3. The undersigned bidder is duly authorized to bind the business entity identified below.

The undersigned bidder further certifies, under oath, that this statement is executed for the purposes of inducing the City of Meriden to consider the bid and make an award in accordance therewith.

Signature of Bidder

Print Legal Name of Bidder

Relationship to Business Entity Below

Business Entity Name, Address, Telephone Number, and Email Address

STATE OF CONNECTICUT)
) ss:
COUNTY OF)

Duly sworn and subscribed to before me
this ___ day of _____, 2023.

Notary Public
My Commission Expires:
Commissioner of the Superior Court

CITY OF MERIDEN, CONNECTICUT

B024-29 – Lincoln Middle School Chiller

REQUEST FOR STATUS AS A MERIDEN-BASED BUSINESS

Bidders are specifically advised that the City of Meriden has adopted Section 3-14 of the Code of the City of Meriden which requires, but is not limited to, a local preference requiring, in part, that a “City-based business” shall mean a business with its principal place of business located within the boundaries of the City of Meriden. A business shall not be considered a “City-based business” unless evidence satisfactory to the Purchasing Department has been submitted with each bid by said business to establish that it has a bona fide principal place of business in the City of Meriden. Such evidence may include evidence of ownership or a long term lease of the real estate from which the principal place of business is operated, or payment of property taxes on the personal property of the business.

In determining the lowest responsible bidder, the Purchasing Department shall also consider the following:

Any City-based business bidder which has submitted a bid not more than ten (10%) percent higher than the low bid. Such City-based business shall agree to accept the award of the bid at the amount of the low bid. The acceptance shall be submitted in writing to the Purchasing Department no later than the same time of the bid opening on the next business day following the opening of the bid.

If more than one City based business bidder have submitted bids not more than ten (10%) percent higher than the low bid and have agreed to accept the award of the bid at the amount of the low bid, the lowest responsible bidder shall be that one which has submitted the lowest bid.

This section shall not apply in those instances where the bid requested involves a cooperative purchasing arrangement between the City of Meriden and other municipalities or the State of Connecticut.

The bidder may submit any additional information he/she desires that he/she feels establishes the company as a city based business, including but not limited to; evidence of ownership, a long term lease of the real estate from which the principal place of business is operated, or payment of property taxes on the personal property of the business.

1) Name of Bidder: _____

2) Meriden Office Address: _____

3) Minority owned: Yes _____ No _____

- 4) The undersigned hereby authorizes and requests any persons, firms, or corporations to furnish any information requested by the City of Meriden, in verification of the recitals comprising this Request for Status as a City Based Business.

Dated at: _____ this: _____ day of _____, 2023

Name of bidder: _____

By: _____

Title: _____

IF REQUESTING STATUS AS A MERIDEN-BASED BUSINESS, SUBMIT THIS FORM WITH YOUR PROPOSAL.

1. Minority owned business? _____yes _____no
2. Years organized. _____
3. Is your company a corporation _____yes _____no
If yes where incorporated? _____
4. How many years have you been engaged in business under your present firm name? _____
5. Former Firm Name (if any)_____
6. List total number of Personnel _____
7. Is any principal of your firm an employee or public official of the City of Meriden, or an immediate family member of an employee or public official of the City of Meriden? (Definition of immediate family includes: an individual's spouse, fiancé or fiancée; the parent, brother or sister of such individual or spouse; and the child of such individual or the spouse of such child.)
_____yes _____no
8. List Vehicles and Equipment that you will use to perform this work: (show age of vehicles and equipment, sizes, capacities, etc.)

9. List the work to be performed by Subcontractors and summarize the dollar value of each subcontract.

10. List the name and address of the more important contracts recently completed by you, starting the approximate gross cost for each, and the month and year completed:

11. General character of work performed by you _____

12. Have you ever failed to complete any contract awarded to you? If so, where and why?

13. Have you ever defaulted on a contract? If so where and why?

14. Have you ever filed bankruptcy: _____ Please explain: _____

15. Will you, upon request, furnish any information that may be required by the City of Meriden? _____
16. The undersigned hereby authorizes and request any person, firm or cooperation to furnish any information requested by the City of Meriden, in verification of the recitals comprising this Statement of Bidder's Qualifications.

Dated this _____ day of _____, 20____ year

 Name of Bidder

 Title

State of _____
 County of _____

_____ being duly sworn deposes and says that they are
 Name _____ of _____
 title _____ name of organization
 and that the answers to the forgoing question and all statement therein contained are true and correct

Subscribed and sworn to before me
 this _____ day of _____, 2023
 day month year

 Notary Public signature

My commission expires _____

FORM OF SURETY GUARANTY

(Shall accompany proposal)

KNOW ALL MEN BY THESE PRESENTS, that for and in consideration of the sum of \$1.00, lawful money of the United States, the receipt whereof is hereby acknowledged, paid the undersaid corporation, and for other valuable consideration the

(Name of Surety Company) .

a corporation organized and existing under the laws of the State of _____

and licensed to do business in the State of _____ certifies and agrees

that if Contract _____

is awarded to - _____
(Name of Bidder)

Corporation will execute the bond or bonds as required by the Contract Documents and will become surety in the full amount of the Contract price for the faithful performance of the Contract and for payment of all persons supplying labor or furnishing or furnishing materials in connection thencewith.

(Surety)

The language of this form shall generally be given on the official form normally provided by the Surety Company complete with the usual proof of Authority of Officers of the Surety Company to execute said official form.

Should a bid be offered with a check as surety without said official form, such bid shall be rejected.

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned

(Name of Principal)

As Principal, and _____, as Surety are firmly bound
(Name of Surety)

Unto the CITY OF MERIDEN, CONNECTICUT hereinafter called the "OWNER", in the penal sum of

_____ DOLLARS, (\$_____) lawful money of the
United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors,
administrators, successors and assigns, jointly and severally, firmly by these presents:

THE CONDITION OF THIS OBLIGATION IS SUCH THAT, WHEREAS, the said Principal has submitted the
Accompanying bid dated _____, 20 _____

For _____

NOW, THEREFORE, if the Principal shall not withdraw said Bid within the Period specified therein after the opening of
the same, or if no period be specified, within thirty (30) days after the said opening and shall within the period specified
therefore, or if no period be specified, within ten (10) days after the prescribed forms are presented to him for signature,
enter into a written Contract with the Owner in accordance with the Bid, as accepted, and give bond with good and
sufficient surety or sureties, as may be required for the faithful performance and proper fulfillment of such Contract; or in
the event of the withdrawal of said Bid within the period specified, or the failure to enter into such Contract and give such
bond within the time specified, if the Principal shall pay the Owner the difference between the amount specified in said
Bid and the Amount for which the Owner may procure the required work or supplies or both, if the latter be in excess of
the former, then the above obligation shall be void and of no effect, otherwise to remain in full force and effect.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, this _____ day of
_____, 2023 .

(Principal)

(Address) (Affix seal)

Witness Signature By: _____

(Surety)

(Address) (Affix seal)

Witness Signature By: _____

BID FORM

**B024-29
Lincoln Middle School Chiller**

Date of Opening: December 28, 2023
At 11:30 AM

To: Rawle Dummett
Purchasing Officer
142 East Main Street, Room 210
Meriden, CT 06450

The undersigned _____, doing business in the City/Town of _____, in the State of _____, herewith, after reading thoroughly the Specifications and other Bid documents (including if any addendum or addenda) submit the following proposal:

Lump sum price:

_____ Dollars & Cents
Written Amount

Receipt of Addenda is acknowledged:

No: _____ Dated: _____

No: _____ Dated: _____

NAME OF BIDDER _____

ADDRESS _____

BY: _____
Print or type name Title

SIGNATURE _____ DATE _____

TELEPHONE _____ E-Mail _____

PLEASE NOTE: All spaces must be filled in with figures or words or your bid may be automatically rejected.

STANDARD FORM OF AGREEMENT
BETWEEN OWNER AND CONTRACTOR
ON THE BASIS OF A STIPULATED PRICE
B024-29 – Lincoln Middle SCHOOL CHILLER

THIS AGREEMENT is dated as of the _____ day of _____ 2023 by and between the City of Meriden, 142 East Main Street Meriden, CT 06450 hereinafter called OWNER and _____ hereinafter called CONTRACTOR.

OWNER and CONTRACTOR, in consideration of the mutual covenants hereinafter set forth, agree as follows:

Article 1. WORK.

CONTRACTOR shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows: furnish labor and materials to install a new chiller at Lincoln Middle School, 124 Columbia Street, Meriden, CT 06451.

The Project for which the Work under the Contract Documents may be the whole or only a part is generally described as follows: furnish labor and materials to install a new chiller at Lincoln Middle School, 124 Columbia Street, Meriden, CT 06451.

Article 2. ENGINEER.

The Project has been designed by Bemis Associates, LLC, 185 Main Street, Farmington, CT 06032 who is hereinafter called ENGINEER and who is to act as Owner's representative, assume all duties and responsibilities and has the rights and authority assigned to ENGINEER in the Contract Documents in connection with completion of the Work in accordance with the contract documents.

Article 3. CONTRACT TIMES.

3.1 The Work will be substantially completed by April 1, 2024, after the date when the Contract Times commence to run as provided in paragraph 2.03 of the General Conditions, and completed and ready for final payment in accordance with paragraph 14.07B of the General Conditions by April 15, 2023 after the date when the Contract Times commence to run.

3.2 Liquidated Damages. OWNER and CONTRACTOR recognize that time is of the essence of this Agreement and that OWNER will suffer financial loss if the Work is not completed within the times specified in paragraph 3.1 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. They also recognize the delays, expense and difficulties involved in proving the actual loss suffered by OWNER if the Work is not completed on time. Accordingly, instead of requiring any such proof, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) CONTRACTOR shall pay OWNER Two Hundred Fifty Dollars (**\$250.00**) for each day that expires after the time specified in paragraph 3.1 for Substantial Completion until the Work is substantially complete. After Substantial Completion, if CONTRACTOR shall neglect, refuse or fail to complete the remaining Work within the time specified in paragraph 3.1 for completion and readiness for final payment or any proper extension thereof granted by OWNER, CONTRACTOR shall pay OWNER Two Hundred Fifty Dollars (**\$250.00**) for each day that expires after the time specified in paragraph 3.1 for completion and readiness for final payment.

Article 4. CONTRACT PRICE.

OWNER shall pay CONTRACTOR for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the amounts determined pursuant to paragraphs 4.1 and 4.2 below:

4.1. For all Work, other than Unit Price Work, a Lump Sum of:

Figures:

Written:

All specific cash allowances are included in the above price and have been computed in accordance with 11.02 of the General Conditions;

Plus
4.2. For all Unit Price Work, an amount equal to the sum of the established unit price for each separately identified item of Unit Price Work times the estimated quantity of that item as indicated in this paragraph 4.2:

UNIT PRICE WORK – N/A

NO.	ITEM	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL ESTIMATED
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TOTAL OF ALL UNIT PRICES:

_____ \$ _____
Written Figures

As provided in paragraph 11.03 of the General Conditions estimated quantities are not guaranteed, and determinations of actual quantities and classification are to be made by ENGINEER as provided in paragraph 9.07 of the General Conditions. Unit prices have been computed as provided in paragraph 11.03C of the General Conditions.

(The Bid may be attached. Any attachments and/or exhibits attached should be listed in Article 8).

If adjustment prices for variations from stipulated Base Bid quantities have been agreed to, insert appropriate provisions.

Article 5. PROGRESS PAYMENTS.

- 5.1 Based upon applications for Payment submitted to the Engineer by the Contractor and Certificates for Payment issued by the Engineer, the Owner shall make progress payments on account to the Contractor as provided below and elsewhere in the Contract Documents.
- 5.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month.

- 5.3 Each Application for Payment shall be based upon the Schedule of Values submitted by the Contractor in accordance with the Contract Documents. The Schedule of Values shall allocate the entire Contract Sum among the various portions of the Work and be prepared in such form and supported by such data to substantiate its accuracy as the Engineer may require. This Schedule, unless objected to by the Engineer, shall be used as a basis for reviewing the Contractor's Applications for Payment.
- 5.4 Applications for Payment shall indicate the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.
- 5.5 Subject to the provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

5.6.1 Take that portion of the Contract sum properly allocable to completed work as determined by multiplying the percentage completion of each portion of the Work by the share of the total Contract Sum allocated to that portion of the work in the Schedule of Values, less retainage of five percent (5 percent). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute may be included as provided in appropriate sections of the General Conditions even though the Contract Sum has not yet been adjusted by Change Order.

5.6.2 Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing) less retainage of five percent (5 percent).

5.6.3 Subtract the aggregate of previous payments made by the Owner; and

5.6.4 Subtract amounts, if any, for which the Engineer has withheld or nullified a Certificate for Payment as provided in Paragraph 14.02.B.5 of the General Conditions.

5.7 The progress payment amount determined in accordance with Paragraph 5.6 shall be further modified under the following circumstances;

(Not applicable)

5.7.1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to ninety-five percent (95) of the Contract Sum, less such amounts as the Engineer shall determine for incomplete Work and unsettled claims; and

5.7.2 Add, if final completion of the Work is thereafter materially delayed, through no fault of the Contractor, additional amounts payable in accordance with Paragraph 14.08 of the General Conditions.

5.8 Reduction or limitation of retainage, if any shall be as follows:

(Not applicable)

5.9 Progress payment requisitions are due monthly on last day of the month for work completed during the contract period. Requisitions are to be sent to the Architect/Engineer and/or City of Meriden Department responsible for management/administration of the contracted work.

Certified Payroll for construction contracts that require State of Connecticut Prevailing Wage Determinations are required for each week of work by the Contractor and any or all the Contractor's Subcontractors and are due monthly with each requisition. One hard copy and one electronic copy shall be sent to the Architect/Engineer and the City of Meriden Purchasing Department. No progresspayments will be issued to the Contractor without accompanying Certified Payroll.

For federally funded construction contracts with Davis Bacon Wage Determinations, Certified Payroll for all employees of the Contractor and any or all of the Contractor's Subcontractors are required to be submitted weekly to the Architect/Engineer and to the City of Meriden Purchasing Department. One hard copy and one electronic copy shall be sent to the Architect/Engineer and the City of Meriden Purchasing Department. Employees on the construction site will be interviewed by City of Meriden Staff and/or City of Meriden subcontracted Project Management/Clerk-of-the-Works/Owner's Representatives for Davis Bacon compliance. No progress payments will be issued to the Contractor without accompanying Certified Payroll.

Article 6. INTEREST.

No interest shall be due or paid on any monies not paid when due.

Article 7. CONTRACTOR'S REPRESENTATIONS.

In order to induce OWNER to enter into this Agreement CONTRACTOR makes the following representations:

7.1. CONTRACTOR has examined and carefully studied the Contract Documents including the Addenda listed in paragraph 8 and the other related data identified in the Bidding Documents including "technical data."

7.2. CONTRACTOR has visited the site and become familiar with and is satisfied as to the general, local and site conditions that may affect cost, progress, performance or furnishing of the Work.

7.3. CONTRACTOR is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress, performance and furnishing of the Work.

7.4. CONTRACTOR has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to the site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 4.02 of the General Conditions. CONTRACTOR accepts the determination of the extent of the "technical data" contained in such reports and drawings upon which CONTRACTOR is entitled to rely. CONTRACTOR acknowledges that such reports and drawings are not Contract Documents and may not be complete for Contractor's purposes. CONTRACTOR acknowledges that OWNER and ENGINEER do not assume responsibility for the accuracy or completeness of information and

data shown or indicated in the Contract Documents with respect to Underground Facilities at or contiguous to the site. CONTRACTOR has obtained and carefully studied assumes responsibility for having done so) all such additional supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences and procedures of construction to be employed by CONTRACTOR and safety precautions and programs incident thereto. CONTRACTOR does not consider that any additional examinations, investigations, explorations, tests, studies or data are necessary for the performance and furnishing of the Work at the Contract Price, within the Contract Times and in accordance with the other terms and conditions of the contract Documents.

7.5. CONTRACTOR is aware of the general nature of work to be performed by OWNER and others at the site that relates to the Work as indicated in the Contract Documents.

7.6. CONTRACTOR has correlated the information known to CONTRACTOR, information and observation obtained from visits to the site, reports and drawings identified in the Contract Documents and all additional examinations, investigations, explorations, tests, studies and data with the Contract Documents.

7.7. CONTRACTOR has given ENGINEER written notice of all conflicts, errors, ambiguities or discrepancies that CONTRACTOR has discovered in the Contract Documents and the written resolution thereof by ENGINEER is acceptable to CONTRACTOR, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

Article 8. CONTRACT DOCUMENTS.

The Contract Documents, which comprise the entire agreement between OWNER and CONTRACTOR concerning the Work, consist of the following:

8.1. This Agreement.

8.2. General Conditions and Supplemental General Conditions.

8.3. Notice of Award – **Attachment A**

8.4. Performance, Payment, and other Bonds – **Attachment B.**

8.5. Insurance certificate – **Attachment C**

8.6. Contractor's Bid Proposal, Non-Collusive Bid Statement, Bidder's Qualification Statement, St of CT Forms that are applicable - **Attachment D**

8.7. Connecticut Department of Labor – Wage and Workplace Standards Division.

8.8. **“By Reference”**: The complete Specifications as included in the bidding documents bearing the title.

8.9. **“By Reference”**: List of Drawings: Sheet No's. M1.1 through E1.2 included in the bidding documents.

The above documents are on file in the City of Meriden's Purchasing Department.

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8.10. Addenda numbers_____.

(Those addenda which pertain exclusively to the bidding process need not be listed.)

8.11. The following which may be delivered or issued after the Effective Date of the Agreement and are not attached hereto: All-Written Amendments and other documents amending, modifying or supplementing the Contract Documents pursuant to paragraphs 3.04 and 3.05 of the General Conditions.

There are no Contract Documents other than those listed above. The Contract Documents may only be amended, modified or supplemented as provided in paragraphs 3.04 and 3.05 of the General Conditions.

Article 9. MISCELLANEOUS.

9.1. Terms used in this Agreement which are defined in Article I of the General Conditions will have the meanings indicated in the General Conditions.

9.2. No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

9.3. OWNER and CONTRACTOR each binds itself, its partners, successors, assigns and legal representatives to the other party hereto, its partners, successors, assigns and legal representatives in respect to all covenants, agreements and obligations contained in the Contract Documents.

9.4. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon OWNER and CONTRACTOR, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

9.5 OTHER PROVISIONS.

Non-Discrimination and Affirmative Action Provisions

(A)(1) The Contractor agrees and warrants that in the performance of the Contract such Contractor 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 Contractor 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 Contractor 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 Contractor that such disability prevents performance of

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the work involved; (2) the Contractor agrees, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, to state that it is an "affirmative action-equal opportunity employer" in accordance with regulations adopted by the commission; (3) the Contractor agrees to provide each labor union or representative of workers with which such

Contractor has a collective bargaining agreement or other contract or understanding and each vendor with which such Contractor has a contract or understanding, a notice to be provided by the commission advising the labor union or workers' representative of the Contractor's commitments under this section, and to post copies of the notice in conspicuous places available to employees and applicants for employment; (4) the Contractor 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 Contractor 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 Contractor as relate to the provisions of this section and section 46a-56.

(B) Any Contractor 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 Contractor shall provide the updated representation to the Commission not later than 30 days after such change. Any Contractor 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 policy adopted by resolution of the board of directors, shareholder, managers, members or other governing body of such Contractor 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 contractor 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..

(C) If the Contract is a municipal public works contract or a quasi-public agency project, the Contractor agrees and warrants that s/he will make good faith efforts to employ minority business enterprises as subcontractors and suppliers of materials on such public works project. The Contractor shall include the provisions of subdivision (A)(1) of this section in every subcontract or purchase order entered into to fulfill any obligation of a municipal public works contract or contract for a quasi-public agency project, and such provisions shall be binding on a subcontractor, vendor or manufacturer, unless exempted by regulations or orders of the

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Commission on Human Rights and Opportunities. The Contractor shall take such action with respect to any such subcontract or purchase order as the Commission may direct as a means of enforcing such provisions, including sanctions for noncompliance in accordance with section 46a-56; provided, if such Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the Commission regarding a state

contract, the contractor may request the state of Connecticut to enter into any such litigation or negotiation prior thereto to protect the interests of the state and the state may so enter.

(D) "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 Contractor's good faith efforts shall include, but shall not be eliminated to, the following factors: The contractor'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, firm 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.

WITNESS WHEREOF, the parties hereto have affixed their names and seals.

THE CITY OF MERIDEN

CONTRACTOR:

Emily E. Holland, Acting City
Manager Duly Authorized

Duly Authorized

Date: _____

Date: _____

PROJECT MANUAL

for

LINCOLN MIDDLE SCHOOL

CHILLER REPLACEMENT

**164 CENTENNIAL AVENUE
MERIDEN, CONNECTICUT 06451**

**Bemis Associates LLC
185 Main Street
Farmington, Connecticut**

November 29, 2023

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SECTION 200050 - GENERAL CONDITIONS FOR MECHANICAL AND ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. The General provisions of the Contract, including General and Supplementary Conditions, and Division 1, General Requirements apply to the work specified in this Section.
- B. Scope of Work: This Section contains special provisions for Divisions 22, 23 and 26.

1.2 EXAMINATION OF SITE AND DRAWINGS:

- A. Before submitting his bid, Contractor shall visit site with plans and specifications in hand, shall consult with the Engineer and shall become thoroughly familiar with all conditions under which his work will be done since he will be held responsible for any assumptions he may make in regard thereto.
- B. The Contractor shall verify and obtain all necessary dimensions at the building.
- C. Certain present building clearances are available for handling equipment.

1.3 INTENT:

- A. Finished Work: The intent of the specifications and drawings is to call for finished work, completed, tested and ready for operation.
- B. Good Practice: It is not intended that the drawings show every pipe, fitting or minor detail and it is understood that while the drawings must be followed as closely as circumstances will permit, the systems shall be installed according to the intent and meaning of the Contract Documents and in accordance with good practice.
- C. Work under each Section shall include giving written notice to the City within 15 days after the Award of the Contract of any materials of apparatus believed inadequate or unsuitable or in violation of any laws or codes, or items of work omitted. In the absence of such written notice, it is mutually agreed that work under each Section has included the cost of all required items and labor for the satisfactory functioning of the entire system without extra compensation.
- D. Any apparatus, appliance, material or work not shown on drawings but mentioned in specifications or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be furnished and installed by Contractor at no additional cost to the City.
- E. Prior to receipt of bids, Contractors shall give written notice to Engineer of any materials or apparatus believed inadequate, unsuitable or in violation of laws, ordinances, rules or regulations of authorities having jurisdiction and any necessary items or work omitted. In the absence of such written notice, it is mutually agreed that Contractor has included the

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cost of all required items in his proposal and that he will be responsible for approved satisfactory functioning of systems without further compensation.

- F. In all cases where apparatus is herein referred to in singular number, it is intended that such reference include as many such items as are required to complete work.
- G. If not otherwise specified or shown on plans, apparatus and materials shall be installed in accordance with manufacturer's published recommendations and instructions and to the complete satisfaction of the Engineer.
- H. It is the intent of these specifications for Mechanical and Electrical Contractors and/or their subcontractors or equipment suppliers to furnish all equipment complete with all accessories.

1.4 REGULATIONS:

- A. Codes: All work shall be done in strict accordance with the 2022 Connecticut State Building Code, 2022 Connecticut State Fire Safety Code, 2021 IBC, 2021 IPC, 2021 IMC, Connecticut Public Health Code, 2021 NFPA 101, all applicable NFPA Codes, NEC, UL, NEMA, O.S.H.A., with all requirements of local utility companies and the requirements of all governmental departments having jurisdiction.
- B. Precedence: Requirements of the above shall take precedence over plans and specifications.
- C. Equipment construction standards shall be as follows: Pressure vessels shall be constructed in accordance with the ASME Code, all electrical equipment shall be UL listed and approved and conform to the N.E.C., gas equipment shall be approved by A.G.A. and conform to N.F.P.A. Codes, piping materials, fittings, valves and accessories shall be constructed in accordance with A.S.T.M. and A.N.S.I. standards for class of work involved. All equipment and materials shall be new and of domestic manufacture. All the above codes shall be referenced and dated in the Connecticut Basic Building Code.
- D. Wherever discrepancies occur between above regulations and agencies and contract drawings and specifications, the requirements of above shall take precedence, except that the contract drawings and specifications shall be minimum requirements and that contractors shall advise engineer of any required changes before proceeding with work.

1.5 APPROVED FITTINGS:

- A. No material other than that contained in the "Latest List of Electric Fittings" approved by the Underwriters' Laboratories, Inc., shall be used in any part of the work. All wiring, conduit, switches and other material for which label service has been established, shall bear the label of the Underwriters' Laboratories, Inc.

1.6 PERMITS, FEES:

- A. Include all necessary notices, obtain all permits and pay all governmental taxes, fees, and other costs. File all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments having jurisdiction. Obtain all required Certificates of the City before request for acceptance and final payment for the work.

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1.7 DEFINITIONS:

- A. Words "finish" or "finished" refer to all rooms and areas listed in Finished Schedule on Drawings. All rooms and areas not covered in Schedule, including underground tunnels and areas above ceilings, shall be considered not finished except as otherwise noted.
- B. The word "provide" means to "furnish and install" reference item.

1.8 PROTECTION:

- A. Work under each section shall include protecting the work and materials of all other sections from damage by work or workmen, and shall include making good any and all damage thus caused.
- B. Each section shall be responsible for work and equipment until finally inspected, tested and accepted. Protect work against theft, weather, injury or damage and carefully store material and equipment received on site which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing materials.
- C. If so specified under the respective section, work may include receiving, unloading, uncrating, storing, protecting, setting in place and connecting up completely of any motor starters, control equipment having mechanical/electrical service connections which may be furnished by City or furnished under another section. Work under each section shall include exercising special care in handling and protecting equipment and fixtures. Any of the above equipment and fixtures which are missing or damaged by reason of mishandling or failure to protect shall be replaced at no additional cost to the City.

1.9 EQUIPMENT SUBSTITUTIONS AND DEVIATIONS:

- A. Wherever more than one manufacturer is mentioned in specifications and drawings, any of these named are considered equally acceptable to that on upon which design was based and, providing all requirements are met, insofar as performance, space requirements, noise levels and special accessories or materials are concerned, any of those named may be included in Contractor's bid.
- B. Where Contractor proposes to use an item of equipment which differs from that upon which design was based, which required any redesign of structure, partitions, foundations, piping, wiring or of any other part of Mechanical or Electrical Layout, all such redesign, new drawings or detailing required shall be prepared by Contractor at his own expense for approval of Engineer.
- C. Where approved substitutions or deviations require a different quantity, size or arrange of structural supports, wiring, conduit, piping, ductwork, and equipment from that upon which design was based, all additional items required by the systems shall, with the approval of Engineer, be furnished by Contractor at no additional cost to City.

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1.10 ELECTRICAL WORK:

- A. The Electrical Section includes all power wiring for all electrical switches, motor starters and unmounted motors, furnished at the job site by other sections or furnished under the Electrical Sections as stated in other sections of the specifications.
- B. The Electrical Section shall install and wire all starters, switches and controls, as specified and/or shown on drawings. This shall include all operating and safety controls. Refer to sections 260000 and 260500 for additional information.
- C. Electrically operated equipment supplied by other sections which will be installed and wired by Electrical Section shall be delivered to him with detailed instructions for their installation and wiring in sufficient time and proper sequence to enable him to meet his work schedule.
- D. Control devices that include mechanical elements, such as float switches, shall be installed by the section furnishing them, but be wired by the Electrical Sections.
- E. Equipment which includes a number of correlated electrical control devices mounted in a single enclosure or on a common base with equipment shall be supplied for installation completely wired as unit with terminal boxes and ample leads and/or terminal strips, ready for electrical wiring.
- F. Electrical Contractor shall furnish local disconnect switch for all equipment and manual motor starter for fractional HP motors.

1.11 DRAWINGS:

- A. The mechanical and electrical drawings are intended to supplement each other and are to be considered as a unit which, taken together in conjunction with the specifications, completely describes the work to be done. All drawings shall be checked to verify spaces in which work will be installed. Where headroom or space conditions appear inadequate, notification shall be given to Engineer before proceeding with installation.
- B. The Engineer may without charge, make modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.
- C. Note that the drawings are diagrammatic and indicate the general arrangement of the Mechanical and Electrical Equipment and systems, without showing every detail and fitting.
- D. Where conflicts occur between drawings and specifications or within either, the item or arrangement of better quality, greater quality or highest cost shall be included in Contract price. Engineer shall determine the manner or item with which work shall be installed.

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- E. Keep one complete set of all drawings, specifications, shop drawings and addenda on the premises at all times in good condition and available to the Engineer and City.

1.12 REVIEWS:

- A. The materials, workmanship, design and arrangement of all work installed under the Mechanical and Electrical sections shall be subject to the review of the Engineer.
- B. Where any specific material process or method of construction or manufactured article is specified by name or by reference to the catalog number of a manufacturer, the specifications are to be used as a guide and not intended to take precedence over the basic duty and performance specified or noted on drawings. In all cases, the specific characteristics of the equipment offered for approval, shall be indicated on the shop drawings.
- C. All component parts of each item of equipment or device shall bear the manufacturer's nameplate, giving name of manufacturer, description, size, type, serial or model number, electrical characteristics, etc. in order to facilitate maintenance or replacement. The nameplate of a subcontractor or distributor will not be acceptable.
- D. If material or equipment is installed before it is reviewed, it shall be removed and replaced at no extra charge to the City if, in the opinion of the Engineer, the material or equipment does not meet the intent of the drawings and specifications.

1.13 SHOP DRAWINGS:

- A. Contractor shall submit for review shop drawings in electronic format of all new equipment, materials, piping, lighting fixtures, devices, panels and wiring. Engineer's review of shop drawings must be completed before any equipment is purchased or any work is installed.
- B. Shop drawings shall consist of manufacturer's certified scale drawings, cuts or catalog, including descriptive literature and complete certified characteristics of equipment, showing dimensions, capacity, code requirements, motor and drive testing as indicated on the drawings or specifications. Also, sheet metal fabrication drawings drawn to scale of 1/4" to the foot or larger.
- C. Certified performance curves for all pumping equipment shall be submitted for review.
- D. Samples, drawings, specifications, catalogs, etc. submitted for review shall be properly labeled indicating specific service for which material or equipment is to be used, division and article number of specifications governing Contractor's name and name of job.

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- E. Catalog, pamphlets or other documents submitted to describe items on which review is being requested, shall be specific and identification in catalog, pamphlet, etc. of item submitted shall be clearly made in ink. Data of a general nature will not be accepted.
- F. Review stamp rendered on shop drawings shall not be considered as a guarantee of measurements of building conditions.

Where drawings are reviewed, said review does not mean that drawings have been checked in detail. Said review does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the Contract Drawings and Specifications.

- G. Failure by the Contractor to submit shop drawings in ample time for checking shall not entitle him to an extension of Contract and no claim for extension by reason of such default will be allowed.
- H. Prior to submission to shop drawings, the Contractor shall thoroughly check each shop drawing, reject those not conforming to the specifications and indicate by his signature that the shop drawings submitted in his opinion meet Contract requirements.

1.14 CUTTING AND PATCHING:

- A. All cutting of openings in walls, floors, partitions, etc. must be done by the Electrical and/or Mechanical Contractor as required to install the work including all cutting of existing construction work. Cutting shall be neatly done and limited to the minimum size necessary. Contractor shall patch and restore to its original condition any work disturbed as a result of work under this Contract.

PART 2 - PRODUCTS

2.1 MATERIALS AND WORKMANSHIP:

- A. All materials and apparatus used shall be new, of first class quality and shall be furnished, delivered, erected, connected and finished in every detail. No materials or apparatus used shall be discontinued or about to be discontinued items.
- B. The Engineer shall have the right to reject any part of the work in case material or workmanship is not of satisfactory quality.
- C. Any unacceptable work and material shall be replaced with acceptable work and material at no additional expense to the City.
- D. In case there is any doubt of the acceptability of any material, submit samples to the Engineer for approval and only definite approval in writing from the Engineer shall be evidence of such approval.
- E. Such approval shall also be subject to the satisfactory installation of the material.
- F. The work in each of these sections shall be constantly under the direction of a competent superintendent who shall be on the premises during such period as the work is in progress.

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The superintendent shall familiarize himself with the work of all other sections involved insofar as they relate to or in any way affect the work of these sections, and shall coordinate the work.

- G. Unless otherwise noted, all equipment and materials shall be installed and/or applied in accordance with the recommendations of the manufacturer of said equipment, including the performance of any tests recommended by the manufacturer.

2.2 EQUIPMENT VARIATIONS:

- A. In these specifications and on the accompanying drawings, one or more makes of materials, apparatus or appliances have been specified for use in this installation. This has been done for convenience in fixing the standard of workmanship performance of any materials, apparatus or appliance which shall be substituted for those mentioned herein shall also conform to these standards.
- B. Where no specified make or material, apparatus or appliance is mentioned, any first class product made by a reputable manufacturer may be used, providing it conforms to the requirements of these specifications and meets the approval of the Engineer prior to installation.
- C. Refer to Article 6 of the General Conditions of the contract for substitution procedures.
- D. To substitute other makes of materials, apparatus or appliance, than those mentioned under the mechanical or electrical sections, a request in writing to be allowed to make the substitution shall be made. This request shall be accompanied by complete plans and specifications of the substitution offered. If so requested by the Engineer, also submit samples of both the specified material or appliance and the substitute.

2.3 MOTOR CONTROL:

- A. All motors will be fed from a motor starter. Motor starters shall be furnished by each respective trade for motor driven equipment provided by them. The Electrical Contractor shall install the starters and shall provide all power wiring to the starters, and from the starters to the motors they control. Where required, remote pushbuttons, plates and pilots will be furnished with the starter and will be installed by the Electrical Contractor, unless otherwise called for under the Temperature Control Section of these specifications. All starters for motors which are to be interlocked with another motor shall have suitable auxiliary contacts.
- B. All small motors without built-in thermal protection shall be furnished with thermal switches. These switches and pilots shall be furnished by the Electrical Contractor.

2.4 ELECTRIC MOTORS:

- A. All motors 1/2 h.p. and above shall be integral horsepower polyphase induction motors conforming to NEMA standards MG-1-1967 and shall be T-frame design in sizes 143 T

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through 445 T. Each shall be NEMA design B with minimum torque values per MG 1-12.37 and 12.38.

- B. Duty shall be continuous, ambient temperature 40 degrees maximum, allowable temperature rise for open drip-proof -90 degrees, TEFC, 80 degrees C with Class B insulation rating all per MG 1-12.42.
- C. Horsepower, speed and frame sized per MG 1-10, 32, 13.02 and 13.06a.
- D. Enclosures - open drip-proof and TEFC per MG 1-1.25, 1.26 and 1.27.
- E. All dimensions per MG 1-11.31a, 11.32a and 11.34a. All motors shall have stainless steel nameplates with NEMA voltage standards shown.
- F. Locked rotor KVA per horsepower shall be designated by proper NEMA code letter per MG 1.10.37.
- G. All motors shall be premium efficiency type with a full load efficiency range of 80 percent to 95 percent. High efficiency motor rating shall meet Northeast Utilities Energy Action Program in accordance with the following schedule:

MINIMUM NOMINAL MOTOR EFFICIENCIES

HP	OPEN DRIP PROOF			HP	TOTALLY ENCLOSED		
	MINIMUM EFFICIENCY				MINIMUM EFFICIENCY		
	1200	1800	3600		1200	1800	3600
1	82.5%	85.5%	80.0%	1	82.5%	85.5%	78.5%
1.5	86.5%	86.5%	85.5%	1.5	87.5%	86.5%	85.5%
2	87.5%	86.5%	86.5%	2	88.5%	86.5%	86.5%
3	89.5%	89.5%	86.5%	3	89.5%	89.5%	88.5%
5	89.5%	89.5%	89.5%	5	89.5%	89.5%	89.5%
7.5	91.7%	91.0%	89.5%	7.5	91.7%	91.7%	91.0%
10	91.7%	91.7%	90.2%	10	91.7%	91.7%	91.7%
15	92.4%	93.0%	91.0%	15	92.4%	92.4%	91.7%
20	92.4%	93.0%	92.4%	20	92.4%	93.0%	92.4%
25	93.0%	93.6%	93.0%	25	93.0%	93.6%	93.0%
30	93.6%	94.1%	93.0%	30	93.6%	93.6%	93.0%
40	94.1%	94.1%	93.6%	40	94.1%	94.1%	93.6%
50	94.1%	94.5%	93.6%	50	94.1%	94.5%	94.1%
60	95.0%	95.0%	94.1%	60	94.5%	95.0%	94.1%
75	95.0%	95.0%	94.5%	75	95.0%	95.4%	94.5%
100	95.0%	95.4%	94.5%	100	95.4%	95.4%	95.0%

- H. Service Factors - open-drip-proof, 1 h.p. through 200-1.15 TEFC all horsepower - 1.0.
- I. Noise level within NEMA standard MG 1-12.49.

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- J. In addition to the above, all motors 1 through 20 h.p. shall be TEFC with drain holes for both horizontal and vertical positions. Each shall be equipped with deep groove double shielded ball bearings prelubricated with provisions for regreasing.
- K. Motors smaller than 1/2 h.p. shall be capacitor-start or split-phase type designed for 120 volts, single phase, 60 cycles alternating current.

2.5 ELECTRICAL MOTOR STARTERS:

- A. Motor starters shall be furnished by each respective trade for motor driven equipment provided by them. The Electrical Contractor shall install the starters and shall provide all power wiring to the starters, and from the starters to the motors they control.
- B. Motor starters shall conform to requirements of NEC, NEMA, UL, CSA, and ANSI and shall be suitable for the required horsepower, duty, voltage, phase, frequency, service, and location. All starters shall be furnished in NEMA enclosures suitable for the environment in which they are to be located.
- C. All starters shall be of the same manufacture and shall be furnished in Cutler-Hammer, Square D, General Electric, or Allen Bradley.
- D. Thermal Overloads:
 - 1. All motors 1/8 horsepower or larger shall be provided with thermal-overload protection. Thermal overloads shall be melting alloy ambient temperature compensating type.
 - 2. Thermal overloads shall be sized in accordance with NEC requirements for the nameplate data of the motor(s) as actually delivered to the site.
- E. Starters for manual control of single phase motors up to one (1) horsepower furnished without integral thermal overloads shall be combination manual disconnect switch and starters with thermal overload protection for each ungrounded leg. Starters shall be inoperable if a thermal unit is removed. These starters shall be 2-pole and shall be provided with green neon pilot light and handle guard/lock-off.
- F. Starters for three phase motors shall be full voltage, circuit breaker combination magnetic starters. All circuit breaker combination magnetic starters shall include melting alloy type thermal overload protection, low voltage protection, and two (2) sets of auxiliary normally open and normally closed contacts. Thermal overload protection shall be provided in each ungrounded leg. Starters shall be inoperable if a thermal unit is removed.

All circuit breaker combination magnetic starters shall be equipped with control power circuits. Provide starters with control power transformers of secondary voltage required for the control power circuitry. Provide control power transformers with secondary fusing.

The disconnect handle on circuit breaker combination magnetic starters shall always be in control of the disconnect device with the door opened or closed. The disconnect handle shall be clearly marked as to whether the disconnect device is "on" or "off", and shall include a two-color handle grip, the black side visible in the "off" position, and the red side visible in the "on" position.

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1. All circuit breaker combination magnetic starters for manual control of three phase motors shall have start-stop push buttons in the cover and shall be provided with red and green pilot lights.
 2. All circuit breaker combination magnetic starters for automatic or interlocking control of three phase motors shall have hand-off-automatic selector switches in the cover and shall be provided with red and green pilot lights.
- G. Starters shall be furnished as part of respective equipment furnished under each Division.

PART 3 - EXECUTION

3.1 CONNECTING TO EXISTING UTILITIES:

- A. Connections to existing utilities that will interrupt the service to the present buildings shall be made at a time agreed upon by the City.
- B. If it is necessary to make connections to existing utilities outside the regular working hours, this shall be noted on the written work order and the respective Contractor will be paid for the additional cost of labor over and above what it would cost at regular day time rates.

3.2 FREIGHT, CARTING AND RIGGING:

- A. Contractor shall pay all freight and carting charges necessary to deliver all equipment furnished under his Contract to the site and furnish all necessary rigging to properly rig and set the apparatus on the foundations, frames, etc.
- B. All scaffolding, blocks and tackle, ropes and chains and other equipment necessary to rig and set the apparatus shall be furnished by the Contractor.
- C. The Contractor shall set, level and align all equipment before starting operations.

3.3 SEISMIC RESTRAINTS:

- A. It is the intent of this seismic restraint portion of the specification to provide restraint of all non-structural building system components provided in Sections 15 and 16 in Seismic Zone II. Restraint systems and devices are intended to withstand, without failure, the "G" forces detailed in the chart below:

Design Level of Acceleration At Equipment Center of Gravity Seismic Zone 2)
(Av - >0.1 to 0.19)

Elevation (feet rel. to grade level)	Rigid* Mnt'd Equip	Non-Struct. Architect Component	Flexible* Mnt'd Equip	Pipe, Duct, Cable trays, Conduit, Etc.	Life Safe. Equip
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Below Grade up to 20 feet above grade	0.125 "g"	0.250 "g"	0.500 "g"	0.350 "g"	1.000 "g"
21 ft. - 300 ft.	0.500 "g"	0.550 "g"	0.750 "g"	0.650 "g"	1.000 "g"
301 ft. - 600 ft.	0.750 "g"	0.900 "g"	1.000 "g"	1.000 "g"	1.000 "g"

- * Rigid mounted equipment is any equipment mounted directly to structure. Flexible mounted equipment is any equipment mounted on resilient supports, ceiling suspended, roof supported or mounted on an independent frame with any primary natural frequency below 16 Hz.
- B. Seismic restraints shall be as required by 2015 IBC, Chapter 16 and State of Connecticut 2018 Building Code.
- C. Seismic Certificant and Analysis
 - 1. Seismic restraint calculations must be provided for all connections of equipment to the structure.
 - 2. Calculations to support seismic restraint designs must be stamped by a registered professional engineer licensed in the State of Connecticut.
 - 3. Analysis must indicate dead loads, derived loads, and materials used for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameters, embedment, and weld length.
 - 4. A seismic design errors and omissions insurance certificate must accompany submittals.
- D. Submit drawings showing locations of all seismic restraints for equipment, piping, and conduit provided under Sections 23 and 26:
 - 1. The term EQUIPMENT includes ALL non-structural components. These specifications are applicable within the facility and 5 feet outside of the foundation wall. Equipment buried underground is excluded but entry of services through the foundation wall is included. Equipment referred to below is a partial list; (equipment not listed is still included in this specification).

Air Separators	Bus Ducts
Piping	
Pumps (All types)	Cable Trays
Switching Gear	Tanks (All types)
Conduit	All Electrical Panels
- E. Submittals shall include a listing of all isolated and non-isolated equipment to be restrained.
- F. Seismic restraints shall not be required for the following installations:
 - 1. Piping in mechanical rooms less than 1 1/4-inch inside diameter.
 - 2. All other piping less than 2 1/2-inch inside diameter.

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3. All electrical conduit less than 2 1/2-inch inside diameter.
 4. All rectangular air-handling ducts less than 6 square feet in cross-sectional area.
 5. All round air-handling ducts less than 28 inches in diameter.
 6. All piping suspended by individual hangers 12 inches or less in length from the top of the pipe to the bottom of the support for the hanger.
 7. All ducts suspended by hangers 12 inches or less in length from the top of the duct to the bottom of the support for the hanger.
- G. Life safety systems defined:
1. All systems involved with fire protection including sprinkler piping, service water supply piping, fire dampers and smoke exhaust systems.
 2. All systems involved with and/or connected to emergency power supply including all generators, transfer switches, transformers and all flowpaths to fire protection and/or emergency lighting systems.
 3. Fresh air relief systems on emergency control sequence including air handlers, conduit, duct, dampers, etc.

3.4 COOPERATION WITH OTHER TRADES:

- A. No piping, conduit, valves, boxes, etc., shall be installed until the entire run has been checked for clearance and the work has been coordinated between all the trades. Each tradesman shall be responsible for taking his own field measurements and maintaining proper clearance from the City's equipment and the work of other trades, and for coordinating his work with that of other Contractors and City. Furnish all necessary information, dimensions, templates, etc. in order that a perfectly coordinated job will result.
- B. Contractor shall carry out his work in conjunction with other trades and shall give full cooperation to other trades. Contractor shall furnish all information necessary to permit work of all trades to be installed in a satisfactory manner.
- C. Where space is so limited that Contractor's work shall be installed in close proximity to the work of other trades or where it is evident that Contractor's work will interfere with other trades, he shall assist in working out space conditions to make satisfactory adjustments. If required or directed by Engineer, the Contractor shall prepare composite working drawings and sections of not less than 3/4" -1'-0" scale clearly showing how his work is to be installed in conjunction with other trades; he shall make corrections necessary to satisfactorily complete installation at no additional cost to City.
- D. All supports for hanging material to be connected to steel structure shall be installed prior to installation of fire proofing material. Any damage to fireproofing caused by late installation of hanging material shall be repaired by the Fire-proofing Contractor at the expense of the Contractor responsible.
- E. The Heating Contractors shall give to the Electrical Contractor all information on switches, controls, pilots, etc. furnished under the Heating Contracts, together with makes and catalog numbers where required to permit the Electrical Contractor to leave the proper boxes to receive same. This information shall be given well in advance so that the Electrical Contractor may install his work as construction progresses. In the event that this information is not given in time to permit the Electrical Contractor to leave proper boxes,

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etc. as construction progresses, it shall be the responsibility of the Contractor to pay all costs of cutting and patching.

3.6 INFORMATION FOR ELECTRICAL CONTRACTOR:

- A. Deliver to the Electrical Contractor all information on motors and controls furnished under the Mechanical Contract, together with makes and catalog numbers, to permit the Electrical Contractor to leave the proper boxes and wiring.

3.7 SLEEVES, INSERTS AND ANCHOR BOLTS:

- A. All pipes and conduits passing through floors, walls or partitions shall be provided with sleeves sized to give a minimum of 1/2" clearance between sleeve and the outside diameter of the pipe, conduit or insulation, enclosing the pipe or conduit.
- B. Sleeves through concrete floors or interior masonry walls shall be Schedule 40 steel pipe, set flush with finished wall or ceiling surfaces, but extending 2 inches above finished floors or shall be in accordance with details on drawings. In all mechanical equipment rooms sleeves shall extend 6 inches above finished floor.
- C. Inserts shall be individual or strip type of steel or malleable iron construction for removable nuts and threaded rods up to 3/4" diameter, permitting lateral adjustment.

3.8 FIRE STOPPING:

- A. General
 - 1. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.
- B. General Description of The Work
 - 1. Only tested firestop systems shall be used in specific locations as follows:
Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
- C. References
 - 1. Test Requirements: ASTM E-814, "Standard Method of Fire Tests of Through Penetration Fire Stops" (July 1997).
 - 2. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually.
 - 3. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments
 - 4. Test Requirements: ASTM E 84-96, "Surface burning characteristics".

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5. All major building codes: ICBO, SBCCI, BOCA, and IBC.
6. Test Requirements: ASTM E-119, “Fire Test of Building Construction and Materials” (UL 263)

D. Quality Assurance

1. Firestop System installation must meet requirements of ASTM E-119, ASTM E-814, ASTM E-84-96, UL 236, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.
2. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

E. Submittals

1. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions to comply with Section 1300.
2. Submit material safety data sheets provided with product delivered to job-site.

F. Installer Qualifications

1. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacture’s products per specified requirements.

G. Products, General

1. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
2. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
3. Firestopping Materials are either “cast-in-place” (integral with concrete placement) or “post installed.” Provide cast-in-place firestop devices prior to concrete placement.

H. Acceptable Manufacturers

1. Subject to compliance with through penetration firestop systems (XHEZ) and joint systems (XHBN) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:
 - a. Hilti, Inc., Tulsa, Oklahoma 800-879-8000

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- b. Other manufacturers listed in the U.L. Fire Resistance Directory – Volume 2

I. Materials

1. Use only firestop products that have been UL 1479, ASTM E-814, or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
2. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.
3. Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction being penetrated.

J. Preparation

1. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
 - a. Verify penetrations are properly sized and in suitable condition for application of materials.
 - b. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
 - c. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
 - d. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
 - e. Do not proceed until unsatisfactory conditions have been corrected.

K. Coordination

1. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.
2. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

L. Installation

1. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.
2. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.

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- a. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
- b. Consult with project manager and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
- c. Protect materials from damage on surfaces subjected to traffic.

M. Field Quality Control

1. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
2. Keep areas of work accessible until inspection by applicable code authorities.
3. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

N. Adjusting and Cleaning

1. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
2. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

3.9 ACCESSIBILITY:

- A. Locate all equipment which must be serviced, operated or maintained in fully accessible positions. Equipment shall include but not be limited to motors, controllers, switchgear, drain points, etc.
- B. In the event that any equipment is not installed to permit convenient servicing, disassemble, removal of parts, etc. the Contractor shall, at his own expense, make all corrections necessary to accomplish this.

3.10 LUBRICATION:

- A. All equipment having moving parts and requiring lubrication which is installed under this Contract, shall be properly lubricated according to manufacturer's recommendations prior to testing and operation. Any such equipment discovered to have been operated before lubrication is subject to rejection and replacement at no cost to the City. Units furnished with sealed bearings are accepted.

3.11 TAGS, CHARTS AND NAMEPLATES:

- A. Each valve, control, switch, electrical panel, motor and any piece of apparatus installed under these sections shall be properly identified.

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- B. Each sectional shutoff valve shall have a brass tag with identifying number. Tag shall be secured to valve stem with sufficient length of copper coated jack chain to allow tag to be easily read.
- C. All other equipment, including panels and switches, shall be provided with a suitable laminated plastic nameplate fastened with screws or rivets. Small equipment labels may use a pressure sensitive tape.
- D. All nameplates and labels shall identify components by proper nomenclature and numbered according to equipment schedule or as designated.
- E. Charts shall be furnished in duplicate and shall include the valve identification number, location and purpose. One chart shall be mounted in frame with a clear glass front and secured to wall in location directed.
Second chart shall be for use throughout building and shall be provided with transparent plastic closure for top and attached 8" bead chain for hanging. Holes to be reinforced with brass grommets. Tags and closures as manufactured by Seton Name Plate Corp., New Haven, Conn., or approved equal.

3.12 INSTRUCTIONS:

- A. Prepare written instructions frames for the proper maintenance and operation of any special equipment furnished and installed under this Contract.
- B. Personally instruct the City's Custodian or official representative in addition to furnishing all manuals, diagrams, etc. in the proper operation and maintenance of all equipment and piping installed under this Contract.
- C. Prepare a portfolio with all tags, operating manuals, parts lists, guarantees, etc. that are packed with all equipment furnished under this Contract and submit same to the Engineer.

3.13 PIPING CODE MARKERS:

- A. All service piping which is accessible for maintenance operations shall be identified with vinyl plastic color bands and legends at each branch and riser take-off, at each passage through wall, floor and ceiling, adjacent to each valve and on all pipe runs marked each 20'-0". Pipe markers to conform to A.S.A. Bulletin A-13. Where pipes are too small for legends, brass identification tags 1-1/2" in diameter with depressed 1/2" high black filled letters shall be fastened with chain. Pipe markers and tags as manufactured by the Seton Name Plate Corp., New Haven, Conn., or equal approved.

3.14 CLEANING PIPING, CONDUITS AND EQUIPMENT:

- A. Thoroughly clean all piping and equipment of all foreign substances inside and out before being placed in operation.

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- B. If any part of a system should be stopped by any foreign matter after being placed in operation, the system shall be disconnected, cleaned and reconnected wherever necessary to locate and remove obstructions.
Any work damaged in the course of removing obstructions shall be repaired or replaced when the system is reconnected at no additional cost to the City.
- C. During the course of construction, all pipe and electrical conduits shall be capped in an approved manner to insure adequate protection against the entrance of foreign matter.

3.15 CLEANING UP:

- A. After completion of the work, remove all waste, rubbish and other materials left as a result of operations and leave the premises in clean condition.
- B. All fixtures, equipment, etc. installed under the Mechanical and Electrical Sections shall be free of dirt, grease and other foreign material and left in perfectly clean condition and ready to use.

3.16 GUARANTEE:

- A. All parts of the work and all equipment shall be guaranteed for a period of 18 months from the date of acceptance of the job by the City.
- B. If during that period of general guarantee, any part of the work installed fails, becomes unsatisfactory or does not function properly due to any fault in material or workmanship, whether or not manufactured or job built, each section shall upon notice from the City, promptly proceed to repair or replace such faulty material or workmanship without expense to the City, including cutting, patching and painting or any other work involved and including repair or restoration of any damaged sections of the premises resulting from such faults.
- C. In the event, that a repetition of any one defect occurs, indicating the probability of further failure, and which can be traced to faulty design, material or workmanship, then repairs or replacement shall not continue to be made but, the fault shall be remedied by a complete replacement of the entire defective unit.
- D. In addition to the general guarantee, obtain and transmit to the City any guarantees or warranties from manufacturers of specialties but only as a supplement to the general guarantee which will not be invalidated by same.

3.17 CITY'S INSTRUCTIONS AND SYSTEM OPERATION:

- A. At the time of the job's acceptance by the City, Contractor shall furnish maintenance and operating instructions for all equipment including parts list. These instructions shall be written in layman's language and shall be inserted in vinyl covered three-ring loose leaf binder. This information in binder shall be first sent to the approved by the Engineer before turning over to the City.
- B. Upon completion of all work and of all tests, each Division shall furnish the necessary skilled labor and helpers for operating the system and equipment for a period of one (1) day

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of eight (8) hours, or in two (4) hours separate sessions. During this period, instruct the City or his representative fully in operation, adjustment and maintenance of all equipment furnished. Give at least forty-eight (48) hours notice to the City in advance of this period.

3.18 CITY'S ACCEPTANCE TEST:

- A. After the various systems are complete as determined by preliminary operating tests, the Contractor shall arrange for the City's final acceptance tests.
- B. The Contractor shall have present at each acceptance test, representatives of the several Contractors whose work is directly or indirectly involved, with instruments as necessary in accordance with the design and to include the following.
 - 1. All equipment installed and operating in accordance with manufacturer's instructions and performance guarantee.
 - 2. All systems operating in accordance with specifications.
 - 3. All distribution systems properly adjusted for distribution to equipment as specified.
 - 4. The various systems properly flushed, cleaned, and free of entrapped air and dirt.
 - 5. All motors installed with proper thermal overload protection and not operating under overload conditions as determined by ammeter readings.
 - 6. All valve charts, etc. as specified in various parts of the specifications installed or ready for delivery to the City.
- C. The date of the City's acceptance of the equipment shall be the start of the 18 months guarantee period.

3.19 TEST:

- A. Conducting Tests: Conduct all tests called for under the various sections or as required and repair or replace any defects. Perform all tests in the presence of and to the satisfaction of the Engineer and such other parties as may have legal jurisdiction.
- B. Defective Work: The City shall have the privilege of stopping any of the work not being properly installed. All such defective work shall be repaired or replaced and the tests shall be repeated.
- C. Repair Damaged Work: Repair all damages resulting from tests and replace damaged materials.

END OF SECTION 200050

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SECTION 230548

VIBRATION ISOLATION AND SEISMIC RESTRAINTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. The General Provisions of the Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to the work specified in this Section.
- B. The General Requirements in Section 20 00 50 shall also govern the work under this Section.

1.2 SECTION INCLUDES:

- A. Vibration isolation and seismic restraints for all mechanical and electrical system including equipment, piping, conduit and ductwork within the building.
- B. The work of this section includes but is not limited to the following:
 - 1. Vibration isolation elements.
 - 2. Equipment isolation bases.
 - 3. Piping flexible connections.
 - 4. Seismic restraints for isolated and non-isolated mechanical and electrical items.

1.3 REFERENCES:

- A. State of Connecticut Building Code.
- B. NFPA 13 - Installation of Sprinkler Systems.
- C. SMACNA - Seismic Restraint Manual Guidelines for Mechanical Systems.
- D. Mason Industries, Inc. Seismic Restraint Guidelines

1.4 QUALIFICATIONS:

- A. Qualifications: Only firms having five years experience designing and manufacturing seismic devices shall be capable of work in this specification.

1.5 SUBMITTALS:

- A. Submit under provisions of Section 20 00 50.
- B. The submittal material shall include copies of descriptive data for all products and materials including but not limited to the following:

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1. Descriptive Data:
 - a. Catalog cuts and data sheets.
 - b. An itemized list showing the items to be isolated and/or seismically restrained, product type or model number to be used and loading and deflection data.
 - c. Seismic restraint calculations.
 - d. (Structural or civil engineer's State of Connecticut professional engineer's seal verifying design and calculations for seismic restraining system used.)

2. Shop Drawings:
 - a. Drawings showing equipment base construction for each machine, including dimensions, structural member sizes, and support point locations.
 - b. Drawings showing methods of suspension, support guides for conduit, piping and ductwork.
 - c. Drawings showing methods for isolation of conduits, pipes and ductwork penetrating walls and floor slabs.
 - d. Concrete and steel details for bases including anchor bolt locations.
 - e. Number location of seismic restraints and anchors for each piece of equipment.
 - f. Specific details of restraints including anchor bolts for mounting and maximum loading at each location, for each piece of equipment and/or pipe and duct locations.

1.6 GENERAL (MANUFACTURER) RESPONSIBILITIES:

- A. Contractor shall have the following responsibilities:
 1. Determine vibration isolation and seismic restraint sizes and locations per specifications.
 2. Provide and install isolation systems and seismic restraints as scheduled or specified.
 3. Guarantee specified isolation system deflection.
 4. Provide installation instructions, drawings and field supervision to assure proper installation and performance.
 5. Substitution of "Internally Isolated" mechanical equipment in lieu of the specified isolation of this section may be acceptable provided that all specified deflections and stamped seismic calculations are supplied by the equipment manufacturer.

1.7 PROJECT RECORD DOCUMENTS:

- A. Submit under provisions of Section 20 00 50.

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- B. Record actual locations and installation of vibration isolators and seismic restraints including attachment points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Mason Industries Inc. models listed below.
- B. Other approved manufacturers providing equivalent products include:
 - 1. Vibration Eliminator Co.
 - 2. Amber/Booth Co.

2.2 SEISMIC RESTRAINT TYPES:

- A. General: Installations shall be designed to safely accept external forces of one-half "G" load in any direction for all rigidly supported equipment without failure and permanent displacement of the equipment. Life safety equipment such as (fire pumps, sprinkler piping and emergency generators) shall be capable of safely accepting external forces up to one "G" load in any direction without permanent displacement of the supported equipment. Seismic restraints shall not short circuit vibration isolation systems or transmit objectionable vibration or noise.
- B. Type I (spring mount): Shall comply with general characteristics of spring isolators having a minimum o.d. to o.h. of .8 to 1 and minimum runout of 50% to solid. Shall incorporate snubbing restraint in all directions. Shall be capable of supporting equipment at a fixed elevation during equipment erection. Cast housings shall be ductile iron or aluminum. System to be field bolted or welded to deck with 1 G acceleration capability. Mason Type SSLFH or as approved.
- C. Type II (snubber): Each corner of side shall incorporate a seismic restraint having a minimum 5/8" thick resilient pad limit stops working in all directions. Restraints shall be made of plate, structural members, or square metal tubing concentric within a welded assembly incorporated resilient pads. Angle bumpers are not acceptable. System to be field bolted or welded to a deck with 1 G acceleration capability. Mason Type Z-1011 and Z-1225.
- D. Type III (cable braces): Metal cable type with approved end fastening devices to equipment and structure. System to be field bolted to deck or overhead structural members using two sided beam clamps to steel or appropriately designed insert for concrete. All parts of system including cables, clamps, excluding fastenings are to be single vendor furnished to assure seismic compliance. Mason Type SCB.
- E. Type IV (neoprene mount): Double deflection neoprene isolator encased in ductile iron or steel casing minimum .30 static deflection. System to be field bolted or welded to deck with 1 G acceleration capacity. Mason Type BR, RBA.

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- F. Type V: Non-isolated equipment to be field bolted or welded (powder shots not acceptable) to resist seismic forces unless under 100 lb. Shear force required. Mason Type SAS, SAB.

2.3 VIBRATION ISOLATION – GENERAL:

- A. Vibration Isolation shall control excessive noise and vibration in the building due to the operation of machinery or equipment, and/or due to interconnected piping, ductwork, or conduit. (The installation of all vibration isolation units, and associated hangers and bases, shall be under the direct supervision of the vibration isolation manufacturer's representative.)
- B. All vibration isolators shall have either known non-deflected heights or calibration markings so that, after adjustment, when carrying their load, the deflection can be verified.
- C. All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer and must be linear over a deflection range of not less than 50% above the design deflection.
- D. The theoretical vertical natural frequency for each support point, bases upon load per isolator and isolator stiffness, shall not differ from the design objectives for the equipment as a whole by more than +/- 10%.
- E. All neoprene mountings shall have a Shore hardness of 30 to 60 +/- 5, after minimum aging of 20 days or corresponding oven aging.

2.4 VIBRATION ISOLATOR TYPES:

- A. Type A: Spring isolators:
 - 1. Minimum diameter of 0.8 of the loaded operating height.
 - 2. Corrosion resistance where exposed to corrosive environment with:
 - a. Springs cadmium plated or electro-galvanized.
 - b. Hardware cadmium plated.
 - c. All other metal parts hot-dip galvanized.
 - 3. Reserve deflection (from loaded to solid height) of 50% of rated deflection.
 - 4. Minimum ¼" thick neoprene acoustical base pad on underside, unless designated otherwise.
 - 5. Designed and installed so that ends of springs remain parallel and all springs installed with adjustment bolts.

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6. Non-resonant with equipment forcing frequencies or support structure natural frequencies.
 7. Mason Type SLF.
 8. When used in conjunction with seismic bracing, seismic restraint Type II shall be installed.
- B. Type B: Spring isolators shall be same as Type A, except:
1. Provide built-in vertical limit stops with minimum ¼” clearance under normal operation.
 2. Tapped holes in top plate for bolting to equipment when subject to wind load.
 3. Capable of supporting equipment at a fixed elevation during equipment erection. Installed and operating heights shall be identical.
 4. Adjustable and removable spring pack with separate neoprene pad isolation.
 5. Capable of accepting 1 G of acceleration.
 6. Mason Type SLR.
- C. Type C: Spring hanger rod isolators:
1. Spring element seated on a steel washer within a neoprene cup incorporating a rod isolation bushing.
 2. Steel retainer box encasing the spring and neoprene cut.
 3. When used in conjunction with seismic bracing, seismic restraint Type III shall be installed.
 4. Mason Type HS.
- D. Type D: Seismic Restraint, Type IV: Double deflection neoprene isolator encased in ductile iron or steel casing minimum .30 static deflection. System to be field bolted or welded to deck with 1 G acceleration capacity. Mason Type BR, RBA.
- E. Type E: Elastomer hanger rod isolators:
1. Molded unit type neoprene element with projecting bushing lining rod clearance hole.
 2. Neoprene element to be minimum 1-3/4” thick.
 3. Steel retainer box encasing neoprene mounting.
 4. Clearance between mounting hanger rod and neoprene bushing shall be minimum of 1/8”.
 5. Minimum static deflection of 0.35”.

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6. When used in conjunction with seismic bracing, seismic restraint Type III shall be installed.
 7. Mason Type HD.
- F. Type F: Combination spring/elastomer hanger rod isolators:
1. Spring and neoprene isolator elements in a steel box retainer. Neoprene double deflection type. Single deflection is unacceptable. Spring seated in a neoprene cup with extended rod bushing.
 2. Characteristics of spring and neoprene as described in Type A and Type E isolators.
 3. When used in conjunction with seismic bracing, seismic restraint Type III shall be installed.
 4. Mason Type DNHS.
- G. Type G: Pad type elastomer mountings:
1. $\frac{3}{4}$ " Minimum thickness.
 2. 50 PSI maximum loading.
 3. Waffled design.
 4. Deflection per pad thickness.
 5. Galvanized steel plate between multiple layers or pad thickness.
 6. Suitable bearing plate to distribute load.
 7. Mason Type Super W.
- H. Type H: Grommet type elastomer bushings:
1. One piece molded bridge bearing neoprene.
 2. Washer / bushing shall surround the anchor bolt.
 3. Flat washer face to avoid metal to metal contact.
 4. Mason Type HG.
- I. Type K: Pipe Anchors: All-directional acoustical pipe anchor consisting of a telescopic arrangement of two sizes of steel tubing separated by a minimum one-half inch thickness of heavy-duty neoprene and duck or neoprene isolation material. Vertical restraints shall be provided by similar material arranged to prevent vertical travel in either direction. Allowable loads on the isolation material travel in either direction. Allowable loads on the isolation material shall not exceed 500 psi and the design shall be balanced for equal resistance in any direction. Isolation to be bolted or welded depending on structure. Mason Type ADA.

2.5 EQUIPMENT BASES:

- A. Integral Structural Steel Base, Type B-1:

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1. Reinforced as required to prevent base flexure at start-up and misalignment of drive and driven units. Centrifugal fan bases complete with motor slide rails.
2. Drills for drive and driven unit mounting template.
3. Must be utilized with seismic restraint Type I, II, or IV.
4. Mason Type M, WFB.

B. Concrete Inertia Base, Type B-2:

1. Vibration isolator manufacturer shall furnish rectangular structural concrete forms for floating foundation. Bases for split case pumps shall be large enough to provide support for suction and discharge base ells. The base depth shall be a minimum of 1/10 of the longest span but not less than 6" or greater than 14".

Forms shall include minimum concrete reinforcement consisting of ½" bars or angles in place in 6" centers running ways and a layer 1 ½" above the bottom and a top layer of reinforcing steel as above for all bases exceeding 120" in one direction. Isolators shall be set into pocket housings which are an integral part of the base construction and set at the proper height to maintain a 1" clearance below the base. Bases shall be furnished with templates and anchor bolt sleeves as part of this system.

2. Must be utilized with seismic restraint Type I, II or IV.
3. Mason Type K, BMK.

C. Isolated Curb, Type B-3:

1. Curb mounted rooftop equipment shall be mounted on structural spring isolation curbs that directly sit on roof construction and are flashed and waterproofed into roof's membrane waterproofing system. Manufacturer's curb shall not be used.
2. All spring locations shall have removable waterproof covers to allow for spring adjustment and/or removal. All curbs shall be pitched. Contractor shall coordinate required pitch with the structural.
3. Curbs shall have a provision for an optional sound barrier kit.
4. All spring mounts shall be as Isolator Type A.
5. Curbs shall have static deflection.
6. Curbs shall be rated for 1 G of acceleration and shall be wind restrained for 110 mph wind loads.
7. Curbs shall have California OSHPD approval.

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8. Sound barrier package, SBC-3. Two layers of waterproof sheetrock and sound insulating material shall be supplied and installed by this contractor.
 9. Curbs to be welded to building steel or bolted to concrete decks to attain acceleration criteria.
 10. Mason Type RSC.
- D. Roof Isolation Rail System, Type B-4: Rooftop fans, condensing units, exterior ducted air handling units, etc., shall be installed on continuous equipment support piers which shall combine a regular equipment support and an isolation system into one assembly. The system shall be designed with 2" or 3" static deflection steel springs which are both adjustable, removable, and interchangeable after equipment has been installed. The system shall maintain the same operating and installed height both with and without the equipment load and shall be fully restrained during wind load conditions allowing no more than 1/4" motion in any direction. The isolation pier shall be designed to accept the membrane waterproofing. The entire assembly shall be cold spray galvanized or plastic coated.
- System design permits minimum 1 G of acceleration. Curbs to be welded to building steel or bolted to concrete decks to attain acceleration criteria. Mason Industries Model RSR.
- E. Non-isolated seismic roof curbs, Type B-5:
1. Curb sections shall be either structural steel channels or 12GA. sheet metal.
 2. Field assembled joints shall include a minimum of 2 rows of three bolts at each connection.
 3. Curb to have a factory installed wood nailer.
 4. System to be bolted or welded to deck.
 5. System shall be designed for minimum 1/2G. of acceleration.
 6. Mason Type RRC.
- F. Dunnage steel mounted rooftop equipment. Type B-6:
1. Rooftop equipment shall be mounted on structural tubular steel boxed rail assembly.
 2. Tubular steel rails shall be attached to seismic rated spring vibration isolators.
 3. Isolators shall be bolted or welded to dunnage steel to meet seismic criteria of 1/2G acceleration.
 4. Entire assembly shall be hot dipped galvanized.
 5. Mason Type RSLR.

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2.6 FLEXIBLE CONNECTORS:

- A. Elastomer Type FC-1:
1. Manufactured of Kevlar reinforcement and EPDM, both molded and cured with hydraulic presses.
 2. Straight connectors to have two spheres reinforced with a molded-in external ductile iron ring between spheres.
 3. Elbows shall be long radius type.
 4. Rated 250 psi at 170 degrees F. Dropping in a straight line to 170 psi at 250 degrees F for sizes 1-1/2" to 12" elbows. Elbows shall be rated no less than 90% of straight connections.
 5. Sizes 10" to 12" to employ control cables with neoprene end fittings isolation from anchor plates by means of 1/2" bridge bearing neoprene bushings.
 6. Minimum safety factor, 4:1 at maximum pressure ratings.
 7. Systems bolted to victaulic type couplings or gate, butterfly, or check valves to have a minimum 5/8" flange spacer installed between conductor and coupling on flange.
 8. Submittals to include test reports.
 9. Mason Type Safeflex SFDEJ.
- B. Flexible Stainless Hose, Type FC-2:
1. Type 321 stainless steel braided flexible metal hose.
 2. 2" pipe size and smaller: threaded carbon steel fittings.
 3. 1 1/2" pipe size and larger: Class 150 carbon steel flanges.
 4. Suitable for operating pressure with 4:1 minimum safety factor.
 5. Flexible Metal Hose Company type DFC and MFC.
- C. Unbraided Exhaust Hose, Type FC-3:
1. Low pressure stainless steel annularly corrugated.
 2. Fitted with flanged ends.
 3. Maximum temperature 1,500 degrees F.
 4. Mason Type SDL-RF.
- D. 60 Degree VEE assembly:
1. Type 304 stainless steel hose and braid.
 2. 4" motion in all directions.
 3. ASA 150 carbon steel flanges.

PART 3 - EXECUTION

3.1 GENERAL SEISMIC RESTRAINT REQUIREMENTS:

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- A. Install seismic restraints in accordance with manufacturers recommendations.
- B. Seismic restraining system Type III: Install taut for non-isolated equipment and slack with ½” cable deflection for isolated systems.
- C. Seismically restrain all piping, conduit and ductwork with Type III or Type V seismic restraint in accordance with guidelines outlined below. Restraints which are to be used in conjunction with vibration isolators shall be Type III.
 - 1. Carbon steel piping shall be braced at maximum 40’ intervals and at turns of more than 4’. Lateral bracing at maximum 80’ intervals. No-hub piping to be braced at maximum 20’ intervals or maximum 40’ using ½ G acceleration rated couplings.
 - 2. Ductwork shall be braced at maximum 30’ and at every turn and duct run end. Lateral bracing at maximum 60’.
- D. Equipment mounted on housekeeping pads: Pads shall be properly doweled or expansion shielded to deck to meet acceleration criteria. Mason Type HPA.
- E. Seismic Restraints are not required for the following:
 - 1. Piping in mechanical rooms or penthouses less than 1-1/4” O.D, except fire protection piping.
 - 2. Piping in other areas less than 2-1/2” O.D. except fire protection piping.
 - 3. Ducts which have a cross sectional area less than 6 square feet.
 - 4. All piping suspended by individual hanger 12” or less in length from the top of the pipe to the bottom of the support for the hanger, except fire protection piping.
 - 5. Fire protection feed mains and cross mains suspended by individual hangers 6” or less in length from the top of the pipe to the bottom of the support for the hanger.
 - 6. All top supported ducts suspended by hangers 12” or less in length from the top of the duct to the bottom of the support for the hanger.
 - 7. Electrical conduit less than 1-1/2” I.D.
- F. For overhead supported equipment, over stress of the building structure must not occur. Bracing can occur from:
 - 1. Flanges to structural beams.
 - 2. Upper or lower truss chords in bar joist construction at panel points.
 - 3. Cast-in-place inserts or drilled and shielded inserts in concrete structures.
- G. Building seismic and expansion joints: Install hinged joints at piping crossing expansion and seismic joints and anchor the piping either side.

Anchors on each end are to be capable of accepting 1.5 times the operating pressure multiplied by the projected area of the pipe.
Fittings shall be able to compensate for 4” motions in all directions.

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1. Offset shall be accomplished by the annular motion of a double sphere connector (TYPE FC-1) bolted to each end of an intermediate steel pipe. Bracket each joint with hinged steel connections. Hinge shall have a pin / slot assembly on both sides. The completed assembly shall be Mason Type Safeflex SFDEJ-HE.

3.2 GENERAL VIBRATION ISOLATION REQUIREMENTS:

- A. A. Install isolators in accordance with manufacturer's recommendations. Vibration isolators shall not cause any change of position resulting in stresses or misalignment. Equipment exposed to the wind such as cooling towers, roof mounted fans, and roof mounted chillers shall be mounted on restrained spring mountings. The springs shall be located on a neoprene acoustical pad within a rigid sided housing that includes vertical limit stops to prevent spring extension when weight is removed and temporary steel spacers between the upper and lower housings. Housings shall serve as blocking during erection. When the equipment is at full operating weight, the springs shall be adjusted to assume the weight and the spacers removed, without changing the installed and operating heights. All restraining bolts shall have large rubber grommets to provide cushioning in the vertical as well as horizontal modes. The hole through the bushing shall be a minimum of 0.75"(20mm) larger in diameter than the restraining bolt. Horizontal clearance on the sides between the spring assembly and the housing shall be a minimum of 0.5"(12mm) to avoid bumping and interfering with the spring action. Vertical limit stops shall be out of contact during normal operation. Cooling tower mounts are to be located between the supporting steel and the roof or the grillage and dunnage as shown on the drawings when there is no provision for direct mounting. Housings and springs shall be powder coated and hardware electro-galvanized. Mountings shall be SLRSO as manufactured by Mason Industries, Inc.
- B. Mechanical equipment shall be isolated from the building structure by means of noise and vibration isolators.
- C. Each fan and motor assembly shall be supported on a single structural steel frame (where noted on the isolation and seismic schedule). Flexible duct connections shall be provided at inlet and discharge ducts.
- D. Provide pairs of horizontal limit springs (Thrust restraints) on fans with more than 6.0 inch static pressure, and on hanger supported, horizontally mounted axial fans where indicated
- E. Provide resiliently mounted equipment, piping, and ductwork with seismic snubbers. Each inertia base shall have minimum of four seismic snubbers located close to isolators. Snub equipment designated for post disaster use to 0.05 inch (1.5 mm) maximum clearance. Other snubbers shall have clearance between 0.15 inch (4 mm) and 0.25 inch (7mm).]
- F. Ductwork connected to rotating equipment shall be supported with Type C or Type F isolators for the first three support points.

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G. Installation of piping vibration isolators:

1. All piping, except fire protection standpipe systems, is included under this section.
2. Vibration isolators shall be installed on all piping outside the shafts as follows:
 - a. Piping in mechanical rooms.
 - b. Piping where exposed on roof.
 - c. Piping connected to rotating equipment and pressure reducing stations.
3. Horizontal suspended pipe 2" and smaller and all steam piping shall be suspended by Type E isolator with a minimum 3/8" deflection. Water pipe larger than 2" shall be supported by Type C or Type F isolator with minimum 1" whichever is greater.
4. Horizontal pipe floor supported at slab shall be supported via Type A with a minimum static deflection of 1" or same deflection as isolated equipment to which pipe connects, whichever is greater.
5. Vertical riser pipe supports under 2" diameter shall utilize Type G isolation pads.
6. Vertical riser guides, if required, shall avoid direct contact of piping with building.
7. Pipe anchors or guides, where required, shall utilize resilient pipe anchors, Mason Industries Type ADA, or equivalent, to avoid direct contact of piping with building.
8. Isolated piping which requires sway bracing shall utilize two neoprene elements, Type G to accommodate tension and compression forces.
9. Pipe extension and alignment connectors: Provide connectors at riser takeoffs, cooling and heating coils, and elsewhere as required, to accommodate thermal expansion and misalignment.

H. Pipe Isolation Schedule

PIPE SIZE - INCH (MM)	ISOLATED DISTANCE FROM EQUIPMENT
1 (25)	120 diameters (3.0m)
2 (50)	90 diameters (4.5m)
3 (80)	80 diameters (6.0m)
4 (100)	75 diameters (7.5m)
6 (150)	60 diameters (9.0m)
8 (200)	60 diameters (12.0m)
10 (250)	54 diameters (13.5m)
12 (300)	50 diameters (15.0m)
16 (400)	45 diameters (18.0m)

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24 (600)

38 diameters (23.0m)

3.3 EQUIPMENT INSTALLATION:

A. Requirements for installation on concrete inertia bases shall be as follows:

1. Minimum operating clearance between concrete inertia and base and housekeeping pad or floor shall be 1”.
2. The equipment structural steel or concrete inertia base shall be placed in position and supported temporarily by blocks or shims, as appropriate, prior to the installation of the machine or isolators.
3. The isolators shall be installed without raising the machine and frame assembly.
4. After the entire installation is complete and under full operational load, the isolators shall be adjusted so that the load is transferred from the blocks to the isolators. When all isolators are properly adjusted, the blocks or shims shall be barely free and shall be removed.
5. Install equipment with flexibility in wiring connection.
6. Verify that all installed isolator and mounting systems permit equipment motion in all directions. Adjust or provide additional resilient restraints to flexibly limit start-up equipment lateral motion to ¼”.
7. Prior to start-up, clean out all foreign matter between bases and equipment. Verify that there are no isolation short circuits in the base, isolators, or seismic restraints.

3.4 INSPECTION:

- A. Upon completion of the installation of all vibration isolation, flexible connections and seismic restraints, the manufacturer’s local representative shall visit the project job site, visibly inspect all installations and report, in writing, any and all deficiencies from the specifications. Any additional corrective measures required to put the system in total compliance shall be the responsibility of the installing contractor.

END OF SECTION 230548

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.
- B. The General Requirements in Section 20 00 50 shall also govern the work under this Section.
- C. Examine all drawings and data and coordinate the work of this Section with all related and adjoining work.

1.2 SCOPE OF WORK:

- A. Provide all labor, materials, equipment and tools required to complete the work described and shown on the contract drawings.

PART 2 -PRODUCTS

2.1 PRODUCTS:

- A. None required.

PART 3 - EXECUTION

3.1 GENERAL:

- A. Work shall be performed only by a firm which employs certified testing, adjusting and balancing technicians as listed by the Sheet Metal Industry National Certification Board of TAB Technicians. The work may be performed by a certified Test, Adjusting and Balancing technician who may be assisted by other TAB technicians. This firm shall provide personnel trained and experienced in system balancing. This requirement will not be waived under any condition.
- B. Before submitting system performance data for approval or acceptance, the firm shall perform all necessary tests and make all necessary adjustments as required to obtain the flow as called for on the Contract Documents.
- C. The balance reports shall include the names, signatures and registration numbers of the technicians assigned to the project. Submit reports prior to final payment.

3.2 ACCEPTABLE FIRMS:

- A. The following listed firms are approved to perform this work:

Environmental Testing and Balance

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James Brennan Company
Technical Associates Group, Inc.
Wing's Testing and Balancing

- B. Request to employ any other balancing and testing firm must be accompanied by a complete brochure of the firm listing previous installations successfully balanced, length of time in business, names and qualifications of employees and list of instruments available for use on the project.

3.3 HYDRONIC SYSTEMS:

- A. Prior to the start of balancing, the firm shall check the rotation of all pumps.
- B. The firm shall compile the following data for each pump insofar as they apply and shall include it on the final submittal:

PUMP DESCRIPTIVE DATA

Pump Number
System Served
Pump Size
Pump Make
Pump Horsepower
Motor Safety Factor
Motor Manufacturer & Size
Voltage & Phase

PUMP DESIGN & DELIVERED CONDITIONS

Pump Rpm
Pump Inlet & Outlet Pressure
Amperage
Brake Horsepower
Gpm Supply

SYSTEM DESIGN & DELIVERED CONDITIONS

Flow (Gpm) through each pump
Inlet & Outlet temperature at 3-way valve
Type of instrument and method used

- C. The firm shall provide all instruments and accessories required to perform the tests and shall make their own provisions for inserting the instruments.
- D. The firm shall notify the City's Representative when they will start work. Prior to this time, the firm shall send their supervising engineer to the office of the City or his Representative to review the design, desired operation, and method of balancing of the job.

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- E. Upon completion of the work, the firm shall certify that all systems are properly balanced and are delivering, returning or exhausting the required quantities. The firm shall deliver to the subcontractor five (5) copies of the test report for transmittal to the Owner's Representative.
- F. Check all safety controls and record control sequences.
- G. Check scheduled air control record the operation by simulating complete operating cycle.
- H. After completion of balancing, mark location of all final positions of dampers.

3.5 INSTALLATION TOLERANCES:

- A. Adjust system to the following tolerances:
 - 1. Supply water temperature 80 degree F to 120 deg. F 0% to +10% of design value.
 - 2. Supply water temperature 120 degree F to 160 deg. F -5% to +10% of design value.
 - 3. Supply water temperature above 160 degree F -10% to +10% of design value.

3.6 FIELD VERIFICATION:

- A. The design Engineer may request verification of data contained in the balancing report. If requested the TAB technician whose initials appear on the data sheets shall take readings selected at random by the Engineer who will compare these readings to those in the submitted report. If the field verification is not satisfactory, the firm doing the TAB work shall completely rebalance the system and a new report shall be prepared and submitted for approval.

END OF SECTION 230593

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. The General Provisions of the Contract, including General and Supplementary Conditions and Division 1, General requirements, apply to the work specified in this Section.
- B. The General Requirements in Section 20 00 50 shall also govern the work under this Section.
- C. Scope of Work: This Section contains details for the insulation of pipe, ductwork and equipment installed under Divisions 22 and 23.

1.2 SUBMITTALS:

- A. In accordance with Section 20 0050, the following items shall be submitted for approval.
 - Piping insulation
 - Fitting insulation
 - Equipment insulation

1.3 MECHANICAL SYSTEMS INSULATION:

- A. Furnish and install all thermal and protective insulation as specified herein for piping, and equipment as shown on the drawings.
- B. The following mechanical items shall be insulated:
 - Piping - hot and cold
 - Fittings - Valve bodies, Victaulic couplings, elbows, tees, etc.
 - Equipment insulation

1.4 SYSTEM PERFORMANCE

- A. Insulation materials furnished and installed hereunder should meet the minimum thickness requirements of ASHRAE 90.1 (2001), "Energy Efficient Design of New Buildings," of the American Society of Heating, Refrigeration, and Air Conditioning Engineers. However, if other factors such as condensation control or personnel protection are to be considered, the selection of the thickness of insulation should satisfy the controlling factor.
- B. Insulation materials furnished and installed hereunder shall comply with NFPA 255 and shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with the following testing standard:

Underwriters' Laboratories, Inc. UL 723

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Adhesives used for applying the sealed jackets shall also conform to these same ratings. The use of wheat paste or any other material not meeting these requirements will not be allowed.

1.5 QUALITY ASSURANCE

- A. Insulation materials and accessories furnished and installed hereunder shall, where required, be accompanied by manufacturers' current submittal or data sheets showing compliance with applicable specifications.
- B. Insulation materials and accessories shall be installed in a workmanlike manner by skilled and experienced workers who are regularly engaged in commercial insulation work.
- C. All covering and insulating materials shall be manufactured by Owens-Corning, Knauf, Johns Manville or Armstrong.

1.6 SEAMS:

- A. On exposed insulation, all longitudinal seams shall be kept at the top and back of the pipe and circumferential joints shall be kept to a minimum. Raw end of insulation shall be concealed by neatly folding the ends of the jackets. Fittings, valve bodies and flanges shall be furnished with the same jacket materials used on adjoining insulation.

1.7 PRIOR TESTING:

- A. Covering shall not be applied until all parts of the work have been tested by the Contractor and reviewed by the Engineer.

1.8 VAPOR BARRIER:

- A. Vapor barrier shall be applied in accordance with the manufacturer's instructions to maintain the integrity of the vapor barrier on cold systems.
- B. An approved vapor retarder mastic compatible with PVC must be applied between pipe insulation and fitting cover, and on fitting cover and throat overlap seam.
- C. For fittings where operating temperature is below 45 deg. For where pipe insulation thickness is greater than 1 ½", two or more layers of Hi-Lo temp insulation inserts shall be installed beneath fitting cover.

1.9 METAL SHIELDS:

- A. Metal shields, 16 gauge galvanized, shall be applied between hangers or supports and the pipe insulation. Shields shall be roll formed to fit the insulation and shall extend up to the center line of the pipe and the length specified for the insert. Insulation shall be rigid type for length of shield to prevent crushing.

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1.10 DELIVERY AND STORAGE OF MATERIALS

- A. All of the insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification.
- B. The contractor shall use whatever means are necessary to protect the insulation materials and accessories (wick material, sealing tape, etc) before, during, and after installation. No insulation material shall be installed that has become damaged in any way. The contractor shall also use all means necessary to protect work and materials installed by other trades.

PART 2 - PRODUCTS

2.1 PIPING:

- A. Insulate all supply and return chilled water lines in the Mechanical Room, with Owens-Corning Fiberglass ASJ with S.S.L. II, pipe insulation with double self-sealing lap having a factory applied jacket, vapor seal all joints, seams, elbows and fittings. All horizontal and vertical insulated piping located in the boiler room and not protected with enclosures shall be protected with color coded Zeston 2000 P.V.C. 30 Mil jacketing.
- B. All piping shall be covered as follows: Apply insulation to clean dry pipe with side and end joints butted tightly. Seal lap of jacket and butt joint strips with Benjamin Foster 82-07 vapor barrier lap adhesive.

Insulate fittings, flanges and valves of piping with mitered pipe insulation, or F/G premolded fittings made smooth with insulating cement and jacket with glass cloth saturated with Benjamin Foster 30-60 lagging adhesive. Vinyl or plastic fitting jackets will be allowed.

- C. Insulate domestic cold water, in the same as for piping above.
- D. Foam insulation:
 - 1. Piping and Fittings. MicroLok plain pipe insulation shall be wired or taped in place over clean, dry pipe with all joints butted firmly together. Vapor retarder shall be Micro-Lok AP-T plus.
 - 2. The insulation shall be finished with metal jacketing with a laminated moisture retarder. Metal jacketing shall be overlapped 2 to 3 inches (51 to 76 mm) and held in place with sheet metal screws or metal bands.
 - 3. Elbows and tees shall be finished with matching metal fitting covers. Other fittings in metal-jacketed systems shall be finished with conventional weather-resistant insulating materials with painted aluminum finish.
- E. Provide minimum insulation thickness in accordance with the following table.
Minimum Pipe Insulation

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Piping System Types	Fluid Temp. Range	Runouts 2 in +	1 in. and less	1-1/4 to 2 in.	2-1/2 to 4 in.	5 and Larger
	F	in.	in.	in.	in.	in.
Plumbing & CHW Systems						
Hot & Recic. Hot Water	100-200	1.0	1.0	1.0	1.5	1.5
Cold Water	Below 70	0.5	1.0	1.5	1.5	1.5

2.2 FITTING COVERS:

- A. Fitting covers may be used in lieu of insulating cement and jacket. Provide color coded fitting covers in Zeston - 2000 P.V.C. (20 Mil thickness) by Manville.
- B. General - The matching insert (fiberglass) should either be wrapped completely around the fitting or snugly positioned inside the fitting for proper fit. The insert shall cover the full inner surface area of the fitting cover. The fitting cover is then to be applied over the fitting and insert, and the throat secured by either tack fastening, taping, or banding.
- C. Cold Pipe - Fitting systems below ambient temperature must have a continuous vapor barrier, either with pressure sensitive PVC Tape, or an approved adhesive system. When PVC Tape is used, a 2" downward lap is required. On cold lines in severe ambient temperatures, the fiberglass insert shall be the same thickness as the adjacent pipe insulation. All joints shall then be sealed with PVC Tape.
- D. For pipes exposed to weather apply a 16 mil embossed aluminum jacket with 2" overlap at longitudinal and circumferential joints. Secure in place with 3/4" x .015" aluminum band 18" on centers. All seams shall be sealed weather tight.

PART 3 – EXECUTION

3.1 SITE INSPECTION

- A. Before starting work under this section, carefully inspect the site and installed work of other trades and verify that such work is complete to the point where installation of materials and accessories under this section can begin.
- B. Verify that all materials and accessories can be installed in accordance with project drawings and specifications and material manufacturer’s recommendations.
- C. Verify, by inspecting product labeling, submittal data, and/or certifications which may accompany the shipments, that all materials and accessories to be installed on the project comply with applicable specifications and standards and meet specified thermal and physical properties.

3.2 PREPARATION

- A. Ensure that insulation is clean, dry, and in good mechanical condition and that all factory-applied facings are intact and undamaged. Wet, dirty, or damaged insulation is not acceptable for installation.
- B. Ensure that pressure testing of piping and fittings has been completed prior to installing insulation.

3.3 INSTALLATION

- A. General
 - 1. Install all insulation materials and accessories in accordance with manufacturer's published instructions and recognized industry practices to ensure that it will serve its intended purpose.
 - 2. Install insulation on piping subsequent to painting, and acceptance tests.
 - 3. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other. Butt insulation joints firmly to ensure complete, tight fit over all piping surfaces.
- B. Fittings
 - 1. Wrap valves, fittings, and similar items in each piping system with wicking material to ensure a continuous path (100% coverage) for the removal of condensation.
 - 2. Cover valves, fittings, and similar items in each piping system using one of the following:
 - a. Mitered sections of insulation equivalent in thickness and composition to that installed on straight pipe runs.
 - b. PVC Fitting Covers insulated with material equal in thickness and composition to adjoining insulation.
 - 3. Seal all fitting joints with contractor supplied VaporWick Sealing Tape or approved vapor retarder mastic compound.
- C. Penetrations

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Extend piping insulation without interruption through walls, floors and similar piping penetrations.

3.4 FIELD QUALITY ASSURANCE

- A. Upon completion of all insulation work covered by this specification, visually inspect the work and verify that it has been correctly installed. This may be done while work is in progress, to assure compliance with requirements herein to cover and protect insulation materials during installation.

3.5 PROTECTION

- A. Replace damaged, removed or disturbed insulation with appropriate fiberglass insulation.
- B. The insulation contractor shall advise the general and/or the mechanical contractor as to requirements for protection of the insulation work during the remainder of the construction period, to avoid damage and deterioration of the finished insulation work.

3.6 SAFETY PRECAUTIONS

- A. Insulation contractor's employees shall be properly protected during installation of all insulation. Protection shall include proper attire when handling and applying insulation materials, and shall include (but not be limited to) disposable dust respirators, gloves, hard hats, and eye protection.
- B. The insulation contractor shall conduct all job site operations in compliance with applicable provisions of the Occupational Safety and Health Act, as well as with all state and/or local safety and health codes and regulations that may apply to the work.

END OF SECTION 230700

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.
- B. The General Requirements in Section 20 00 50 shall also govern the work under this Section.
- C. Examine all drawings and data and coordinate the work of this Section with all related and adjoining work.

1.2 SCOPE OF WORK:

- A. This Contract includes all labor, material, equipment, tests and appliances required to furnish and install all HVAC as shown on drawings, implied and herein specified.
- B. The present location of the building will be as shown on drawings. Visit the site and examine the Architectural, Structural and other Mechanical trades showing all details of construction before submitting proposal.
- C. Connect all radiation, fan coil units, air handling units and equipment with piping, ductwork and controls and leave ready to operate. Check all Architectural, Structural, Mechanical and Electrical drawings and coordinate all work accordingly.
- D. Provide seismic restraints, vibration isolators and flexible connections in accordance with Section 230548. Provide flexible connections at all locations where pipes cross building seismic or expansion joints. Coordinate with Architectural.
- E. Drawings are diagrammatic and indicate the general arrangement of piping and do not show all minor details and fittings. Such items shall be included, as well as reasonable modification, in the layout as directed to prevent conflict with other trades. Attention is brought to Section 20 00 50, "Coordination Drawings".

1.3 SUBMITTALS:

- A. In accordance with Section 20 00 50, the following items shall be submitted for review.

Pipe and fittings
Hydronic Equipment and Specialties

1.4 MOTOR CONTROL:

- A. Each electric motor of 3 phase characteristics shall be furnished with an automatic starter as specified in Section 20 00 50, Motor Control.

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PART 2 -PRODUCTS

2.1 PIPE AND FITTINGS:

A. Copper Tubing:

1. Type "L", ASTM Specifications B88, shall be used for water lines.
2. Fittings shall be wrought copper or cast brass solder- joint pressure rated type.
3. Type "K" shall be used for underground piping with flared fittings.

B. Steel Piping:

1. Pipe shall be Standard Wall (Sch. 40) black carbon steel, ASTM A-120, Grade B, with threaded ends for sizes 1/2" through 2", for hot water heating piping.
2. All steam condensate return piping shall be run in (SCH 80) black steel.
3. Fittings shall be standard weight (125 lbs.), cast iron screwed, ASTM A126, Class A, for sizes 1/2" through 2". Piping 2" and under shall be screwed.
4. Victaulic Grade E couplings, fittings and accessories in conjunction with grooved end schedule 40 piping will be permitted in existing and new construction for hot water heating system.

2.2 PIPE AND FITTINGS:

- A. All fittings on welded lines shall be furnished in accordance with ASTM A105 Specification designed for welding. Branch outlets on mains 2-1/2" and smaller to be made with Weldolets or Threadolets. Welding fittings on mains and branches 3" and larger are to be full size of reducing tube designed for welding. All flanged valves 3" and larger and special equipment connections to be installed with weld neck flanges for welded construction.
- B. All nipples shall be extra strong as follows: Pipe size 1/2" to 4" - 6" close. Pipe size 5" - 12" - 12" close and of the same material as the piping they are used with.
- C. All copper tubing shall be furnished in Type "L" using sweat fittings unless otherwise noted. Copper tubing shall be furnished in Chase, Anaconda, Bridgeport or Revere.
- D. All black steel over 4" or other welded pipe shall have long radius welding ells and tees of the same wall thickness as the pipe. Welding tees will not be required where the mains and branches comply with the following schedule:

<u>Min. Size of Mains</u>	<u>Max. Size of Branch</u>
2 1/2"	3/4"
3"	1 1/4"
4"	2"
5"	3"
6"	4"
8"	6"

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10"	8"
12"	10"

- E. Welding flanges shall be slip-on or welding neck type, 300 psig forged steel conforming to ANSI Specification B-16.5.
- F. All necessary precautions shall be taken when welding in the new building to prevent combustion of structure.

2.3 GROOVE PIPING:

- A. Victaulic couplings may be used in lieu of welding, thread or flanging on 2 1/2" through 30" carbon steel pipe, on heating water services from -30 deg. F. to 230 deg. F. within the manufacturer's rated working pressures. Pipe grooving shall be cut grooved and/or rolled grooved as per manufacturer's latest spec. Installation is per manufacturer's latest recommendations. All piping shall be Schedule 40. grooved piping shall be used only in concealed or service areas. Grooved piping will not be accepted in finished areas with no ceiling.

- B. Piping Components

Grooved couplings consisting of two or more pieces of ductile or malleable iron. Coupling gaskets will be a synthetic rubber gasket with a central cavity pressure responsive design. Coupling bolts and nuts shall be heat treated carbon steel, track head conforming to physical properties of ASTM-A-183. All grooved couplings shall be as manufactured by Victaulic Co. Style 77, 07 or equal.

- C. For piping 2 1/2" and larger, full size branch connections shall be made with manufactured grooved end tees. Branch connections for less than full size shall be made with Victaulic hole cut products. Style 920 or Style 921 branch connections with locating collar engaging into hole or style 72 outlet coupling used to join grooved pipe and to create a branch connection.

Gaskets for branch connection shall be Victaulic Grade "E" EPDM Compound with working temperature of -30 deg. F. to 230 deg. F.

- D. Flanges

Vic-Flange Style 741 (2-24") for connection to ANSI class 125 and 150 flanged components.

- E. Fittings

Fittings shall be full flow cast fittings, steel fittings or segmentally welded fittings with grooves or shoulders designed to accept Victaulic grooved end couplings.

1. Standard Fittings - shall be cast of ductile iron conforming to ASTM A-536 (Grade 65-45-12) or malleable iron conforming to ASTM A-47, Grade 32510, painted with a rust inhibiting modified vinyl Alkyd enamel or hot-dip galvanized to ASTM A-153 or zinc electroplated to ASTM B-633, as required.
2. Standard Steel Elbow Fittings - (14" - 24"), shall be forged steel conforming to ASTM A-106 Grade B (0.375" wall), painted with rust inhibiting modified vinyl Alkyd enamel or hot-dip galvanized to ASTM A-153.

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3. Standard Segmentally Welded Fittings - shall be factory fabricated, by fitting manufacturer, of carbon steel pipe as follows, 3/4" - 4" conforming to ASTM A-53, Type F; 5" - 6" Sch. 40 conforming to ASTM A-53, Type E or S, Grade B; 8" - 12" Sch. 30 conforming to ASTM A-53, Type E or S, Grade B; 14" - 24" 0.375" wall conforming to ASTM A-53, Type E or S, Grade B, painted with rust inhibiting modified vinyl Alkyd enamel or hot-dip galvanized to ASTM A-153, as required.

F. Victaulic Pipe Hanging (Victaulic Hanging Standard A-130)

1. Style 07 Zero-Flex for rigid piping systems should be supported as per Building Services B31.9 Hanging.
2. Style 77 flexible piping systems are supported as per Victaulic Hanging Standard A-130.

2.4 PIPING JOINTS:

- A. Welded Joints shall be fusion welded in accordance with American Standard B31.1, Section 6, except as modified hereinafter. Changes in direction of piping shall be made with welding fittings only. Mitering, notching or direct welding of pipe to the main in order to form tees or ells will not be permitted. Branch connections may be made with welding tees or forced branch outlet fittings, as manufactured by Bonney Forge, either being acceptable without size limitation. Bonney Thredolets shall be used in lieu of Hald couplings when reducing from a welded run to a screwed branch. Outlet fittings where used shall be forged, flared for improved flow where attached to the run, reinforced against external strains and designed to maintain full pipe bursting strength. Fillet welds shall be used for welding screwed and slip-on steel flanges to pipes. Where lateral connections are to be used, either lateral fittings or Bonney Latrolets are acceptable. Wedded joints shall be used in finished areas with no ceiling.

- B. Screwed Joints: The ends of pipes to be threaded shall be cut square and reamed. Pipe threads shall be standard taper, shall be cut straight and clean and to full depth, and shall be free from dirt, chips and burrs when the joint is made. Pipe joint lubricant or compound shall be selected for the pipe line service and shall be applied to male threads only. Screwed joints shall not be caulked.

- C. Flanged Joints: This heading covers flanged joints of all types, including those made with flange unions. Flanged joints shall be made with suitable reinforced gaskets. Clean all parts and align the joint before assembling; support pipes or heavy parts independently. Opposite bolts shall be pulled up successively. Screwed steel flanges shall be welded to pipes; slip-on steel flanges shall be welded front and back.

Cast iron flanges shall not be welded to pipes. If raised face flanges are to be bolted against plain face flanges, the raised face shall be removed and a full face gasket used. Where flanged base elbows are installed, the base shall not be used for anchoring the line or otherwise subjected to tension or shear.

- D. Soldered Joints in Copper Tubing: Cut the ends of tubes square, remove burrs, clean tube ends and fitting sockets with emery cloth and remove all particles before applying flux and

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making the joint. Insert tubes to full socket depth. Use the following solders at the given conditions.

- 95 - 5% Tin-Antimony/all services/high pressure 250 degrees F. Max.
- Silver - 35 to 45% alloy-refrigerant piping/high pressure and temperature.

2.5 PIPE HANGERS:

- A. Securely hang and anchor pipe as shown and required with proper provision for expansion, contraction and elimination of undue stress and strain on piping.
- B. Provide a pipe hanger within two (2) feet of each elbow, tee, wye, valve, strainer and similar device.
- C. Secure and support runs at base and at sufficiently close intervals to hold pipe at alignment and to carry safely the weight of piping and contents without undue stress thereon.
- D. Except as indicated to the contrary, secure and support all horizontal piping as follows and required to prevent sagging, undue pipe movement and preserve proper alignment in each run.

<u>Piping</u>	<u>Sizes</u>	<u>Maximum Interval</u>
Cast Iron	All sizes	At each hub or joint
Steel	2" & smaller	Six (6) feet
Steel	2 1/2" & larger	Ten (10) feet
Copper Tubing	1 1/4" & smaller	Five (5) feet
Copper Tubing	1 1/2" & larger	Eight (8) feet

- E. Hangers up to and including 2" shall be the adjustable band type equal to Empire. Figure 310 for iron pipe and Fig. 310CT for copper tubing.
- F. Hangers for piping 2-1/2" and up shall be the clevis type, equal to Empire. Figure 11 for iron pipe and Figure 110CT for copper tubing.
- G. Hangers shall be suspended from one of the following devices:
 - 1. "C" clamps.
 - 2. Trapeze hanger assemblies consisting of back-to-back horizontal steel channels with end-type rod hangers.
 - 3. Expansion shield embedded into concrete or masonry.
- H. On chilled water systems, provide over-sized hangers.
- I. Refer to Section 230548 for Seismic Restraints.

2.6 VALVES:

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- A. This Contractor shall furnish and install valves where shown on plans and also wherever necessary to make the system complete in its operation. All valves shall be as manufactured by Stockham, Jamesbury, Centerline, Appollo, Milwaukee and Victaulic.

Chilled Water:

2" and smaller

Ball valves	Apollo 71-100/200
Check valves	Stockham B-310-T
Vertical check valves	Stockham B-310-T

2-1/2" and larger

Butterfly valves	Stockham - LG712-BS3-B (Lug Style)
Check valves	Centerline - Series 800 S.S. plate and spring, and nypalon seats.

Furnish all valve materials suitable for service intended. No gate valves shall be allowed. Provide all valves with factory installed extension stems.

2.7 UNIONS:

- A. All unions shall be furnished in Nibco-633 or equal in Chase, Revere, Jefferson and Anaconda.

2.8 GASKETS:

- A. Where flanges occur, they shall be packed with Klinger or approved equivalent high quality non-asbestos material composed of fibers for industrial maintenance service with high chemical stability and heat resistance. Nitrile rubber bonded.

Temperature	750 deg. F. max.
Pressure	1450 psi max.
Compressibility	ASTM F36A
Tensile Strength	ASTM F152

2.9 FLOOR AND CEILING PLATES:

- A. Furnish and install satin chrome plated pressed metal floor and ceiling plates on all exposed pipes passing through floors, walls, ceilings, and partitions throughout.

2.10 REAMING OF PIPES:

- A. All pipes to be carefully reamed after cutting and threading.

2.11 PIPE ANCHORS:

- A. Furnish and install all steel clamps around mains not less than 1/4" thick and welded to pipe and necessary angle braces to substantial construction to meet job conditions. Anchored mains shall be properly guided.

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- B. Vertical risers, if any, shall be anchored by similar clamps secured to floor, concealed in wall construction.

2.12 EXPANSION LOOPS AND JOINTS:

- A. Furnish and install all expansion joints with mains and loops properly anchored and guided to allow for the necessary expansion of mains and all run outs shall be piped to allow for necessary expansion on risers and mains. In cases where space is limited, expansion joints with compensators, guides and anchors may be used in place of expansion loops as approved by the Engineer.
- B. Provide all expansion joints in Keflex or equal in Fulton Syphon, Flexonics or Adscos, with compensator guides and anchors. Piping joints 3" and larger shall be free-flexing type with Type 304 stainless steel bellows and 150-lb. van stone flanges. Lines of 2-1/2" and smaller shall be equipped with Quadra Side H compensators having multi-ply stainless steel bellows, carbon steel thread and shroud, each for 1" compression and 3" extension.
- C. Pipe alignment guides shall be installed in accordance with manufacturer's published bulletin. Anchors shall have sufficient strength to prevent movement of the piping beyond anchor points.

2.13 HANGERS AND SLEEVES:

- A. All horizontal piping shall be supported in a good, firm and substantial manner. No chains, horizontal pieces of pipe or hangers formed by means of perforated steel bands, pipe rings and hooks will be permitted. Provide cast iron ceiling plates for all hangers in finished basement ceilings. All hangers shall be oversized
- B. Furnish and place "Hole-Outs" plastic preformed knockout sleeves for all pipes passing through concrete or tile floors or partitions. All pipes passing through toilet room and mechanical room floors shall be provided with grouted, split Schedule 80 steel pipe sleeves, packed with hair felt and Portland cement to allow for flushing of floors without leakage. All pipes and conduits passing through floors, walls or partitions shall be provided with sleeves sized to give a minimum of 1/2" clearance between sleeve and the outside diameter of the pipe, conduit or insulation, enclosing the pipe or conduit.
- C. Sleeves through concrete floors or interior masonry walls shall be Schedule 40 steel pipe, set flush with finished wall or ceiling surfaces, but extending 2 inches above finished floors or shall be in accordance with details on drawings. In all mechanical equipment rooms or penthouses, sleeves shall extend 6 inches above finished floor.
- D. All outside piping passing through exterior walls, foundation walls and floors shall be furnished with flanged C.I. wall sleeves in Zurn, J.R. Smith or Josam. Furnish with flashing clamp where sleeve passes through waterproof membrane.

2.14 SPECIALTIES FOR CHILLED WATER SYSTEM:

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- A. Furnish and install all chilled water equipment in Bell & Gossett as specified below and as shown on the drawings.
1. Expansion tank with bladder shall be furnished on hot water system ASME stamped and designed for 125 lbs. working pressure and 200 deg.F. Test pressure in steel to conform with U-69 construction, precharged to 55 psig. Number of tanks and size shall be shown on drawings. Provide B&G automatic air vents as required.
 2. Pressure reducing valve for each closed system.
 3. B & G Triple Duty flow control valves shall be furnished in either the angle type or straightaway to suit each individual location and full size of each main or branch main.
 4. Furnish all pumps as called for in schedule and following paragraph.
 5. Air eliminator shall be furnished ASME stamped and designed for 125 psig working pressure. Size and capacity shall be shown on drawings.
 6. Provide B&G circuit setter plus calibrated balancing valves Model C.B. on all radiation and air handling equipment.
- B. Furnish and install the following accessories and equipment in make other than Bell & Gossett.
1. Thermometers: Install Ashcroft Fig. 7173T BI-Metal "Every Angle" thermometers where shown and/or called for on plans or in specifications.
 2. Thermometers shall have 5" aluminum hermeticism sealed case with stainless steel stem with 1/2" NPT connection. Install in separable well in brass with lagging extension neck. Stem length and dial range shall be 6" and 0 degrees to 250 degrees F., respectively.
 3. Furnish and install on non-critical systems, gauges suitable for use on hot water where indicated on drawings or called for in specifications. Gauge shall be Ashcroft Fig. 2070 with silver brazed boudon tube, aluminum back flange type epoxy coated case, chrome ring, 1/4" NPT lower connection, stainless steel movement with 1% accuracy. Pressure range shall be as required. Furnish 1/4" needlepoint valve in Crane #88 for each gauge. Where sharp pressure fluctuations may occur, mount gauge on a 1/4" Fig. 1106B pulsation dampener. Provide compound gauges where required or called for.
 4. Furnish and install gauges on all pump discharge and compound gauges on all pump suction.
 5. Furnish and install balancing valves on supply and return mains and branch mains from 1-1/2" and larger.
 6. Expansion fittings shall be provided in Flexonics Type H expansion joints, sized as required to take up all expansion in mains and/or branches or equal in Anaconda.
 7. Furnish and install all balancing valves on radiation, air handling unit coil, fan coil unit coil, cabinet and unit heater coil, etc., runouts 2" and smaller in Tour Andersson STA-D Series with "A metal" construction. Branch mains 2 1/2" and larger shall be provided with Tour Andersson STA-F Series balancing valve.
 8. Furnish and install dielectric fittings.
 9. Furnish and install brass cap with chain on all strainers, drains and hose connections.

2.15 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating

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nonconductive insulating material. Include end connections compatible with pipes to be joined.

- B. Dielectric Unions:
Description:

Standard: ASSE 1079.

Pressure Rating: 150 psig minimum at 180 deg F

End Connections: Solder-joint copper alloy and threaded ferrous.

- C. Dielectric Flanges:
Description:

Standard: ASSE 1079.

Factory-fabricated, bolted, companion-flange assembly.

Pressure Rating: 150 psig minimum at 180 deg F

End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

- D. Dielectric-Flange Insulating Kits:
Description:

Nonconducting materials for field assembly of companion flanges.

Pressure Rating: 150 psig.

Gasket: Neoprene or phenolic.

Bolt Sleeves: Phenolic or polyethylene.

Washers: Phenolic with steel backing washers.

- E. Dielectric Nipples:
Description:

Standard: IAPMO PS 66.

Electroplated steel nipple, complying with ASTM F 1545.

Pressure Rating: 300 psig at 225 deg F.

End Connections: Male threaded or grooved.

Lining: Inert and noncorrosive, propylene.

2.16 CHEMICAL FEEDING EQUIPMENT (CHILLED WATER SYSTEMS):

- A. For each closed system the Contractor shall furnish and install the following apparatus (including isolation and drain valves):
1. One shot combination filter feeder, minimum 10 gallon capacity with quarter turn cap and 3 ½" opening. The feeder shall be rated for 200 psi service.
- B. The Contractor shall provide ports to test the chemical concentration.
- C. Furnish one year's supply of filters and the formulas for control of scale and corrosion in the closed hot water recirculating system. Formulations shall not contain any ingredients

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which may be harmful to system materials of construction. Provide MSD sheets on all chemical products. No system shall be operated without the benefit of chemical protection. Once the recommended chemical residual is achieved, any additional chemicals required to re-treat the system due to water loss or to accomplish other work shall be provided by the Mechanical Contractor.

2.17 GLYCOL SOLUTION:

- A. Contractor shall provide propylene glycol-based heat transfer fluid to achieve 20% concentration of the primary chilled water loop. Provide (1) additional drum. The fluid shall be Dowfrost manufactured by Dow Chemical. The fluid shall meet the following requirements:
1. The fluid must be an industrially inhibited propylene glycol (phosphate-based).
 2. The fluid must be dyed (bright yellow) to facilitate leak detection.
 3. The fluid must be easily analyzed for glycol concentration and inhibitor level.
 4. For systems containing more than 250 gallons of fluid, annual analysis must be provided free of charge by the fluid manufacturer.
 5. The fluid must pass ASTM D1384 (less than 0.5 mils penetration per year for all system metals).
 6. The reserve alkalinity of the fluid must be at least 15 to provide long-term resistance to acidic pH.
- B. Follow these Installation procedures:
1. Clean new or lightly corroded existing systems with a 1% to 2% solution of trisodium phosphate in water prior to the installation of industrially inhibited propylene glycol fluid.
 2. Extensively corroded existing systems should be cleaned by an industrial cleaning company and all necessary replacements and repairs should be made.
 3. Use only good quality water in solution with the propylene glycol fluid. Use water with low levels (less than 25 ppm) of chloride and sulfate, and less than 50 ppm of hard water ions (Ca⁺⁺, Mg⁺⁺). Distilled or deionized water is recommended. If good quality water is unavailable, purchase pre-diluted solutions of industrially inhibited propylene glycol fluid from the fluid manufacturer or, if available, from the distributor.

2.18 BASE MOUNTED CENTRIFUGAL PUMPS:

- A. Furnish and install the base mounted centrifugal pumps complete with motors and trim meeting the performance, size, electrical requirements as scheduled or otherwise specified in Bell & Gossett. Maximum operating temperature shall be 225 degrees F with a maximum working pressure of 175 PSI.
- B. All base mounted centrifugal pumps shall be furnished complete with motor and trim suitable for service indicated on plans or otherwise specified. Manufacturer shall provide with drain pan. Pump shall be of the single stage end suction design with a class 30 cast iron volute with a foot integrally cast to the pump. Volute shall include gauge, vent and drain tapings. The connection style shall be flanged. The mechanical contractor shall coordinate system

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connection sizes with trim and pump size and provide all fittings and hardware necessary to connect pump to system piping. The pump internals shall be capable of being serviced without disturbing piping connections to the pump.

- C. The pump impeller shall be cast bronze enclosed type (bronze fitted). The liquid cavity shall be sealed off at the pump shaft by an internally-flushed mechanical seal with ceramic seat and carbon steel ring. Replaceable bronze shaft sleeve shall completely cover the wetted area under the seal.
- D. Pump shall come from the factory fully assembled and mounted to a baseplate. The baseplate shall be of structural steel with fully enclosed sides and ends and securely welded cross members. Grouting area shall be fully open. Contractor shall provide grout. A flexible type, center dropout design coupler capable of absorbing torsional vibration shall be employed between the pump and the motor. Coupler shall be shielded by an ANSI/OSHA compliant coupler guard securely fastened to the base frame.
- E. Furnish motors for all base mounted centrifugal pumps meeting the electrical requirements scheduled and specified in accordance with specification section 20 00 50. All three phase motors of 1HP or greater shall be supplied as premium efficiency, inverter ready motors, suitable for VFD operation.

Motors shall be selected to be non-overloading at any point along the pump curve and shall meet NEMA specifications. Pump and motor shall be factory aligned and (if required) re-aligned in the field by the installing contractor.

- F. Pumps shall be of the maintainable design. Provide owner with complete parts list with service information.
- G. Each pump shall be factory tested per Hydraulic Institute standards and name-plated prior to shipment. Impeller shall be both hydraulically and dynamically balanced, keyed to the shaft and secured by a locking cap screw or nut.
- H. Each pump shall be factory primed and painted to prevent rust and corrosion of the pump exterior surfaces.
- I. Mechanical contractor to provide pressure gauges vents and other trim for each base mounted pump. Pump shall be installed, aligned and started in accordance with manufacturer's recommendations.
- J. Provide seismic restraints and vibration isolation for each pump in accordance with specification section 23 05 48.

PART 3 -EXECUTION

3.1 INSTALLATION:

- A. Furnish and install water piping as shown on plans.

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- B. Provide chilled water shutoff valves and combination shutoff and balancing cock for all equipment, hose cocks and drain valves at all low points. Provide air vents on all equipment where they are required for proper operation of the system.
- C. Provide balancing cocks on all main branches for balancing flow to and from the various zones. Provide on all low points of mains or branches, brass hose cocks with hose connection for draining the system.
- D. Check all electrical drawings as well as the structural drawings to make sure that his piping will not conflict with such work.
- E. All piping work shall be installed with proper provision to allow for expansion and contraction of lines so as to prevent any undue strains on pipe and fittings, any trapping of lines or lifting or dislocating of any appliances. Rectify without cost to the City any conditions of noisy circulation due to trapped or air bound lines, including the expense of cutting and repairing of the building structure incident to making such alterations.
- F. Install the work to conform to space conditions and the work of other trades. The drawings indicate generally the runs and sizes of piping and, although the size must not be decreased, nor the drawings deviated from, except as unforeseen space conditions may require, the right is reversed to make minor changes in the arrangement of the work to meet conditions arising during construction.
- G. Check all architectural and structural drawings to determine seismic and expansion joint location. Provide expansion fittings at all locations where pipes cross expansion or seismic joints. Coordinate with Structural and Architectural for locations.

3.2 MISCELLANEOUS PIPING:

- A. Connect to the overhead cold water line in Mechanical Equipment Room and extend water piping to makeup connection on the hot water system, connecting up pressure reducing valve and relief valves on system as shown on diagrams.
- B. Furnish and install copper drain lines from compression tanks, and extend to floor drain, service sink and/or sump whether or not same is shown.
- C. All cold water piping shall be run in Type "L" copper tubing using sweat fittings.
- D. Provide drain from relief valves to waste.
- E. Provide drain line from receiver and run to sump pump or floor drain.

3.3 TESTING:

- A. All flow piping shall be tested and made tight.

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- B. All piping, including chilled water piping, shall be tested and made tight at 100 psi or 50 psi above the city pressure before any piping is concealed or approved.
- C. After the system is thoroughly cleaned, it shall be put into operation by this Contractor. All parts of the system shall be thoroughly tested and this Contractor shall carefully instruct the City's authorized representative as to the proper operation and care of the entire system.
- D. All low pressure piping shall be tested and made tight at 100 lbs. per square inch hydrostatic pressure before any piping is concealed or covered.
- E. Contractor shall waste all returns for a minimum period of two weeks after all steam lines, return lines and heating surfaces have been connected up and in operation or until all traces of grease, oil and dirt disappear.
- F. After the systems are thoroughly cleaned, they shall be put into operation by the Mechanical Contractor after all traps and strainers have been removed and cleaned. All parts of the system shall be thoroughly tested and this Contractor shall carefully instruct the City's authorized representatives as to the proper operation and care of the entire system.

3.4 FLUSHING OUT SYSTEM:

- A. Contractor shall flush out the chilled water systems before balancing up the systems.

3.5 BALANCING AND VENTING OF CHILLED WATER SYSTEM:

- A. Contractor shall provide all labor and materials as required to assist the Balancing Contractor in proper balancing of the water systems. Contractor shall return to the job and shall make necessary adjustments and corrections to the systems as required by the Balancing Contractor in order to achieve satisfactory system performance in accordance with design parameters.
- B. Contractor shall carefully vent the system when filling same and return to the job during the eighteen months guarantee period as required, to assure the City of a proper operating system.
- C. System shall be slowly filled with cold water to purge air and shall maintain 4 psig on a gauge located conveniently near the top of the system.

END OF SECTION 232113

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

- A. The General Provisions of the Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to the work specified in this Section.
- B. The General Requirements in Section 20 00 50 shall also govern the work under this Section.
- C. Section includes design, performance criteria, refrigerants, controls, and installation requirements for air-cooled rotary screw packaged chillers.

1.02 SCOPE

- A. Section includes design, performance criteria, controls and control connections, chilled water connections, electrical power connections and refrigerants of the chiller package.

1.03 REFERENCES

- A. Products shall be designed, rated and certified in accordance with applicable sections of the following Standards and Codes:
 - 1.To comply with the most recent versions of applicable Standards and Codes of ARI 550 / 590.
 - 2.ARI 370 - Standard for Sound Rating of Large outdoor Refrigerating and Air-conditioning Equipment.
 - 3.To comply with the most recent versions of applicable Standards and Codes of ASHRAE 15.
 - 4.Units shall meet the efficiency standards of the latest ASHRAE 90.1 Standard FEMP standard current version.
 - 5. Unit shall comply with ASME section VIII

1.04 QUALITY ASSURANCE

- A. UL 1995 -- Standard for Heating and Cooling Equipment.
- B. Manufactured facility to be ISO 9001.
- C. Factory Functional Test: The chiller shall be pressure tested, evacuated and fully charged with HFC-513A refrigerant and oil. In addition, a factory functional test to verify correct operation by cycling condenser fans, closing compressor contacts and reading data points from temperature and pressure sensors.

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- D. Qualifications: Equipment manufacturer must specialize in the manufacture of the products specified and have five years experience with the equipment and refrigerant offered.
- E. Regulatory Requirements: Comply with the codes and standards specified.

1.05 SUBMITTALS

- A. Submit shop drawings and product data in accordance with specification requirements.
- B. Submittals shall include the following:
 - 1. Dimensioned plan and elevation view drawings, required clearances, and location of all field connections,
 - 2. 1/3 octave band sound ratings per ARI Standard 370.
 - 3. Single line schematic drawing of the field power hookup requirements, indicating all items that are furnished.
 - 4. Certification of factory run test.
 - 5. Installation and operating manuals.
 - 6. Summary of all auxiliary utility requirements such as electricity, water, etc. Summary shall indicate quality and quantity of each required utility.
 - 7. Single line schematic drawing of the field power hookup requirements, indicating all items that are furnished.
 - 8. Schematic diagram of control system indicating points for field interface/connection.
 - 9. Diagram shall fully delineate field and factory wiring.

1.06 OPERATION AND MAINTENANCE DATA

- A. Include manufacturer's descriptive literature, installation checklist, start-up instructions and maintenance procedure.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Chillers shall be delivered to the job site completely assembled and charged with refrigerant and oil by the manufacturer.
- B. Comply with the manufacturer's instructions for rigging and handling.
- C. If unit is to be stored, comply with manufacturer instructions for storage.
- D. During shipment, provide protective covering over vulnerable components. Fit nozzles and open pipe ends with enclosures.

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1.08 WARRANTY

- A. Warranty (domestic): The refrigeration equipment manufacturer’s warranty shall be for a period of 18 months from the time the installation was accepted by the Owner. It shall cover replacement parts (and the labor to replace them) having proven defective within the above period.
- B. Extended Compressor Warranty: 5 Years
- C. Extended Unit Warranty: 4 years extended warranty, entire unit, parts and labor.
- D. Refrigerant Warranty: 5 years.
- E. Delayed Warranty Start: None. (Startup within 6 months of shipment)

1.09 Sustained Operational Performance and Reliability

- A. During the first 24 months of operation, the manufacturer shall perform quarterly remote or on-site operating inspections to confirm the chiller’s operational performance. Resulting from each inspection, the manufacturer shall provide the owner with a report describing the condition of the equipment and each of its major components, a log of its current operating data, any issues needing to be addressed, and any recommended corrective actions.
- B. Manufacturer shall include chiller spring start-up and fall draining and winterizing services for the first 24 months of operation.

1.10 Summary of General Options

- A. Warranty: List design requirement options listed in section 1.06.
- B. Sustained Operational Performance: List design requirement options listed in section 1.09.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Basis of Design - Daikin Applied Model AWVA; including the standard product features and all special features required per the plans and specifications
- B. Optional Products - Equipment manufactured by York model YLAA or Smardt model QTC may be acceptable. Naming these products as equal does not imply that their standard construction or configuration is acceptable or meets the specifications. Optional equipment proposed, must

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meet the specifications including all architectural, mechanical, electrical, and structural details, all scheduled performance and the job design, plans and specifications.

2.02 UNIT DESCRIPTION

- A. Furnish and install as shown on the plans, factory assembled, factory charged with R-513a, air-cooled, rotary-screw compressor packaged chillers in the quantity and size specified. Each chiller shall consist of multiple semi-hermetic screw compressors, direct-expansion evaporator, air-cooled condenser section, control system and all components necessary for protected and controlled unit operation.
- B. Chiller shall be factory run-tested to verify operation. Operating controls and refrigerant charge shall be checked for proper operation and optimum performance.

2.03 DESIGN REQUIREMENTS

- A. General: Provide a complete rotary screw packaged chiller as specified and as shown on the drawings. The unit shall be in accordance with the standards referenced in section 1.03.
- B. Operating Range: The chiller shall have the ability to control leaving chilled fluid temperature from 15F to 65F.
- C. Performance: Refer to the schedule of performance on the drawings. The chiller shall be capable of stable operation to a minimum percentage of full load (without hot gas bypass) of 25%. Performance shall be in accordance with AHRI Standard 550/590.
- D. Manufacturer must provide both sound power and sound pressure data in decibels. Sound pressure data per AHRI 370 must be provided in 8 octave band format at full load. In addition, A-weighted sound pressure at 30 feet should be provided at 100%, 75%, 50% and 25% load points to identify the full operational noise envelope. Sound power must be provided in 1/8 octave band format to highlight any tonal quality issues. If manufacturer cannot meet the noise levels (per the attached chart), sound attenuation devices and/or barrier walls must be installed to meet this performance level

Sound Pressure (at 30 feet)											
63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Overall dBA	75% Load dBA	50% Load dBA	25% Load dBA
Sound Power											
63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Overall dBA	75% Load dBA	50% Load dBA	25% Load dBA

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2.04 CHILLER COMPONENTS

A. Compressor

Compressor motors: Motors shall be high-torque, two-pole, semi-hermetic type with inherent thermal protection on all three phases, and cooled by suction gas. The compressors shall be field serviceable, semi-hermetic, single-rotor screw type with one central helical rotor. The gate rotor contact element shall be constructed of engineered composite material, dimensionally stable up to 1500°F and wear resistant for extended life. Compressors shall be vibration isolated from the frame by neoprene compression mounts and include an internal discharge compressor muffler. If a twin-screw design is used, the manufacturer shall provide an extended 5-year parts and labor warranty covering all additional moving parts. Each compressor shall be equipped with a suction service shutoff valve. If compressor does not have an internal discharge compressor muffler, additional sound attenuation must be provided. Each compressor shall be equipped with a VFD providing compressor speed control as a function of the cooling load. Each VFD shall provide controlled motor acceleration and deceleration, and shall provide protection for the following conditions: electronic thermal overload, over/under current, stalled motor, input and output phase loss, high load current, and current unbalance. The VFD shall provide a minimum 95% displacement power factor at all load points. Compressors used in VFD controlled units must have electrically insulated, ceramic bearings to mitigate bearing and/or lubricant damage from stray electric current passage. Compressor shall be able to control compression ratio to optimize efficiency at all operating conditions. Units without this protection must have an extended 5-year compressor warranty.

1. The unit controller shall display the following operating messages:
 - a. Line voltage not present
 - b. Voltage present, starter ready
 - c. Motor accelerating
 - d. Motor at full speed
 - e. Motor at full speed, ramp time expired
 - f. Stop command received, motor decelerating
 - g. Thermal overload has reached 90% to 99%
 - h. Thermal overload at 100%, motor stopped
 - i. Thermal overload reduced to 60%, motor can restart
 - j. Passcode enabled
 - k. Passcode disabled
 - l. Thermal overload content in percentage
2. The unit controller shall display the following alarms and faults:
 - a. Over Current-Hold
 - b. Over Current-Unload
 - c. Over Current-Alarm
 - d. Overheat-Hold
 - e. Overheat-Unload
 - f. Overheat-Alarm
 - g. Communication Fault

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- h. System power not three phase
 - i. Phase sequence incorrect
 - j. Line frequency less than 25 Hz
 - k. Line frequency more than 72 Hz
 - l. Excessive current unbalance
 - m. Operating parameters lost
 - n. No current after “Run” command
 - o. Undercurrent trip occurred
 - p. Overcurrent trip occurred
 - q. Control power too low
 - r. Motor stalled during acceleration
 - s. External fault
3. The unit controller shall display the following data:
- a. Output Frequency
 - b. Output Current
 - c. Output Voltage
 - d. Output Power
 - e. Fault Code

B. Evaporator

The evaporator shall be of the direct expansion type with single pass on the refrigerant and water side for high efficiency counterflow heat transfer and low pressure drops, carbon steel shell, and high efficiency finned copper tubes rolled into steel tube sheets. The evaporator shall be designed, inspected, and stamped in accordance with ASME Section VIII requirements.

1. The evaporator shall be protected with an electric resistance immersion heater. The evaporator shall be insulated with 3/4” thick CFC and HCFC-free closed-cell flexible elastomeric foam insulation material with 100% adhesive coverage. The insulation shall have an additional outer protective layer of 3mm thick PE embossed film to provide superior damage resistance. Insulation without the protective outer film shall not be acceptable. UV resistance level shall meet or exceed a rating of ‘Good’ in accordance with the UNI ISO 4892 - 2/94 testing method. This combination of an immersion heater and insulation shall provide freeze protection down to -20°F (-29°C) ambient air temperature.
2. Flow Switch: The evaporator shall be equipped with a factory-mounted and wired flow switch.
3. Evaporator shall have standard left-hand grooved connections when looking at the unit control panel.
4. The water-side working pressure shall be a minimum of 653 psig (4502 kPa). Evaporators shall be designed and constructed according to, and listed by Underwriters Laboratories (UL).

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C. Condenser

Coil shall be microchannel design and shall have a series of flat tubes containing multiple, parallel flow microchannels layered between the refrigerant manifolds. Tubes shall be 9153 aluminum alloy. Tubes made of 3102 alloy or other alloys of lower corrosion resistance shall not be accepted. Coils shall consist of a two-pass arrangement. Each condenser coil shall be factory leak tested with high-pressure air under water. Coils shall withstand 1000+ hour acidified synthetic sea fog (SWAAT) test (ASTM G85-02) at 120°F (49°C) with 0% fin loss and develop no leaks.

D. Refrigerant Circuit

The unit must have refrigerant circuits completely independent of each other with one compressor per circuit; multiple per circuit shall not be acceptable. Each circuit shall include an electronic expansion valve, liquid line shut-off valve, replaceable core filter-drier, sight glass with moisture indicator, and combination discharge check and shutoff valve.

1. Unit shall be equipped with a liquid line solenoid valve and suction shut-off valve.

E. Construction

Unit formed sheet metal components shall be painted using a corrosion resistant paint system, for aesthetics and long-term durability. Paint system will include a base primer with a high-quality polyester resin topcoat. Painted galvanized parts shall be G60 or greater and finished, unabraded panel surfaces shall be capable to be exposed to an ASTM B117 salt spray environment and exhibit no visible red rust at a minimum of 3,000 hours exposure. Finished, abraded surfaces shall be tested per ASTM D1654, having a mean scribe creepage not exceeding 1/16” at 1,000 hours minimum exposure to an ASTM B117 salt spray environment. Unit shall have condenser coil grilles and base frame grilles.

1. Unit casing and all structural members and rails shall be fabricated of pre-painted or galvanized steel to meet ASTM B117, 500-hour salt spray test.

2. Upper condenser coil and base section of unit shall have protective, 12 GA, PVC-coated, wire grille guards and have painted steel wraps enclosing the coil end sections and piping.

F. Electrical Panel

1. Control Panel: Single-point power connection to disconnect switch with through-the-door handle and with individual circuit breakers. A UL-approved weatherproof electrical panel shall contain the unit control system, control interlock terminals and field-power connection points. Box shall be designed in accordance with NEMA 3R rating. Hinged control panel access doors shall be tool-lockable. Barrier panels shall be provided to protect against accidental contact with line voltage when accessing the control system. Fan motors shall have inherent overload protection and compressor motors shall have three-phase motor overload protection. Factory-supplied power components shall include:

- Individual contactors and circuit breakers for fan motors,
- Circuit breakers and factory-mounted transformers for each control-circuit,
- Unit power terminal blocks for connection to remote disconnect switch,

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- d. Terminals for power supply to the evaporator heater circuit.
- e. Fan motors shall have inherent overload protection and compressor motors shall have three-phase motor overload protection.
- 2. The control logic shall be designed to maximize operating efficiency and equipment life with protections for operation under unusual conditions and to provide a history of operating conditions. The system shall intelligently stage the unit to sustain leaving water temperature precision and stability while minimizing compressor cycling.
- 3. Equipment protection functions controlled by the microprocessor shall include high discharge pressure, loss of refrigerant, loss of water flow, freeze protection, and low refrigerant pressure. User controls shall include:
 - a. auto/stop switch,
 - b. chilled water set-point adjustment,
 - c. anti-recycle timer,
 - d. digital display with water temperature and setpoint,
 - e. operating temperatures and pressures, and diagnostic messages.
- 4. The following features and functions shall be included:
 - a. Durable liquid crystal display (LCD) screen type, having minimum four 20-character lines with 6 key input pad conveniently mounted on the unit controller. Default language and units of measure shall be English and I-P respectively. Messages shall be in plain English. Coded messages, LED indicators and LED displays are not acceptable.
 - b. Separate control section and password protection for critical parameters.
 - c. Remote reset of chilled water temperature using a 4-20mA signal
 - d. Soft-load operation, protecting the compressor by preventing full-load operation during the initial chilled fluid pull-down period
 - e. BAS communication flexibility through modular plug-in BACnet® with MSTP
 - f. Non-volatile program memory allowing auto-restart after a power failure.
 - g. Recording of safety shutdowns, including date-and-time stamp, system temperatures and pressures. A minimum of six previous occurrences shall be maintained in a revolving memory
 - h. Start-to-start and stop-to-start cycle timers, providing minimum compressor off time while maximizing motor protection
 - i. Lead-lag compressor staging for part-load operation by manual selection or automatically by circuit run hours
 - j. Discharge pressure control through intelligent cycling of condenser fans to maximize efficiency
 - k. Pro-active compressor unloading when selected operating parameters exceed design settings, such as high discharge pressure or low evaporator pressure
 - l. Diagnostic monitoring of unit operation, providing a pre-alarm signal in advance of a potential shutdown, allowing time for corrective action
 - m. The unit shall be equipped with ground fault protection.

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2.05 OPTIONS AND ACCESSORIES

- A. The following options are to be included:
 - 1. Low Ambient Control: Provide fan cycling control to allow unit operation down to 32°F
 - 2. Ground Fault Protection: Factory installed circuit breaker to protect equipment from damage from line-to-ground fault currents less than those required for conductor protection.
 - 3. Phase loss with under/over voltage protection and with LED indication of the fault type to guard against compressor motor burnout.
 - 4. BAS interface module to provide interface with the BACnet MSTP protocol.
 - 5. Compressor Sound Reduction - Acoustic reduction blankets shall be factory installed on each compressor.
 - 6. The following accessories are to be included:
 - a. Factory-mounted thermal dispersion type flow switch
 - b. Wye strainer, to be installed at the evaporator inlet and sized for the design flow rate , with perforation diameter of 0.063" (for Brazed Plate evaporators) or 0.125" (for Shell-and-Tube evaporators) with blowdown valve and Victaulic couplings (factory mounted)

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in strict accordance with manufacturer’s requirements, submittal drawings, and contract documents.
- B. A strainer with perforations no larger than 0.125" (3.2 mm) diameter (provided by the unit manufacturer) shall be placed in the supply water line just prior to the inlet of the evaporator. Care shall be exercised when welding pipe or flanges to the evaporator to prevent any slag from entering the vessel.
- C. Adjust and level chiller in alignment on supports.
- D. Arrange piping to enable dismantling and permit head removal for tube cleaning.
- E. Coordinate electrical installation with electrical contractor.
- F. Coordinate controls with control contractor.
- G. Provide all appurtenances required to ensure a fully operational and functional chiller.
- H. Communication Wiring

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1. Conduit shall be installed between each chiller's unit control panel and the building for current and future control wiring for equipment located external to the facility. The conduit installation shall be per all NEC and local electrical codes inclusive of the depth of the conduit and placement of the communications conduit in relation to the chiller's power conduit and water piping. If multiple units are in close proximity, a single conduit from the building LAN may be run to the closest unit. Then conduit shall be extended from the closest chiller control panel to multiple units in a star configuration. Consult the equipment manufacturer regarding cabling options and limitations for multiple units.
 2. A minimum capacity CAT 5e Ethernet cable shall be provided in the communications conduit to the chiller from a network switch in the facility. After connecting the conduit to each unit's control panel, the CAT 5e cable shall be extended 3 feet and coiled inside each panel for connection as required for chiller communications. The cable length, continuity, electrical isolation and installation shall be per NEC requirement and local code requirements for communication cabling running from a building to a location exterior to the building.
- I. Coordinate controls and BMS interface with controls contractor.
 - J. Provide all material required for a fully operational and functional chiller.

3.02 SCHEDULE

- A. Units shall be factory charged with HFC-513a refrigerant.
- B. Factory Start-Up Services: Provide factory supervised start-up on-site for a minimum of two working days ensure proper operation of the equipment. During the period of start-up, the factory authorized technician shall instruct the owner's representative in proper care and operation of the equipment.
- C. The contractor shall furnish manufacturer complete submittal wiring diagrams of the unit as applicable for field maintenance and service

END OF SECTION 236426

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. The General Provisions of the Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to the work specified in this Section.
- B. Section 260000, General Electrical, shall govern the work under all Sections of Division 26.

1.2 DESCRIPTION:

- A. Work Included: The electrical work shall consist of all labor, equipment and services required to complete, ready for correct operation, all of the work called for by the accompanying drawings and these specifications.
- B. The work shall include, but is not limited to:
 - 1. Demolition.
 - 2. Raceways and Boxes.
 - 3. Branch Circuit Wiring.
 - 4. H.D. Fused Disconnect Switch

1.3 SITE CONDITIONS:

- A. Prior to submitting bid, visit the site and identify existing conditions and difficulties that will affect work called for by the Contract Documents.
- B. No compensation will be granted for additional work caused by unfamiliarity with site conditions that are visible or readily construed by experienced observers. Include in the bid amount all demolition work required.
- C. The Contractor shall verify and obtain all necessary dimensions at the site.

1.4 DEFINITIONS:

- A. Furnish: The word "furnish" is used to mean "supply and deliver the referenced item to the project site, ready for unloading, unpacking, assembly, and installation".
- B. Install: The word "install" is used to describe operations at the project site involving the referenced item including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations".
- C. Normally Occupied: The words "normally occupied" are used to mean "all rooms within a building except for crawlspaces, underground tunnels, attic spaces, mechanical rooms, telephone rooms, data distribution rooms, and electrical rooms".

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- D. Or Approved Equal: The words "or approved equal" are used to mean "any product which in the opinion of the Engineer is essentially equal in quality, size, arrangement, appearance, construction, and performance to that product specified or shown on the drawings".
- E. Provide: The word "provide" means "to furnish and install the referenced item, complete and ready for the intended use".
- F. Remove: The word "remove" means "to disconnect from its present position, remove from the project site, and to dispose of in a legal manner".

1.5 QUALITY ASSURANCE:

A. Codes and Standards

- 1. All work under this section shall comply with the applicable requirements of the National Electrical Code, local electrical and other codes, laws, regulations and standards including those of all state authorities. Where references are made in laws codes regulation and standards, these documents, including the latest revisions and amendments in effect as of the date of bid opening, shall form part of these specifications. Upon completion of the work, the contractor shall furnish Certificates of Approval from the local inspection authorities having jurisdiction for approving materials, equipment, installation pertaining to the electrical work as may be required by the local and/or state authority for the issuance of a permanent Certificate of Occupancy. All expenses arising from the procurement of these Certifications shall be paid by the contractor and shall be included in the lump sum contract price.
- 2. Codes enforced at time of bidding include: 2022 Connecticut State Building Code, 2021 IBC, 2022 Connecticut Fire Safety Code, 2020 National Electrical Code, ICC/ANSI A117.1-2009, Accessible and Usable Buildings and Facilities, ADA, and 2021 International Energy Conservation Code (IECC).

B. Submittals

- 1. The contractor shall submit for approval a complete list of materials, fixtures and equipment to be incorporated in the work. The list shall include manufacturer's names and catalog numbers, descriptive data, manufacturer's ratings and application recommendations, cuts, diagrams, performance curves and such other information as may be required by the Owner to judge compliance with the requirements of the contract and suitability to the application. Items on the list shall be clearly identified as to proposed application. Approval of materials and equipment will be based on manufacturer's published ratings. Submittal procedures shall be in accordance with Division 1 of these specifications.
- 2. When directed by the Owner, the contractor shall submit in approved form for record, a Certificate of Compliance with a cited code or standard for the designated materials and equipment; such certificates may be accepted in lieu of samples. Any materials or equipment submitted for approval, which are not in accordance with the specifications requirements may be rejected.
- 3. As part of the coordination work required of the contractor, installation drawings shall be prepared by the contractor as necessary. It is intended that these drawings be used to

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coordinate the work of the various trades and to clarify details of proposed assembly, erection and installation. Installation drawings shall be prepared when indicated in these specifications or on the electrical drawings, or when directed by the Owner for comment or approval when an installation condition or problem arises which the contractor wishes the Owner to review. All installation drawings submitted for review will be considered and treated as shop drawings and the requirements pertaining to shop drawings shall govern.

C. Equipment alternates, substitutions, and deviations:

1. Wherever more than one manufacturer is mentioned in the specifications or on the drawings, any of those named shall be considered equally acceptable to that on upon which design was based, and providing all aspects of the specification are met insofar as quality, construction, performance, space requirements, noise levels and special accessories or materials, any of those named may be included in Contractor's bid.
2. Bidders wishing to obtain approval on brands other than those specified by name shall submit their request to the Engineer not less than ten (10) business days before the date fixed for opening of bids. Approval by the Engineer will be in the form of an Addendum to the specifications issued to all prospective bidders, indicating that the additional brand or brands are approved as equal to those specified so far as the requirements of the project are concerned.
3. Wherever a single manufacturer is used in the specifications or on the drawings and is followed by the words "or approved equal" the Contractor must use the item named or he may apply for an alternate equipment deviation.
4. Alternate equipment to that specified or shown on the drawings, as proposed to be provided by the contractor, must be essentially equal in quality, size, construction, and performance to that item specified or shown on the drawings.
5. Submittals for alternate equipment shall list all deviations and differences from the specified equipment. Failure to submit this list will result in rejection of the submittal.

Any deviations and differences not listed but discovered after installation shall be rectified as directed by the Engineer at the Contractor's cost.
6. Furnish samples of alternate equipment proposed to be provided when so requested by the Engineer.
7. Where the Contractor proposes to use an item of equipment which differs from that upon which design was based, which requires any redesign of the structure, partitions, foundations, piping, wiring or of any other part of Mechanical, Electrical Layout, all such redesign, new drawings or detailing required shall be prepared by Contractor at his own expense for approval of the Engineer.
8. Where approved substitutions or deviations require a different quantity, size or arrangement of structural supports, wiring, conduit, piping, ductwork, and equipment from that upon which design was based, all additional items required by the systems shall, with the approval of the Engineer, be furnished by Contractor at no additional cost to Owner.

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- D. Allow sufficient time so that the delivery and installation of equipment will not be delayed as a result of the time required to review, process and transmit submittals, including resubmittals. Failure by the Contractor to transmit submittals to the Engineer in ample time for review and processing shall not entitle him to an extension of the Contract Time and no claim for an extension of time by reason of such default will be allowed.
- E. Submittals, shop drawings, and samples will be reviewed with reasonable promptness and will be stamped indicating appropriate action as follows:
1. “No Exceptions Taken” means that fabrication, manufacture, or construction may proceed providing submittal complies with contract documents.
 2. “Amend as Noted” means that fabrication, manufacture, or construction may proceed, providing the submittal complies with Engineer’s notations and contract documents.
 3. “Resubmit” means that submittal, or equipment proposed to be provided, does not comply fully with the contract documents and that fabrication, manufacture, or construction shall not proceed. Resubmit in accordance with the Engineer’s notations and contract documents.
 4. “Rejected” means that submittal does not comply with contract documents, or that equipment proposed to be provided does not comply with the specified requirements or is not equal or better in quality and performance than that item specified. Fabrication, manufacture, or construction shall not proceed. Resubmit in accordance with the contract documents and specified requirements.
- F. If material or equipment is installed prior to review, or without review, it shall be removed and replaced at no extra charge to the Owner if, in the opinion of the Engineer, the material or equipment is not in compliance with the Contract Documents.
- G. Record Drawings
1. The contractor shall maintain an accurate record of all deviations in work as actually installed from work as indicated. This record shall be kept current and shall be kept available at the site for inspection. Upon completion of the work, and before final payment is authorized, marked prints with signed certifications of accuracy shall be delivered to the engineer.
- H. Manuals
1. The contractor shall furnish to the Owner operating and maintenance instructions for each piece of equipment and each device.
 2. The instructions shall provide detailed descriptions of the operation and maintenance of the equipment or device and shall include manufacturer's literature, detailed wiring diagrams, device internal wiring diagrams, characteristics curves and graphs, data sheets and descriptive literature. The instructions shall be furnished to the Owner 30 days prior to the completion of the building work.

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I. Product Handling

1. All work, materials and equipment, whether incorporated into the building or not, shall be protected from damage due to moisture, dirt, plaster, concrete, or from carelessness.
2. All material and equipment which is damaged, including installed work, shall be repaired or replaced to the satisfaction of the Owner.
3. After work is complete, all equipment, including switchboards, transformers, panelboards, lighting fixtures and lamps, shall be cleaned of all construction dirt.

1.6 INTENT OF SPECIFICATIONS:

- A. It is the intent of these Specifications each subcontractor or equipment suppliers to furnish all equipment complete with all motors, drives and magnetic starters throughout for all equipment furnished under these specifications. The above shall also apply to any additions to this Contract, either as covered by and Addenda or Change Orders.
- B. The Electrical Contractor shall provide overload and short circuit protection for all motors unless provided by equipment supplier for packaged type equipment.

1.7 GUARANTEE FOR EQUIPMENT AND SYSTEMS:

- A. Refer to Specifications.
- B. The entire Electrical System included under this Section of the Specifications shall be guaranteed by this Contractor against original defects of equipment and workmanship for a period of 12 months from date of acceptance, unless otherwise specified.

1.8 CUTTING AND PATCHING:

- A. Cutting and patching for all electrical work inside building shall be done in accordance with Division 1.

1.9 SLEEVES AND OPENINGS:

- A. This Electrical Contractor shall furnish and install all necessary sleeves and openings as required to permit the installation of the electrical systems.

1.10 ACCESS PANELS:

- A. Provide access panels to make all junction and pull boxes accessible as required by The National Electrical Code.

1.11 PAINTING:

- A. All painting of electrical work will be done in accordance with Division 9 unless otherwise specified.

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1.12 RUBBISH AND CLEANING:

- A. This Contractor shall be responsible for removal of all rubbish and trash created by the installation of the electrical systems and equipment from the job site. Contractor shall sweep clean all areas.

1.14 INSTRUCTIONS:

- A. The Superintendent of the electrical work for this particular project shall spend all necessary time required to instruct the custodians of the building, together with representatives from the Maintenance Department, in the installation including all special controls and devices installed or connected under this contract.

1.15 POWER SHUTDOWNS:

- A. Any power shutdown required for the completion of the electrical work shall be scheduled with the owner at least ten working days in advance and shall be done at owner's convenience.

1.17 SEISMIC:

- A. Provide seismic restraining devices on all required items of electrical equipment in accordance with ICC Chapter 16. Refer to specification Section 200050 and details on mechanical drawings.

END OF SECTION 260000

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SECTION 260500

BASIC ELECTRICAL MATERIALS & METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. The Bidding Requirements, Contract Forms and Conditions of the Contract, including General Conditions of the Contract for Construction, and Division 1 - General Requirements, apply to the work specified in this Section.
- B. Section 260000, General Electrical, shall also govern the work under this Section.
- C. This Section includes requirements that are binding on other Sections of Division 26.

1.2 SCOPE:

- A. Scope of work consists of installation of materials to be furnished under this Section, and without limiting generality thereof consists of furnishing labor, materials, equipment, hoisting, plant, transportation, rigging, staging, appurtenances, and services necessary and/or incidental to properly complete all electrical work as shown on the drawings, as described in these specifications or as reasonably inferred from either as being required in opinion of the Owner.
- B. Work Included: Provide complete electrical services where shown on the drawings, as specified herein and as needed for a complete and proper installation including but not necessarily limited to:
 - 1. General
 - 2. Conduits & Raceways
 - 3. Identification
 - 4. Wire and Cables
 - 5. Wiring Devices
 - 6. Outlet Boxes, Junction Boxes, Pull Boxes
 - 7. Supporting Devices
 - 8. Disconnect Switches
 - 9. Grounding.

1.3 QUALITY ASSURANCE:

- A. Refer to Section 260000.

1.4 SUBMITTALS:

- A. Shop Drawings: Submit for all items listed in Paragraph 1.2.B.

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PART 2 - PRODUCTS

2.1 GENERAL:

- A. Provide only materials that are new and of type and quality specified, or approved equal. Where Underwriters' Laboratories, Inc. has established standards for such materials, provide only materials bearing the UL label.
- B. Provide materials and equipment necessary to make installation complete in every detail, and to conform to manufacturers' latest installation instructions, under this contract whether or not specifically shown on drawings or specified herein.

2.2 TEMPORARY FACILITIES:

- A. Refer to the requirements of Division 1 regarding temporary facilities.
- B. Scaffolding and other temporary construction shall be rigidly built in accordance with Local and State requirements. Remove from premises upon completion of work.
- C. Provide temporary construction required for electrical work as directed by the Owner.

2.3 RACEWAYS:

- A. Electrical Metallic Tubing:
 - 1. Shall be manufactured from high grade mild strip steel, shall be hot dipped galvanized, and shall be chromated and lacquered to form additional protective layer. EMT conduit shall conform to UL 797 and ANSI C80.3 and shall be as manufactured by Allied Tube and Conduit, or approved equal.
 - 2. Connectors and couplings shall be galvanized steel set screw type. Provide gland compression type couplings and connectors for exposed work in wet locations.
 - 3. Shall be used for all interior branch circuit wiring.
- B. Flexible Steel Conduit:
 - 1. Shall be manufactured from high grade strip steel and shall be hot dipped in a molten zinc bath. The steel strip shall be formed into interlocking convolutions that are continuously joined, metal to metal, assuring continuous grounding contact. Flexible steel conduit shall be UL listed and shall be as manufactured by AFC Cable Systems, or approved equal.
 - 2. May be used in short lengths where EMT cannot be installed due to interferences and obstacles.
 - 3. Provide for final connections to motor driven equipment or where subject to vibration.
- C. Liquid tight Flexible Steel Conduit:
 - 1. Shall be similar to flexible steel conduit, but with pressure-extruded moisture and oil-proof outer jacket of gray polyvinyl chloride plastic. Liquid tight flexible steel conduit shall be UL listed (UL 360) and shall be as manufactured by AFC Cable Systems, or approved equal.

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2. Fittings, couplings and connectors shall be hot dipped galvanized and threaded, liquid tight type.
3. Provide where located outdoors or in damp or wet areas for final connections to motor driven equipment or where subject to vibration.

D. Rigid PVC Conduit:

1. Shall be heavy wall schedule 40 PVC for underground work and extra heavy wall schedule 80 PVC for underground work below vehicular traffic areas. Joints and fittings shall be solvent welded all to ASTM standards for underground installation and in accordance with Article 352 of the National Electric Code.
2. Joints shall be made watertight.
3. Furnish conduit system in Carlon, Cantex, or JM Eagle.
4. Flexible PVC conduit (ENT) shall not be used.
5. Shall be used for all work outside the existing building footprint.

2.4 IDENTIFICATION:

- A. Identify all junction boxes and pull boxes installed above ceilings and in unfinished spaces with branch circuit designations. Identification shall be done with black felt tip permanent marker in a neat and readily legible manner.

2.5 SAFETY SWITCHES:

- A. Furnish and install disconnect switches where shown on the drawings.

2.6 CONDUCTORS:

- A. All branch circuit conductors shall be copper rated 600 volts, 90 deg. C., Type THWN-2 for sizes smaller than #8 AWG, and Type XHHW-2 for sizes #8 AWG and larger.
- B. Grounding and bonding conductors shall be soft drawn copper, ASTM B3 solid bare copper for sizes smaller than #8AWG, ASTM B8 stranded bare copper for sizes #8AWG and larger.
- C. Minimum gauge conductors for power and lighting shall be #12 AWG. Increase to #10 AWG for runs exceeding 75'-0", and #8AWG for runs exceeding 150'-0".
- D. Wire Size #8 AWG and larger shall be stranded. Wire of size smaller than #8 AWG shall be solid.
- E. Wire and cable conductors shall be soft drawn copper with conductivity of not less than 98 percent of ANSI Standard for annealed copper. Aluminum conductors shall not be used.

2.7 OUTLET, JUNCTION AND PULL BOXES:

- A. Provide outlet boxes as required for a complete installation.
- B. Outlet boxes shall be code gauge galvanized steel and shall be of shapes and sizes to suit their respective locations and installations, and shall be provided with covers to suite their function and installation. Outlet boxes shall be equipped with fixture stud or straps where required.

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- C. The minimum box size for all wall outlet boxes shall be nominal 4” square x 2 1/8” deep (2-gang). Provide larger size outlet boxes, or gangable type boxes where required for the installation.
- D. For exposed work in normally unoccupied (unfinished) areas, provide pressed steel boxes with galvanized or cadmium plated steel covers with rounded corners. Provide cast boxes for work exposed to wet locations and where called for on the drawings.
- E. For above ground pull boxes, provide galvanized code-gauge sheet steel units with screwed on covers, of size and shape required to accommodate wires without crowding, and to suit the location. Provide pull boxes as specified herein, as required for job conditions, and as follows:
 - 1. Indoors: NEMA Type 1.
 - 2. Outdoors or Damp or Wet Locations: NEMA Type 3R.
 - 3. Hosedown and Splashing Water Locations: NEMA Type 4.
- H. Wireways shall be code gauge galvanized steel, manufactured standard sections and fittings, with hinged and/or screw covers, indoors NEMA Type 1/Outdoors NEMA Type 3R. Wireways shall be sized to code conductor fill requirements and shall be provided as required for job conditions.

2.8 WIRING DEVICES:

- A. All devices shall be furnished in Hubbell or approved equal in Pass & Seymour, or Leviton. Devices specified herein are based on Hubbell unless otherwise noted.
- B. Lighting Switches:
 - 1. Toggle Type: Institutional Heavy Duty specification grade, flush mounting, quiet operation AC type with abuse resistant colored nylon toggle operator, heat resistant composition plastic housing, silver cadmium oxide contacts and copper alloy spring contact arm. Rated at 120-277 VAC, capable of full capacity on tungsten or fluorescent lamp load. Designed for side or back wiring with up to No. 10 wire, and with #8 brass terminal screws.

	<u>20 AMP</u>	<u>30 AMP</u>
Single Pole	#HBL1221	#HBL3031
Two Pole	#HBL1222	#HBL3032
Three way	#HBL1223	#HBL3033
Four way	#HBL1224	-

- C. Receptacles:
 - 1. Duplex convenience receptacles shall be heavy duty specification grade, 2 pole, 3 wire grounding, NEMA 5-20R, rated 20AMP at 125 Volts AC.
 - 2. Receptacles shall have a one-piece nickel plated brass wrap around mounting strap with integral ground contacts and ground tension retaining clips, tandem bypass contact, heat resistant thermoplastic rynite base, and high impact thermoplastic polyester face. Receptacles shall be back and side wired, shall have a back wired green ground terminal, automatic ground clip, and threaded bronze square head center rivet assembly. Duplex Receptacle #HBL5362

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3. Ground Fault Duplex convenience receptacles shall be heavy duty specification grade, 2 pole, 3 wire grounding, NEMA 5-20R, rated 20AMP at 125 volts AC. Receptacles shall have a solid brass wrap around mounting strap with pre-tensioned ground contacts, tandem modified bypass contacts, all glass circuit board with conformal coating for superior moisture immunity, 7 noise filtering capacitors, heat resistant thermoplastic base and high impact nylon face. Receptacles shall be side wired and shall have a green ground terminal. Duplex GFCI Receptacle #GF5362.

D. Cover Plates:

1. Cover plates for flush outlets shall be specification grade non-magnetic Type 302 stainless steel, brushed finish. Where multiple devices are ganged together they shall be mounted under a common cover plate. Provide switch and receptacle combination plates where switches and receptacles are located together. Cover plates shall be furnished in same Manufacturer as devices.

2.9 CIRCUIT BREAKERS:

- A. Provide circuit breakers as noted on the drawings.

2.10 ACCESS PANELS:

- A. Provide access panels for electrical equipment and wiring splices which are not readily accessible. This includes electrical equipment and wiring splices installed above hung ceilings which are not readily removable, within walls, inside chases, or inside dead cavity spaces.
- B. Access panels shall be prime painted steel, with screwdriver lock, shall bear the same fire rating as the wall or ceiling in which they are installed, and shall be of sufficient size for wiring splice access or electrical equipment removal and replacement.

Access panels shall be provided in Milcor manufacture, or approved equal. Provide Milcor Type A in acoustical tile surfaces, Type K for plastered surfaces, and Type M for masonry construction.

2.11 OTHER MATERIALS:

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the contractor subject to the approval of the engineer.

PART 3 - EXECUTION

3.1 GENERAL:

- A. Unless specifically noted or shown otherwise, install all equipment and material specified herein or shown on drawings whether or not specifically itemized herein. PART 3 covers particular installation methods and requirements peculiar to certain items and classes of materials and equipment.

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- B. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until satisfactory conditions are corrected.
- C. The electrical drawings are diagrammatic, but are required to be followed as closely as actual construction and work of other trades will permit. Where deviations are required to conform with actual construction and the work of the other trades, make such deviations without additional cost to the Owner.
- D. Data indicated on the drawings and in these specifications are as exact as could be secured, but their absolute accuracy is not warranted. The exact locations, distances, levels and other conditions will be governed by actual construction and the drawings and specifications should be used only for guidance in such regard.
- E. Verify all measurements at the building. No extra compensation will be allowed because of differences between work shown on the drawings and actual measurements at the site of construction.
- F. Do not scale drawings. Scale indicated on drawings is for establishing reference points only. Actual field conditions shall govern all dimensions.
- G. Coordinate:
 - 1. Coordinate as necessary with other trades to assure proper and adequate provisions in the work of those trades for interface with the work of this Section.
 - 2. Coordinate delivery of electrical equipment to project prior to installation. Equipment stored for an extended period of time prior to installation may be subject to rejection by Engineer.
 - 3. Coordinate the installation of electrical items with the schedule for work of other trades to prevent unnecessary delays in the total work.
 - 4. Where electrical items are shown in conflict with locations of structural members and mechanical or other equipment, provide required supports and wiring to clear the encroachment.
 - 5. Prior to roughing, the contractor shall obtain exact fixture and device locations from the Engineer. Outlet and fixture locations shown on the drawings are to be used for general reference only. Roughing of fixtures and outlets shall not proceed until exact locations, heights, and orientations of fixtures and outlets have been agreed upon with the Engineer and Owner.
 - 6. Arrange installation to provide access to equipment for easy maintenance and repair.

3.2 INSTALLATION OF RACEWAYS AND FITTINGS:

- A. Install wire and cable in approved raceways as specified and as approved by authorities having jurisdiction.
- B. All conduits shall be concealed from view above ceilings, in chases, and in walls. Conduits may only be installed exposed to view in mechanical and electrical rooms and where run overhead in rooms without ceilings.

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- C. Run conduit and cable parallel to or at right angles with lines of the building, to present a neat appearance.
 - 1. Make bends with standard conduit elbows or conduit bent to not less than the same radius.
 - 2. Make bends free from dents and flattening.
- D. Provide code sized conduit unless a larger size is shown on the drawings or specified herein. Minimum size shall be $\frac{3}{4}$ ".
- E. Securely and rigidly support conduit throughout the work with approved conduit clips and hangers all in conformance with code seismic requirements.
 - 1. Do not use mechanics wire for supporting conduit.
 - 2. Do not support conduits on hung ceilings or from mechanical or electrical equipment.
 - 3. Steel supports and racks shall be galvanized steel channel and fittings, unistrut or approved equal.
 - 4. Provide clamps and support rods as required.
 - 5. Steel support rods or support bolts for conduits shall be $\frac{1}{8}$ inch diameter for each inch or fraction thereof of diameter of conduit size, but no rod or bolt shall be less than $\frac{1}{4}$ " in diameter.
 - 6. Horizontal and vertical conduit supports shall not be more than 10' apart or more than 1' from any fitting.
- F. Do not install conduit runs exposed on the building exterior.
- G. Maintain at least 3" clearance between conduits and heating pipes when running parallel to these pipes, and at least 1" clearance when running perpendicular to these pipes.
- H. Provide double locknuts on all conduits terminating in sheet metal enclosures.
- I. Provide expansion couplings for rigid metallic and non-metallic conduits where such conduits are subject to thermal expansion and contraction.
- J. Provide full wall steel flexible conduit for all conduit penetrations through fire walls. Full wall steel flexible conduit shall be 3-hour through penetration fire wall rated and shall be as manufactured by AFC Cable Systems, or approved equal.
- K. Provide necessary sleeves and chases where conduits and cables pass through floors, walls, ceilings, and roofs, and provide other necessary openings and spaces, all arranged for in proper time to prevent unnecessary cutting. Perform cutting and patching in accordance with the provisions for the original work.
- L. Provide offsets prior to entrance into outlet boxes and other electrical equipment for proper adjustment to finished building surfaces.
- M. Seal around all conduit and cable penetrations through fire rated walls and ceilings with 3M Brand CP25N/S fire barrier caulking.
- N. Carefully clean and dry all conduit before installation of conductors. Plug conduit ends to exclude dust, moisture, plaster, or mortar while building is under construction. Lubricants or cleaning

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agents which might have deleterious effect on conductor coverings shall not be used for drawing conductors into raceways.

- O. All wiring shall be installed in electrical metallic tubing unless otherwise specified herein or called for on the drawings.

3.3 SLEEVES:

- A. Provide EMT sleeves for each conduit and cable passing through walls, partitions, and floors.
 - 1. Set pipe sleeves in place before wall, floor, or partition is finished. Seal between sleeves and wall, partition, or floor.
 - 2. Support conduit and cable free from sleeves.
 - 3. Provide sleeves two pipe sizes larger than the conduit or cable passing through, or provide a minimum of 1/2" clearance.
- B. Caulk the space between sleeve and conduit or cable using 3M Brand OP25N/S fire barrier caulking.
- C. Fireproof all penetrations made in fire rated walls or floors with UL approved materials to prevent passage of fire and smoke and maintain original fire rating of floors or walls.
- D. Provide chrome plated escutcheon plates for each sleeve where exposed to view in finished areas.

3.4 CONDUCTOR INSTALLATION:

- A. General:
 - 1. The interior of all conduits shall be cleared of burrs, moisture, dirt and obstructions before wires are pulled.
 - 2. Lubricant for pulling wires shall be inert to cable and conduit, shall not in any way restrict ease of pulling through conduit with passage of time, and shall be special lubricant designed specifically for cable pulling and shall be chemically compatible with cable.
- B. Color Coding:
 - 1. Consistent phase identification of all conductors shall be maintained as follows:

	<u>120/208V</u>	<u>277/480V</u>
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral Wire	White	Natural Grey

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Provide colored plastic tape of specified color code identification for large size conductors available only in black. Wrap tape three complete turns around conductor, at ends and at connections and splices. Provide same color coding for switch legs as corresponding phase conductor.

C. Minimum Conductor Sizes:

1. The minimum branch circuit conductor size shall be #12AWG. Provide #10AWG conductors for branch circuits where the conductor run exceeds 75 feet, and #8AWG conductors where the conductor run exceeds 150 feet.

D. Provide the number of conductors required for a given branch circuit, or as required for circuitry, whether indicated on the drawings or not.

E. Neutral Conductors:

1. All branch circuits shall be installed with a separate neutral conductor. Shared neutrals for groups of branch circuits shall not be permitted.

F. Provide each circuit with a dedicated ground wire. Use #12 minimum size.

G. Identify conductors passing through pull boxes, junction boxes, and wireways to indicate circuit designation. Identify pull boxes and junction boxes as specified herein.

H. Branch circuit wiring and arrangement of home runs have been designed for maximum economy consistent with adequate sizing for voltage drops, circuit ampacities and other considerations.

1. Install the wiring with circuits arranged as shown on the drawings, except as otherwise approved in advance by the Engineer.
2. Do not make changes and rearrange circuits without prior approval.
3. If more than 3 current carrying conductors are installed in one conduit they shall be derated in accordance with the National Electric Code.
4. Do not install more than three 30 Amp single phase or four 20 Amp single phase circuits in the same conduit.

I. Splices and Connections:

1. Makes splices electrically and mechanically secure with pressure-type connectors.
 - a. For wires size #8AWG and smaller, provide solderless, screw-on connectors, “Scotch-Lock” or equal, 600V rating, of size and type to manufacturer’s recommendation, with temperature ratings equal to the conductor insulation.
 - b. Make splices and terminations to conductors #6AWG and larger with corrosion-resistant, high conductivity, pressure indent, hex screw or bolt clamp connectors, with or without tongues, designed specifically for intended service.

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2. Insulate splices with a minimum of two layers of scotch brand No. 33 vinyl-plastic electrical tape where insulation is required.
3. Tape joints as required with rubber tape 1 ½ times the thickness of the conductor insulation, then cover with the vinyl-plastic electrical tape specified above.
4. Provide high conductivity copper alloy bolt-on lugs with pressure plate and socket set screw or hex head screw to attach wire and cable to disconnect switches, transformers, and other electrical equipment as required.

3.5 OUTLET BOXES:

- A. All outlet boxes in finished areas shall be concealed from view above hung ceilings or recessed (flush) in walls and floors. Outlet boxes may only be exposed to view or surface mount type in mechanical and electrical rooms, or for feeding items overhead in rooms without ceilings.
- C. Install outlet boxes at uniform heights and straight and true with reference to walls, floors, ceilings and casework.
- D. Provide knockout plugs in boxes with unused openings.
- E. Secure all outlet boxes to building structure with metal straps, rods, or bolts independently of entering conduits or cables.
- F. Provide bar hanger outlets in hollow framed partitions with bar hanger secured to partition studs with self-threading screws, or drill through hangers with Caddy or equal clips.
- G. Provide horizontal separation for outlet boxes mounted on opposite sides of common wall. Back to back or thru-wall boxes will not be permitted.

3.6 PULL BOXES AND JUNCTION BOXES:

- A. Provide pull boxes and junction boxes where shown on the plans and where required to facilitate proper pulling of wires and cables. Install pull boxes or pull fittings no less than one every 100 ft. of straight horizontal conduit run, or three 90 degree bends, unless otherwise noted.

3.7 WIRING DEVICES:

- A. Wherever possible install switches directly adjacent to the strike side of door. Check drawings for door swing.
- B. Device mounting heights indicated below are general. Refer to drawings for special cases. Mounting heights are to centerline of device whether shown on plans or indicated below.

Receptacles	1'-6" AFF
Switches	4'-0" AFF

- C. Where receptacles and outlets are shown over counters, refer to drawings for mounting heights.

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- D. Install receptacles vertically with grounding posts at top of device, except locate grounding post to left for horizontal mounting.

3.8 WIRING DEVICE PLATES:

- A. Set plates so that all edges are in contact with mounting surface. Provide common device plate for multi-device locations.
- B. Provide electric outlet and switch sealers for all receptacles, switches and technology outlets installed at exterior walls.
- C. Align all wall plate screws with screw slots aligned in the vertical position.

3.9 MOTOR POWER AND CONTROL WIRING:

- A. Contractor shall provide and be responsible for the complete power wiring of all motors and motorized equipment.
- B. Furnish proper overload and short circuit protection for all new motors. Provide a combination thermal overload and disconnect for switch all equipment using fractional horsepower motors.
- C. Check electrical connections and sizing of motor circuit protection and prevent damage to motor and equipment from incorrect direction of rotation.
- D. Provide mounting for motor and equipment disconnect switches adjacent to motor and supported independent of motor.
- E. Connections to miscellaneous building equipment:
 - 1. Wire to and connect to, all items of building equipment not specifically described in this Section but to which electrical power is required.
 - 2. Coordinate as necessary with other trades and suppliers to verify types, numbers and locations of equipment.

3.10 GROUNDING SYSTEM:

- A. Provide a complete grounding system which will thoroughly ground the non-current carrying metal parts of every piece of installed equipment, as described herein and as indicated on the drawings.
- B. System shall be mechanically and electrically connected to provide an independent return path to the grounding sources.
- C. Each grounding conductor shall have a minimum capacity of 25 percent of the rated capacity of the equipment it grounds, unless otherwise indicated.
- D. The minimum size of grounding conductors shall be No. 12 AWG copper. Insulation color of grounding conductors shall be green.
- E. Provide a separate green ground conductor for each branch circuit.

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3.11 SPECIAL REQUIREMENTS:

- A. Wiring shall be bundle tied where passing through pull boxes, wireways, and panelboards in neat and orderly manner with plastic cable ties. Cable ties shall be Ty-Raps as manufactured by Thomas & Betts, or equal.
- B. Provide miscellaneous hardware and support accessories, including support rods, nuts, bolts, screws, and other such items, with galvanized or cadmium plated finish, or other approved rust inhibiting coatings.
- C. Unload electrical equipment and materials delivered to site. Pay cost for rigging, hoisting, lowering and moving electrical equipment on site, in building or on roof. During construction provide additional protection against moisture, dust accumulation and physical damage of electrical equipment. Provide temporary heaters within units, as approved to evaporate excessive moisture and provide ventilation as required.

3.12 TESTING AND INSPECTION:

- A. Provide personnel and equipment, make required tests, and secure required approvals from the Engineer and governmental agencies having jurisdiction.
- B. When material and/or workmanship is found to not comply with the specified requirements, within three days after receipt of notice of such non-compliance remove the non-complying items from the job site and replace them with items complying with the specified requirements, all at no additional cost to the Owner.
- C. Perform all required adjustments and settings. Verify and correct deficiencies as necessary including voltages, tap settings, trip settings and phasing of equipment from distribution system to point of use.
- D. Provide all necessary testing equipment.
- E. In the Owner's Presence:
 - 1. Test all parts of the electrical system and prove that all such items provided under this Section function electrically in the required manner.

3.13 PROJECT COMPLETION:

- A. Upon completion of the work of this Section, thoroughly clean all exposed portions of the electrical installation, removing all traces of soil, labels, grease, oil and other foreign material, and using only the type cleaner recommended by the manufacturer of the item being cleaned.
- B. Equipment with damage to painted finish shall be repaired to satisfaction of the Engineer.
- C. On the first day the facility is in operation, for at least eight hours, at a time directed by the Engineer, provide a qualified foreman and crew to perform such electrical work as may be required by the Engineer.

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- E. Thoroughly indoctrinate the Owner's operation and maintenance personnel in the contents of the operations and maintenance manual required to be submitted under these Specifications.

3.14 EQUIPMENT SPECIFIED:

- A. Contractor shall furnish equipment or systems in manufacturers specified or named herein or on the drawings. No other manufacturers shall be considered.

END OF SECTION 260500

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SECTION 262923 VARIABLE FREQUENCY DRIVES FOR HVAC APPLICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.
- B. The General Requirements in Section 200050 shall also govern the work under this section.

1.2 DESCRIPTION

- A. 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.
- B. 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. All VFDs installed on this project shall be from the same manufacturer.

1.3 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Institute of Electrical and Electronic Engineers (IEEE)
 - a) Standard 519-1992, IEEE Guide for Harmonic Content and Control.
 - 2. Underwriters laboratories
 - a) UL508C
 - 3. National Electrical Manufacturer's Association (NEMA)
 - a) ICS 7.0, AC Adjustable Speed Drives
 - 4. IEC 16800 Parts 1 and 2
- B. Qualifications:
 - 1. 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.
 - 2. 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.
 - 3. Acceptable Manufactures:
 - a) ABB ACH550 Series

1.4 SUBMITTALS

- A. Submittals shall include the following information:
 - 1. Outline dimensions, conduit entry locations and weight.
 - 2. Customer connection and power wiring diagrams.

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3. 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.
4. Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD).
 - a) The VFD manufacturer shall provide calculations; specific to the installation, showing total harmonic voltage distortion is less than 5%. Input filters shall be sized and provided as required by the VFD manufacturer to ensure compliance with the IEEE electrical system standard 519. All VFDs shall include a minimum of 5% equivalent impedance reactors, no exceptions.

PART 2 – PRODUCTS

2.01 VARIABLE FREQUENCY DRIVES

- A. 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.
 1. Environmental operating conditions: 0 – 40° C continuous. Altitude 0 to 3300 feet above sea level, up to 95% humidity, non-condensing. All circuit boards shall have conformal coating.
 2. Enclosure shall be rated UL type 1 and shall be UL listed as a plenum rated VFD.
- B. All VFDs shall have the following features:
 1. 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.
 2. 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.
 3. 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.
 4. 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).

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5. 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.
 6. 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.
 7. 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.
 8. 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.
- D. All VFDs to have the following adjustments:
1. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed.
 2. 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.
 3. Two (2) programmable analog inputs shall accept current or voltage signals.
 4. 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.
 5. Six (6) programmable digital inputs.
 6. 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.
 7. 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

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- 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.
8. Two independently adjustable accel and decel ramps with 1 – 1800 seconds adjustable time ramps.
 9. 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.
 10. 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.
 11. The VFD shall include password protection against parameter changes.
- E. 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.
- F. 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
- G. 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.
- H. Serial Communications
1. 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.
 2. 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

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- 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:
- a. Data Sharing – Read Property – B.
 - b. Data Sharing – Write Property – B.
 - c. Device Management – Dynamic Device Binding (Who-Is; I-AM).
 - d. Device Management – Dynamic Object Binding (Who-Has; I-Have).
 - e. Device Management – Communication Control – B.
3. 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.
- I. 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.
- J. All VFDs through 60HP shall be protected from input and output power miswiring. The VFD shall sense this condition and display an alarm on the keypad. The VFD shall not be damaged by this condition.
- K. OPTIONAL FEATURES – Optional features to be furnished and mounted by the drive manufacturer. All optional 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.
1. 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
 2. Door interlocked padlockable circuit breaker that will disconnect all input power from the drive and all internally mounted options.
- L. The following operators shall be provided:
- a. Bypass Hand-Off-Auto
 - b. Drive mode selector and light
 - c. Bypass mode selector and light
 - d. Bypass fault reset

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- e. Bypass LDC display, 2 lines, for programming and status / fault / warning indications
1. 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.
 2. 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.
 3. 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.
 4. 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.
 5. 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.
 6. 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.
 7. 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.
 8. 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

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- 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.
9. 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.
 10. 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.
 11. The bypass controller shall have six programmable digital inputs, and five programmable Form-C relay outputs.
 12. The relay outputs from the bypass shall be programmable for any of the following indications.
 - a. System started
 - b. System running
 - c. Bypass override enabled
 - d. Drive fault
 - e. Bypass fault
 - f. Bypass H-O-A position
 - g. Motor proof of flow (broken belt)
 - h. Overload
 - i. Bypass selected
 - j. Bypass run
 - k. System started (damper opening)
 - l. Bypass alarm
 - m. Over temperature
 13. 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.
 14. 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.
 15. 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.
 16. Class 10, 20, or 30 (selectable) electronic motor overload protection shall be included.

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PART 3 – EXECUTION

3.1 INSTALLATION

- A. Installation shall be the responsibility of the mechanical contractor. The contractor shall install the drive in accordance with the requirements of the VFD manufacturer's installation manual.

3.2 START-UP

- A. Certified factory start-up shall be provided for each drive by a factory certified service center. A certified start-up form shall be filled out for each drive with a copy provided to the Meriden Public Schools, and a copy kept on file at the manufacturer.

3.3 PRODUCT SUPPORT

- A. Factory trained application engineering and service personnel that are thoroughly familiar with the VFD products offered shall be locally available at both the specifying and installation locations. A toll free 24/365 technical support line shall be available.
- B. A computer based training CD or 8-hour professionally generated video (VCR format) shall be provided to the Meriden Public Schools at the time of project closeout. The training shall include installation, programming and operation of the VFD, bypass and serial communication.

3.4 WARRANTY

- A. Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time and expenses.

END OF SECTION 262923

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

- A. The General Provisions of the Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to the work specified in this Section.
- B. The General Requirements in Section 20 00 50 shall also govern the work under this Section.
- C. Section includes design, performance criteria, refrigerants, controls, and installation requirements for air-cooled rotary screw packaged chillers.

1.02 SCOPE

- A. Section includes design, performance criteria, controls and control connections, chilled water connections, electrical power connections and refrigerants of the chiller package.

1.03 REFERENCES

- A. Products shall be designed, rated and certified in accordance with applicable sections of the following Standards and Codes:
 - 1.To comply with the most recent versions of applicable Standards and Codes of ARI 550 / 590.
 - 2.ARI 370 - Standard for Sound Rating of Large outdoor Refrigerating and Air-conditioning Equipment.
 - 3.To comply with the most recent versions of applicable Standards and Codes of ASHRAE 15.
 - 4.Units shall meet the efficiency standards of the latest ASHRAE 90.1 Standard FEMP standard current version.
 - 5. Unit shall comply with ASME section VIII

1.04 QUALITY ASSURANCE

- A. UL 1995 -- Standard for Heating and Cooling Equipment.
- B. Manufactured facility to be ISO 9001.
- C. Factory Functional Test: The chiller shall be pressure tested, evacuated and fully charged with HFC-513A refrigerant and oil. In addition, a factory functional test to verify correct operation by cycling condenser fans, closing compressor contacts and reading data points from temperature and pressure sensors.

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- D. Qualifications: Equipment manufacturer must specialize in the manufacture of the products specified and have five years experience with the equipment and refrigerant offered.
- E. Regulatory Requirements: Comply with the codes and standards specified.

1.05 SUBMITTALS

- A. Submit shop drawings and product data in accordance with specification requirements.
- B. Submittals shall include the following:
 - 1. Dimensioned plan and elevation view drawings, required clearances, and location of all field connections,
 - 2. 1/3 octave band sound ratings per ARI Standard 370.
 - 3. Single line schematic drawing of the field power hookup requirements, indicating all items that are furnished.
 - 4. Certification of factory run test.
 - 5. Installation and operating manuals.
 - 6. Summary of all auxiliary utility requirements such as electricity, water, etc. Summary shall indicate quality and quantity of each required utility.
 - 7. Single line schematic drawing of the field power hookup requirements, indicating all items that are furnished.
 - 8. Schematic diagram of control system indicating points for field interface/connection.
 - 9. Diagram shall fully delineate field and factory wiring.

1.06 OPERATION AND MAINTENANCE DATA

- A. Include manufacturer's descriptive literature, installation checklist, start-up instructions and maintenance procedure.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Chillers shall be delivered to the job site completely assembled and charged with refrigerant and oil by the manufacturer.
- B. Comply with the manufacturer's instructions for rigging and handling.
- C. If unit is to be stored, comply with manufacturer instructions for storage.
- D. During shipment, provide protective covering over vulnerable components. Fit nozzles and open pipe ends with enclosures.

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1.08 WARRANTY

- A. Warranty (domestic): The refrigeration equipment manufacturer’s warranty shall be for a period of 18 months from the time the installation was accepted by the Owner. It shall cover replacement parts (and the labor to replace them) having proven defective within the above period.
- B. Extended Compressor Warranty: 5 Years
- C. Extended Unit Warranty: 4 years extended warranty, entire unit, parts and labor.
- D. Refrigerant Warranty: 5 years.
- E. Delayed Warranty Start: None. (Startup within 6 months of shipment)

1.09 Sustained Operational Performance and Reliability

- A. During the first 24 months of operation, the manufacturer shall perform quarterly remote or on-site operating inspections to confirm the chiller’s operational performance. Resulting from each inspection, the manufacturer shall provide the owner with a report describing the condition of the equipment and each of its major components, a log of its current operating data, any issues needing to be addressed, and any recommended corrective actions.
- B. Manufacturer shall include chiller spring start-up and fall draining and winterizing services for the first 24 months of operation.

1.10 Summary of General Options

- A. Warranty: List design requirement options listed in section 1.06.
- B. Sustained Operational Performance: List design requirement options listed in section 1.09.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Basis of Design - Daikin Applied Model AWVA; including the standard product features and all special features required per the plans and specifications
- B. Optional Products - Equipment manufactured by York model YLAA or Smardt model QTC may be acceptable. Naming these products as equal does not imply that their standard construction or configuration is acceptable or meets the specifications. Optional equipment proposed, must

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meet the specifications including all architectural, mechanical, electrical, and structural details, all scheduled performance and the job design, plans and specifications.

2.02 UNIT DESCRIPTION

- A. Furnish and install as shown on the plans, factory assembled, factory charged with R-513a, air-cooled, rotary-screw compressor packaged chillers in the quantity and size specified. Each chiller shall consist of multiple semi-hermetic screw compressors, direct-expansion evaporator, air-cooled condenser section, control system and all components necessary for protected and controlled unit operation.
- B. Chiller shall be factory run-tested to verify operation. Operating controls and refrigerant charge shall be checked for proper operation and optimum performance.

2.03 DESIGN REQUIREMENTS

- A. General: Provide a complete rotary screw packaged chiller as specified and as shown on the drawings. The unit shall be in accordance with the standards referenced in section 1.03.
- B. Operating Range: The chiller shall have the ability to control leaving chilled fluid temperature from 15F to 65F.
- C. Performance: Refer to the schedule of performance on the drawings. The chiller shall be capable of stable operation to a minimum percentage of full load (without hot gas bypass) of 25%. Performance shall be in accordance with AHRI Standard 550/590.
- D. Manufacturer must provide both sound power and sound pressure data in decibels. Sound pressure data per AHRI 370 must be provided in 8 octave band format at full load. In addition, A-weighted sound pressure at 30 feet should be provided at 100%, 75%, 50% and 25% load points to identify the full operational noise envelope. Sound power must be provided in 1/8 octave band format to highlight any tonal quality issues. If manufacturer cannot meet the noise levels (per the attached chart), sound attenuation devices and/or barrier walls must be installed to meet this performance level

Sound Pressure (at 30 feet)											
63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Overall dBA	75% Load dBA	50% Load dBA	25% Load dBA
Sound Power											
63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Overall dBA	75% Load dBA	50% Load dBA	25% Load dBA

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2.04 CHILLER COMPONENTS

A. Compressor

Compressor motors: Motors shall be high-torque, two-pole, semi-hermetic type with inherent thermal protection on all three phases, and cooled by suction gas. The compressors shall be field serviceable, semi-hermetic, single-rotor screw type with one central helical rotor. The gate rotor contact element shall be constructed of engineered composite material, dimensionally stable up to 1500°F and wear resistant for extended life. Compressors shall be vibration isolated from the frame by neoprene compression mounts and include an internal discharge compressor muffler. If a twin-screw design is used, the manufacturer shall provide an extended 5-year parts and labor warranty covering all additional moving parts. Each compressor shall be equipped with a suction service shutoff valve. If compressor does not have an internal discharge compressor muffler, additional sound attenuation must be provided. Each compressor shall be equipped with a VFD providing compressor speed control as a function of the cooling load. Each VFD shall provide controlled motor acceleration and deceleration, and shall provide protection for the following conditions: electronic thermal overload, over/under current, stalled motor, input and output phase loss, high load current, and current unbalance. The VFD shall provide a minimum 95% displacement power factor at all load points. Compressors used in VFD controlled units must have electrically insulated, ceramic bearings to mitigate bearing and/or lubricant damage from stray electric current passage. Compressor shall be able to control compression ratio to optimize efficiency at all operating conditions. Units without this protection must have an extended 5-year compressor warranty.

1. The unit controller shall display the following operating messages:
 - a. Line voltage not present
 - b. Voltage present, starter ready
 - c. Motor accelerating
 - d. Motor at full speed
 - e. Motor at full speed, ramp time expired
 - f. Stop command received, motor decelerating
 - g. Thermal overload has reached 90% to 99%
 - h. Thermal overload at 100%, motor stopped
 - i. Thermal overload reduced to 60%, motor can restart
 - j. Passcode enabled
 - k. Passcode disabled
 - l. Thermal overload content in percentage
2. The unit controller shall display the following alarms and faults:
 - a. Over Current-Hold
 - b. Over Current-Unload
 - c. Over Current-Alarm
 - d. Overheat-Hold
 - e. Overheat-Unload
 - f. Overheat-Alarm
 - g. Communication Fault

**LINCOLN MIDDLE SCHOOL – CHILLER REPLACEMENT
MERIDEN, CONNECTICUT**

- h. System power not three phase
 - i. Phase sequence incorrect
 - j. Line frequency less than 25 Hz
 - k. Line frequency more than 72 Hz
 - l. Excessive current unbalance
 - m. Operating parameters lost
 - n. No current after “Run” command
 - o. Undercurrent trip occurred
 - p. Overcurrent trip occurred
 - q. Control power too low
 - r. Motor stalled during acceleration
 - s. External fault
3. The unit controller shall display the following data:
- a. Output Frequency
 - b. Output Current
 - c. Output Voltage
 - d. Output Power
 - e. Fault Code

B. Evaporator

The evaporator shall be of the direct expansion type with single pass on the refrigerant and water side for high efficiency counterflow heat transfer and low pressure drops, carbon steel shell, and high efficiency finned copper tubes rolled into steel tube sheets. The evaporator shall be designed, inspected, and stamped in accordance with ASME Section VIII requirements.

- 1. The evaporator shall be protected with an electric resistance immersion heater. The evaporator shall be insulated with 3/4” thick CFC and HCFC-free closed-cell flexible elastomeric foam insulation material with 100% adhesive coverage. The insulation shall have an additional outer protective layer of 3mm thick PE embossed film to provide superior damage resistance. Insulation without the protective outer film shall not be acceptable. UV resistance level shall meet or exceed a rating of ‘Good’ in accordance with the UNI ISO 4892 - 2/94 testing method. This combination of an immersion heater and insulation shall provide freeze protection down to -20°F (-29°C) ambient air temperature.
- 2. Flow Switch: The evaporator shall be equipped with a factory-mounted and wired flow switch.
- 3. Evaporator shall have standard left-hand grooved connections when looking at the unit control panel.
- 4. The water-side working pressure shall be a minimum of 653 psig (4502 kPa). Evaporators shall be designed and constructed according to, and listed by Underwriters Laboratories (UL).

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C. Condenser

Coil shall be microchannel design and shall have a series of flat tubes containing multiple, parallel flow microchannels layered between the refrigerant manifolds. Tubes shall be 9153 aluminum alloy. Tubes made of 3102 alloy or other alloys of lower corrosion resistance shall not be accepted. Coils shall consist of a two-pass arrangement. Each condenser coil shall be factory leak tested with high-pressure air under water. Coils shall withstand 1000+ hour acidified synthetic sea fog (SWAAT) test (ASTM G85-02) at 120°F (49°C) with 0% fin loss and develop no leaks.

D. Refrigerant Circuit

The unit must have refrigerant circuits completely independent of each other with one compressor per circuit; multiple per circuit shall not be acceptable. Each circuit shall include an electronic expansion valve, liquid line shut-off valve, replaceable core filter-drier, sight glass with moisture indicator, and combination discharge check and shutoff valve.

1. Unit shall be equipped with a liquid line solenoid valve and suction shut-off valve.

E. Construction

Unit formed sheet metal components shall be painted using a corrosion resistant paint system, for aesthetics and long-term durability. Paint system will include a base primer with a high-quality polyester resin topcoat. Painted galvanized parts shall be G60 or greater and finished, unabraded panel surfaces shall be capable to be exposed to an ASTM B117 salt spray environment and exhibit no visible red rust at a minimum of 3,000 hours exposure. Finished, abraded surfaces shall be tested per ASTM D1654, having a mean scribe creepage not exceeding 1/16” at 1,000 hours minimum exposure to an ASTM B117 salt spray environment. Unit shall have condenser coil grilles and base frame grilles.

1. Unit casing and all structural members and rails shall be fabricated of pre-painted or galvanized steel to meet ASTM B117, 500-hour salt spray test.

2. Upper condenser coil and base section of unit shall have protective, 12 GA, PVC-coated, wire grille guards and have painted steel wraps enclosing the coil end sections and piping.

F. Electrical Panel

1. Control Panel: Single-point power connection to disconnect switch with through-the-door handle and with individual circuit breakers. A UL-approved weatherproof electrical panel shall contain the unit control system, control interlock terminals and field-power connection points. Box shall be designed in accordance with NEMA 3R rating. Hinged control panel access doors shall be tool-lockable. Barrier panels shall be provided to protect against accidental contact with line voltage when accessing the control system. Fan motors shall have inherent overload protection and compressor motors shall have three-phase motor overload protection. Factory-supplied power components shall include:

- Individual contactors and circuit breakers for fan motors,
- Circuit breakers and factory-mounted transformers for each control-circuit,
- Unit power terminal blocks for connection to remote disconnect switch,

**LINCOLN MIDDLE SCHOOL – CHILLER REPLACEMENT
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- d. Terminals for power supply to the evaporator heater circuit.
- e. Fan motors shall have inherent overload protection and compressor motors shall have three-phase motor overload protection.
- 2. The control logic shall be designed to maximize operating efficiency and equipment life with protections for operation under unusual conditions and to provide a history of operating conditions. The system shall intelligently stage the unit to sustain leaving water temperature precision and stability while minimizing compressor cycling.
- 3. Equipment protection functions controlled by the microprocessor shall include high discharge pressure, loss of refrigerant, loss of water flow, freeze protection, and low refrigerant pressure. User controls shall include:
 - a. auto/stop switch,
 - b. chilled water set-point adjustment,
 - c. anti-recycle timer,
 - d. digital display with water temperature and setpoint,
 - e. operating temperatures and pressures, and diagnostic messages.
- 4. The following features and functions shall be included:
 - a. Durable liquid crystal display (LCD) screen type, having minimum four 20-character lines with 6 key input pad conveniently mounted on the unit controller. Default language and units of measure shall be English and I-P respectively. Messages shall be in plain English. Coded messages, LED indicators and LED displays are not acceptable.
 - b. Separate control section and password protection for critical parameters.
 - c. Remote reset of chilled water temperature using a 4-20mA signal
 - d. Soft-load operation, protecting the compressor by preventing full-load operation during the initial chilled fluid pull-down period
 - e. BAS communication flexibility through modular plug-in BACnet® with MSTP
 - f. Non-volatile program memory allowing auto-restart after a power failure.
 - g. Recording of safety shutdowns, including date-and-time stamp, system temperatures and pressures. A minimum of six previous occurrences shall be maintained in a revolving memory
 - h. Start-to-start and stop-to-start cycle timers, providing minimum compressor off time while maximizing motor protection
 - i. Lead-lag compressor staging for part-load operation by manual selection or automatically by circuit run hours
 - j. Discharge pressure control through intelligent cycling of condenser fans to maximize efficiency
 - k. Pro-active compressor unloading when selected operating parameters exceed design settings, such as high discharge pressure or low evaporator pressure
 - l. Diagnostic monitoring of unit operation, providing a pre-alarm signal in advance of a potential shutdown, allowing time for corrective action
 - m. The unit shall be equipped with ground fault protection.

**LINCOLN MIDDLE SCHOOL – CHILLER REPLACEMENT
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2.05 OPTIONS AND ACCESSORIES

- A. The following options are to be included:
 - 1. Low Ambient Control: Provide fan cycling control to allow unit operation down to 32°F
 - 2. Ground Fault Protection: Factory installed circuit breaker to protect equipment from damage from line-to-ground fault currents less than those required for conductor protection.
 - 3. Phase loss with under/over voltage protection and with LED indication of the fault type to guard against compressor motor burnout.
 - 4. BAS interface module to provide interface with the BACnet MSTP protocol.
 - 5. Compressor Sound Reduction - Acoustic reduction blankets shall be factory installed on each compressor.
 - 6. The following accessories are to be included:
 - a. Factory-mounted thermal dispersion type flow switch
 - b. Wye strainer, to be installed at the evaporator inlet and sized for the design flow rate , with perforation diameter of 0.063" (for Brazed Plate evaporators) or 0.125" (for Shell-and-Tube evaporators) with blowdown valve and Victaulic couplings (factory mounted)

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in strict accordance with manufacturer’s requirements, submittal drawings, and contract documents.
- B. A strainer with perforations no larger than 0.125" (3.2 mm) diameter (provided by the unit manufacturer) shall be placed in the supply water line just prior to the inlet of the evaporator. Care shall be exercised when welding pipe or flanges to the evaporator to prevent any slag from entering the vessel.
- C. Adjust and level chiller in alignment on supports.
- D. Arrange piping to enable dismantling and permit head removal for tube cleaning.
- E. Coordinate electrical installation with electrical contractor.
- F. Coordinate controls with control contractor.
- G. Provide all appurtenances required to ensure a fully operational and functional chiller.
- H. Communication Wiring

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1. Conduit shall be installed between each chiller's unit control panel and the building for current and future control wiring for equipment located external to the facility. The conduit installation shall be per all NEC and local electrical codes inclusive of the depth of the conduit and placement of the communications conduit in relation to the chiller's power conduit and water piping. If multiple units are in close proximity, a single conduit from the building LAN may be run to the closest unit. Then conduit shall be extended from the closest chiller control panel to multiple units in a star configuration. Consult the equipment manufacturer regarding cabling options and limitations for multiple units.
 2. A minimum capacity CAT 5e Ethernet cable shall be provided in the communications conduit to the chiller from a network switch in the facility. After connecting the conduit to each unit's control panel, the CAT 5e cable shall be extended 3 feet and coiled inside each panel for connection as required for chiller communications. The cable length, continuity, electrical isolation and installation shall be per NEC requirement and local code requirements for communication cabling running from a building to a location exterior to the building.
- I. Coordinate controls and BMS interface with controls contractor.
 - J. Provide all material required for a fully operational and functional chiller.

3.02 SCHEDULE

- A. Units shall be factory charged with HFC-513a refrigerant.
- B. Factory Start-Up Services: Provide factory supervised start-up on-site for a minimum of two working days ensure proper operation of the equipment. During the period of start-up, the factory authorized technician shall instruct the owner's representative in proper care and operation of the equipment.
- C. The contractor shall furnish manufacturer complete submittal wiring diagrams of the unit as applicable for field maintenance and service

END OF SECTION 236426

LIST OF DRAWINGS

COVER

MD1.1 FIRST FLOOR PART PLAN - MECHANICAL DEMOLITION

M1.1 FIRST FLOOR PART PLAN - MECHANICAL NEW WORK

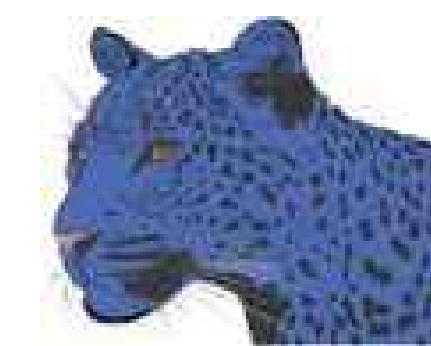
M1.2 MECHANICAL SCHEDULES & TEMPERATURE CONTROL DIAGRAM

ED1.1 ELECTRICAL DEMOLITION PLAN

E1.1 ELECTRICAL NEW WORK PLAN



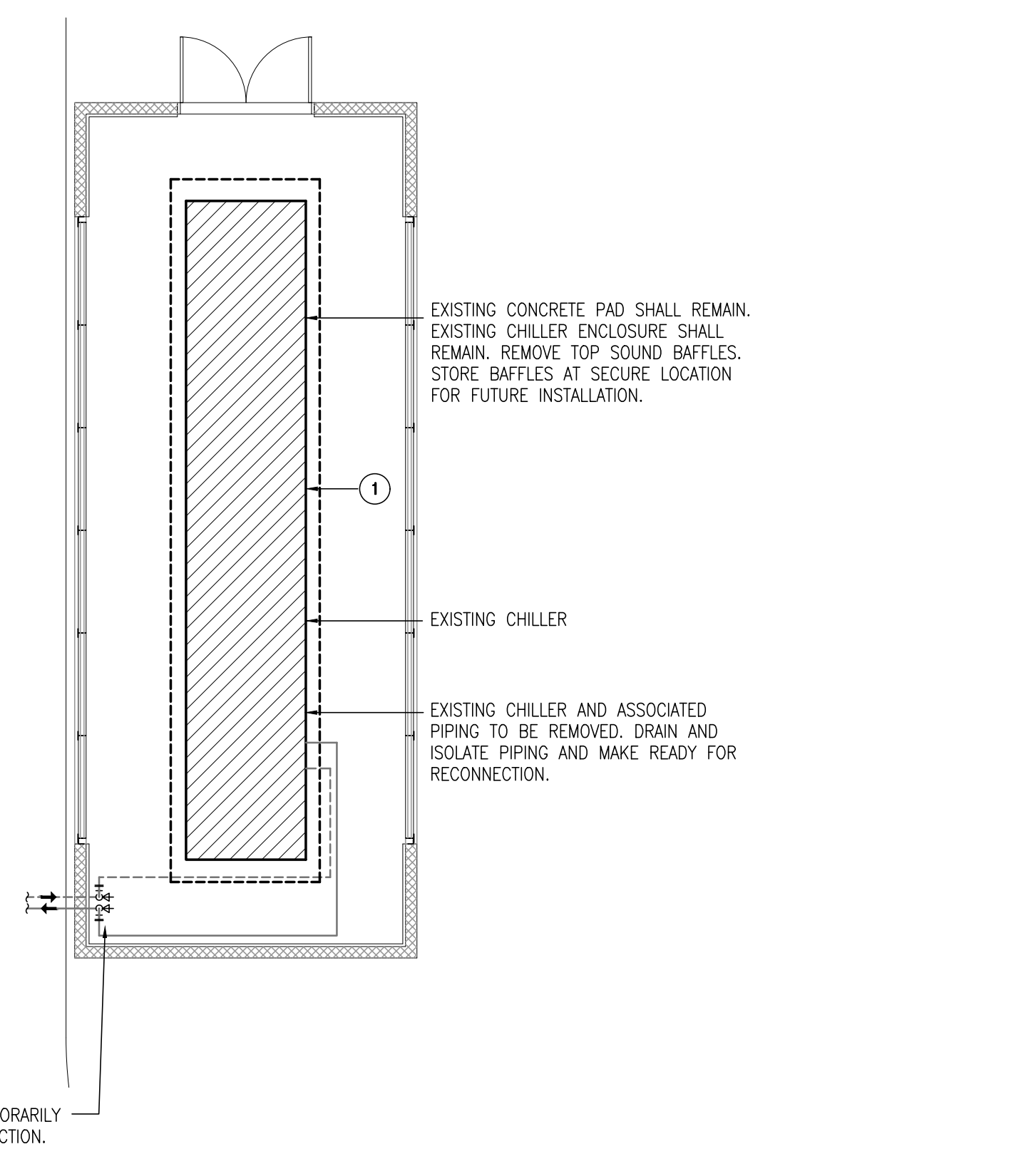
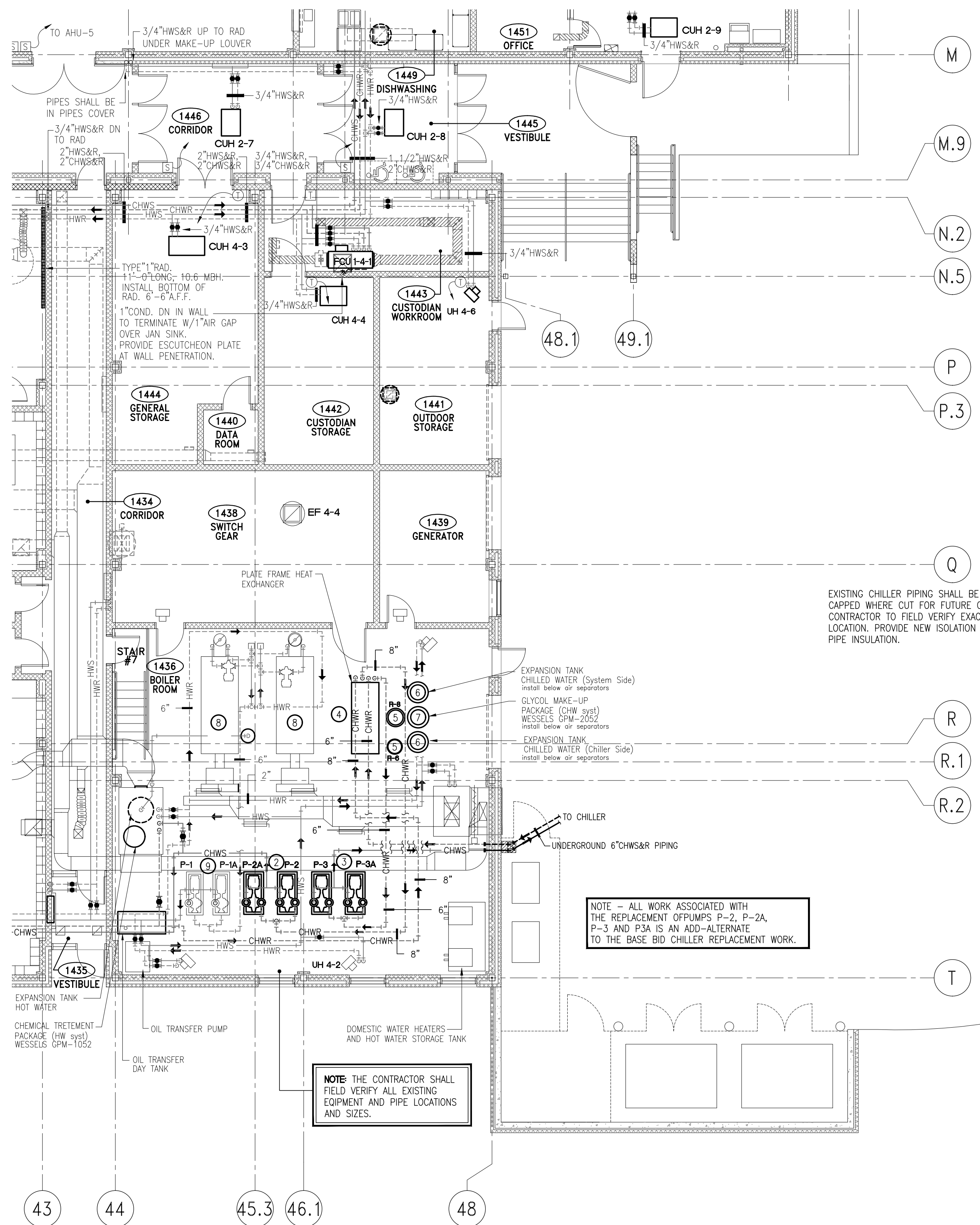
LINCOLN MIDDLE SCHOOL



CHILLER REPLACEMENT

164 CENTENNIAL AVE.
MERIDEN, CONNECTICUT 06451

M/E/P ENGINEER
BEMIS ASSOCIATES LLC
185 MAIN STREET
FARMINGTON, CONNECTICUT
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Fax: 860-321-7070



GENERAL DEMOLITION NOTES

- 1 - THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE LOCATION AND PROTECTION OF ALL EXISTING UTILITY LINES INCLUDING ELECTRICAL, SEWER, WATER, GAS, TELEPHONE, ETC. THE DRAWINGS SHOW DIAGRAMMATICALLY THE APPROXIMATE LOCATION OF UTILITIES WHERE INFORMATION IS AVAILABLE, BUT THE DRAWINGS ARE NOT EXACT AS TO THE QUANTITY, EXTENT OR LOCATION. THE CONTRACTOR SHALL EXERCISE EXTREME CAUTION DURING ALL PHASES OF THE WORK TO LOCATE, IDENTIFY, AND PROTECT EXISTING UTILITIES. THE CONTRACTOR SHALL RECORD RECORD LOCATION OF AND REPAIR DAMAGE TO EXISTING UTILITIES WHICH ARE ENCOUNTERED AS A RESULT OF WORK UNDER THIS CONTRACT.
- 2 - COORDINATE ALL DEMOLITION WORK WITH THE REQUIREMENTS OF THE NEW SCOPE OF WORK.

MECHANICAL DEMOLITION WORK NOTES

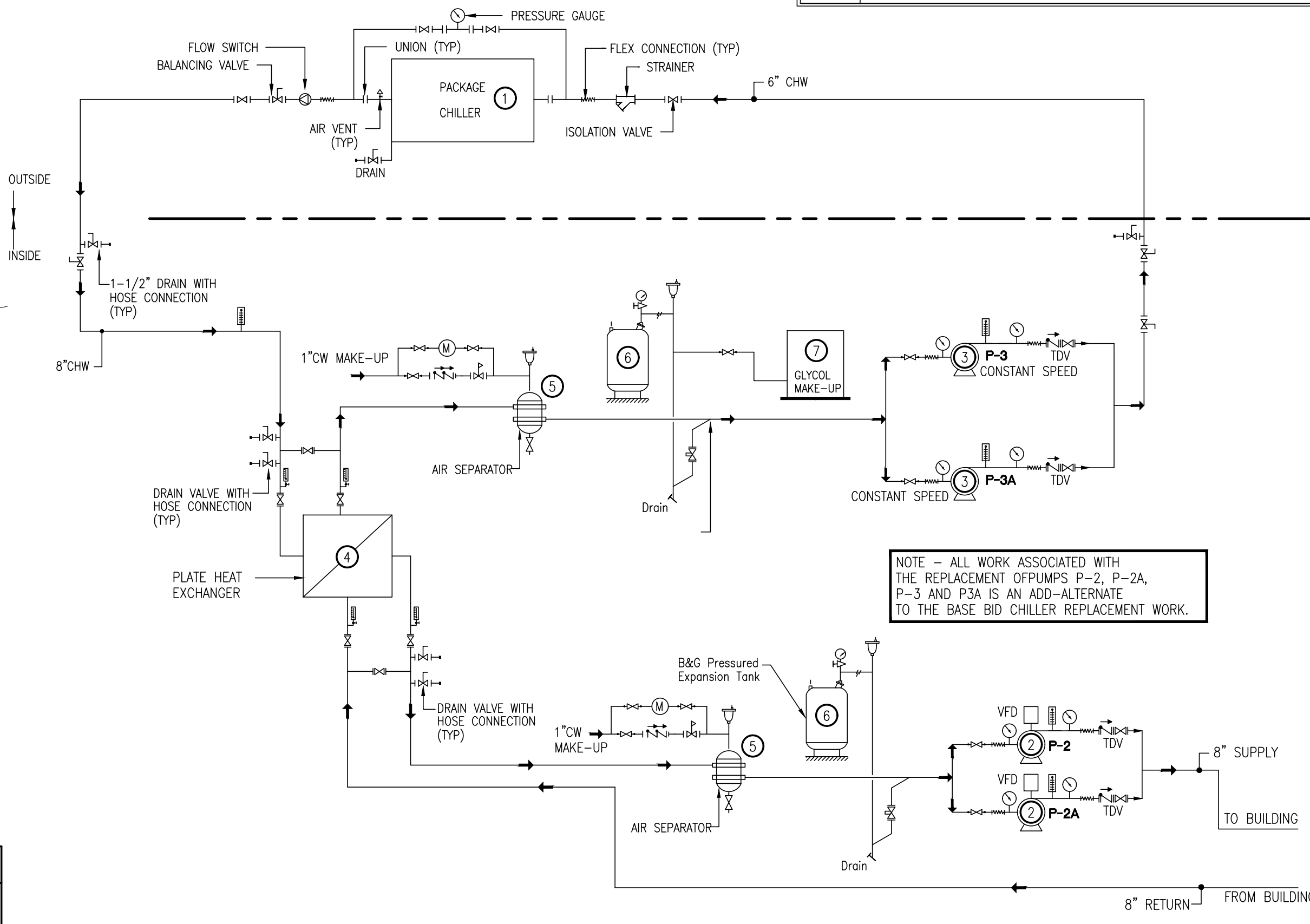
- 1 - PRIOR TO SUBMITTING BID, CONTRACTOR SHALL VISIT THE SITE AND IDENTIFY EXISTING CONDITIONS AND DIFFICULTIES THAT WILL AFFECT WORK TO BE PERFORMED. NO COMPENSATION WILL BE GRANTED FOR ADDITIONAL WORK CAUSED BY UNFAMILIARITY WITH SITE CONDITIONS THAT ARE VISIBLE OR READILY CONSTRUED BY EXPERIENCED OBSERVERS. INCLUDE IN THE BID ALL REQUIRED DEMOLITION WORK.
- 2 - THE DEMOLITION DRAWINGS ARE INTENDED ONLY TO DEFINE THE GENERAL SCOPE OF DEMOLITION WORK AND TO ASSIST THE CONTRACTOR DURING BIDDING. THE DEMOLITION DRAWINGS MAY NOT SHOW EVERY ITEM WHICH MUST BE DISCONNECTED, REMOVED, OR RELOCATED IN ORDER TO FACILITATE NEW WORK. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DEMOLITION WORK REQUIRED WHETHER OR NOT SHOWN ON THE PLANS.
- 3 - COORDINATE AND SCHEDULE ALL WORK WITH THE OWNER TO MINIMIZE INCONVENIENCE TO THE BUILDING OCCUPANTS. ALL SERVICES AND SYSTEMS SERVING OCCUPIED AREAS OF THE BUILDING SHALL BE MAINTAINED IN OPERATION DURING WORKING SHIFTS.
- 4 - CONTRACTOR IS RESPONSIBLE FOR ANY TEMPORARY WORK REQUIRED TO KEEP THE BUILDING OCCUPIED DURING CONSTRUCTION.
- 5 - REMOVE AND/OR RELOCATE ALL EXISTING MECHANICAL WORK AS NECESSARY FOR THE PERFORMANCE OF THE WORK OF THIS CONTRACT.
- 6 - REMOVE ALL DEMOLITION MATERIAL FROM THE JOB SITE UNLESS NOTED DIFFERENTLY.
- 7 - CONTRACTOR SHALL FIELD VERIFY LOCATION AND SIZE OF EXISTING CHILLED AND CHILLER WATER SUPPLY AND RETURN PIPING.
- 8 - CONTRACTOR SHALL MEASURE AND RECORD EXISTING PUMPS FLOW AND HEAD PRIOR TO ANY DEMOLITION.

- MECHANICAL DEMOLITION WORK SYMBOLS -

TAG	ACTION
①	EXISTING CHILLER WITH ASSOCIATED PIPING, VALVES AND ACCESSORIES SHALL BE REMOVED. CAP CHILLER WATER SUPPLY AND RETURN PIPING FOR FUTURE CONNECTION. EXISTING CONCRETE PAD SHALL REMAIN
②	EXISTING CHILLED WATER PUMPS AND ASSOCIATED PIPING SHALL BE REMOVED AND REPLACED. CAP CHILLED WATER SUPPLY AND RETURN PIPING FOR FUTURE CONNECTION. EXISTING CONCRETE PAD SHALL BE REMOVED AND REPLACED
③	EXISTING CHILLER PUMPS AND ASSOCIATED PIPING SHALL BE REMOVED AND REPLACED. CAP CHILLER WATER SUPPLY AND RETURN PIPING FOR FUTURE CONNECTION. EXISTING CONCRETE PAD SHALL BE REMOVED AND REPLACED
④	EXISTING PLATE HEAT EXCHANGER SHALL REMAIN.
⑤	EXISTING AIR SEPARATOR SHALL REMAIN
⑥	EXISTING COMPRESSION TANK SHALL REMAIN
⑦	EXISTING GLYCOL MAKE-UP ASSEMBLY SHALL REMAIN. PROVIDE PROPYLENE GLYCOL SOLUTION TO MAINTAIN 30% SOLUTION CONCENTRATION
⑧	EXISTING BOILERS SHALL REMAIN
⑨	EXISTING HOT WATER PUMPS SHALL REMAIN.

NOTE - ALL WORK ASSOCIATED WITH THE REPLACEMENT OF PUMPS P-2, P-2A, P-3 AND P-3A IS AN ADD-ALTERNATE TO THE BASE BID CHILLER REPLACEMENT WORK.

NOTE: THE CONTRACTOR SHALL FIELD VERIFY ALL EXISTING EQUIPMENT AND PIPE LOCATIONS AND SIZES.

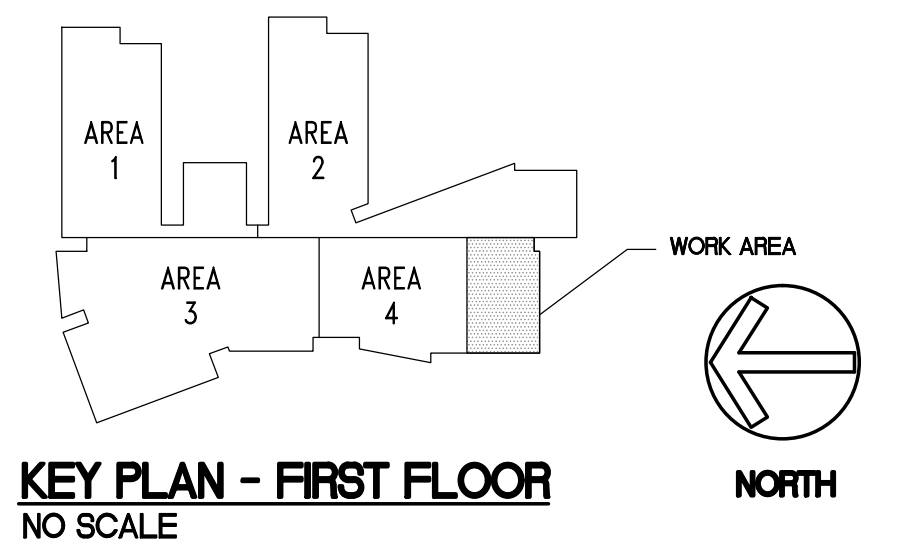


NOTE - ALL WORK ASSOCIATED WITH THE REPLACEMENT OF PUMPS P-2, P-2A, P-3 AND P-3A IS AN ADD-ALTERNATE TO THE BASE BID CHILLER REPLACEMENT WORK.

EXISTING CHILLED WATER PIPING DIAGRAM
NO SCALE

FIRST FLOOR PART PLAN - MECHANICAL DEMOLITION
SCALE: 1/8"=1'-0"

EXISTING PUMP SCHEDULE (for reference only)																
PUMP NO.	LOCATION	AREA SERVED	TYPE	MANUFACTURER	SERIES	MODEL	GPM	HEAD	RPM	HP	VOLTS	PH	SUCTION DIFFUSER MODEL/SYS SIDE/PUMP SIDE	Triple Duty Valve	EFF.	REMARKS
P-2	BOILER ROOM	CHILLED WATER LOOP	BASE MOUNTED	BELL & GOSSET	VSC	6x6x12L	1241	117	1750	60	460	3				
P-2A	BOILER ROOM	STAND-BY	BASE MOUNTED	BELL & GOSSET	VSC	6x6x12L	1241	117	1750	60	460	3				
P-3	BOILER ROOM	CHILLER	BASE MOUNTED	BELL & GOSSET	VSC	6x6x9 3/4B	691	74	1750	20	460	3				
P-3A	BOILER ROOM	STAND-BY	BASE MOUNTED	BELL & GOSSET	VSC	6x6x9 3/4B	691	74	1750	20	460	3				



KEY PLAN - FIRST FLOOR
NO SCALE

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CHILLER AND PUMPS REPLACEMENT
MERIDEN, CONNECTICUT**

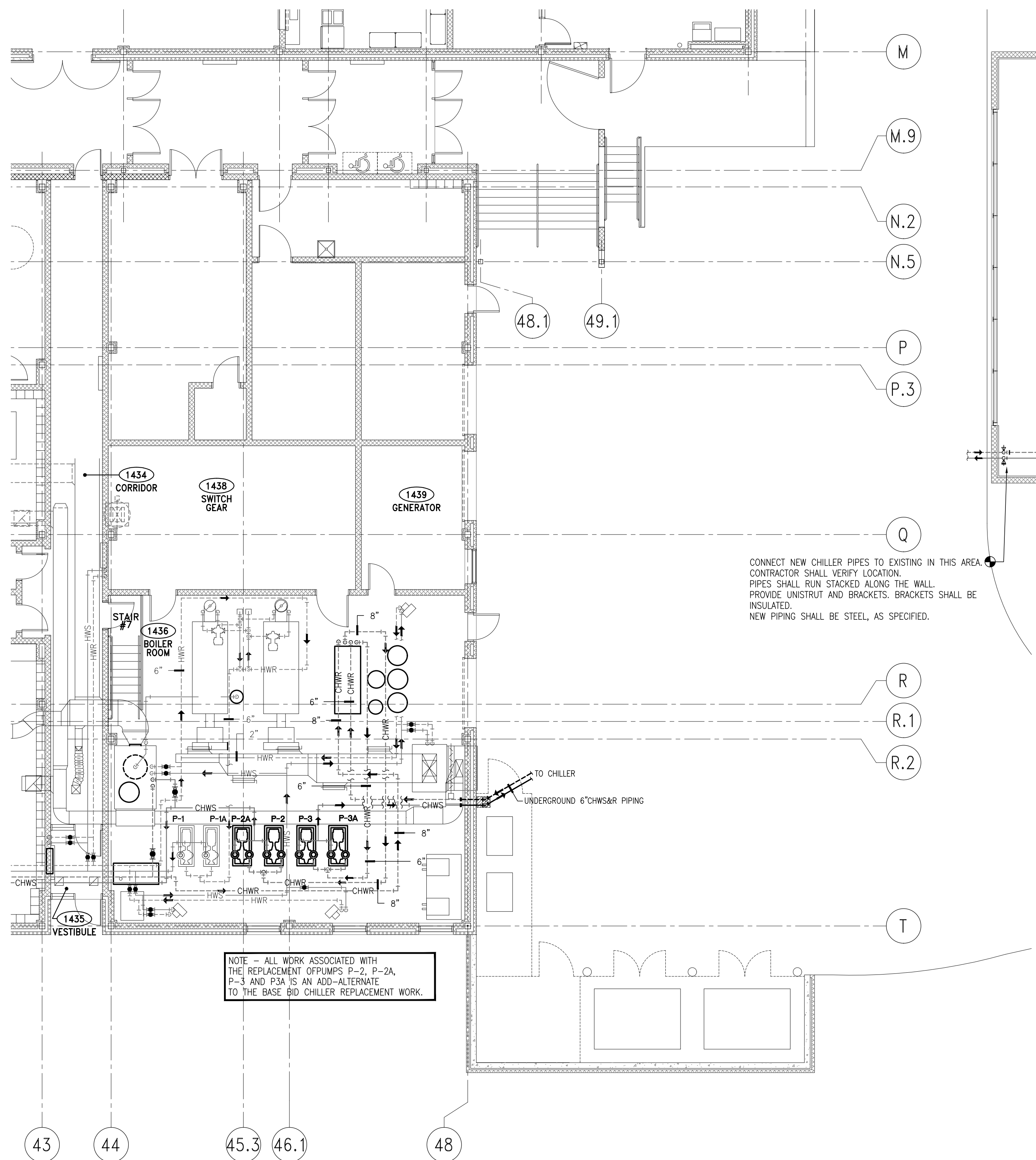
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TITLE
FIRST FLOOR PART PLAN - MECHANICAL DEMOLITION

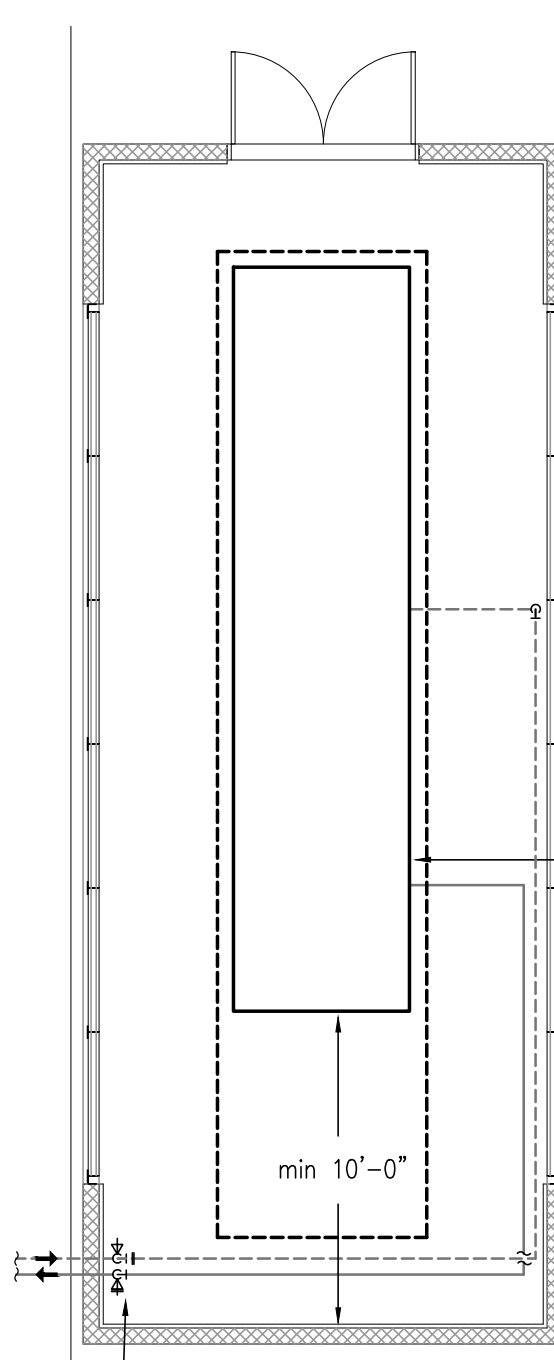
DATE 11/10/2023

DWG. NO.

MD1.1



FIRST FLOOR PART PLAN - MECHANICAL NEW WORK
SCALE: 1/8"=1'-0"



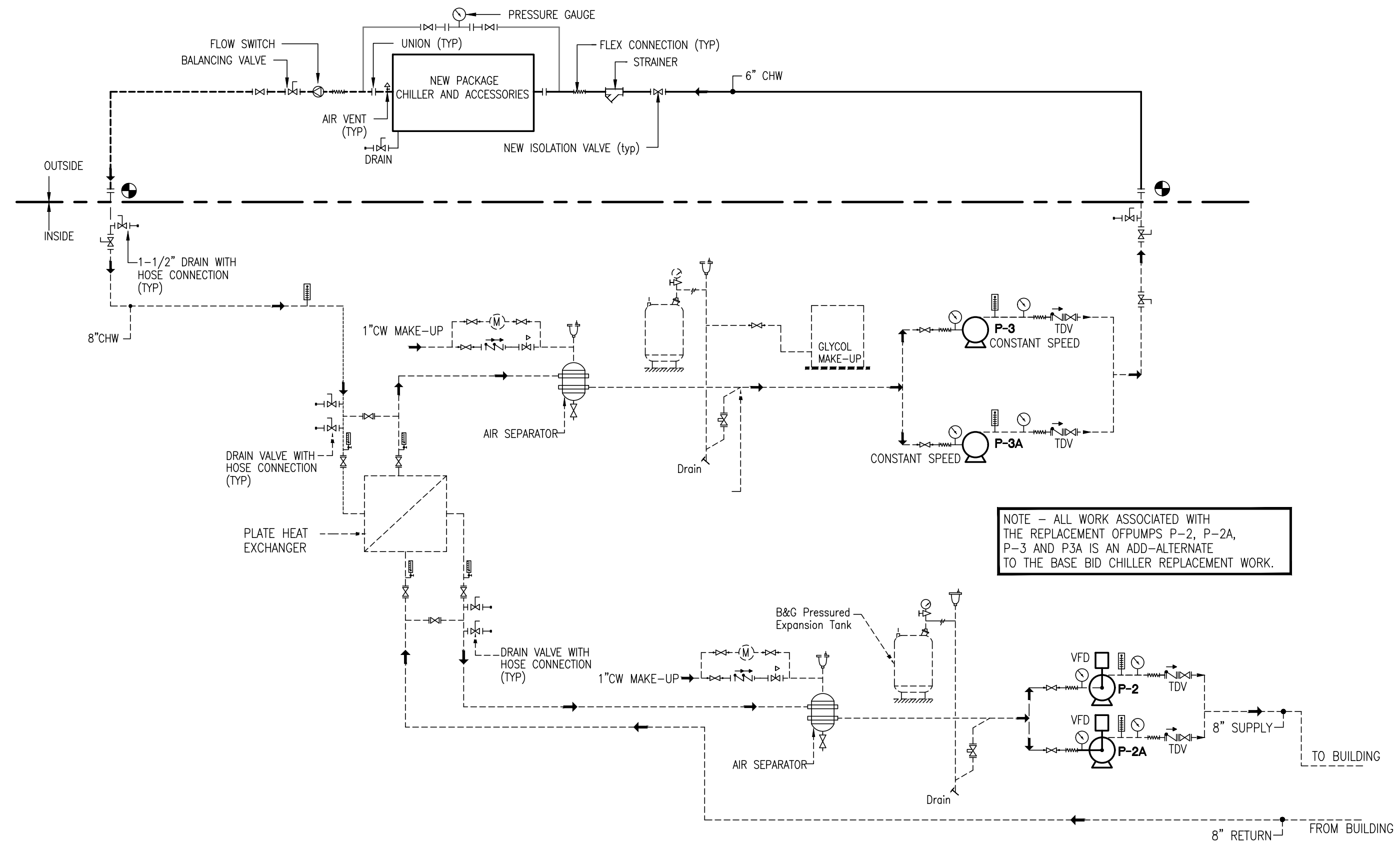
NEW CHILLER
REFER TO SCHEDULE. CONNECT NEW PIPING AND CONTROLS TO EXISTING AS INDICATED AND PLACE BACK INTO SERVICE. REINSTALL EXISTING SOUND Baffles.
PROVIDE (16) NEOPRENE WAFFLE PADS TO BE INSTALLED UNDER THE CHILLER.
PROVIDE CONNECTION TO CHILLER IN ACCORDANCE WITH CHILLER MANUFACTURERS RECOMMENDATIONS. (TYPICAL FOR CHILLER WATER SUPPLY & RETURN PIPING).
PROVIDE CHILLER WITH INTEGRAL DISCONNECT SWITCH.

CONNECT NEW CHILLER PIPES TO EXISTING IN THIS AREA. CONTRACTOR SHALL VERIFY LOCATION. PIPES SHALL RUN STACKED ALONG THE WALL. PROVIDE UNISTRUT AND BRACKETS. BRACKETS SHALL BE INSULATED. NEW PIPING SHALL BE STEEL, AS SPECIFIED.

- GENERAL NOTES :**
- DRAWINGS ARE DIAGRAMMATIC AND SHOW GENERAL INTENT OF WORK. ALL CONTRACTORS MUST COORDINATE WITH OTHER TRADES OTHER TRADES BEFORE PROCEEDING WITH ANY WORK.
 - THE CONTRACTOR SHALL COORDINATE THE ROUTING AND INSTALLATION OF ALL SYSTEMS TO AVOID CONFLICTS.
 - THE CONTRACTOR SHALL VISIT THE SITE AND FAMILIARIZE HIMSELF WITH THE EXISTING CONDITIONS PRIOR TO SUBMITTING HIS BID.
 - THE CONTRACTOR SHALL FIELD VERIFY ALL EXISTING PIPE LOCATIONS AND SIZES.
 - INSTALL PIPES TO ALLOW EASY ACCESS TO VALVES.
 - THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY TEMPORARY WORK REQUIRED TO KEEP THE BUILDING OCCUPIED DURING THE CONSTRUCTION.

MECHANICAL SYMBOL LIST

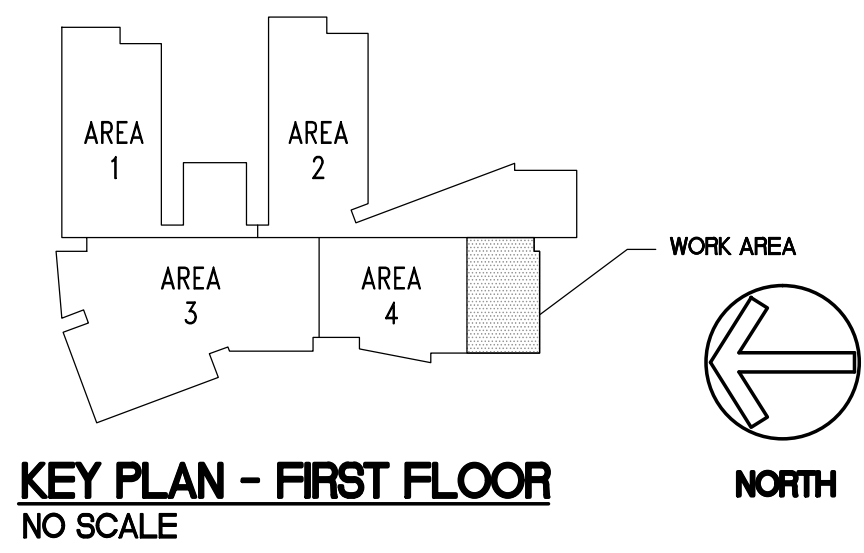
SYMBOL	ABBREV.	DESCRIPTION
—	CHWS	CHILLED WATER SUPPLY
---	CHWR	CHILLED WATER RETURN
—●—		SHUTOFF VALVE
—↓—		RISER DOWN
—↑—		RISER UP
—↓↑—		RISE OR DROP
—T—		BRANCH-TOP CONNECTION
—●—	POC	POINT OF CONNECTION



CHILLED WATER PIPING DIAGRAM
NO SCALE

NOTE - ALL WORK ASSOCIATED WITH THE REPLACEMENT OF PUMPS P-2, P-2A, P-3 AND P3A IS AN ADD-ALTERNATE TO THE BASE BID CHILLER REPLACEMENT WORK.

NOTE - ALL WORK ASSOCIATED WITH THE REPLACEMENT OF PUMPS P-2, P-2A, P-3 AND P3A IS AN ADD-ALTERNATE TO THE BASE BID CHILLER REPLACEMENT WORK.



KEY PLAN - FIRST FLOOR
NO SCALE

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CHILLER AND PUMPS REPLACEMENT
MERIDEN, CONNECTICUT**

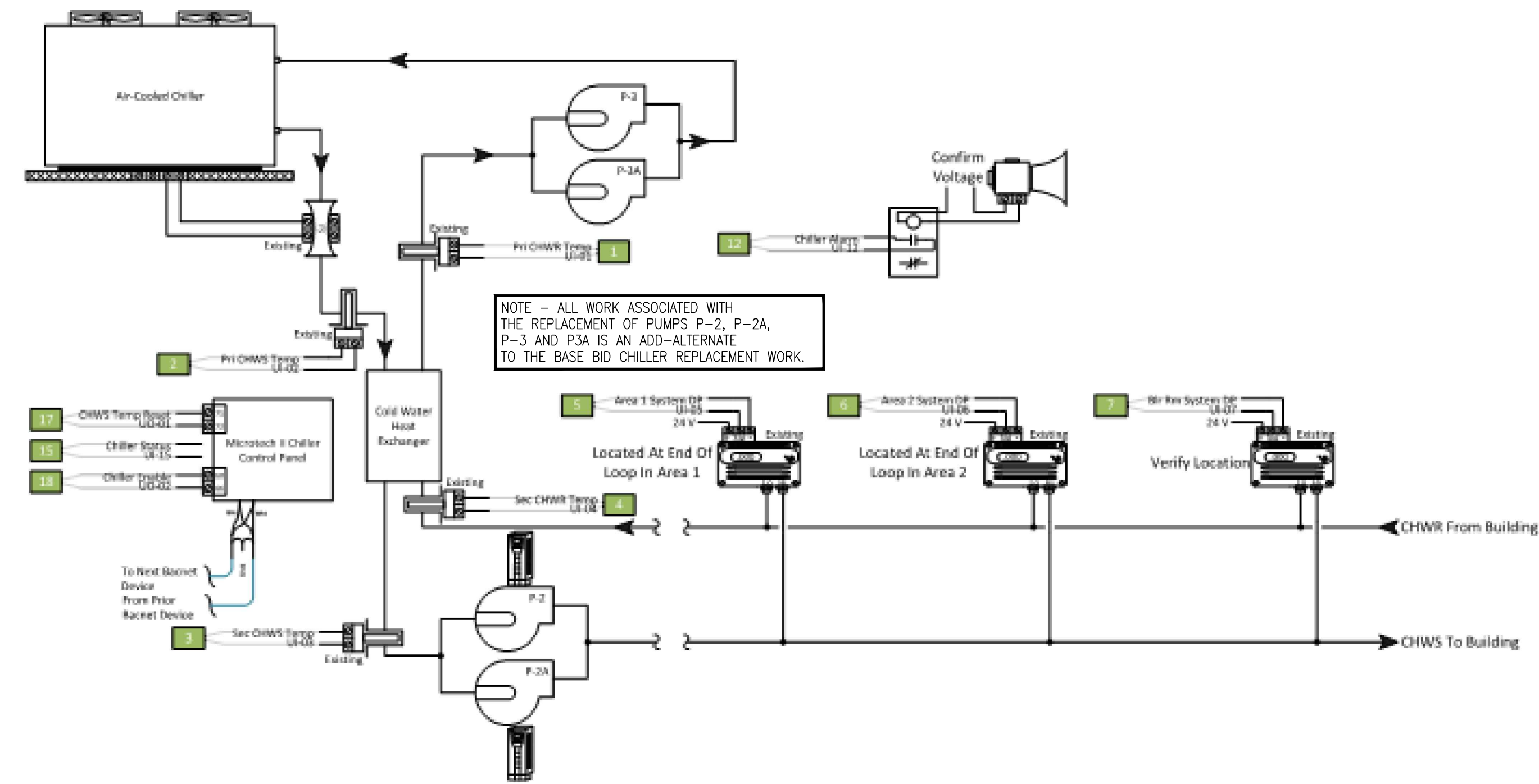
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TITLE
**FIRST FLOOR PART
PLAN - MECHANICAL
NEW WORK**

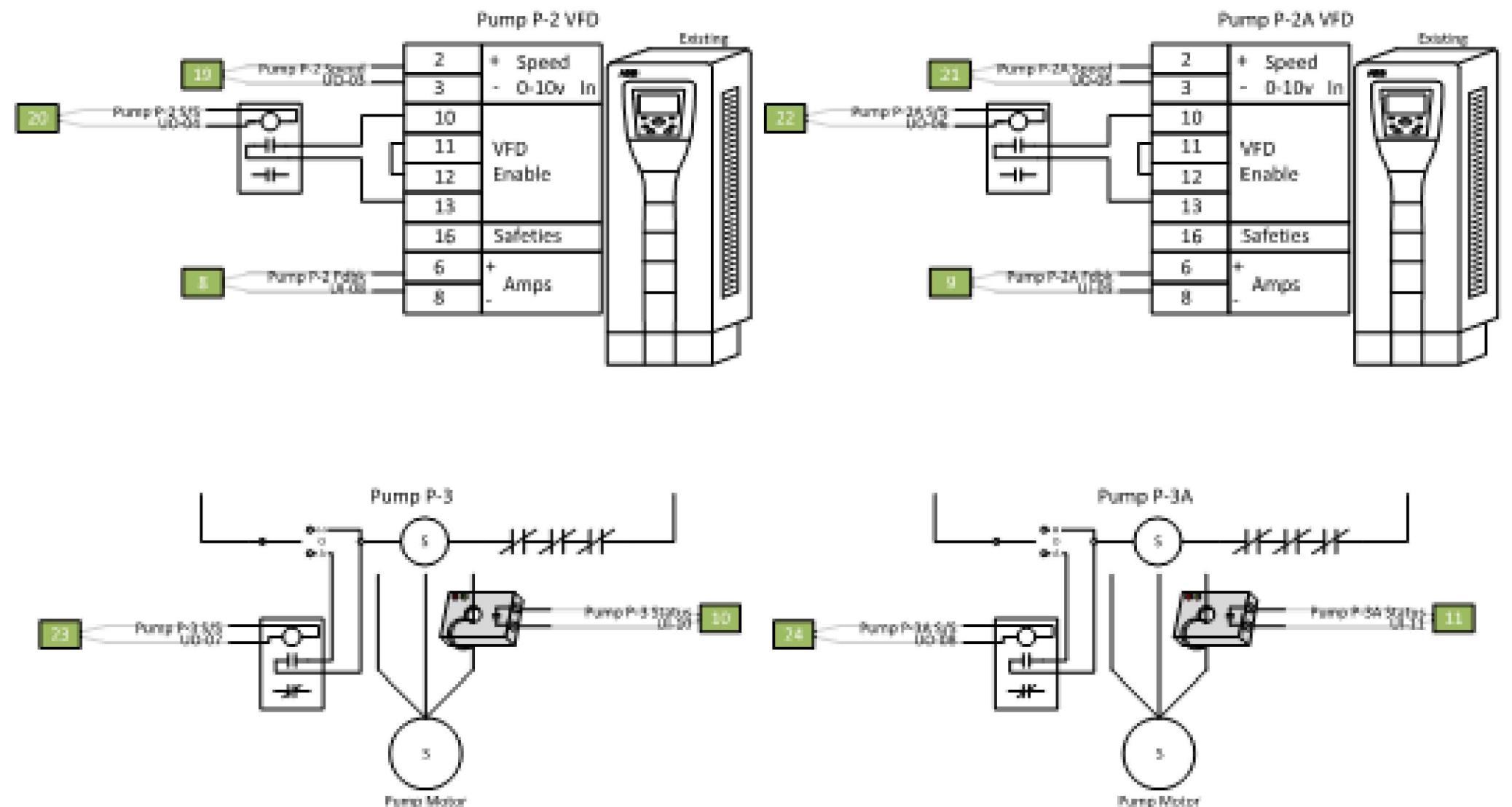
DATE 11/10/2023

DWG. NO.

M1.1



NOTE - ALL WORK ASSOCIATED WITH THE REPLACEMENT OF PUMPS P-2, P-2A, P-3 AND P-3A IS AN ADD-ALTERNATE TO THE BASE BID CHILLER REPLACEMENT WORK.



Sequence of Operations for Hot Water System.
 General: The system consists of an air cooled chiller, a cold water heat exchanger, two primary loop water pump and two secondary loop water pumps which are controlled by VFD's.
 Scheduled Lead/Lag Control: The BMS will control the cold water system with a manual selection through the graphic icon. Both the primary and secondary loop pumps will be operated on a lead/lag basis to be switched weekly at a customer determined day of the week and time of day.
 Chilled Water Control: The BMS will send a signal to the chiller control panel to maintain a chilled water supply temperature of 42F (Adj).
 Secondary Loop Pump Control: The BMS will enable the lead pump whenever the call for cooling has been enabled. The speed of the lead pump will be modulate to maintain a balance determined differential pressure setpoint. There are several differential pressure sensors throughout the building. The BMS will modulate the speed of the pump based on the differential pressure transmitter with the lowest differential pressure reading. If the lead pump is at full speed and the differential pressure continues to drop the BMS will enable the lag pump and modulate the speed of both pumps in unison an alarm will also be initiated at the workstation. Once the differential pressure reaches a point that the lead pump is able to maintain the differential pressure setpoint on its own the lag pump will be disabled. Should the speed of the lead pump approach the low speed threshold, approximately 30% the BMS will modulate open the chilled water bypass valve so as to allow the lead pump to operate slightly higher than the manufacturers recommended low speed. Once the decision has been made to shut down the chiller the BMS keep both the primary and the secondary pumps operational for a 10 minute (Adj) period to allow for the chiller to perform its own shutdown procedures.
 Safeties/Monitoring/Alarms: The BMS will monitor a general alarm signal from the chiller control panel. Should the BMS receive this signal the BMS will immediately disable the chiller and initiate an alarm at the workstation. The BMS will also monitor the status of both of the primary and both of the secondary chilled water pumps. Should the BMS fail to determine that the lead primary or secondary pumps are not operational the BMS will automatically disable the lead pump and enable the lag pump. The BMS will also initiate an alarm at the workstation.

CHILLER CONTROL DIAGRAM
NO SCALE

PUMP SCHEDULE (add alternate)																			
PUMP No.	LOCATION	AREA SERVED	TYPE	MANUFACTURER	SERIES	MODEL	GPM	HEAD (FT)	Control HEAD (FT)	RPM	HP	VOLTS	PH	Duty point Pump EFFICIENCY	SUCTION DIFFUSER			TRIPLE DUTY VALVE	REMARKS
															MODEL	SYS. SIDE	SUCT. SIDE		
P-2	BOILER RM.	CHILLED WATER LOOP	BASE MTD.	BELL & GOSSETT	VSX-VSC	5x6x13.5A	1241	117	35.1	1705	60	460	3	80.9%	GG-3	5	6	3DS-6S	1,2,3,5,6,7
P-2A	BOILER RM.	CHILLED WATER LOOP (STAND-BY)	BASE MTD.	BELL & GOSSETT	VSX-VSC	5x6x13.5A	1241	117	35.1	1705	60	460	3	80.9%	GG-3	5	6	3DS-6S	1,2,4,5,6,7
P-3	BOILER RM.	CHILLER	BASE MTD.	BELL & GOSSETT	VSX-VSC	4x6x10.5A	719	74	22.2	1702	20	460	3	79.0%	GG-3	4	6	3DS-4S	1,2,3,5,6,7
P-3A	BOILER RM.	CHILLER (STAND-BY)	BASE MTD.	BELL & GOSSETT	VSX-VSC	4x6x10.5A	719	74	22.2	1702	20	460	3	79.0%	GG-3	4	6	3DS-4S	1,2,4,5,6,7

REMARKS:
 1. UNIT SHALL BE SEISMICALLY SUPPORTED.
 2. INSTALL ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.
 3. OPERATING.
 4. STANDBY.
 5. SYSTEM WITH 30% PROPYLENE GLYCOL CONCENTRATION
 6. PROVIDE WITH PREMIUM EFFICIENCY MOTOR
 7. PROVIDE VARIABLE FREQUENCY DRIVE.

CHILLER PERFORMANCE POINTS AT AHRI AMBIENT RELIEF										
Point #	% Load	Unit Capacity Tons	Input Power kW	Efficiency EER	Fluid Flow GPM	EVAPORATOR			CONDENSER	
						WPD ft H2O	ENT deg F	LWT deg F	OAT deg F	ALT ft
1	100.0	300.0	367.4	9.799	717.9	27.3	54.00	44	95	0
2	75.0	225.0	178.3	15.15	717.9	27.3	51.5	44	80	0
3	50.0	150.0	80.10	22.47	717.9	27.3	49	44	65	0
4	25	75.0	31.79	28.31	717.9	27.3	46.5	44	55	0

PACKAGED AIR-COOLED SCROLL CHILLER	
SELECTION BASED ON:	DAIKIN MODEL AW018B
Fluid Type	Propylene Glycol, 30%Glycol concentration
Leaving Evap. Temp.	44 deg. F
Entering Evap. Temp.	54.0 deg. F
Ambient Temperature	95 deg. F
Unit Capacity	300 Tons
Unit Input Power	367.4 kW
Unit Efficiency (EER)	9.8 Btu/W.h
Unit IPLV/P (EER)	19.97 Btu/W.h
Evaporator Flow Rate	717.9 gpm
Evaporator Flow (with glycol)	207.8/834.8 gpm
Min/Max	
Pressure Drop	35.7 ft H2O
Glycol Type	Propylene
Glycol Concentration	30%
Glycol Freeze point	NA
Rated Voltage	460V, 3PH, 60 Hz
Single Point Connection	595A MCA
FLA Fan Motors (each)	2.6A
Fuse Size (recommended)	800A
Refrigerant	R-513A
Compressors	2 Screw
Dimensions	372"Lx88"Wx100"H
Unit Operating Weight	19,246 lb
CHILLER CONTROLS SHALL BE BACNET COMPATIBLE (coord with TOC before ordering)	
UNITS USING CFC BASED REFRIGERANTS WILL NOT BE ACCEPTABLE.	

CHILLER SOUND PRESSURE LEVELS DATA (without insulation)												
Hz	OCTIVE BAND CENTER FREQUENCY							OVERALL A-WEIGHTED DBA	75% LOAD DBA	50% LOAD DBA	25% LOAD DBA	
	63	125	250	500	1000	2000	4000					8000
DB	75	70	67	73	72	66	58	48	75	71	68	66

NOTE: SOUND VALUES ARE RATED IN ACCORDANCE WITH ARI STANDARD 370. SOUND PRESSURE RATINGS ARE VALUES AT 30 FL. FROM SIDES OF UNIT.

CHILLER SOUND POWER LEVELS DATA (without insulation)												
Hz	OCTIVE BAND CENTER FREQUENCY							OVERALL A-WEIGHTED DBA	75% LOAD DBA	50% LOAD DBA	25% LOAD DBA	
	63	125	250	500	1000	2000	4000					8000
DB	102	97	94	100	99	93	85	75	102	98	95	95

NOTE: PER ARI STANDARD 370.

VFD SCHEDULE (add alternate)						
UNIT SERVED	MANUF.	MODEL	HP	VOLTS	PH.	REMARKS
P-2	ABB	ACH 580	60	460	3	
P-2A	ABB	ACH 580	60	460	3	
P-3	ABB	ACH 580	20	460	3	
P-3A	ABB	ACH 580	20	460	3	

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LINCOLN MIDDLE SCHOOL
CHILLER AND PUMPS REPLACEMENT
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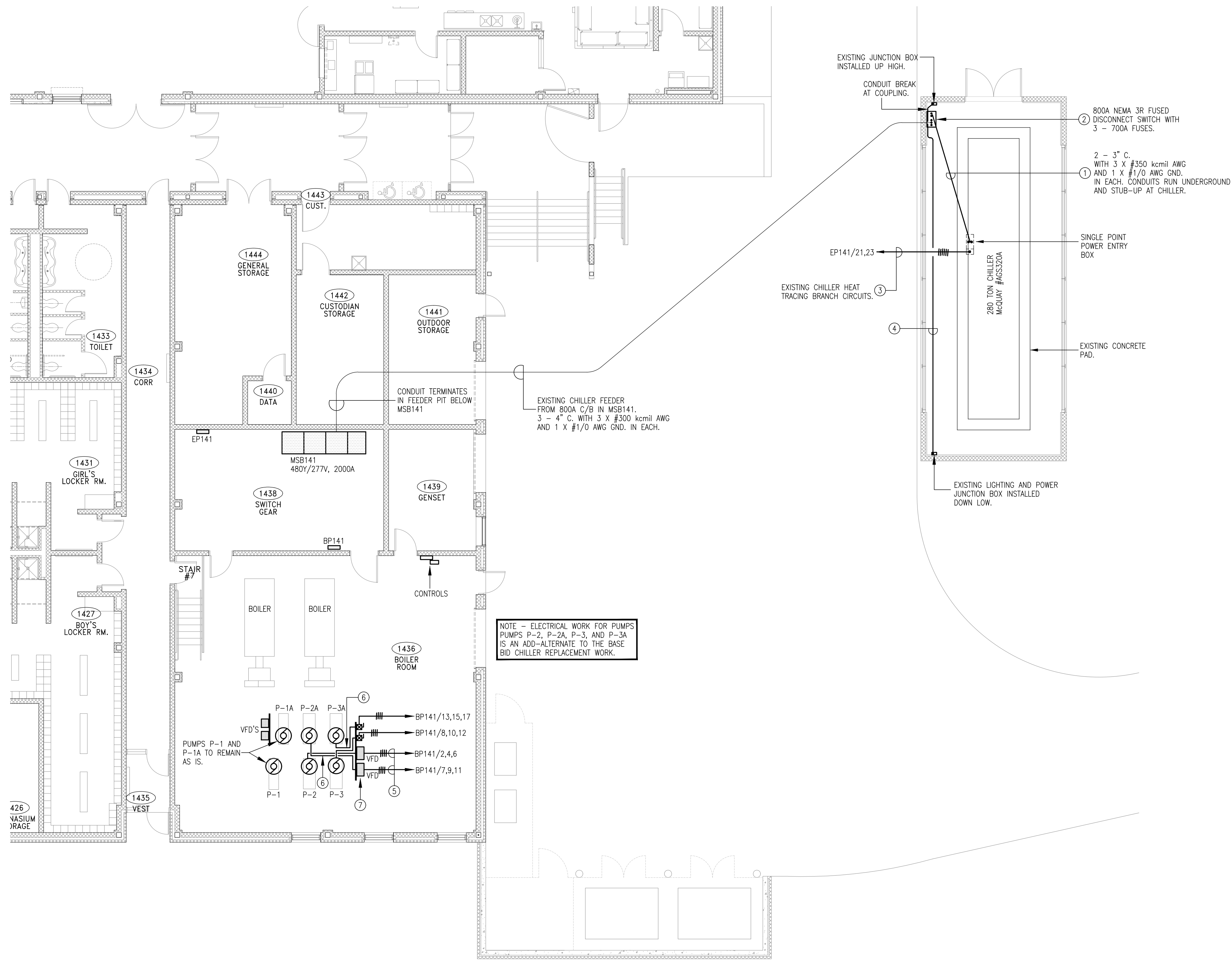
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TITLE
MECHANICAL SCHEDULES AND TEMPERATURE CONTROL DIAGRAM

DATE 11/10/2023

DWG. NO.
M1.2



PART FIRST FLOOR PLAN
SCALE: 1/8"=1'-0"

GENERAL ELECTRICAL DEMOLITION WORK NOTES

- PRIOR TO SUBMITTING BID, VISIT THE SITE AND IDENTIFY EXISTING CONDITIONS AND DIFFICULTIES THAT WILL AFFECT WORK TO BE PERFORMED. NO COMPENSATION WILL BE GRANTED FOR ADDITIONAL WORK CAUSED BY UNFAMILIARITY WITH SITE CONDITIONS THAT ARE VISIBLE OR READILY CONSTRUED BY EXPERIENCED OBSERVERS. INCLUDE IN THE BID ALL DEMOLITION WORK REQUIRED.
- THE DEMOLITION DRAWINGS ARE INTENDED ONLY TO DEFINE THE GENERAL SCOPE OF DEMOLITION WORK AND TO ASSIST THE CONTRACTOR DURING BIDDING. THE DEMOLITION DRAWINGS MAY NOT SHOW EVERY ITEM WHICH MUST BE DISCONNECTED, REMOVED, OR RELOCATED IN ORDER TO FACILITATE NEW WORK. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DEMOLITION WORK REQUIRED WHETHER OR NOT SHOWN ON THE PLANS.
- COORDINATE AND SCHEDULE ALL WORK WITH THE OWNER TO MINIMIZE INCONVENIENCE TO THE BUILDING OCCUPANTS.
- REMOVE AND/OR RELOCATE ALL EXISTING ELECTRICAL WORK AS NECESSARY FOR COORDINATION WITH THE WORK OF OTHER TRADES.
- MECHANICAL EQUIPMENT SHALL BE REMOVED UNDER OTHER DIVISIONS OF THIS CONTRACT. EQUIPMENT SHALL BE DISCONNECTED UNDER THIS DIVISION.
- EXISTING ELECTRICAL EQUIPMENT, WIRING, AND RACEWAYS SHALL NOT BE REUSED UNLESS SPECIFICALLY NOTED OTHERWISE.
- REMOVE ALL DEMOLITION MATERIAL FROM THE JOB SITE UNLESS THE OWNER WANTS TO RETAIN ANY SUCH MATERIAL FOR HIS USE. MATERIAL REQUESTED BY THE OWNER FOR SALVAGE SHALL BE DELIVERED TO THE OWNER'S DESIGNATED MATERIAL STORAGE AREA.

ITEM SPECIFIC ELECTRICAL DEMOLITION WORK NOTES

TAG	ACTION
1	DISCONNECT AND REMOVE EXISTING UNDERGROUND CHILLER BRANCH CIRCUIT CONDUITS AND CONDUCTORS RUNNING FROM DISCONNECT SWITCH TO THE CHILLER. THE CONDUITS SHALL BE CUT BACK FLUSH WITH THE CHILLER CONCRETE PAD.
2	DISCONNECT AND REMOVE EXISTING FUSED DISCONNECT SWITCH. RETAIN THE EXISTING INCOMING FEEDER CONDUCTORS AND CONDUITS IN PLACE AND PREP FOR RECONNECTION TO NEW DISCONNECT SWITCH.
3	FIELD LOCATE EXISTING HEAT TRACING BRANCH CIRCUIT CONDUIT AT CHILLER. CUT BACK THE BRANCH CIRCUIT CONDUIT AS REQUIRED TO ALLOW INSTALLATION OF A FLUSH GRADE PULL BOX. RETAIN THE CONDUCTORS IN PLACE LEAVING SUFFICIENT LENGTH FOR SPLICING TO NEW CONDUCTORS.
4	DISCONNECT AND REMOVE EXISTING CONDUIT AND CONDUCTORS RUNNING BETWEEN JUNCTION BOXES AS REQUIRED TO ALLOW REMOVAL AND REPLACEMENT OF THE EXISTING CHILLER ENCLOSURE ACOUSTICAL Baffles. PREP FOR INSTALLATION OF NEW REPLACEMENT CONDUIT AND CONDUCTORS.
5	DISCONNECT EXISTING PUMPS P-2 AND P-2A BRANCH CIRCUIT FEEDS FROM THE RESPECTIVE VFD'S. RETAIN THE FEEDS IN PLACE AND PREP FOR RECONNECTION TO NEW VFD'S.
6	DISCONNECT AND REMOVE EXISTING BRANCH CIRCUIT CONDUCTORS AND CONDUITS RUNNING FROM THE LOAD SIDE OF THE STARTER/DISCONNECTS TO PUMPS P-3 AND P-3A. DISCONNECT AND REMOVE EXISTING BRANCH CIRCUIT CONDUCTORS AND CONDUITS RUNNING FROM THE LOAD SIDE OF THE VFD'S TO PUMPS P-2 AND P-2A.
7	DISCONNECT AND REMOVE EXISTING VFD'S SERVING PUMPS P-2 AND P-2A.

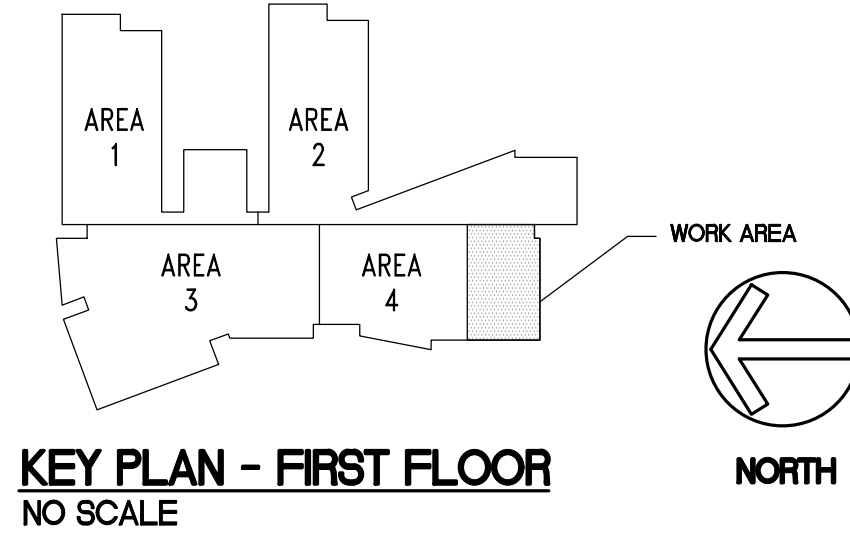
ELECTRICAL DRAWING LEGEND

SYMBOLS

- PANELBOARD.
- COMBINATION STARTER/DISCONNECT SWITCH.
- VARIABLE FREQUENCY DRIVE.
- MOTOR POWER CONNECTION, EQUIPMENT AS DESIGNATED.
- 12" SQ. FLUSH GRADE PULL BOX. PROVIDE IN HUBBELL #PC1212BA12/PC1212HA17.
- BRANCH CIRCUIT WIRING. CROSS LINES INDICATE NUMBER OF CONDUCTORS.
- BRANCH CIRCUIT HOMERUN IN CONDUIT. CROSS LINES INDICATE NUMBER OF CONDUCTORS.

ABBREVIATIONS

- A AMPS.
- AWG AMERICAN WIRE GAUGE.
- C CONDUIT.
- C/B CIRCUIT BREAKER.
- GND GROUND.
- H.D. HEAVY DUTY.
- JB JUNCTION BOX.
- NTS NOT TO SCALE.
- PB PULL BOX.
- V VOLTS.
- WP WEATHER PROOF.



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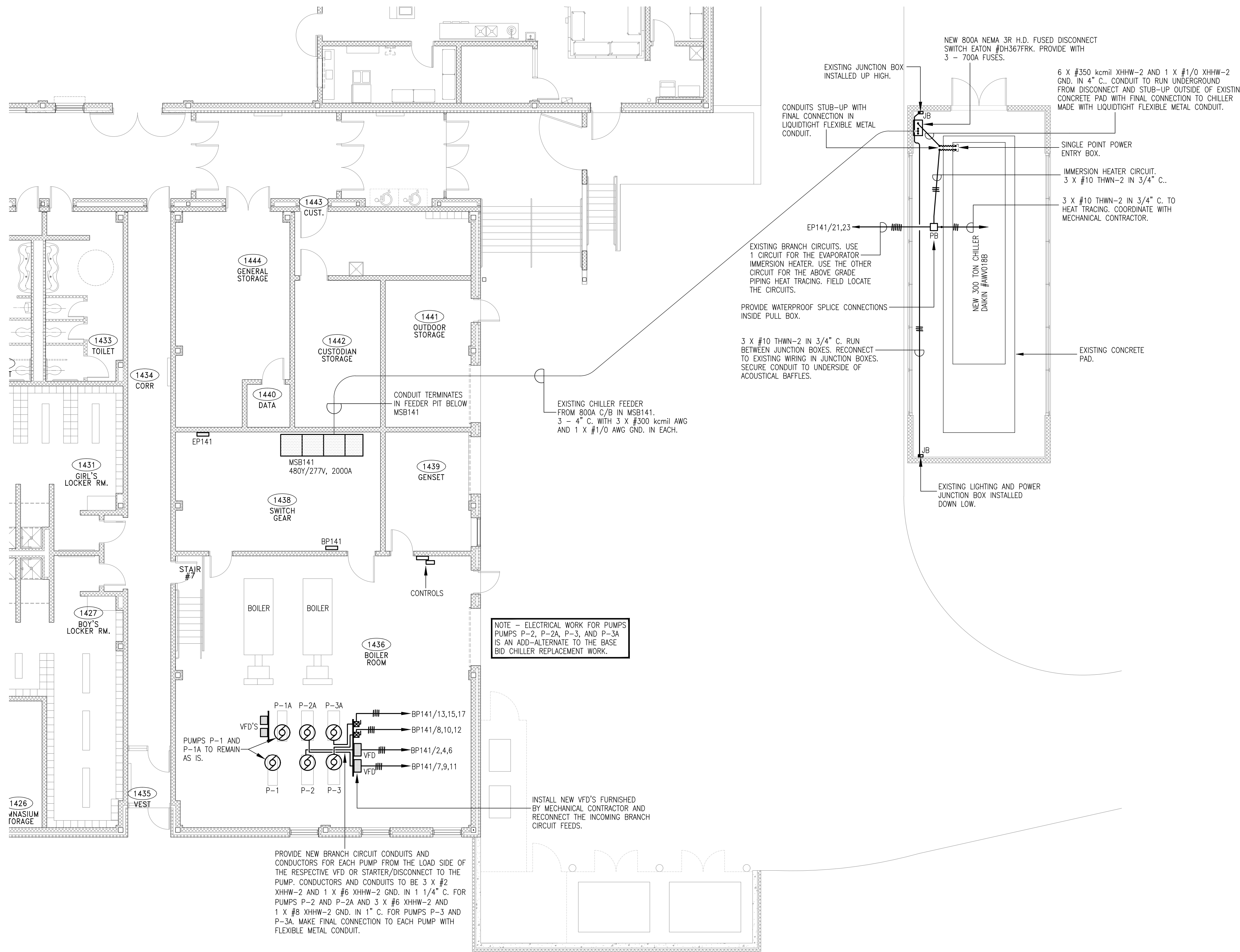
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TITLE
ELECTRICAL DEMOLITION PLAN

DATE 11/10/2023

DWG. NO.
ED1.1



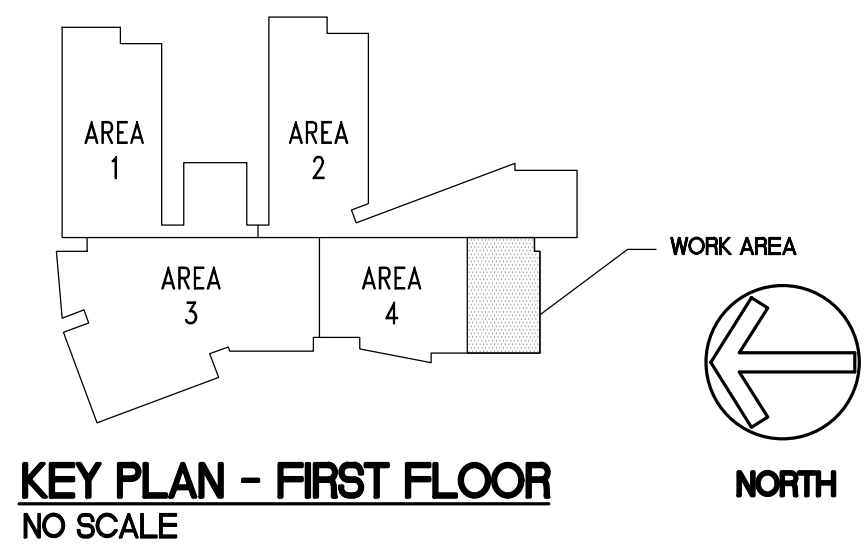
PART FIRST FLOOR PLAN
SCALE: 1/8"=1'-0"

- ELECTRICAL SPECIFICATION NOTES**
- THE PROJECT SCOPE OF WORK INCLUDES BUT IS NOT LIMITED TO THE FOLLOWING:
 - DEMOLITION
 - BRANCH CIRCUIT WIRING IN CONDUIT.
 - PULL BOX.
 - DISCONNECT SWITCH.
 - EQUIPMENT CONNECTIONS.
 - THE CONTRACTOR SHALL VERIFY AND OBTAIN ALL NECESSARY DIMENSIONS AT THE BUILDING AND SITE.
 - FINISHED WORK: THE INTENT OF THE SPECIFICATIONS AND DRAWINGS IS TO CALL FOR FINISHED WORK, COMPLETED, TESTED AND READY FOR OPERATION.
 - GOOD PRACTICE: IT IS NOT INTENDED THAT THE DRAWINGS SHOW EVERY CONDUIT, JUNCTION BOX, FITTING OR MINOR DETAIL AND IT IS UNDERSTOOD THAT WHILE THE DRAWINGS MUST BE FOLLOWED AS CLOSELY AS CIRCUMSTANCES WILL PERMIT, THE SYSTEMS SHALL BE INSTALLED ACCORDING TO THE INTENT AND MEANING OF THE CONTRACT DOCUMENTS AND IN ACCORDANCE WITH GOOD PRACTICE.
 - CODES AND STANDARDS - COMPLY WITH ALL FEDERAL, STATE AND LOCAL CODES AND STANDARDS WHEREVER APPLICABLE INCLUDING THE FOLLOWING: 2022 CONNECTICUT STATE BUILDING CODE, 2021 INTERNATIONAL BUILDING CODE, 2022 CONNECTICUT FIRE SAFETY CODE, 2021 INTERNATIONAL FIRE CODE, 2020 NFPA 70 NATIONAL ELECTRICAL CODE, ICC/ANSI A117.1-2017 ACCESSIBLE AND USABLE BUILDINGS AND FACILITIES, ADA, NFPA, UNDERWRITERS LABORATORIES, FACTORY MUTUAL INSURANCE COMPANY, NEMA STANDARDS.
 - NOTE THAT THE DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE GENERAL ARRANGEMENT OF THE ELECTRICAL EQUIPMENT AND SYSTEMS, WITHOUT SHOWING EVERY DETAIL AND FITTING.
 - RACEWAYS:
 - PROVIDE EMT CONDUIT FOR ALL WORK INSIDE THE BUILDING. CONNECTORS, COUPLINGS, AND FITTINGS SHALL BE GALVANIZED STEEL SET-SCREW TYPE. FLEXIBLE STEEL CONDUIT SHALL BE USED IN SHORT LENGTHS FOR FINAL EQUIPMENT CONNECTIONS. PROVIDE ZINC PLATED MALLEABLE IRON SQUEEZE TYPE CONNECTORS, COUPLINGS, AND FITTINGS FOR FLEXIBLE STEEL CONDUIT.
 - PROVIDE RIGID PVC CONDUIT FOR ALL WORK OUTSIDE THE BUILDING FOOTPRINT. PVC CONDUIT SHALL BE HEAVY WALL SCHEDULE 40 PVC FOR UNDERGROUND WORK AND EXTRA HEAVY WALL SCHEDULE 80 PVC FOR UNDERGROUND WORK BELOW VEHICULAR TRAFFIC AREAS. JOINTS AND FITTINGS SHALL BE SOLVENT WELDED ALL TO ASTM STANDARDS FOR UNDERGROUND INSTALLATION AND IN ACCORDANCE WITH ARTICLE 352 OF THE NATIONAL ELECTRIC CODE.
 - PROVIDED RIGID STEEL CONDUIT FOR UNDERGROUND HORIZONTAL AND VERTICAL SWEEPS AND BENDS IN CONDUIT RUNS OUTSIDE THE BUILDING FOOTPRINT. RIGID STEEL CONDUIT CONNECTORS, COUPLINGS, AND FITTINGS SHALL BE THREADED AND GALVANIZED.
 - THE MINIMUM CONDUIT BURIAL DEPTH SHALL BE 24".
 - CONDUCTORS SHALL BE COPPER, RATED 600 VOLTS, 90 DEG. C., COLOR CODED, TYPE THWN-2 FOR SIZES #10 AWG AND SMALLER AND TYPE XHHW-2 FOR SIZES #8 AWG AND LARGER.
 - WIRE SIZE #8 AWG AND LARGER SHALL BE STRANDED. WIRE OF SIZE SMALLER THAN #8 AWG SHALL BE SOLID.
 - MINIMUM SIZE CONDUCTOR SHALL BE #12 AWG. MINIMUM CONDUIT SIZE SHALL BE 3/4" DIAMETER.
 - INTERIOR RACEWAYS AND CABLE SHALL BE RUN PARALLEL TO OR AT RIGHT ANGLES TO WALL LINES.
 - INTERIOR RACEWAYS AND CABLE SHALL BE SUPPORTED FROM THE STRUCTURE BY STRAP HANGERS, ROD HANGERS, OR RACK MOUNTED, OR OTHER APPROVED ELECTRICAL MOUNTING.

NOTE - ELECTRICAL WORK FOR PUMPS P-2, P-2A, P-3, AND P-3A IS AN ADD-ALTERNATE TO THE BASE BID CHILLER REPLACEMENT WORK.

PROVIDE NEW BRANCH CIRCUIT CONDUITS AND CONDUCTORS FOR EACH PUMP FROM THE LOAD SIDE OF THE RESPECTIVE VFD OR STARTER/DISCONNECT TO THE PUMP. CONDUCTORS AND CONDUITS TO BE 3 X #2 XHHW-2 AND 1 X #6 XHHW-2 GND. IN 1 1/4" C. FOR PUMPS P-2 AND P-2A AND 3 X #6 XHHW-2 AND 1 X #8 XHHW-2 GND. IN 1" C. FOR PUMPS P-3 AND P-3A. MAKE FINAL CONNECTION TO EACH PUMP WITH FLEXIBLE METAL CONDUIT.

INSTALL NEW VFD'S FURNISHED BY MECHANICAL CONTRACTOR AND RECONNECT THE INCOMING BRANCH CIRCUIT FEEDS.



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TITLE
ELECTRICAL
NEW WORK PLAN

DATE 11/10/2023

DWG. NO.
E1.1



Opportunity * Guidance * Support



THIS IS A PUBLIC WORKS PROJECT

Covered by the

PREVAILING WAGE LAW

CT General Statutes Section 31-53

If you have QUESTIONS regarding your wages
CALL (860) 263-6790

Section 31-55 of the CT State Statutes requires every contractor or subcontractor performing work for the state to post in a prominent place the prevailing wages as determined by the Labor Commissioner.

Sec. 31-53b. Construction safety and health course. New miner training program. Proof of completion required for mechanics, laborers and workers on public works projects. Enforcement. Regulations. Exceptions. (a) Each contract for a public works project entered into on or after July 1, 2009, by the state or any of its agents, or by any political subdivision of the state or any of its agents, described in subsection (g) of section 31-53, shall contain a provision requiring that each contractor furnish proof with the weekly certified payroll form for the first week each employee begins work on such project that any person performing the work of a mechanic, laborer or worker pursuant to the classifications of labor under section 31-53 on such public works project, pursuant to such contract, has 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, has completed a new miner training program approved by the Federal Mine Safety and Health Administration in accordance with 30 CFR 48 or, in the case of telecommunications employees, has completed at least ten hours of training in accordance with 29 CFR 1910.268.

(b) Any person required to complete a course or program under subsection (a) of this section who has not completed the course or program shall be subject to removal from the worksite if the person does not provide documentation of having completed such course or program by the fifteenth day after the date the person is found to be in noncompliance. The Labor Commissioner or said commissioner's designee shall enforce this section.

(c) Not later than January 1, 2009, the Labor Commissioner shall adopt regulations, in accordance with the provisions of chapter 54, to implement the provisions of subsections (a) and (b) of this section. Such regulations shall require that the ten-hour construction safety and health courses required under subsection (a) of this section be conducted in accordance with federal Occupational Safety and Health Administration Training Institute standards, or in accordance with Federal Mine Safety and Health Administration Standards or in accordance with 29 CFR 1910.268, as appropriate. The Labor Commissioner shall accept as sufficient proof of compliance with the provisions of subsection (a) or (b) of this section a student course completion card issued by the federal Occupational Safety and Health Administration Training Institute, or such other proof of compliance said commissioner deems appropriate, dated no earlier than five years before the commencement date of such public works project.

(d) This section shall not apply to employees of public service companies, as defined in section 16-1, or drivers of commercial motor vehicles driving the vehicle on the public works project and delivering or picking up cargo from public works projects provided they perform no labor relating to the project other than the loading and unloading of their cargo.

(P.A. 06-175, S. 1; P.A. 08-83, S. 1.)

History: P.A. 08-83 amended Subsec. (a) by making provisions applicable to public works project contracts entered into on or after July 1, 2009, replacing provision re total cost of work with reference to Sec. 31-53(g), requiring proof in certified payroll form that new mechanic, laborer or worker has completed a 10-hour or more construction safety course and adding provision re new miner training program, amended Subsec. (b) by substituting "person" for "employee" and adding "or program", amended Subsec. (c) by adding "or in accordance with Federal Mine Safety and Health Administration Standards" and setting new deadline of January 1, 2009, deleted former Subsec. (d) re "public building", added new Subsec. (d) re exemptions for public service company employees and delivery drivers who perform no labor other than delivery and made conforming and technical changes, effective January 1, 2009.

The Prevailing wage rates applicable to this project are subject to annual adjustments each July 1st for the duration of the project.

Each contractor shall pay the annual adjusted prevailing wage rate that is in effect each July 1st, as posted by the Department of Labor.

It is the contractor's responsibility to obtain the annual adjusted prevailing wage rate increases directly from the Department of Labor's website.

The annual adjustments will be posted on the Department of Labor's Web page: www.ct.gov/dol. For those without internet access, please contact the division listed below.

The Department of Labor will continue to issue the initial prevailing wage rate schedule to the Contracting Agency for the project.

All subsequent annual adjustments will be posted on our Web Site for contractor access.

Contracting Agencies are under no obligation pursuant to State labor law to pay any increase due to the annual adjustment provision.

Effective October 1, 2005 - Public Act 05-50: any person performing the work of any mechanic, laborer, or worker shall be paid prevailing wage

All Person who perform work ON SITE must be paid prevailing wage for the appropriate mechanic, laborer, or worker classification.

All certified payrolls must list the hours worked and wages paid to All Persons who perform work ON SITE regardless of their ownership i.e.: (Owners, Corporate Officers, LLC Members, Independent Contractors, et. al)

Reporting and payment of wages is required regardless of any contractual relationship alleged to exist between the contractor and such person.

~~Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clause (29 CFR 5.5 (a) (1) (ii)).

Please direct any questions which you may have pertaining to classification of work and payment of prevailing wages to the Wage and Workplace Standards Division, telephone (860)263-6790.

As of: April 19, 2023

As of: April 19, 2023

Informational Bulletin

THE 10-HOUR OSHA CONSTRUCTION SAFETY AND HEALTH COURSE

(applicable to public building contracts entered into *on or after July 1, 2007*, where the total cost of all work to be performed is at least \$100,000)

- (1) This requirement was created by Public Act No. 06-175, which is codified in Section 31-53b of the Connecticut General Statutes (pertaining to the prevailing wage statutes);
- (2) The course is required for public building construction contracts (projects funded in whole or in part by the state or any political subdivision of the state) entered into on or after July 1, 2007;
- (3) It is required of private employees (not state or municipal employees) and apprentices who perform manual labor for a general contractor or subcontractor on a public building project where the total cost of all work to be performed is at least \$100,000;
- (4) The ten-hour construction course pertains to the ten-hour Outreach Course conducted in accordance with federal OSHA Training Institute standards, and, for telecommunications workers, a ten-hour training course conducted in accordance with federal OSHA standard, 29 CFR 1910.268;
- (5) The internet website for the federal OSHA Training Institute is http://www.osha.gov/fso/ote/training/edcenters/fact_sheet.html;
- (6) The statutory language leaves it to the contractor and its employees to determine who pays for the cost of the ten-hour Outreach Course;
- (7) Within 30 days of receiving a contract award, a general contractor must furnish proof to the Labor Commissioner that all employees and apprentices performing manual labor on the project will have completed such a course;
- (8) Proof of completion may be demonstrated through either: (a) the presentation of a *bona fide* student course completion card issued by the federal OSHA Training Institute; *or* (2) the presentation of documentation provided to an employee by a trainer certified by the Institute pending the actual issuance of the completion card;
- (9) Any card with an issuance date more than 5 years prior to the commencement date of the construction project shall not constitute proof of compliance;

- (10) Each employer shall affix a copy of the construction safety course completion card to the certified payroll submitted to the contracting agency in accordance with Conn. Gen. Stat. § 31-53(f) on which such employee's name first appears;
- (11) Any employee found to be in non-compliance shall be subject to removal from the worksite if such employee does not provide satisfactory proof of course completion to the Labor Commissioner by the fifteenth day after the date the employee is determined to be in noncompliance;
- (12) Any such employee who is determined to be in noncompliance may continue to work on a public building construction project for a maximum of fourteen consecutive calendar days while bringing his or her status into compliance;
- (13) The Labor Commissioner may make complaint to the prosecuting authorities regarding any employer or agent of the employer, or officer or agent of the corporation who files a false certified payroll with respect to the status of an employee who is performing manual labor on a public building construction project;
- (14) The statute provides the minimum standards required for the completion of a safety course by manual laborers on public construction contracts; any contractor can exceed these minimum requirements; and
- (15) Regulations clarifying the statute are currently in the regulatory process, and shall be posted on the CTDOL website as soon as they are adopted in final form.
- (16) Any questions regarding this statute may be directed to the Wage and Workplace Standards Division of the Connecticut Labor Department via the internet website of <http://www.ctdol.state.ct.us/wgwkstnd/wgemenu.htm>; or by telephone at (860)263-6790.

THE ABOVE INFORMATION IS PROVIDED EXCLUSIVELY AS AN EDUCATIONAL RESOURCE, AND IS NOT INTENDED AS A SUBSTITUTE FOR LEGAL INTERPRETATIONS WHICH MAY ULTIMATELY ARISE CONCERNING THE CONSTRUCTION OF THE STATUTE OR THE REGULATIONS.

November 29, 2006

Notice
To All Mason Contractors and Interested Parties
Regarding Construction Pursuant to Section 31-53 of the
Connecticut General Statutes (Prevailing Wage)

The Connecticut Labor Department Wage and Workplace Standards Division is empowered to enforce the prevailing wage rates on projects covered by the above referenced statute.

Over the past few years the Division has withheld enforcement of the rate in effect for workers who operate a forklift on a prevailing wage rate project due to a potential jurisdictional dispute.

The rate listed in the schedules and in our Occupational Bulletin (see enclosed) has been as follows:

Forklift Operator:

- **Laborers (Group 4) Mason Tenders** - operates forklift solely to assist a mason to a maximum height of nine feet only.
- **Power Equipment Operator (Group 9)** - operates forklift to assist any trade and to assist a mason to a height over nine feet.

The U.S. Labor Department conducted a survey of rates in Connecticut but it has not been published and the rate in effect remains as outlined in the above Occupational Bulletin.

Since this is a classification matter and not one of jurisdiction, effective January 1, 2007 the Connecticut Labor Department will enforce the rate on each schedule in accordance with our statutory authority.

Your cooperation in filing appropriate and accurate certified payrolls is appreciated.

STATUTE 31-55a

- SPECIAL NOTICE -

To: All State and Political Subdivisions, Their Agents, and Contractors

Connecticut General Statute 31-55a - Annual adjustments to wage rates by contractors doing state work.

Each contractor that is awarded a contract on or after October 1, 2002, for (1) the construction of a state highway or bridge that falls under the provisions of section 31-54 of the general statutes, or (2) the construction, remodeling, refinishing, refurbishing, rehabilitation, alteration or repair of any public works project that falls under the provisions of section 31-53 of the general statutes shall contact the Labor Commissioner on or before July first of each year, for the duration of such contract, to ascertain the prevailing rate of wages on an hourly basis and the amount of payment or contributions paid or payable on behalf of each mechanic, laborer or worker employed upon the work contracted to be done, and shall make any necessary adjustments to such prevailing rate of wages and such payment or contributions paid or payable on behalf of each such employee, effective each July first.

- The prevailing wage rates applicable to any contract or subcontract awarded on or after October 1, 2002 are subject to annual adjustments each July 1st for the duration of any project which was originally advertised for bids on or after October 1, 2002.
- Each contractor affected by the above requirement shall pay the annual adjusted prevailing wage rate that is in effect each July 1st, as posted by the Department of Labor.
- It is the **contractor's** responsibility to obtain the annual adjusted prevailing wage rate increases directly from the Department of Labor's Web Site. The annual adjustments will be posted on the Department of Labor Web page: www.ctdol.state.ct.us. For those without internet access, please contact the division listed below.
- The Department of Labor will continue to issue the initial prevailing wage rate schedule to the Contracting Agency for the project. All subsequent annual adjustments will be posted on our Web Site for contractor access.

Any questions should be directed to the Contract Compliance Unit, Wage and Workplace Standards Division, Connecticut Department of Labor, 200 Folly Brook Blvd., Wethersfield, CT 06109 at (860)263-6790.

NOTICE

TO ALL CONTRACTING AGENCIES

Please be advised that Connecticut General Statutes Section 31-53, requires the contracting agency to certify to the Department of Labor, the total dollar amount of work to be done in connection with such public works project, regardless of whether such project consists of one or more contracts.

Please find the attached “Contracting Agency Certification Form” to be completed and returned to the Department of Labor, Wage and Workplace Standards Division, Public Contract Compliance Unit.

Inquiries can be directed to 860.263.6790.



CONNECTICUT DEPARTMENT OF LABOR
WAGE AND WORKPLACE STANDARDS DIVISION

Contracting Agency Certification Form

I, _____, acting in my official capacity as _____,
Authorized Representative Title
for _____, located at _____,
Contracting Agency Address

do hereby certify that the total dollar amount of work to be done in connection with

_____, located at _____,
Project name and number Address

shall be \$ _____, which includes all work, regardless of whether such project
contains of one or more contracts.

Contractor Information

Name: _____

Address: _____

Authorized Representative: _____

Approximate Starting Date: _____

Approximate Completion Date: _____

Signature

Date

Return to:

Connecticut Department of Labor
Wage & Workplace Standards Division
200 Folly Brook Blvd.
Wethersfield, CT 06109

Rate Schedule Issued (Date): _____

CONNECTICUT DEPARTMENT OF LABOR
WAGE AND WORKPLACE STANDARDS DIVISION

CONTRACTORS WAGE CERTIFICATION FORM
Construction Manager at Risk/General Contractor/Prime Contractor

I, _____ of _____
Officer, Owner, Authorized Rep. Company Name

do hereby certify that the _____
Company Name

Street

City

and all of its subcontractors will pay all workers on the

Project Name and Number

Street and City

the wages as listed in the schedule of prevailing rates required for such project (a copy of which is attached hereto).

Signed

Subscribed and sworn to before me this _____ day of _____, _____.

Notary Public

Return to:
Connecticut Department of Labor
Wage & Workplace Standards Division
200 Folly Brook Blvd.
Wethersfield, CT 06109

Rate Schedule Issued (Date): _____

***FRINGE BENEFITS EXPLANATION (P):**

Bona fide benefits paid to approved plans, funds or programs, except those required by Federal or State Law (unemployment tax, worker’s compensation, income taxes, etc.).

Please specify the type of benefits provided:

- 1) Medical or hospital care _____ 4) Disability _____
- 2) Pension or retirement _____ 5) Vacation, holiday _____
- 3) Life Insurance _____ 6) Other (please specify) _____

CERTIFIED STATEMENT OF COMPLIANCE

For the week ending date of _____,

I, _____ of _____, (hereafter known as

Employer) in my capacity as _____ (title) do hereby certify and state:

Section A:

1. All persons employed on said project have been paid the full weekly wages earned by them during the week in accordance with Connecticut General Statutes, section 31-53, as amended. Further, I hereby certify and state the following:

- a) The records submitted are true and accurate;
- b) The rate of wages paid to each mechanic, laborer or workman and the amount of payment or contributions paid or payable on behalf of each such person to any employee welfare fund, as defined in Connecticut General Statutes, section 31-53 (h), are not less than the prevailing rate of wages and the amount of payment or contributions paid or payable on behalf of each such person to any employee welfare fund, as determined by the Labor Commissioner pursuant to subsection Connecticut General Statutes, section 31-53 (d), and said wages and benefits are not less than those which may also be required by contract;
- c) The Employer has complied with all of the provisions in Connecticut General Statutes, section 31-53 (and Section 31-54 if applicable for state highway construction);
- d) Each such person is covered by a worker’s compensation insurance policy for the duration of his employment which proof of coverage has been provided to the contracting agency;
- e) The Employer does not receive kickbacks, which means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided directly or indirectly, to any prime contractor, prime contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable treatment in connection with a prime contract or in connection with a prime contractor in connection with a subcontractor relating to a prime contractor; and
- f) The Employer is aware that filing a certified payroll which he knows to be false is a class D felony for which the employer may be fined up to five thousand dollars, imprisoned for up to five years or both.

2. OSHA~The employer shall affix a copy of the construction safety course, program or training completion document to the certified payroll required to be submitted to the contracting agency for this project on which such persons name first appears.

(Signature)

(Title)

Submitted on (Date)

[New] In accordance with Section 31-53b(a) of the C.G.S. each contractor shall provide a copy of the OSHA 10 Hour Construction Safety and Health Card for each employee, to be attached to the first certified payroll on the project.

PAYROLL CERTIFICATION FOR PUBLIC WORKS PROJECTS											Connecticut Department of Labor Wage and Workplace Standard, Division 200 Folly Brook Blvd. Wethersfield, CT 06109										
In accordance with Connecticut General Statute, 31-53 Certified Payroll, with a statement of compliance shall be submitted monthly to the contracting agency.											WEEKLY PAYROLL										
CONTRACTOR NAME AND ADDRESS: Landon Corporation, 15 Connecticut Avenue, Northford, CT 06472						SUBCONTRACTOR NAME & ADDRESS XYZ Corporation 2 Main Street Yanlic, CT 06389					WORKER'S COMPENSATION INSURANCE CARRIER Traveler, Insurance Company POLICY# #BAC8888928 EFFECTIVE DATE: 11/1/09 EXPIRATION DATE: 12/31/09										
PAYROLL NUMBER	Week-Ending Date	PROJECT NAME & ADDRESS	DAY AND DATE							Tot. Hours	BASE HOURLY RATE	TYPE OF FRINGE BENEFITS	GROSS PAY FOR ALL WORK PERFORMED THIS WEEK	TOTAL DEDUCTIONS				GROSS PAY FOR THIS PREVAILING RATE JOB	CHECK# AND NET PAY		
			S	M	T	W	TH	F	S					FICA	FEDERAL WITH-HOLDING	STATE WITH-HOLDING	LIST OTHER				
PERSON/WORKER, ADDRESS and SECTION	APPROXIMATE RATE	MALE/FEMALE AND RACE	WORK CLASSIFICATION	HOURS WORKED EACH DAY							Total Off Hour	TOTAL FRINGE BENEFIT PLAN CASH	Per Hour 1 through 6 (see back)								
1	9126/09	DOT 105-296, Route 82	Electrical Lineman E-1 1234567 Owner OSHA 12:1456		8	8	8	8	8	8		S-TIME 40	\$ 30.75 Base Rate	1. \$ 5.60 2. \$ 3. \$ 4. \$ 5. \$ 6. \$	\$1,582.80				P-xxx	\$1,582.80	#123 \$ xxx.xx
	65%	MIB	Electrical Apprentice OSHA2:14567		8	8	8	8	8			S-TIME 40	\$ 19.99 Base Rate	1. \$ 2. \$ 3. \$ 4. \$ 5. \$ 6. \$	\$1,464.80	xx.xx	00(x.xx)	xx.xx	G-xxx	\$1,464.80	#124 \$xxx.xx
		M/H	Project Manager			8						S-TIME 6	\$ Base Rate	1. \$ 2. \$ 3. \$ 4. \$ 5. \$ 6. \$	\$1,500.00	xx.xx	xx.xx	xx.xx	M-xxx		#125 100(xx)
												S-TIME	\$ Base Rate	1. \$ 2. \$ 3. \$ 4. \$ 5. \$ 6. \$							
												0-TIME	\$ Cash Fringe	4. \$ 5. \$ 6. \$							

OSHA 10 -A TI ACH CARD TO 1ST CERTIFIED PAYROLL

***FRINGE BENEFITS EXPLANATION (P):**

Bona fide benefits paid to approved plans, funds or programs, except those required by Federal or State Law (unemployment tax, worker's compensation, income taxes, etc.).

Please specify the type of benefits provided:

- 1) Medical or hospital care _____ Disability _____
- 2) Pension or retirement _____ 5) Vacation, holiday _____
- 3) Life Insurance Utopia 6) Other (please specify) _____

CERTIFIED STATEMENT OF COMPLIANCE

For the week ending date of 9_1_26 / 0_9 _____

I, Robert Craft of XYZ Corporation (hereafter known as

Employer) in my capacity as ow_ne_r _____ (title) do hereby certify and state:

Section A:

I. All persons employed on said project have been paid the full weekly wages earned by them during the week in accordance with Connecticut General Statutes, section 31-53, as amended. Further, I hereby certify and state the following:

- a) The records submitted are true and accurate;
- b) The rate of wages paid to each mechanic, laborer or workman and the amount of payment or contributions paid or payable on behalf of each such employee to any employee welfare fund, as defined in Connecticut General Statutes, section 31-53 (h), are not less than the prevailing rate of wages and the amount of payment or contributions paid or payable on behalf of each such employee to any employee welfare fund, as determined by the Labor Commissioner pursuant to subsection Connecticut General Statutes, section 31-53 (d), and said wages and benefits are not less than those which may also be required by contract;
- c) The Employer has complied with all of the provisions in Connecticut General Statutes, section 31-53 (and Section 31-54 if applicable for state highway construction);
- d) Each such employee of the Employer is covered by a worker's compensation insurance policy for the duration of his employment which proof of coverage has been provided to the contracting agency;
- e) The Employer does not receive kickbacks, which means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided directly or indirectly, to any prime contractor, prime contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable treatment in connection with a prime contract or in connection with a prime contractor in connection with a subcontractor relating to a prime contractor; and
- f) The Employer is aware that filing a certified payroll which he knows to be false is a class D felony for which the employer may be fined up to five thousand dollars, imprisoned for up to five years or both.

2. OSHA-The employer shall affix a copy of the construction safety course, program or training completion document to the certified payroll required to be submitted to the contracting agency for this project on which such employee's name first appears.

_____ Y _____ O _____ 10/2/09
 _____ (T=W-i-le-) --- Submitted on (Date)

Section B: Applies to CONNDOT Projects ONLY

That pursuant to CONNDOT contract requirements for reporting purposes only, all employees listed under Section B who performed work on this project are not covered under the prevailing

W tsYonne :::e:I Statutes Section 31-53. (1) B.Og

(Signature)

(Title)

SubmhtecYon (Date)

Note: CTDOL will assume all hours worked were performed under Section A unless clearly delineated as Section B WWS-CP! as such. Should an employee perform work under both Section A and Section B, the hours worked and wages paid must be segregated for reporting purposes.

*****THIS IS A PUBLIC DOCUMENT***
 *****DO NOT INCLUDE SOCIAL SECURITY NUMBERS*****

Information Bulletin

Occupational Classifications

The Connecticut Department of Labor has the responsibility to properly determine "job classification" on prevailing wage projects covered under C.G.S. Section 31-53(d).

Note: This information is intended to provide a sample of some occupational classifications for guidance purposes only. It is not an all-inclusive list of each occupation's duties. This list is being provided only to highlight some areas where a contractor may be unclear regarding the proper classification. If unsure, the employer should seek guidelines for CTDOL.

Below are additional clarifications of specific job duties performed for certain classifications:

- **ASBESTOS WORKERS**

Applies all insulating materials, protective coverings, coatings and finishes to all types of mechanical systems.

- **ASBESTOS INSULATOR**

Handle, install apply, fabricate, distribute, prepare, alter, repair, dismantle, heat and frost insulation, including penetration and fire stopping work on all penetration fire stop systems.

- **BOILERMAKERS**

Erects hydro plants, incomplete vessels, steel stacks, storage tanks for water, fuel, etc. Builds incomplete boilers, repairs heat exchanges and steam generators.

- **BRICKLAYERS, CEMENT MASONS, CEMENT FINISHERS, MARBLE MASONS, PLASTERERS, STONE MASONS, PLASTERERS. STONE MASONS, TERRAZZO WORKERS, TILE SETTERS**

Lays building materials such as brick, structural tile and concrete cinder, glass, gypsum, terra cotta block. Cuts, tools and sets marble, sets stone, finishes concrete, applies decorative steel, aluminum and plastic tile, applies cements, sand, pigment and marble chips to floors, stairways, etc.

- **CARPENTERS, MILLWRIGHTS. PILEDRIVERMEN. LATHERS. RESILEINT FLOOR LAYERS, DOCK BUILDERS, DIKERS, DIVER TENDERS**

Constructs, erects, installs and repairs structures and fixtures of wood, plywood and wallboard. Installs, assembles, dismantles, moves industrial machinery. Drives piling into ground to provide foundations for structures such as buildings and bridges, retaining walls for earth embankments, such as cofferdams. Fastens wooden, metal or rockboard lath to walls, ceilings and partitions of buildings, acoustical tile layer, concrete form builder. Applies firestopping materials on fire resistive joint systems only. Installation of curtain/window walls only where attached to wood or metal studs. Installation of insulated material of all types whether blown, nailed or attached in other ways to walls, ceilings and floors of buildings. Assembly and installation of modular furniture/furniture systems. Free-standing furniture is not covered. This includes free standing: student chairs, study top desks, book box desks, computer furniture, dictionary stand, atlas stand, wood shelving, two-position information access station, file cabinets, storage cabinets, tables, etc.

- **LABORER, CLEANING**

- The clean up of any construction debris and the general (heavy/light) cleaning, including sweeping, wash down, mopping, wiping of the construction facility and its furniture, washing, polishing, and dusting.

- **DELIVERY PERSONNEL**

- If delivery of supplies/building materials is to one common point and stockpiled there, prevailing wages are not required. If the delivery personnel are involved in the distribution of the material to multiple locations within the construction site then they would have to be paid prevailing wages for the type of work performed: laborer, equipment operator, electrician, ironworker, plumber, etc.

- An example of this would be where delivery of drywall is made to a building and the delivery personnel distribute the drywall from one "stockpile" location to further sub-locations on each floor. Distribution of material around a construction site is the job of a laborer or tradesman, and not a delivery personnel.

- **ELECTRICIANS**

Install, erect, maintenance, alteration or repair of any wire, cable, conduit, etc., which generates, transforms, transmits or uses electrical energy for light, heat, power or other purposes, including the Installation or maintenance of telecommunication, LAN wiring or computer equipment, and low voltage wiring. ****License required per Connecticut General Statutes: E-1,2 L-5,6 C-5,6 T-1,2 L-1,2 V-1,2,7,8,9.***

- **ELEVATOR CONSTRUCTORS**

Install, erect, maintenance and repair of all types of elevators, escalators, dumb waiters and moving walks. **License required by Connecticut General Statutes: R-1,2,5,6.*

- **FORK LIFT OPERATOR**

Laborers Group 4) Mason Tenders - operates forklift solely to assist a mason to a maximum height of nine (9) feet only.

Power Equipment Operator Group 9 - operates forklift to assist any trade, and to assist a mason to a height over nine (9) feet.

- **GLAZIERS**

Glazing wood and metal sash, doors, partitions, and 2 story aluminum storefronts. Installs glass windows, skylights, store fronts and display cases or surfaces such as building fronts, interior walls, ceilings and table tops and metal store fronts. Installation of aluminum window walls and curtain walls is the "joint" work of glaziers and ironworkers, which require equal composite workforce.

- **IRONWORKERS**

Erection, installation and placement of structural steel, precast concrete, miscellaneous iron, ornamental iron, metal curtain wall, rigging and reinforcing steel. Handling, sorting, and installation of reinforcing steel (rebar). Metal bridge rail (traffic), metal bridge handrail, and decorative security fence installation. Installation of aluminum window walls and curtain walls is the "joint" work of glaziers and ironworkers which require equal composite workforce.

- **INSULATOR**

- Installing fire stopping systems/materials for "Penetration Firestop Systems": transit to cables, electrical conduits, insulated pipes, sprinkler pipe penetrations, ductwork behind radiation, electrical cable trays, fire rated pipe penetrations, natural polypropylene, HVAC ducts, plumbing bare metal, telephone and communication wires, and boiler room ceilings.

- **LABORERS**

Acetylene burners, asphalt rakers, chain saw operators, concrete and power buggy operator, concrete saw operator, fence and guard rail erector (except metal bridge rail (traffic), decorative security fence (non-metal)).

installation.), hand operated concrete vibrator operator, mason tenders, pipelayers (installation of storm drainage or sewage lines on the street only), pneumatic drill operator, pneumatic gas and electric drill operator, powermen and wagon drill operator, air track operator, block paver, curb setters, blasters, concrete spreaders.

- **PAINTERS**

Maintenance, preparation, cleaning, blasting (water and sand, etc.), painting or application of any protective coatings of every description on all bridges and appurtenances of highways, roadways, and railroads. Painting, decorating, hardwood finishing, paper hanging, sign writing, scenic art work and drywall hhg for any and all types of building and residential work.

- **LEAD PAINT REMOVAL**

- Painter's Rate

1. Removal of lead paint from bridges.
2. Removal of lead paint as preparation of any surface to be repainted.
3. Where removal is on a Demolition project prior to reconstruction.

- Laborer's Rate

1. Removal of lead paint from any surface NOT to be repainted.
2. Where removal is on a *TOTAL* Demolition project only.

- **PLUMBERS AND PIPEFITTERS**

Installation, repair, replacement, alteration or maintenance of all plumbing, heating, cooling and piping. **License required per Connecticut General Statutes: P-1,2,6,7,8,9 J-1,2,3,4 SP-1,2 S-1,2,3,4,5,6,7,8 B-1,2,3,4 D-1,2,3,4.*

- **POWER EQUIPMENT OPERATORS**

Operates several types of power construction equipment such as compressors, pumps, hoists, derricks, cranes, shovels, tractors, scrapers or motor graders, etc. Repairs and maintains equipment. **License required, crane operators only, per Connecticut General Statutes.*

- **ROOFERS**

Covers roofs with composition shingles or sheets, wood shingles, slate or asphalt and gravel to waterproof roofs, including preparation of surface. (demolition or removal of any type of roofing and or clean-up of any and all areas where a roof is to be relaid.)

- **SHEETMETAL WORKERS**

Fabricate, assembles, installs and repairs sheetmetal products and equipment in such areas as ventilation, air-conditioning, warm air heating, restaurant equipment, architectural sheet metal work, sheetmetal roofing, and aluminum gutters. Fabrication, handling, assembling, erecting, altering, repairing, etc. of coated metal material panels and composite metal material panels when used on building exteriors and interiors as soffits, fascia, louvers, partitions, canopies, cornice, column covers, awnings, beam covers, cladding, sun shades, lighting troughs, spires, ornamental roofing, metal ceilings, mansards, copings, ornamental and ventilation hoods, vertical and horizontal siding panels, trim, etc. The sheet metal classification also applies to the vast variety of coated metal material panels and composite metal material panels that have evolved over the years as an alternative to conventional ferrous and non-ferrous metals like steel, iron, tin, copper, brass, bronze, aluminum, etc. Fabrication, handling, assembling, erecting, altering, repairing, etc. of architectural metal roof, standing seam roof, composite metal roof, metal and composite bathroom/toilet partitions, aluminum gutters, metal and composite lockers and shelving, kitchen equipment, and walk-in coolers. To include testing and air –balancing ancillary to installation and construction.

- **SPRINKLER FITTERS**

Installation, alteration, maintenance and repair of fire protection sprinkler systems.

****License required per Connecticut General Statutes: F-1,2,3,4.***

- **TILE MARBLE AND TERRAZZO FINISHERS**

Assists and tends the tile setter, marble mason and terrazzo worker in the performance of their duties.

- **TRUCK DRIVERS**

~How to pay truck drivers delivering asphalt is under REVISION~

Truck Drivers are requires to be paid prevailing wage for time spent "working" directly on the site. These drivers remain covered by the prevailing wage for any time spent transporting between the actual construction location and facilities (such as fabrication, plants, mobile factories, batch plant, borrow pits, job headquarters, tool yards, etc.) dedicated exclusively, or nearly so, to performance of the contract or project, which are so located in proximity to the actual construction location that it is reasonable to include them. ****License required, drivers only, per Connecticut General Statutes.***

For example:

- Material men and deliverymen are not covered under prevailing wage as long as they are not directly involved in the construction process. If, they unload the material, they would then be covered by prevailing wage for the classification they are performing work in: laborer, equipment operator, etc.
- Hauling material off site is not covered provided they are not dumping it at a location outlined above.
- Driving a truck on site and moving equipment or materials on site would be considered covered work, as this is part of the construction process.

➤ *Any questions regarding the proper classification should be directed to:*
Public Contract Compliance Unit
Wage and Workplace Standards Division
Connecticut Department of Labor
200 Folly Brook Blvd, Wethersfield, CT 06109
(860) 263-6790.

**Connecticut Department of Labor
Wage and Workplace Standards Division
FOOTNOTES**

⇒ Please Note: If the “Benefits” listed on the schedule for the following occupations includes a letter(s) (+ a or + a+b for instance), refer to the information below.

Benefits to be paid at the appropriate prevailing wage rate for the listed occupation.

If the “Benefits” section for the occupation lists only a dollar amount, disregard the information below.

**Bricklayers, Cement Masons, Cement Finishers, Concrete Finishers, Stone Masons
(Building Construction) and
(Residential- Hartford, Middlesex, New Haven, New London and Tolland Counties)**

- a. Paid Holiday: Employees shall receive 4 hours for Christmas Eve holiday provided the employee works the regularly scheduled day before and after the holiday. Employers may schedule work on Christmas Eve and employees shall receive pay for actual hours worked in addition to holiday pay.

Elevator Constructors: Mechanics

- a. Paid Holidays: New Year’s Day, Memorial Day, Independence Day, Labor Day, Veterans’ Day, Thanksgiving Day, Christmas Day, plus the Friday after Thanksgiving.
- b. Vacation: Employer contributes 8% of basic hourly rate for 5 years or more of service or 6% of basic hourly rate for 6 months to 5 years of service as vacation pay credit.

Glaziers

- a. Paid Holidays: Labor Day and Christmas Day.

Power Equipment Operators

(Heavy and Highway Construction & Building Construction)

- a. Paid Holidays: New Year’s Day, Good Friday, Memorial day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day, provided the employee works 3 days during the week in which the holiday falls, if scheduled, and if scheduled, the working day before and the working day after the holiday. Holidays falling on Saturday may be observed on Saturday, or if the employer so elects, on the preceding Friday.

Ironworkers

- a. Paid Holiday: Labor Day provided employee has been on the payroll for the 5 consecutive work days prior to Labor Day.

Laborers (Tunnel Construction)

- a. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day. No employee shall be eligible for holiday pay when he fails, without cause, to work the regular work day preceding the holiday or the regular work day following the holiday.

Roofers

- a. Paid Holidays: July 4th, Labor Day, and Christmas Day provided the employee is employed 15 days prior to the holiday.

Sprinkler Fitters

- a. Paid Holidays: Memorial Day, July 4th, Labor Day, Thanksgiving Day and Christmas Day, provided the employee has been in the employment of a contractor 20 working days prior to any such paid holiday.

Truck Drivers

(Heavy and Highway Construction & Building Construction)

- a. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Christmas day, and Good Friday, provided the employee has at least 31 calendar days of service and works the last scheduled day before and the first scheduled day after the holiday, unless excused.

Important Information:

Welders: Rate for craft to which welding is incidental.

*Note: Hazardous waste removal work receives additional \$1.25 per hour for truck drivers.

**Note: Hazardous waste premium \$3.00 per hour over classified rate

Crane with 150 ft. boom (including jib) - \$1.50 extra

Crane with 200 ft. boom (including jib) - \$2.50 extra

Crane with 250 ft. boom (including jib) - \$5.00 extra

Crane with 300 ft. boom (including jib) - \$7.00 extra

Crane with 400 ft. boom (including jib) - \$10.00 extra

All classifications that indicate a percentage of the fringe benefits must be calculated at the percentage rate times the "base hourly rate".

Apprentices duly registered under the Commissioner of Labor's regulations on "Work Training Standards for Apprenticeship and Training Programs" Section 31-51-d-1 to 12, are allowed to be paid the appropriate percentage of the prevailing journeymen hourly base and the full fringe benefit rate, providing the work site ratio shall not be less than one full-time journeyman instructing and supervising the work of each apprentice in a specific trade.

The Prevailing wage rates applicable to this project are subject to annual adjustments each July 1st for the duration of the project.

Each contractor shall pay the annual adjusted prevailing wage rate that is in effect each July 1st, as posted by the Department of Labor.

It is the contractor's responsibility to obtain the annual adjusted prevailing wage rate increases directly from the Department of Labor's website.

The annual adjustments will be posted on the Department of Labor's Web page: www.ct.gov/dol. For those without internet access, please contact the division listed below.

The Department of Labor will continue to issue the initial prevailing wage rate schedule to the Contracting Agency for the project.

All subsequent annual adjustments will be posted on our Web Site for contractor access.

Contracting Agencies are under no obligation pursuant to State labor law to pay any increase due to the annual adjustment provision.

Effective October 1, 2005 - Public Act 05-50: any person performing the work of any mechanic, laborer, or worker shall be paid prevailing wage

All Person who perform work ON SITE must be paid prevailing wage for the appropriate mechanic, laborer, or worker classification.

All certified payrolls must list the hours worked and wages paid to All Persons who perform work ON SITE regardless of their ownership i.e.: (Owners, Corporate Officers, LLC Members, Independent Contractors, et. al)

Reporting and payment of wages is required regardless of any contractual relationship alleged to exist between the contractor and such person.

~~Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clause (29 CFR 5.5 (a) (1) (ii)).

Please direct any questions which you may have pertaining to classification of work and payment of prevailing wages to the Wage and Workplace Standards Division, telephone (860)263-6790.