VILLAGE OF LARCHMONT
WESTCHESTER COUNTY, NEW YORK

VILLAGE HALL – AIR CONDITIONING SYSTEM REPLACEMENT

Bid Opening Date: 11:00 AM, June 28, 2024
Village Hall – 120 Larchmont Avenue

Pre-Bid Meeting: 9:00 AM, May 3, 2024
Village Hall – 120 Larchmont Avenue

VILLAGE OF LARCHMONT
WESTCHESTER COUNTY, NEW YORK

GENERAL INFORMATION TO BIDDERS

VA#24-001– VILLAGE HALL – AIR CONDITIONING SYSTEM REPLACEMENT

SCOPE OF WORK:

The Village of Larchmont proposes to remove the existing air conditioning systems including associated window air conditioners, PTAC units, air handlers, condensers, as well as associated ductwork and refrigerant and condensate piping as indicated in "Appendix 1. The system is to be replaced by a VRF system including indoor and outdoor units as well as ductwork and refrigerant piping. Award will be made by the Village to the lowest qualified bidder.

Add Alternate 1 proposes to remove existing thermostatic control valves and replace with solenoid valves on the existing steam radiators along with associated control wiring and thermostats as indicated in "Appendix 1". Award will be made by the Village to the lowest qualified bidder.

GENERAL REQUIREMENTS:

1. Definitions of Terms:

The words "Village" & "Owner" and "Bid" &"Proposal" are used synonymously in these specifications.

2. Proposal Compliance:

All proposals shall be submitted in a sealed envelope clearly labeled with the name of the bidder containing the identifying words "**BID DOCUMENT"** and addressed as follows:

Bid for:	**VILLAGE OF LARCHMONT VILLAGE HALL AIR CONDITIONING UPGRADES VA#24-001**
Attention:	**Mr. Justin Datino Village Administrator**
Opening:	**11:00 A.M., Friday, June 28, 2024**

Proposal and bid security shall be delivered to Mr. Justin Datino, Village Administrator, 120 Larchmont Avenue, Larchmont, New York on or before **9:00 A.M., Friday, June 28, 2024**. Proposal submitted in unmarked envelopes will not be accepted. However, time permitting the Village will accept resubmitted proposals granted they are properly labeled.

3. Proposal Form:

Each bid submitted must be written or typed on the attached "Form of Proposal." Failure to do so will cause grounds for disqualification. Proposals that are illegible or that contain any omissions, erasures, alterations, additions or items not called for in the itemized proposal, or that contain irregularities of any kind may be rejected. All blank spaces must be filled in with unit costs expressed in both words and figures. It is implied that all unit prices shall include all labor, materials, equipment, mobilization and overhead costs. In case of a difference between the stipulated amount of the proposal written in words and the stipulated amount written in figures, the stipulated amount stated in words shall govern.

4. Withdrawal of Bids & Proposals:

No bid will be allowed to be withdrawn for any reason whatsoever, after it has been deposited with the Village, until after a period of forty-five (45) days. Once the bids and proposals are opened, prices shall remain in effect for the duration of the contract, which requires completion of the work.

5. Bids to Remain Open:

All bids shall remain open for 90 days after the day of the opening of Bids, but the Village may, in their sole discretion, release any bid and return the bid security prior to that date.

6. Acceptance or Rejection:

The Village of Larchmont reserves the right to reject any or all proposals to accept any bid, to omit any item or items or to waive any informality in a proposal, as deemed advisable in the interest of the Village. The Village may reject a proposal in which any unit bid price, which in its judgment appears to be unrealistic or out of balance with known costs or other unit prices in the proposal.

The Village may reject any proposal where there is substantial evidence that the bidder has performed previous Village work in willful contravention of the terms and conditions of the specifications and contract, has delayed such work unnecessarily, and who has by neglect or indifference performed work so as to cause numerous complaints from and annoyance to property owners within the vicinity of such work.

7. Bidder's Qualification:

Each bidder shall be skilled and regularly engaged in the class of work bid upon. The bidder shall carefully examine the location selected for the work and make themselves familiar with the drawings and specifications of the same before submitting a bid on one or more proposals, in order that no misunderstanding shall exist in regard to the nature and character of the work to be done. No bids will be considered from bidders who are unable to show that they have successfully and satisfactorily performed work substantial in extent and similar in character to that on which they are bidding.

Each bidder shall carefully fill out in detail the experience and equipment questionnaire provided in the proposal. In addition, each bidder shall furnish financial references upon the form provided in the proposal. All such information will be utilized by the Village in comparing the history, reputation, organization, capacity and responsibility of the various bidders for satisfactory and faithful performance of work of the character herein contemplated.

8. Familiarity with Bid Documents, Site Conditions, and Governing Law:

Each bidder is required to be familiar with all of this documents terms and conditions in addition to understanding all federal, state and locals laws, regulations and ordinances regarding performing the work in accordance to this contract. Failure of the bidder to fully familiarize himself with conditions related to these specifications and to the project location for which the work is to be performed, shall not relieve any bidder from any obligation set forth in this contract.

It is expected that bidders, where appropriate, will make a personal inspection of the site and take measurements to obtain the necessary information as to the location, foundation material, space requirements, etc., to enable them to make up their bid proposals accurately. No allowance will be made for any claim that bids were made on incomplete information as to the nature and character of the site(s) or the work involved. It is expressly understood that the Village of Larchmont does not guarantee the accuracy of any data given or shown on the plans regarding the location, character or extent of existing surface or sub-surface conditions.

Scheduling an inspection of site may be made by contacting:

- **Justin Ross, Senior Mechanical Engineer, EDR (315) 471-0688 ext. 762 or by e-mail jross@edrdpc.com weekdays, between 9:00 a.m. and 4:00 p.m**.

9. Term of Contract / Commencement and Completion of Work:

The bidder, to whom this contract is awarded, shall be prepared to start work on or about October 2, 2024 or as directed by the Village Administrator after signing the contract. The Village and Contractor will review a project schedule to mutually determine how best to commence the work expeditiously, and to satisfactorily complete the contract.

Unless a granted letter of project extension is written by the Village, all identified work under the scope of work of this contract shall be completed no later than Friday, February 28, 2025.

Should weather or unforeseen conditions prevent the timely completion of any or all work identified in this contract, the contractor will be provided the opportunity to request a delay for the scheduled completion of the work. The request shall be made to the Village Administrator who can determine on week by week basis an extension to the schedule the work. The contractor shall honor the all prices bid for duration of the contract.

10. Bid Security and Bonds:

Each Bidder shall, at the time of filing his proposal, deliver therewith cash or certified check in an amount not less than 5% of the total bid price, or a **bid bond** in the amount of 5% of the bid price. The checks of the unsuccessful bidders shall be returned within 30 days of the bid opening. The successful

bidder shall execute and deliver to the Village of Larchmont a written contract in the form attached hereto within ten (10) days after notice that the contract has been awarded.

The successful Bidder, at his own cost and expense, shall furnish, at the time of delivering said contract, a **performance bond** in full amount of the contract price with a surety company approved by the Village Attorney of the Village of Larchmont, as surety and conditioned upon the faithful performance of the work in accordance with the contract and as security for the payment of labor and materials furnished. .

The said contract and bond shall be accompanied by proof of carriage by the successful bidder of worker's compensation, public liability and property damage insurance, and by a liability insurance policy covering the Village of Larchmont, all in the form and amounts shown on page of the Information for Bidders. The form of this bond is included herein. If the Bidder, to whom the contract is awarded, shall fail to sign and execute said contract and performance bond and furnish the required insurance, then the aforesaid cash, certified check or bid bond shall be considered as liquidated damages and shall be forfeited to the Village of Larchmont.

11. Errors, Interpretations, and Addenda:

Should bidders find any omissions, discrepancies or errors in the contract documents or should any bidder have doubt to the clarity of meaning of any written language, they should immediately notify the Project Engineer, Justin Ross jross@edrdpc.com , and request an addendum or an RFI response. The deadline for submitting an RFI to the Village is **3:00pm Friday, May 31, 2024**. The Village will answer all timely submitted RFI's by **Friday, June 14, 2024**.

- **Questions regarding these bid specifications shall be directed to Justin Ross, Senior Mechanical Engineer, EDR (315) 471-0688 ext. 762 or by e-mail jross@edrdpc.com weekdays, between 9:00 a.m. and 4:00 p.m**.

12. Payment:

Payment for services will be made after presentation, inspection and acceptance of all finished work, verification by the Village's Project Engineer, and approval by the Village Administrator of an executed claim submitted on company letterhead with an attached AIA Claim Form or equal, and upon submission of certified payrolls and an approved performance bond. The fee schedule shown on the "Form of Proposal" shall dictate the basis of payment. Five percent (5%) of the value of work completed will be withheld for a period of one year pending a final inspection.

13. Engineering Charges:

If the work embraced in the contract is not completed on or before **Friday, February 28, 2025**, engineering and inspection expenses incurred by the Village in connection with the work from the completion date originally filed in the contract to the final date of completion of the work may be

charged to the contractor and be deducted by the Village from the final monies due the Contractor. Such charges will be assessed in cases where the work has been unduly delayed by the Contractor because of inefficient operation, insufficient work force, and lack of adequate equipment or for any other reason for which the Village determines the Contractor liable. The rate of engineering charges shall be assessed at $250.00 per day for each day after the final date of completion. Furthermore, the Village shall assess the same rate of charge throughout the duration of the contract any day thereafter, for which the Contractor elects to work on any non-Village business day.

14. Termination by the Owner:

If the Contractor defaults or neglects to carry out the work in accordance with the contract documents or fails to perform any provision of the contract, the Village of Larchmont may, after seven days written notice to the Contractor and without prejudice to any other remedy he may have, make good such deficiencies and may deduct the cost thereof from the payment then or thereafter due the Contractor or, at this option, may terminate the contract and take possession of the site and of all materials, equipment and machinery thereon owned by the Contractor and may finish the work by whatever method he may deem expedient, and if the unpaid balance of the contract sum exceeds the expense of finishing the work, such excess shall be paid to the Contractor, but if such expense exceeds such unpaid balance, the Contractor shall pay the difference to the Village of Larchmont.

15. Insurance:

The successful bidder is required to furnish and maintain insurance in the name of the Village of Larchmont, and their officers in the following minimum amounts:

Liability and Property Damage Insurance:

A. ***Comprehensive Public Liability Insurance*** with limits of not less than $2,000,000.00 for any one person and $5,000,000.00 for any one accident or occurrence for personal injury including death, and $1,000,000.00 for any one accident or occurrence for damage to property. Property Damage Insurance shall include the legal liability of its Contractor for loss or damage to property of the Village of Larchmont.

B.

Such insurance shall include coverage for:

(1) Explosion, collapse and undermining damage to underground utilities and property.
(2) Contractual Liability including Contractor's obligations under the general conditions of this contract.
(3) Broad Form Property Damage.

C. ***Automobile Liability Insurance*** with limits of not less than $2,000,000.00 for any one person and $5,000,000.00 for any one accident for bodily injury including death, and $2,000,000.00 for property damage, covering:

(1) All owned vehicles
(2) Hired Cars and trucks
(3) All other non-owned vehicles

D. ***Worker's Compensation and Employers' Liability Insurance and Unemployment Insurance*** shall be secured and maintained as required by New York State. Public Liability, Bodily Injury and Property Damage:

(1)	Injury or death of one person:	$2,000,000
(2)	Injury to more than one person in a single occurrence:	2,000,000
(3)	Property damage	2,000,000

All insurance required of the Contractor shall be in form and written with companies acceptable to the Owner and evidence of such insurance, Certificates of Insurance shall be delivered to the Village of Larchmont owners and certificate holders. Such certificates shall show any special coverage or provisions required by the Conditions of Contract and shall provide for thirty (30) days prior written notice to the Owner in case of cancellation or material change to any of the insurance coverages.

If, at any time, any of the said policies shall be or become unsatisfactory to the Village of Larchmont, as to form or substance, or if a company issuing such a policy shall be or become unsatisfactory to the Village of Larchmont the Contractor shall promptly obtain a new policy, submit same to the Village of Larchmont for approval and submit a certificate thereof as hereinafter provided.

Upon the failure of the Contractor to furnish, deliver and maintain such insurance as above mentioned, this Contract may, at the election of the Village, be forthwith declared suspended, discontinued and terminated. Failure of the Contractor to take out and maintain any required insurance shall not relieve the Contractor from any liability under the Contract, nor shall this insurance requirement be construed to conflict with obligations of the Contractor concerning incompletion. All required insurance must be in effect and continued during the life of the Contract.

The Contractor's policy shall include:

(1) A contractual "HOLD HARMLESS" endorsement as follows: "The Contractor shall, during the performance of this work, take all necessary precautions and place proper guards for the prevention of accident, and shall indemnify and save harmless the Village of Larchmont, their employees, officers and agents from all claims, suits and actions and all damages and costs to which they may be put by reason of death or injury to all persons or property of another resulting from unskillfulness, willfulness, negligence or carelessness in the performance of the work, or in guarding and protecting the same, or from any improper methods, materials, implements or appliances used in its performance or construction or on

account of any direct or indirect act or omission by the Village of Larchmont, or any of their employees, officers or agents may have directly or indirectly caused or contributes thereto."

(2) Endorsement that insurance company will give at least thirty (30) days written notice to the Village of Larchmont prior to any modification or cancellation of any such policy.

The Contractor shall also take out and maintain during the life of this contract such contingent property damage and public liability policies in the above amounts as will protect the Village of Larchmont, their officials, employees and agents.

Such policies shall include:

(1) An endorsement as to the description of the work and contract number.
(2) An endorsement that the contract will pay the insurance premiums.
(3) An endorsement that the insurance company will give at least ten (10) days written notice to the Village of Larchmont prior to modification or cancellation of any such policy.

Proper certificates of the above-mentioned policies must be submitted prior to the commencement of any work. All required insurance must be in effect and continued so during the life of the Contract, at the Contractor's expense, and is subject to the approval of the Village Attorney as to adequacy, form and correctness. **No work shall commence or payments will be made to the Contractor until submission and approval of the insurance certificates.**

16. Provisions of the New York State Labor Law:

There follow stipulations from the Labor Law applicable to all municipal contracts:

(1) Section 220; Subd 2, re: 8 hour day, 40 hour week. The minimum hourly wage rates (including supplements) to be paid shall not be less than that designated by the Secretary of Labor and any re-determination of the prevailing rate of wages after the Contract is approved shall be deemed to be incorporated herein by reference as of the effective date of redetermination and shall form a part of these contract documents.

The minimum hourly supplement to be paid shall be in accordance with the prevailing practices in the locality where the work is located and shall not be less than that designated by the Secretary of Labor. Supplement, as defined in Section 220 of the Labor Law, as amended, means all remuneration for employees paid in any medium other than cash or reimbursements for expenses or any payments which are not wages within the meaning of the law, including, but not limited to, health, welfare, non-occupational disability, retirement, vacation benefits, holiday pay and life insurance.

(2) Section 220, Subd. 3 and 220-d, re: Minimum Wage Rates and Supplements, which are included in these Specifications.

The Contract shall be forfeited by a contractor and he shall not be entitled to receive any sum of money for any work performed hereunder on his second conviction of willfully paying less than the stipulated wage scale (including supplements) as provided in the Labor Law, Section 220, as amended, or the stipulated minimum hourly wage scale (including supplements) as provided in the Labor Law, Section 220-d, as amended.

(3) Section 220-e, re: Anti-discrimination, including all sub-parts.

Each Prime Contractor agrees, in accordance with the applicable provision of the Labor Law of the State of New York, to the following:

(a) That in the hiring of employees for the performance of work under this contract or any subcontract hereunder no contractor, subcontractor, nor any person acting on behalf of such contractor or subcontractor, shall be reason of disability, religion, sex, age, color, sexual or effectual preference, or national origin discriminate against any citizen of the State of New York who is qualified and available to perform the work to which the employment relates.

(b) That no Contractor, Subcontractor, nor any person on his behalf shall, in any manner, discriminate against or intimidate any employee hired for the performance of work under this Contract on account of disability, religion, sex, age, race, color, sexual or effectual preference or national origin.

(c) That there may be deducted from the amount payable to a contractor by the Owner under this contract, a penalty of two hundred and fifty dollars ($250.00), for each calendar day during which such person was discriminated against or intimidated in violation of the provisions of this Contract.

(d) That this Contract may be canceled or terminated by the owner and all monies due or to become due hereunder may be forfeited, for a second or any subsequent violations of the terms or conditions of this Article of the Contract.

(e) The aforesaid provisions of this Section covering every Contract for or on behalf of the Owner for the manufacture, sale or distribution of materials, equipment or supplies shall be limited to operations performed within the territorial limits of the State of New York.

17. Provisions of the General Municipal Law:

Section 103-c, re: Ground for Cancellation of Contract. Each Prime Contractor hereby agrees to the provision of Section 103(a) of the General Municipal Law which requires that upon the refusal of a person, when called before a grand jury, head of state department, temporary state commission or other state agency, the organized crime task force in the Department of Law, head of a city department or other city agency which is empowered to compel the attendance of witnesses and examine them under oath, to testify in an investigation concerning any transaction or contract had with the state, any political

subdivision thereof, a public authority or with any public department, agency or official of the state, or of any political subdivision thereof, or of a public authority, to sign a waiver of immunity against subsequent criminal prosecution or to answer any relevant questions concerning such transaction or contract;

(4) Such person, and any firm, partnership or corporation of which he is a member, partner, director or officer shall be disqualified from thereafter selling to or submitting bids to or receiving awards from or entering into any contract with any municipal corporation or fire district, or any public department, agency or official thereof, for goods, work or services, for a period of five (5) years after such refusal, and to provide also that;

(5) Any and all contracts made with any municipal corporation or any public department agency or official thereof, by which person, and by any firm, partnership, or corporation of which he is a member, partner, director or officer may be canceled or terminated by the municipal corporation or fire district without incurring any penalty or damages on account of such cancellation or termination, but any monies owing by the municipal corporation or fire district for goods delivered or work done prior to the cancellation or termination shall be paid.

Section 103-d, re: Non-collusion. Each Prime Contractor agrees, pursuant to General Municipal Law §103-d, to subscribe and affirm the following statement:

By submission of this bid, each bidder and each person signing on behalf of any bidder certified, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of knowledge and belief:

(1) The prices in this bid have been arrived at independently without collusion, consultation, communication or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;

(2) Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor; and

(3) No attempt has been made or will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.

Section 108, re: Workers' Compensation Insurance. This Contract shall be void and of no effect unless the person or corporation making or performing such contract shall secure compensation for the benefit of, and keep insured during the life of the contract, such employees, in compliance with the provisions of the Worker's Compensation Law.

Section 109, re: Non-assignment of Public Contracts. As provided in Section 109 of the General Municipal Law, the prime Contractor is prohibited from assigning, transferring, conveying, subletting or

otherwise disposing of the same, or his right, title, or interest therein, or his power to execute such contract or any other person or corporation without previous consent in writing of the officer, board or agency awarding the contract. If any prime Contractor, to whom any contract is let, granted or awarded, as required by law, by any officer, board or agency in a political subdivision, or of any district therein, shall without the previous written consent specified in subdivision 1 of this section, assign, transfer, convey, sublet or otherwise dispose of such contract, or his right, title or interest therein, or his power to execute such contract, to any other person or corporation, the officer, board or agency which let, made, granted or awarded such contract shall revoke and annul such contract, and the political subdivision of district therein, as the case may be, and such officer, board or agency shall be relieved and discharged from any and all liability and obligations growing out of such contract to such Contractor, and to the person or corporation to which such contract shall have been assigned, transferred, conveyed, sublet or otherwise disposed of, and such Contractor, and his assignees, transferees or sub lessees shall forfeit and lose all monies, theretofore earned under such contract, except so much as may be required to pay his employees. The provisions of this section shall not hinder, prevent, or affect any assignment by any such Contractor for the benefit of his creditors made pursuant to the laws of this state. In the event a dispute arises out of this contract or which in any way affects the rights of any of the parties to it, the Contractor agrees to bring any action, proceeding or the legal process only in the State or Federal court jurisdiction in which the project is located and in no other forum.

18. Contact Information:

- **Justin Ross, Senior Mechanical Engineer, EDR (315) 471-0688 ext. 762 or by e-mail jross@edrdpc.com weekdays, between 9:00 a.m. and 4:00 p.m**.

UTILITIES & EMERGENCY SERVICES:

Dig Safely New York……. 1-800-962-7962 or (811)
Larchmont Water Department…… (914) 834-4893
Village of Larchmont Police Department……..… (914) 834-1000 or (911)
Village of Larchmont Fire Department……..…… (914) 834-0016
Con Edison Gas Operations 24 Hour Number……..…… 1-(800) 752-6633

VILLAGE OF LARCHMONT
WESTCHESTER COUNTY, NEW YORK
Contract VA-24-001

VILLAGE HALL AIR CONDITIONING SYSTEM REPLACEMENT

SCOPE OF WORK:

The Village of Larchmont proposes to remove the existing air conditioning system including associated window air conditioners, PTAC units, air handlers, condensers, as well as associated ductwork and refrigerant and condensate piping. The system is to be replaced by a VRF system including indoor and outdoor units as well as ductwork and refrigerant piping. Award will be made by the Village to the lowest qualified bidder.

Add Alternate 1 proposes to add a solenoid valve to existing steam radiators along with associated control wiring and thermostats as indicated on attachment 1. Award will be made by the Village to the lowest qualified bidder.

The scope of work includes furnishing all labor, materials and equipment necessary to complete the work described herein.

GENERAL REQUIREMENTS:

1. Specifications Referenced:

A. The Contractor shall provide adequate personnel and equipment to complete the work as specified herein and within the agreed upon schedule.

B. The Contractor is responsible for reporting to the Village Administrator or designee any conditions encountered during construction which materially differ from those shown on the drawings or indicated in the Specifications. These conditions shall be reported prior to continuing the related construction work.

2. Compliance with NYS Code Rule 753 – Protection of Underground Facilities:

The Contractor shall be responsible for notifying all utility companies which may have existing services within the work limits by contacting the "Dig Safely New York" at 1-800-962-7962 (*or 811*).

The Contractor must allow ample time for investigation and identification of any and all services of the utility companies located at the project site. All costs associated with verifications of the locations of underground facilities pursuant to Code Rule No. 753, as amended shall be included in the price bid. Furthermore it shall remain the Contractor's responsibility to locate and maintain any underground

service other than that owned by a utility company. These items include sprinkler systems, invisible dog fences, oil filler lines etc.

TECHNICAL SPECIFICATIONS:

The specifications for the split system air conditioners, air handlers, condensers, branch selectors, associated appurtenances, and complete installation, are set forth in the "**Appendix 1"** section of these Bid Documents. When a contractor proposes to furnish the equivalent or equal of any article described in the bid documents, such contractor shall attach to its proposal a letter or memorandum giving full details, including as to how the proposed is equal to or better than the relevant items identified in the bid documents. If no such information or memorandum is attached to the proposal, then such contractor shall furnish the article specified and will not submit an equivalent or equal after its proposal is opened recorded. If any detailed specifications require specific brand names, model number, dimension or capacities of components, same have been carefully selected and specified for the service intended because of reliability, and availability of replacement parts on a local basis.

Since item specified by brand name, model number, dimension, size or capacity are readily available to all manufacturers and/or potential contractors, substitutes or alternates claimed to be equal may not be acceptable unless same are clearly demonstrated by contractor to the Village to be equal or superior to that specified. All equipment shall be manufactured and delivered in strict accordance with the bid documents, and ready for immediate use, prior to acceptance thereof by the Village.

The awarded contractor shall provide the Village with an as-built drawing certified by a New York State Licensed Professional Engineer.

All construction drawings, details, general and technical specifications are provided on the attached "Appendix 1" which includes twenty (20) sheets. These documents can be emailed in the form of a PDF file upon request.

VILLAGE OF LARCHMONT
Contract VA-24-001

BID PROPOSAL

To the Village Board of the Village of Larchmont
Larchmont, NY 10538

Sir/Madam:

The undersigned, as Bidder, declares that the only persons interested in this proposal, or the Contract proposed to be made, as principals, are as stated; that he has carefully examined the Information for Bidders and the Specifications pertaining thereto including "Appendix 1"; and he proposes and agrees, if this Proposal is accepted that he will enter into a Contract with the Village of Larchmont to furnish all the necessary work, labor, materials, tools, machinery and equipment called for in the Specifications in the manner and with the time prescribed for the following prices. For furnishing and delivering free of Federal and State Taxes.

BID PROPOSAL:

1	**Base bid:** Remove and replace air conditioning system and appurtenances (detailed "Appendix-1")	**$**
2	**Add alternate: Install solenoid valves in existing radiators**	**$**

TOTAL AMOUNT OF BID IN WORDS (Items 1-4):_____

BIDDER'S FIRM NAME: _____

ADDRESS OF FIRM: _____

_____

SIGNED: _____ DATE: _____

PRINTED: _____ TELEPHONE#:_____

TITLE: _____ FAX #:_____

E-MAIL ADDRESS: _____

VILLAGE OF LARCHMONT
120 LARCHMONT AVENUE
LARCHMONT, NY 10538

Experience & References

1. Name of Contractor: _____

   Business Address: _____

   _____
   City, State and Zip Code

2. Federal ID Number: _____ Telephone #: _____

   Fax #: _____

3. Please indicate all classes of work for which your company is experienced. For the top six categories, break down in percentage the amount of work performed for each class. Do not include any work subcontracted out to another company.

AC System Replacement	(%)	Electrical Power Wiring	(%)
Refrigerant Piping	(%)	Electrical Control Wiring	(%)
Condensate Piping	(%)	Perimeter Patching & Breeching	(%)
Demolition	(%)		

4. If a Corporation, provide the following:

   State of incorporation: _____

   President: _____ Number of Years: _____

   Treasurer: _____ Number of Years: _____

   Secretary: _____ Number of Years: _____

5. If a Partnership, provide the following:

   Name of Partner: _____ Number of Years: _____

   Residence: _____

Name of Partner: _____ Number of Years: _____

Residence: _____

Name of Partner: _____ Number of Years: _____

Residence: _____

6. If a Joint Venture, provide the following for each company:

Name of Company: _____

Address: _____

Name of Company: _____

Address: _____

Name of Company: _____

Address: _____

7. Other form of business organization:_____

_____

_____

8. Provide all of the following regarding Surety & Bonding:

Name of Bonding Company: _____

Address: _____

Name of Contact Agent: _____

9. Attach to this Application, a letter from the Surety Company stating the Contractor's Aggregate Bonding Capacity and Single Contract Limit.

10. Largest Performance and Payment Bond amount ever furnished by the Contractor to a Municipality, Agency or Private Owner.

BOND AMOUNT: _____

NAME OF PROJECT: _____

WORK LOCATION: _____

DESCRIPTION OF WORK: _____
_____

OWNER: _____

OWNER'S REP.:_____ TELEPHONE #:_____

ARCH./ENG'R:_____ TELEPHONE #:_____

CONTRACT AMOUNT: _____

START DATE: _____ COMP. DATE: _____

11. Bank Reference_____

Contact Agent: _____ Telephone #:_____

Credit Limit Available: _____

Will you, upon request of the Village of Larchmont, fill out a detailed financial statement and furnish any other information requested by the Village regarding the financial history of your firm?

YES / NO

How many years have you been conducting business with the above-mentioned bank?

_____

12. List three or more of your company's recent projects similar for each class of work checked in item number three (3) above. If this Application is being filed as part of a Bid Requirement for the Village of Larchmont, the projects listed below should be similar in scope of work and financial size to the Bid Proposal. (Attach additional sheets or photos if necessary.)

1. NAME OF PROJECT: _____

WORK LOCATION: _____
DESCRIPTION OF WORK: _____

OWNER: _____
OWNER'S REP.:_____ TELEPHONE #:_____ ARCH. /ENG'R:_____ TELEPHONE #:_____ CONTRACT AMOUNT: _____ START DATE: _____ COMP. DATE; _____

2. NAME OF PROJECT: _____

WORK LOCATION: _____
DESCRIPTION OF WORK: _____

OWNER: _____
OWNER'S REP.:_____ TELEPHONE #:_____ ARCH. /ENG'R:_____ TELEPHONE #:_____ CONTRACT AMOUNT: _____ START DATE: _____ COMP. DATE: _____

3. NAME OF PROJECT: _____

WORK LOCATION: _____
DESCRIPTION OF WORK: _____

OWNER: _____
OWNER'S REP.:_____ TELEPHONE #:_____ ARCH. /ENG'R:_____ TELEPHONE #:_____ CONTRACT AMOUNT: _____ START DATE: _____ COMP. DATE: _____

13. List below any projects for which your firm is presently under contract. In addition, list any projects for which your firm has submitted a Bid Proposal (or estimate) or any projects for which your firm is considering submitting a Bid Proposal (or estimate) within the next thirty (30) days. Also include any work for which you are a subcontractor. (Attach additional sheets or photos if necessary.)

1. NAME OF PROJECT: _____

WORK LOCATION: _____
DESCRIPTION OF WORK: _____

OWNER: _____
OWNER'S REP.:_____ TELEPHONE #:_____ ARCH. /ENG'R:_____ TELEPHONE #:_____ CONTRACT AMOUNT: _____ START DATE: _____ COMP. DATE: _____

2. NAME OF PROJECT: _____

WORK LOCATION: _____
DESCRIPTION OF WORK: _____

OWNER: _____
OWNER'S REP.:_____ TELEPHONE #:_____ ARCH. /ENG'R:_____ TELEPHONE #:_____ CONTRACT AMOUNT: _____ START DATE: _____ COMP. DATE: _____

3. NAME OF PROJECT: _____

WORK LOCATION: _____
DESCRIPTION OF WORK: _____

OWNER: _____
OWNER'S REP.:_____ TELEPHONE #:_____ ARCH. /ENG'R:_____ TELEPHONE #:_____ CONTRACT AMOUNT: _____ START DATE: _____ COMP. DATE: _____

14. Attach to this application any additional information regarding key personnel employed or associated with your firm such as resumes, letters of recommendation, a statement from a certified public accountant or any other information demonstrative to the firm's experience, employee skills, financial capacity and managerial abilities.

List below the names of all personnel & titles for which attached supporting documents are submitted:

_____ _____

_____ _____

_____ _____

15. Has your firm or any key party employed by your firm failed to complete any work awarded or has any municipality/owner ever found your firm or key party thereof to be in default?

YES / NO

If yes, provide the following:

NAME OF PROJECT: _____ WORK LOCATION: _____ DESCRIPTION OF WORK: _____

OWNER: _____
OWNER'S REP.:_____ TELEPHONE #:_____ ARCH. /ENG'R:_____ TELEPHONE #:_____ CONTRACT AMOUNT: _____ START DATE: _____ COMP. DATE: _____

Reasons for failure to complete work or contract default:

_____

_____

(Attach additional sheets if necessary)

16. Is the undersigned able to furnish labor that can work in harmony with any other elements of labor, which may be working in conjunction with the Village's projects or within any project work limits?

YES / NO

If no, attach a full explanation.

17. For the past five years, list below any of the following:

A. Any litigation in which your firm, or any partner or employee was a defendant.

B. Any civil, criminal or administrative proceedings involving public contracts, safety or environmental laws or regulations including those of OSHA, NYSDOT, NYSDEC, EPA, DEP or any other similar agency of any state.

C. Any civil, criminal or administrative proceedings involving payment of minimum wage, prevailing wages, affirmative action or equal opportunity for any municipality, county or state which you have performed work.

D. Any deaths or injuries that occurred in connection with any project your firm or employee of your firm has undertaken.

E. Any municipal code violations or citations for traffic law infractions for which your firm or any party employed by your firm has received in connection with the course of work.

F. Any projects for which there have been liens placed upon. State all relevant information included dollar amount of lien and all parties associated with the lien.

_____

_____

_____

_____

_____

_____

_____

(Attach additional sheets if necessary)

BUSINESS REFERENCE SHEET

Name of Contractor: _____

Business Address: _____

_____
(City, State and Zip Code)

Provide below the following types of business supplier references: (1) HVAC EQUIPMENT, (1) ELECTRICAL AND (1) PLUMBING

1. Reference Name: _____ Contact Person: _____

   Address: _____ Phone #:_____

   Description and dates of commodities and services provided w/ project location: _____

   _____

2. Reference Name: _____ Contact Person: _____

   Address: _____ Phone #:_____

   Description and dates of commodities and services provided w/ project location: _____

   _____

3. Reference Name: _____ Contact Person: _____

   Address: _____ Phone #:_____

   Description and dates of commodities and services provided w/ project location: _____

   _____

EXPERIENCE AND REFERENCES
FORM AFFIRMATION

The Village of Larchmont reserves the right to request at any time, additional information regarding the Applicant's experience, manpower, equipment, safety records, procedures, both financial and bonding capacity, completed projects, work currently under contract, and any information pertinent to the Applicant's skill, ability and integrity to perform work for the Villages.

The undersigned, on behalf of the Applicant, hereby certifies that the foregoing information is true and complete. The undersigned further certifies that he or she is authorized to sign this affirmation on behalf of the Applicant.

Dated this _____ day of _____, 20_____.

_____
(Name of Applicant/Bidder)

By _____

Title_____

State of _____)

County of _____)

_____being duly sworn deposes and says

that he or she is _____of_____

_____
(Name of Organization)

and that the foregoing questions and all statements and information provided therein contained are true and correct.

Subscribed and sworn to before me

this _____ day of _____, 20_____.

_____
(Notary Public)

My commission expires _____, 20_____.

NON COLLUSION AFFIDAVIT

This Affidavit must be completed, notarized and included in your bid proposal submission. Failure to do so will result in the rejection of your bid proposal. A separate Affidavit must be submitted by each principal of any joint venture.

PROJECT: Village Hall – Air Conditioning System Replacement

I, _____, acting on behalf of
(Name of Person)

_____
(Person, Company, Corporation, Firm or Organization)

Of which I am _____, submitting a bid request for proposal
(Title of Person)

f\or the abovementioned project certify and affirm that

_____
(Person, Company, Corporation, Firm or Organization)

has neither directly or indirectly entered into any agreements, conferred with any other vendor(s) or participated in any "collusion" or otherwise taken any action to compromise the process of open competitive bidding in connection with the aforementioned project. False statements made herein may be subject to any criminal prosecution and disbarment from bidding future Village projects.

_____
Name of Company or Firm

_____ Signature
and Title of Official Making Affidavit

Subscribed and sworn to before me

this _____ day of _____, 20_____.

_____
(Notary Public)

My commission expires _____, 20_____.

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that _____

_____

(Contractor)

as Principal, hereinafter called the Contractor, and _____

_____

(Title of Surety)

as Surety, hereinafter called Surety, are held and firmly bound unto_____

_____

(Owner/Contracting Agency)

_____ as Oblige hereinafter called Owner, in the amount of_____ Dollars ($_____) for the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Contractor has by written agreement dated_____ 20____ entered into a Contract with Owner for_____ _____ in accordance with drawings and specifications prepared by_____

_____

(Title of Designer)

which contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, the Contractor shall promptly and faithfully perform said Contract, then this obligation shall be null and void; otherwise shall remain in full force and effect.

GENERAL RELEASE

(TO-BE SUBMITTED WITH REQUISITION FOR FINAL PAYMENT)

KNOW ALL MEN BY THESE PRESENTS, that _____
(Contractor)

for and in consideration of the sum of _____

lawful money of the United States of America, to it in hand paid by:

_____

(Owner/Contracting Agency)

have remised, released, quit-claimed, and forever discharged, and by these presents do for its successors and assigns remise, release, quit-claim, and forever discharge the said:

_____

(Owner/Contracting Agency)

and its successors and assigns and administrators, of and from and all manner of action and actions, caused and causes of action, suits, debts, dues, sum and sums of money, accounts, reckonings, bonds, bills, specialties, covenants, contracts, controversies, agreements, promises, variances, trespasses, damages, judgments, patents, extents, executions, claims and demands whatsoever in law and unity which against the said:

_____

(Owner/Contracting Agency)

now have or which heirs, executors, or administrator hereafter can, shall, or may have, for upon or by reason of any matter, cause or thing whatsoever, from the beginning of the world to the day of the date of these presents rising out of the construction, in accordance with contract entered into between parties hereto, dated _____ two thousand and _____, any admittance or supplements thereto.

IN WITNESS WHEREOF, the undersigned corporation has caused this agreement to be signed by its _____and its corporate seal to be hereto affixed and duly attested by its_____ this _____day of _____, 20___.

ATTEST: PRINCIPAL:

_____ _____

SUBMITTALS

All submittals prepared by or for the Contractor, shall be thoroughly checked by the Contractor for Accuracy and conformance to the intent of the Contract Documents before being submitted to the Village Administrator and shall bear the Contractor's signature certifying that they have been so checked. Before submitting them to the Village Administrator, all submittals shall be properly labeled and consecutively numbered. **Contractor shall attach this completed sheet to all submittals**. The Contractor shall note, in writing, if there are any deviations from the Contract drawings and specifications.

CONTRACT NUMBER: **VA-24-001** DATE: _____

PROJECT: **Year 2024 VILLAGE HALL AC SYSTEM UPGRADES**

MATERIALS REFERENCED: _____

MANUFACTURER: _____

ITEM/MODEL NUMBER: _____

This document has been reviewed, coordinated and checked for accuracy of content and for compliance with the Contract Documents. The information contained herein has been coordinated with all other Contract Work.

CONTRACTOR: _____

PRINTED NAME: _____ SIGNATURE: _____

VILLAGE OF LARCHMONT REVIEW - DO NOT WRITE BELOW THIS LINE

☐ **NO EXCEPTION TAKEN** ☐ **MAKE CORRECTIONS NOTE**

☐ **REJECTED** ☐ **REVISE AND RESUBMIT**

Checking is only for general conformance with the design concept of the project and general compliance with the information given in the con
tract documents. Any action shown is subject to the requirements of the plans and specifications. Contractor is responsible for dimensions which shall be confirmed and correlated at the job site; fabrication processes and techniques of construction; coordination of his work with that of all other trades; and the satisfactory performance of his work.

DATE: _____ BY: _____

VILLAGE OF LARCHMONT
WESTCHESTER COUNTY, NEW YORK
CONTRACT #VA-24-001

ARTICLES OF AGREEMENT

_____doing business
(Name of Bidder)

as _____
(Name of Company)

of _____
(Address)

hereby agrees to furnish material to the Village of Larchmont, Westchester County, New York in accordance with the Proposal, Information for Bidders, and Specifications which are attached to these Articles of Agreement and hereby made a part of this contract, (all of which Contract Documents the Contractor acknowledges he has read and examined) and to accept in full payment for the material listed on the Form of Proposal, accepted by the Village of Larchmont, at the unit prices submitted on the bid proposal, a copy of which is annexed and made a part hereof and for the proposed total contract bid value of _____.

The Village of Larchmont, Westchester County, New York agrees to make payment in full for material accepted, after delivery within the time period specified, and satisfactory demonstration to appropriate officials and upon the Contractor's providing the standard manufacturer's warranty against defective materials and workmanship for a period of not less than one year after date of delivery.

Upon the failure of the Contractor to perform in any manner, in accordance with the Proposals, Information for Bidders and Specifications, the Village has the right to cancel this Contract and in such event, the bid security shall be considered as liquidated damages and shall be forfeited to the Village.

IN WITNESS WHEREOF, the Village of Larchmont, has caused this Contract to be executed by its duly authorized officers who, however, incur no possible liability by reason of the execution thereof or of anything herein contained, and has hereunto set his hand and
seal this_____ day of _____.

VILLAGE OF LARCHMONT

ATTEST:_____ **By**:_____
Village Clerk Village Administrator

ATTEST:_____ **By**: _____
Witness Contractor

SECTION 230518 - ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With rough-brass finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

~~b. Chrome Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.~~

~~c.~~b. Insulated Piping: One-piece, stamped-steel type.

~~d.~~c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

~~e.~~d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.

~~f.~~e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

~~g.~~f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.

~~h.~~g. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.

~~i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.~~

~~j.~~h. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.

~~k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.~~

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 230518

SECTION 230529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01. SUMMARY

A. Section Includes:

1. Fastener systems.

2. Equipment supports.

1.02. PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

2. Design seismic-restraint hangers and supports for piping and equipment.

1.03. ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Equipment supports.

1.04. INFORMATION SUBMITTALS

A. Welding certificates.

1.05. QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code – Steel”.

PART 2 PRODUCTS

2.01. METAL PIPE HANGERS AND SUPPORTS

A. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.02. FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.03. EQUIPMENT SUPPORTS

A. Description: Welded, shop or field-fabricated equipment support made from structural carbon-steel shapes.

2.03. MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A240/A240M, stainless-steel plates, shapes, and bars; type 316.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 EXECUTION

3.01. HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

B. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

C. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

D. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

E. Install lateral bracing with pipe hangers and supports to prevent swaying.

F. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

G. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

3.02. EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03. METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04. ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.05. PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06. HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

C. ~~Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.~~

D. Use thermal-hanger shield inserts for insulated piping and tubing.

D. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

D. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

6. C-Clamps (MSS Type 23): For structural shapes.

7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

a. Light (MSS Type 31): 750 lb.

b. Medium (MSS Type 32): 1500 lb.

c. Heavy (MSS Type 33): 3000 lb.

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.

3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

L. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 220553

PIPING AND EQUIPMENT IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

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

    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. emedco.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
3. Letter Color: Black.
4. Background Color: White.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
8. Fasteners: Stainless-steel rivets.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

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

1. emedco.
2. National Marker Company.
3. Stranco, Inc.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

C. Letter Color: White.

D. Background Color: Red.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

H. Fasteners: Stainless-steel rivets.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

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

1. Kolbi Pipe Marker Co.
2. Emedco.

3. Carlton Industries, LP.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

~~A. Piping Color-Coding: Painting of piping is specified in Section 09900 "Painting."~~

~~B.~~A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

~~C. Pipe Label Color Schedule:~~
~~1. Effluent Water Piping: White letters on safety grey background.~~
~~2. Sanitary Waste Piping: Black letters on safety grey background.~~

END OF SECTION 220553

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

1.02 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

F. TDH: Total dynamic head.

1.03 INFORMATIONAL SUBMITTALS

A. Strategies and Procedures Plan: Within 90 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

B. Certified TAB reports.

1.04 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC NEBB or TABB.

2. TAB Technician: Employee of the TAB specialist and certified by AABC NEBB or TABB as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

I. Examine operating safety interlocks and controls on HVAC equipment.

J. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures for balancing the systems.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Duct systems are complete with terminals installed.

b. Fans are operating, free of vibration, and rotating in correct direction.

c. Windows and doors are installed.

d. Suitable access to balancing devices and equipment is provided.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.

2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."

3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check for airflow blockages.

H. Verify that air duct system is sealed as specified in Section 1 "Metal Ducts."

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.

b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.

c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.

d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:

a. Measure static pressure directly at the fan outlet or through the flexible connection.

b. Measure static pressure directly at the fan inlet or through the flexible connection.

c. Measure static pressure across each component that makes up the air-handling system.

d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

4. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.

5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.

2. Measure inlets and outlets airflow.

3. Adjust each inlet and outlet for specified airflow.

4. Re-measure each inlet and outlet after they have been adjusted.

3.06 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply and Exhaust Fans and Equipment with Fans: Plus 15 percent – not less then designed.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.07 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.

2. Include a list of instruments used for procedures, along with proof of calibration.

3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:
    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.

15. Test conditions for fans performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.

    b. Conditions of filters.

    c. Cooling coil, wet- and dry-bulb conditions.

    d. Face and bypass damper settings at coils.

    e. Fan drive settings including settings and percentage of maximum pitch diameter.

    f. Inlet vane settings for variable-air-volume systems.

    g. Settings for supply-air, static-pressure controller.

    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

    1. Quantities of supply and exhaust airflows.

    2. Duct, outlet, and inlet sizes.

E. Fan Test Reports: For supply, return, and exhaust fans, include the following:

    1. Fan Data:

        a. System identification.

        b. Location.

        c. Make and type.

        d. Model number and size.

        e. Manufacturer's serial number.

        f. Arrangement and class.

        g. Sheave make, size in inches, and bore.

        h. Center-to-center dimensions of sheave and amount of adjustments in inches.

    2. Motor Data:

        a. Motor make, and frame type and size.

        b. Horsepower and rpm.

c. Volts, phase, and hertz.

d. Full-load amperage and service factor.

e. Sheave make, size in inches, and bore.

f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.

b. Total system static pressure in inches wg.

c. Fan rpm.

d. Discharge static pressure in inches wg.

e. Suction static pressure in inches wg.

F. Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.

b. Location and zone.

c. Traverse air temperature in deg F.

d. Duct static pressure in inches wg.

e. Duct size in inches.

f. Duct area in sq. ft..

g. Indicated airflow rate in cfm.

h. Indicated velocity in fpm.

i. Actual airflow rate in cfm.

j. Actual average velocity in fpm.

k. Barometric pressure in psig.

G. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.

b. Location and zone.

c. Apparatus used for test.

d. Area served.

e. Make.

f. Number from system diagram.

g. Type and model number.

h. Size.

i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.

b. Air velocity in fpm.

c. Preliminary airflow rate as needed in cfm.

d. Preliminary velocity as needed in fpm.

e. Final airflow rate in cfm.

f. Final velocity in fpm.

g. Space temperature in deg F.

A. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.

b. Serial number.

c. Application.

d. Dates of use.

e. Dates of calibration.

3.08 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Owner.

B. Owner shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.

2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.

3. If the second verification also fails, design professional may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.09 ADDITIONAL TESTS

1. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

2. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 230719

HVAC PIPING INSULATION

PART 1 GENERAL

1.01. SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Refrigerant suction and hot-gas piping, indoors and outdoors.

1.02. ACTION SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.

~~2. Detail attachment and covering of heat tracing inside insulation.~~

~~3. Detail insulation application at pipe expansion joints for each type of insulation.~~

~~4.~~2. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.

~~5.~~3. Detail removable insulation at piping specialties.

~~6.~~4. Detail application of field-applied jackets.

~~7.~~5. Detail application at linkages of control devices.

1.03. INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.04. QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 PRODUCTS

2.01. INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials. Conductivity shall match requirements of NYS ECC 2022.

2.02. ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

C. PVC Jacket Adhesive: Compatible with PVC jacket.

2.03. MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.

2. Service Temperature Range: Minus 20 to plus 180 deg F.

3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.

4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.

2. Service Temperature Range: Minus 20 to plus 180 deg F.

3. Solids Content: 60 percent by volume and 66 percent by weight.

4. Color: White.

2.04. SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Permanently flexible, elastomeric sealant.

3. Service Temperature Range: Minus 100 to plus 300 deg F.

4. Color: White or gray.

2.05. FIELD-APPLIED JACKETS

A. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.

2. Color: White.

3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.06. TAPES

A. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Width: 2 inches.

2. Thickness: 6 mils.

3. Adhesion: 64 ounces force/inch in width.

4. Elongation: 500 percent.

5. Tensile Strength: 18 lbf/inch in width.

2.07. SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

PART 3 EXECUTION

3.01. PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.02. GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.

2. Testing agency labels and stamps.

3. Nameplates and data plates.

4. Manholes.

5. Handholes.

6. Cleanouts.

3.03. PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

3.04. GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

D. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

E. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

3.05. INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.

2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.06. FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.07. FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded

valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.08. PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.

2. Underground piping.

3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.09. INDOOR PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping: Flexible elastomeric, 1 inch thick.

3.10. OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping: Insulation shall be the following:

1. Flexible Elastomeric: 2 inches thick.

3.11. INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:

1. None.

2. PVC: 20 mils thick.

3.12. OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:

1. PVC: 20 mils thick.

END OF SECTION

SECTION 232213 - STEAM AND CONDENSATE HEATING PIPING

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PART 1 - GENERAL

1.1 SUMMARY

A. Section includes pipe and fittings for LP steam less than 15 psig and condensate piping.

1. Steel pipe and fittings.
2. Joining materials.

B. Related Requirements:

1. Section 232216 "Steam and Condensate Heating Piping Specialties" for strainers, flash tanks, special-duty valves, steam traps, thermostatic air vents and vacuum breakers, and steam and condensate meters.

1.2 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressures and temperatures unless otherwise indicated:

1. LP Steam Piping: 15 psig.
2. Condensate Piping: 250 deg F.
3. Makeup-Water Piping: 80 psig.
4. Blowdown-Drain Piping: Equal to pressure of the piping system to which it is attached.
5. Air-Vent and Vacuum-Breaker Piping: Equal to pressure of the piping system to which it is attached.
6. Safety-Valve-Inlet and -Outlet Piping: Equal to pressure of the piping system to which it is attached.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, plain ends, welded and seamless, Grade B, and Schedule as indicated in piping applications articles.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125, 150, and 300 as indicated in piping applications articles.

C. Malleable-Iron Threaded Fittings: ASME B16.3; Classes 150 and 300 as indicated in piping applications articles.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in piping applications articles.

E. Cast-Iron Threaded Flanges and Flanged Fittings: ASME B16.1, Classes 125 and 250 as indicated in piping applications articles; raised ground face, and bolt holes spot faced.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

PART 3 - EXECUTION

3.1 LP STEAM PIPING APPLICATIONS

A. LP Steam Piping: Schedule 40, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.

B. Condensate Piping above Grade: Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.

~~C. Condensate Piping below Grade: Schedule 80, Type S, Grade B, steel pipe; Class 125 cast iron fittings; and threaded joints.~~

~~3.2 ANCILLARY PIPING APPLICATIONS~~

~~A. Blowdown Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.~~

~~B. Vacuum-Breaker Piping: Outlet, same as service where installed.~~

~~C. Safety Valve Inlet and Outlet Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.~~

~~3.3~~3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless otherwise indicated.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install piping to allow application of insulation.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

K. Install drains, consisting of a tee fitting, NPS 3/4 full port-ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

L. Install steam supply piping at a minimum uniform grade of 0.2 percent downward in direction of steam flow.

M. Install condensate return piping at a minimum uniform grade of 0.4 percent downward in direction of condensate flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side down.

O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to top of main pipe.

~~P. Install valves according to the following Sections or other Sections as needed:~~

~~1. Section 230523 "Valves for HVAC Piping."~~

~~Q.~~P. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

~~R.~~Q. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

~~S.~~R. Install shutoff valve immediately upstream of each dielectric fitting.

~~T.~~S. Install strainers on supply side of control valves, pressure-reducing valves, traps, and elsewhere as indicated. Install NPS 3/4 nipple and full port ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

~~U.~~T. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.

~~V.~~U. Install drip legs at low points and natural drainage points such as ends of mains, bottoms of risers, and ahead of pressure regulators, and control valves.

1. On straight runs with no natural drainage points, install drip legs at intervals not exceeding 300 feet.
2. Size drip legs same size as main.

~~3.4~~3.3 STEAM AND CONDENSATE PIPING SPECIALTIES INSTALLATION

A. Comply with requirements in Section 232216 "Steam and Condensate Heating Piping Specialties" for installation requirements for strainers, flash tanks, special-duty valves, steam traps, thermostatic air vents and vacuum breakers, and steam and condensate meters.

~~3.5~~3.4 HANGERS AND SUPPORTS

A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for installation of hangers and supports. Comply with requirements below for maximum spacing.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.

C. Install hangers for steel steam supply piping with the following maximum spacing:

1. NPS 3/4: Maximum span, 9 feet.
2. NPS 1: Maximum span, 9 feet.
3. NPS 1-1/2: Maximum span, 12 feet.
4. NPS 2: Maximum span, 13 feet.
5. NPS 2-1/2: Maximum span, 14 feet.

6. NPS 3 and Larger: Maximum span, 15 feet.

D. Install hangers for steel steam condensate piping with the following maximum spacing:

1. NPS 3/4: Maximum span, 7 feet.
2. NPS 1: Maximum span, 7 feet.
3. NPS 1-1/2: Maximum span, 9 feet.
4. NPS 2: Maximum span, 10 feet.
5. NPS 2-1/2: Maximum span, 11 feet.
6. NPS 3 and Larger: Maximum span, 12 feet .

E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

~~3.6~~3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

~~3.7~~3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Size for supply and return piping connections shall be the same as or larger than equipment connections.

~~B. Install traps and control valves in accessible locations close to connected equipment.~~

~~C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.~~

~~D.~~B. ~~Install vacuum breakers downstream from control valve, close to coil inlet connection.~~=

~~E.~~C. Install a drip leg at coil outlet.

~~3.8~~3.7 FIELD QUALITY CONTROL

A. Prepare steam and condensate piping according to ASME B31.9, "Building Services Piping," and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush system with clean water. Clean strainers.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform the following tests and inspections:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength.
3. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

E. Prepare test and inspection reports.

END OF SECTION 232213

SECTION 232216 - STEAM AND CONDENSATE HEATING PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following piping specialties for steam and condensate piping:

~~1. Strainers.~~
~~2. Flash tanks.~~
~~3. Stop-check valves.~~
~~4. Safety valves.~~
~~5. Pressure-reducing valves.~~
~~6. Steam traps.~~
~~7. Thermostatic air vents and vacuum breakers.~~
~~8. Flexible connectors.~~
~~9. Steam meters.~~
1. ~~Condensate meters.~~Solenoid Control Valves
~~10.~~2. Wall-mounted thermostats

~~B. Related Requirements:~~

~~1. Section 230523 "Valves for HVAC Piping" for specification and installation requirements for gate valves common to most piping systems.~~

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

~~1. Strainer.~~
~~2. Flash tank.~~
~~3. Valve.~~
~~4. Steam trap.~~
~~5. Air vent and vacuum breaker.~~
~~6. Connector.~~
1. ~~Meter.~~Solenoid Control Valves
~~7.~~2. Wall-mounted Thermostat

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressures and temperatures unless otherwise indicated:

1. LP Steam Piping: 15 psig.
2. ~~Condensate Piping: 15 psig at 250 deg F.~~
3. ~~Makeup Water Piping: 80 psig at 73 deg F.~~
4. ~~Blowdown Drain Piping: Equal to pressure of the piping system to which it is attached.~~
5. ~~Air Vent and Vacuum Breaker Piping: Equal to pressure of the piping system to which it is attached.~~
6. ~~Safety Valve Inlet and Outlet Piping: Equal to pressure of the piping system to which it is attached.~~

2.2 SOLENOID CONTROL VALVES

A. Valve Body Assembly
   1. Service
      a. Steam models up to 15 psi (both valve body and valve actuator must be rated for high temperature).
   2. System Static Pressure Limits: 400 psi
   3. Seat Leakage: ANSI Class IV (0.01%) with pressure at inlet
   4. Body: Forged brass
   5. Stem: Nickel-plated
   6. Seat: Brass

B. Actuator
   1. Voltage: 120 Vac/60 Hz
   2. Power Requirements: 6.5 watts, 7.5 Va.
   3. Control Signal: On/off, 2 position, spring return
   4. Timing, Full Open to Full Close: 25 Sec max for 60 Hz and 9 sec max spring return
   5. Materials: Stainless steel base plate, aluminum cover
   6. Humidity: 5% to 95% relative humidity, non-condensing

2.3 Wall-mounted Thermostat

A. Temperature range: 40°F to 90°F

B. Operating humidity: 5% to 95% relative humidity

C. Voltage: 24V/60Hz

D. Power requirements: ~~Battery or h~~Hardwired

E. Accuracy: +/- 1°F

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F. Settings: Switch positions of Heat/Off

G. Unit must be programmable with off-hour controls per NYS ECC 2020 C403.4.2

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~~2.2 STRAINERS~~

~~A. Y-Pattern Strainers:~~

~~1. Body: ASTM A 126, Class B cast iron, with bolted cover and bottom drain connection.~~
~~2. End Connections: Threaded ends for strainers NPS 2 and smaller; flanged ends for strainers NPS 2-1/2 and larger.~~
~~3. Strainer Screen: Stainless steel, .045 perforated stainless steel basket.~~
~~4. Tapped blowoff plug.~~
~~5. CWP Rating: 250 psig working steam pressure.~~

~~2.3 STOP-CHECK VALVES~~

~~A. Stop-Check Valves:~~

~~1. Body and Bonnet: Malleable iron.~~
~~2. End Connections: Flanged.~~
~~3. Disc: Cylindrical with removable liner and machined seat.~~
~~4. Stem: Brass alloy.~~
~~5. Operator: Outside screw and yoke with cast-iron handwheel.~~
~~6. Packing: PTFE impregnated packing with two-piece packing gland assembly.~~
~~7. Pressure Class: 250.~~

~~2.4 SAFETY VALVES~~

~~A. Bronze or Brass Safety Valves: ASME labeled.~~

~~1. Disc Material: Forged copper alloy.~~
~~2. End Connections: Threaded inlet and outlet.~~
~~3. Spring: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.~~
~~4. Pressure Class: 250.~~
~~5. Drip-Pan Elbow: Cast iron and having threaded inlet and outlet, with threads complying with ASME B1.20.1.~~
~~6. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.~~

~~2.5 PRESSURE-REDUCING VALVES~~

~~A. ASME labeled.~~

~~B. Size, Capacity, and Pressure Rating: Factory set for inlet and outlet pressures indicated.~~

~~C. Description: Pilot-actuated diaphragm type, with adjustable pressure range and positive shutoff.~~

D. Body: Cast iron.

E. End Connections: Threaded connections for valves NPS 2 and smaller and flanged connections for valves NPS 2-1/2 and larger.

F. Trim: Hardened stainless steel.

G. Head and Seat: Replaceable, main head stem guide fitted with flushing and pressure arresting device cover over pilot diaphragm.

H. Gaskets: Non-asbestos materials.

2.6 STEAM TRAPS

A. Thermostatic Traps:

1. Body: Bronze angle-pattern body with integral union tailpiece and screw-in cap.
2. Trap Type: Balanced pressure.
3. Bellows: Stainless steel or monel.
4. Head and Seat: Replaceable, hardened stainless steel.
5. Pressure Class: 125.

B. Float and Thermostatic Traps:

1. Body and Bolted Cap: ASTM A 126 cast iron.
2. End Connections: Threaded.
3. Float Mechanism: Replaceable, stainless steel.
4. Head and Seat: Hardened stainless steel.
5. Trap Type: Balanced pressure.
6. Thermostatic Bellows: Stainless steel or monel.
7. Thermostatic air vent capable of withstanding 45 deg F of superheat and resisting water hammer without sustaining damage.
8. Vacuum Breaker: Thermostatic with phosphor bronze bellows, and stainless steel cage, valve, and seat.
9. Maximum Operating Pressure: 125 psig.

2.7 THERMOSTATIC AIR VENTS AND VACUUM BREAKERS

A. Thermostatic Air Vents:

1. Body: Cast iron, bronze, or stainless steel.
2. End Connections: Threaded.
3. Float, Valve, and Seat: Stainless steel.
4. Thermostatic Element: Phosphor bronze bellows in a stainless steel cage.
5. Pressure Rating: 125 psig.
6. Maximum Temperature Rating: 350 deg F.

B. Vacuum Breakers:

1. Body: Cast iron, bronze, or stainless steel.
2. End Connections: Threaded.
3. Sealing Ball, Retainer, Spring, and Screen: Stainless steel.
4. O-Ring Seal: Ethylene propylene rubber.
5. Pressure Rating: 125 psig.
6. Maximum Temperature Rating: 350 deg F.

2.8 FLEXIBLE CONNECTORS

A. Stainless-Steel Bellows, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforced, protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4 inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for valves installed in piping to verify actual locations of piping connections before installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Furnish and install products required to satisfy most stringent requirements indicated.

B. Install products level, plumb, parallel, and perpendicular with building construction.

C. Properly support instruments, tubing, piping, wiring, and conduits to comply with requirements indicated. Brace all products to prevent lateral movement and sway.

D. Fastening Hardware:

1. Stillson wrenches, pliers, and other tools that will cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for assembling and tightening nuts.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

E. Install products in locations that are accessible and that will permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

3.3 ELECTRIC POWER

A. Furnish and install electrical power to products requiring electrical connections.

B. Furnish and install circuit breakers. Comply with requirements in Section 260500 "General Electrical Requirements."

C. Furnish and install power wiring. Comply with requirements in Section 260500 "General Electrical Requirements."

D. Furnish and install raceways. Comply with requirements in Section 260500 "General Electrical Requirements."

3.4 CONTROL VALVES

A. Install pipe reducers for valves smaller than line size. Position reducers as close to valve as possible but at distance to avoid interference and impact to performance. Install with manufacturer-recommended clearance.

B. Install flanges or unions to allow drop-in and -out valve installation.

C. Clearance:

1. Locate valves for easy access and provide separate support of valves that cannot be handled by service personnel without hoisting mechanism.
2. Install valves with at least 12 inches of clear space around valve and between valves and adjacent surfaces.

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D. Threaded Valves:

1. Note internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.
2. Align threads at point of assembly.
3. Apply thread compound to external pipe threads, except where dry seal threading is specified.
4. Assemble joint, wrench tight. Apply wrench on valve end as pipe is being threaded.

E. Flanged Valves:

1. Align flange surfaces parallel.
2. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

3.5 CONNECTIONS

A. Connect electrical devices and components to electrical grounding system. Comply with requirements in Section 260500 "General Electrical Requirements."

3.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 260500 "General Electrical Requirements."

B. Install engraved phenolic nameplate with valve identification on valve

3.7 CLEANING

A. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from exposed interior and exterior surfaces.

B. Wash and shine glazing.

C. Polish glossy surfaces to a clean shine.

3.8 CHECKOUT PROCEDURES

A. Control Valve Checkout:

1. Check installed products before continuity tests, leak tests, and calibration.
2. Check valves for proper location and accessibility.
3. Check valves for proper installation for direction of flow, elevation, orientation, insertion depth, or other applicable considerations that will impact performance.
4. Verify that control valves are installed correctly for flow direction.
5. Verify that valve body attachment is properly secured and sealed.
6. Verify that valve actuator and linkage attachment are secure.
7. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
8. Verify that valve ball, disc, and plug travel are unobstructed.
9. After piping systems have been tested and put into service, but before insulating and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks. Replace the valve if leaks persist.

3.9 ADJUSTMENT, CALIBRATION, AND TESTING

A. Stroke and adjust control valves following manufacturer's recommended procedure, from 100 percent open to 100 percent closed back to 100 percent open.

B. Stroke control valves with pilot positioners. Adjust valve and positioner following manufacturer's recommended procedure, so valve is 100 percent closed, 50 percent closed, and 100 percent open at proper air pressures.

C. Check and document open and close cycle times for applications with a cycle time of less than 30 seconds.

For control valves equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

D.

~~PART 3 - EXECUTION~~

~~3.1 VALVE APPLICATIONS~~

~~A. Install shutoff duty valves at branch connections to steam supply mains, at steam supply connections to equipment, and at the outlet of steam traps.~~

~~B. Install safety valves on pressure reducing stations and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install safety valve discharge piping, without valves, to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.~~

~~3.2 PIPING INSTALLATION~~

~~A. Install piping to permit valve servicing.~~

~~B. Install drains, consisting of a tee fitting, NPS 3/4 full port ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.~~

~~C. Install valves according to:~~

~~1. Section 230523 "Valves for HVAC Piping."~~

~~D. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment and elsewhere as indicated.~~

~~E. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.~~

~~F. Install shutoff valve immediately upstream of each dielectric fitting.~~

~~G. Install strainers on supply side of control valves, pressure reducing valves, traps, and elsewhere as indicated. Install NPS 3/4 nipple and full port ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.~~

~~3.3 STEAM TRAP INSTALLATION~~

~~A. Install steam traps in accessible locations as close as possible to connected equipment.~~

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B. Install full-port ball valve, strainer, and union upstream from trap; install union, check valve, and full-port ball valve downstream from trap unless otherwise indicated.

3.4 PRESSURE REDUCING VALVE INSTALLATION

A. Install pressure reducing valves in accessible location for maintenance and inspection.

B. Install bypass piping around pressure reducing valves, with globe valve equal in size to area of pressure reducing valve seat ring, unless otherwise indicated.

C. Install gate valves on both sides of pressure reducing valves.

D. Install unions or flanges on both sides of pressure reducing valves having threaded or flanged end connections, respectively.

E. Install strainers upstream for pressure reducing valve.

F. Install safety valve downstream from pressure reducing valve station.

3.5 SAFETY VALVE INSTALLATION

A. Install safety valves according to ASME B31.9, "Building Services Piping."

B. Pipe safety valve discharge without valves to atmosphere outside the building.

C. Install drip pan elbow fitting adjacent to safety valve and pipe drain connection to nearest floor drain.

D. Install exhaust head with drain to waste, on vents equal to or larger than NPS 2-1/2.

3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Install traps and control valves in accessible locations close to connected equipment.

B. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

C. Install vacuum breakers downstream from control valve, close to coil inlet connection.

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END OF SECTION 232216

SECTION 232300

REFRIGERANT PIPING

PART 1 GENERAL

1.01. SUMMARY

A. Section Includes:

1. Refrigerant pipes and fittings.

2. Refrigerant piping valves and specialties.

3. Refrigerants.

1.02. ACTION SUBMITTALS

A. Product Data: For each type of valve, refrigerant piping, and refrigerant piping specialty.

B. Shop Drawings:

1. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

2. Show interface and spatial relationships between piping and equipment.

3. Shop Drawing Scale: 1/4 inch equals 1 foot.

1.03. INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.04. CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.05. QUALITY ASSURANCE

A. Comply with ASHRAE 15, “Safety Code for Refrigeration Systems.”

B. Comply with ASME B31.5, “Refrigeration Piping and Heat Transfer Components.”

PART 2 PRODUCTS

2.01. PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.

2. Suction Lines for Heat-Pump Applications: 535 psig.

3. Hot-Gas and Liquid Lines: 535 psig.

2.02. COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type ~~K or L~~ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8/A5.8M.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.

2. End Connections: Socket ends.

3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.

4. Working Pressure Rating: Factory test at minimum 500 psig.

5. Maximum Operating Temperature: 250 deg F.

2.03. REFRIGERANTS

A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

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

a. DuPont Fluorochemicals Div.

b. Genetron Refrigerants; Honeywell International Inc.

c. Mexichem Fluor Inc.

PART 3 EXECUTION

3.01. PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

3.02. PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping adjacent to machines to allow service and maintenance.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

J. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection.

K. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

L. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.

2. Install horizontal suction lines with a uniform slope downward to compressor.

3. Install traps and double risers to entrain oil in vertical runs.

4. Liquid lines may be installed level.

M. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

N. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

O. Identify refrigerant piping and valves according to Section 230553~~15075~~ "Piping and Equipment Identification~~Identification for HVAC Piping and Equipment.~~"

3.03. PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.

2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

3.04. HANGERS AND SUPPORTS

A. Comply with requirements for pipe hangers and supports specified in Section ~~15060~~ 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.

2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.

3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.

4. Spring hangers to support vertical runs.

5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:

1. NPS 1/2: Maximum span, 60 inches; minimum rod, 1/4 inch.

2. NPS 5/8: Maximum span, 60 inches; minimum rod, 1/4 inch.

3. NPS 1: Maximum span, 72 inches; minimum rod, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod, 3/8 inch.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod, 3/8 inch.
8. NPS 3: Maximum span, 10 feet; minimum rod, 3/8 inch.
9. NPS 4: Maximum span, 12 feet; minimum rod, 1/2 inch.

D. Support multi-floor vertical runs at least at each floor.

3.05. FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in “Performance Requirements” Article.
    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

B. Prepare test and inspection reports.

3.06. SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.07. ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.

2. Verify that compressor oil level is correct.

3. Open compressor suction and discharge valves.

4. Open refrigerant valves except bypass valves that are used for other purposes.

5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

SECTION 233113

METAL DUCTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.

2. Sheet metal materials.

3. Sealants and gaskets.

4. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.

2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.02 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's “HVAC Duct Construction Standards - Metal and Flexible” and performance requirements and design criteria indicated in “Duct Schedule” Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's “HVAC Duct Construction Standards - Metal and Flexible” and ASCE/SEI 7.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ANSI/ASHRAE 62.1.

1.03. ACTION SUBMITTALS

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

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.

2. Factory- and shop-fabricated ducts and fittings.

3. Duct layout indicating sizes, configuration, and static-pressure classes.

4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Equipment installation based on equipment being used on Project.
10. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
11. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.04. INFORMATION SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling including the following:
    a. Luminaires.
    b. Air outlets and inlets.
    c. Access panels.

B. Welding certificates

1.05. QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D9.1M/D9.1, “Sheet Metal Welding Code,” for duct joint and seam welding.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 – "Systems and Equipment" and Section 7 – "Construction and Systems Start-up."

C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 – "HVAC System Construction and Insulation."

PART 2 PRODUCTS

2.01. RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02. SHEET METAL MATERIALS

~~A.~~ General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

A.

~~B.~~ Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

B.

~~1.~~ Galvanized Coating Designation: G60.

1.

a. Finishes for Surfaces Exposed to View: Mill phosphatized.

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~~C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article. See "Sheet Metal Materials" Article in the Evaluations for discussion on applicable materials and coatings in first four paragraphs below.~~

C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

~~D. Reinforcement Shapes and Plates: ASTM A240/A240M, steel plates, shapes, and bars; type 316.~~

~~D. Tie Rods: Stainless steel, 1/4 inch minimum diameter for lengths 36 inches or less; 3/8 inch minimum diameter for lengths longer than 36 inches.~~

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2.03. SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

2. Tape Width: 3 inches.

3. Sealant: Modified styrene acrylic.

4. Water resistant.

5. Mold and mildew resistant.

6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.

7. Service: Indoor and outdoor.

8. Service Temperature: Minus 40 to plus 200 deg F.

9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.

2. Solids Content: Minimum 65 percent.

3. Shore A Hardness: Minimum 20.

4. Water resistant.

5. Mold and mildew resistant.

6. VOC: Maximum 75 g/L (less water).

7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.

8. Service: Indoor or outdoor.

9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.

2. Type: S.

3. Grade: NS.

4. Class: 25.

5. Use: O.

6. One or both subparagraphs below may be required to comply with Project requirements or authorities having jurisdiction. Retain first subparagraph below if required for LEED-NC, LEED-CI, or LEED-CS Credit IEQ 4.1.

7. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

8. Sealant shall comply with the testing and product requirements of the California Department of Health Services' “Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.”

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.04. HANGERS AND SUPPORTS

~~A. Hanger Rods for Corrosive Environments: Stainless steel, all-thread rods.~~

A. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

~~Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.~~

B.

C. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

~~A.~~ Trapeze and Riser Supports:

E.

~~1.~~ Supports for ~~Stainless~~Galvanized-Steel Ducts: ~~Stainless~~Galvanized-steel shapes and plates.

a.

PART 3 EXECUTION

3.01. DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

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G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.02. DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards – Metal and Flexible."

B. Seal ducts at minimum to the following seal classes according to SMACNA's "HVAC Duct Construction Standards – Metal and Flexible".

1. Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible."

~~2.~~9. Outdoor, Supply-Air Ducts: Seal Class A.

~~3.~~10. Outdoor, Exhaust Ducts: Seal Class C.

~~4.~~11. Outdoor, Return-Air Ducts: Seal Class C.

~~5.~~12. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.

~~6.~~13. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.

~~7.~~14. Unconditioned Space, Exhaust Ducts: Seal Class C.

~~8.~~15. Unconditioned Space, Return-Air Ducts: Seal Class B.

~~9.~~16. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.

~~10.~~17. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.

~~11.~~18. Conditioned Space, Exhaust Ducts: Seal Class B

~~12.~~19. Conditioned Space, Return-Air Ducts: Seal Class C.

3.03. HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, power-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.

2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

5. Do not use power-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.04. CONNECTIONS

A. Make connection to equipment with flexible connectors complying with Section 15820 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.05. DUCT CLEANING

A. Clean new duct systems(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 15820 “Air Duct Accessories” for access panels and doors.

2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.

3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.

2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).

2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3. Supply-air ducts and turning vanes.

4. Exhaust-air ducts and turning vanes.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.

2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.

4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.

5. Provide drainage and cleanup for wash-down procedures.

6. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.06. START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.07. DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel

B. Supply Ducts:

a. Ducts Connected to Terminal Units:

i. Pressure Class: Positive 1-inch wg.
ii. Minimum SMACNA Seal Class: A.
iii. SMACNA Leakage Class for Rectangular: 12.

b. Ducts Connected to Constant-Volume Air-Handling Units:

i. Pressure Class: Positive 2-inch wg.
ii. Minimum SMACNA Seal Class: A.
iii. SMACNA Leakage Class for Rectangular: 6.

C. Return Ducts:

a. Ducts Connected to Terminal Units:

i. Pressure Class: Positive or negative 1-inch wg.
ii. Minimum SMACNA Seal Class: A.
iii. SMACNA Leakage Class for Rectangular: 12.

b. Ducts Connected to Air-Handling Units:

i. Pressure Class: Positive or negative 2-inch wg.
ii. Minimum SMACNA Seal Class: A.
iii. SMACNA Leakage Class for Rectangular: 6.

~~A. Exhaust Ducts:~~

~~1. Duct Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:~~

~~a. Pressure Class: Negative 2-inch wg.~~

~~b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.~~

~~c. SMACNA Leakage Class for Rectangular: 12.~~

~~d. SMACNA Leakage Class for Round and Flat Oval: 12.~~

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~~B.~~D. Outside-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Duct Connected to Terminal Units~~Fans~~:

   a. Pressure Class: Positive or negative 1~~2~~-inch wg.

   b. Minimum SMACNA Seal Class: A.

   c. SMACNA Leakage Class for Rectangular: 12.

2. Duct Connected to Air-Handling Units:

   d. Pressure Class: Positive or negative 2-inch wg.

   e. Minimum SMACNA Seal Class: A.

   SMACNA Leakage Class for Rectangular: 12.

   ~~c.~~f.

   ~~d. SMACNA Leakage Class for Round and Flat Oval: 12.~~

E. Liner

a. Supply Air Ducts: Fibrous glass, Type I, 1 inch thick.
b. Return Air Ducts: Fibrous glass, Type I, 1 inch thick.

~~C.~~F. Intermediate Reinforcement:

1. ~~Stainless~~ Galvinized Steel Ducts: ~~Stainless~~ Galvinized Steel.

~~D.~~G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible, "Figure 4-2, "Rectangular Elbows."

   a. Velocity 1000 fpm or Lower:

      1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.

      2) Mitered Type RE 4 without vanes.

~~E.~~H. Velocity 1000 to 1500 fpm:

1. Radius Type 1 with minimum 1.0 radius -to-diameter ration.

2. Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.

3. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible, "Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

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~~F.~~I. Velocity 1500 fpm or Higher:

1. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.

2. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

3. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

4. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible, " Figure 4-2, "Rectangular Elbows."

    a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.

    b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

    ~~c.~~ Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible." Figure 4-3, "Vanes and Van Runners," and Figure 4-4, "Vane Support in Elbows."

~~Contract No.~~

~~G.~~J. Branch Configuration

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Figure 4-6, "Branch Connection."

   a. Rectangular Main to Rectangular Branch: 45-degree entry.

   b. Rectangular Main to Round Branch: Spin in.

END OF SECTION

~~Contract No.~~

SECTION 233300

AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Flange connectors.

2. Turning vanes.

3. Duct-mounted access doors.

4. Duct accessory hardware.

~~5. Differential Pressure Switches~~

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.03 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For centrifugal fans to include in emergency, operation, and maintenance manuals.

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PART 2 PRODUCTS

2.01 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.02 MATERIALS

A. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and No. 2 finish for exposed ducts.

B. Reinforcement Shapes and Plates: Compatible materials for stainless-steel ducts.

C. Tie Rods: Stainless steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.03 TURNING VAN~~LV~~ES

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

1. Ductmate Industries, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of stainless sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

E. Vane Construction: Double wall.

2.04 DUCT-MOUNTED ACCESS DOORS

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

1. Aire Technologies.

2. Ductmate Industries, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.

b. Stainless steel sheet metal with insulation fill and thickness as indicated for duct pressure class.

c. Vision panel.

d. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.

e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Stainless sheet steel, with bend-over tabs and foam gaskets.

3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.

b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.

c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches.

d. Access Doors Larger Than 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.

2.05 DUCT ACCESS PANEL ASSEMBLIES

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

1. Ductmate Industries, Inc.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0428-inch stainless steel.

D. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.06 FLEXIBLE CONNECTORS

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

1. Ductmate Industries, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch- wide, 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..

2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.

3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..

2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.

3. Service Temperature: Minus 50 to plus 250 deg F.

2.07 DUCT ACCESSORY HARDWARE

~~A.~~ Instrument Test Holes: Stainless steel to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

A.

~~B.~~ Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

~~2.08 DIFFERENTIAL PRESSURE SWITCHES~~

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

~~1. Dwyer, Michigan City, IN~~

~~2. Neobits, Santa Clara, CA~~

~~3. Or approved equal.~~

~~B. Vertical Plane Mounting~~

~~C. NEMA 7 Enclosure rating appropriate for Class 1 Div 1 environments.~~

~~D. Pressure range of each differential pressure switch shall be selected to match the corresponding duct system.~~

~~E.~~B. ~~Pressure set point shall be field adjustable.~~

PART 3 EXECUTION

3.01 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

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B. Install duct accessories of materials suited to duct materials; use stainless-steel accessories in stainless-steel and fibrous-glass ducts, stainless-steel accessories in ~~stainless~~galvanized-steel ducts, and aluminum accessories in aluminum ducts.

C. Install test holes at fan inlets and outlets and elsewhere as indicated.

D. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. At outdoor-air intakes and mixed-air plenums.
2. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
3. At each change in direction and at maximum 50-foot spacing.
4. Upstream from turning vanes.
5. Control devices requiring inspection.
6. Elsewhere as indicated.

E. Install access doors with swing against duct static pressure.

F. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

G. Label access doors according to Section 230553~~15075~~ "~~Identification for HVAC Piping and Equipment~~Identification for HVAC Ductwork and Equipment" to indicate the purpose of access door.

H. Install flexible connectors to connect ducts to equipment.

I. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

J. Install duct test holes where required for testing and balancing purposes.

~~K. Differential Pressure Switches~~

~~1. To be installed in all ductwork serving classified spaces after the fan and before any air terminals. Units shall be calibrated to detect airflow and to send a signal when air flow is not detected. Coordinate with Instrumentation and Controls.~~

3.02 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.

2. Inspect locations of access doors and verify that ~~purpose~~the purpose of access door can be performed.

~~1.~~3. Operate fire and smoke dampers to verify full range of movement and verify proper heat-response device installed.

~~2.~~4. Inspect turning vanes for proper and secure installation.

END OF SECTION

~~Contract No.~~

SECTION 233319

FIXED LOUVERS

PART 1 GENERAL

1.01. SUMMARY

A. Section includes:

1. Fixed, extruded-aluminum louvers.
~~2. Fixed, fiberglass louvers~~

1.02. ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work, Show frame profiles and blade profiles, angles, and spacing.

C. Samples: For each type of metal finish required.

1.03. INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on tests performed according to AMCA 500-L.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

B. Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

2.02. FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Drainable-Blade Louver:

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

    a. Greenheck Fan Corporation.

    b. Reliable Products, Inc.

    c. Ruskin Company.

2. Louver Depth: 64 inches.

3. Frame and Blade Nominal Thickness: Not less than 0.080 inch.

4. Mullion Type: Exposed.

5. Louver Performance Ratings:

    a. Free Area: Not less than 8.0 sq. ft. for 48-inch-wide by 48-inch-high louver.

    b. Point of Beginning Water Penetration: Not less than 1000 fpm.

    c. Air Performance: Not more than 0.10-inch wg static pressure drop at 800-fpm free-area exhaust velocity.

B. Louver Screens:

1. Provide screen at each exterior louver.
    a. Interior face.
    b. Screening Type: Bird screening.

2. Louver Screen Frames: Same type and form of metal as indicated for louver to which screens are attached.

3. Louver Screening:

    a. Bird Screening: Aluminum, ½-inch-square mesh, 0.063-inch wire.

C. Materials:

1. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

2. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

3. Fasteners: Use types and sizes to suit unit installation conditions.

    a. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.

b. For fasteners aluminum, use aluminum or 300 series stainless-steel fasteners.
c. For color-finished louvers, use fasteners with heads that match color of louvers.

4. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. Fabrication:

1. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowance made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

2. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

E. ALUMINUM FINISHES

1. AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.
~~a.~~ Color: As selected by Architect from full range of industry colors and color densities.

~~2.03 FIXED FIBERGLASS LOUVERS~~

~~A. Horizontal, Drainable-Blade Louver:~~
~~1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:~~
~~a. Hartzall~~
~~b. Ruskin Company.~~
~~2. Louver Depth: 4 inches.~~
~~3. Frame and Blade Nominal Thickness: Not less than 0.080 inch.~~
~~4. Louver Performance Ratings:~~
~~a. Free Area: Not less than 6.0 sq. ft. for 48-inch-wide by 48-inch-high louver.~~
~~b. Point of Beginning Water Penetration: Not less than 780 fpm.~~
~~c. Air Performance: Not more than 0.10-inch wg static pressure drop at 800 fpm free area exhaust velocity.~~
~~5. Louvers shall comply with ASTM D 4385-8A and be tested and show recard for ASTM D 2584-68.~~
~~6. Material:~~
~~a. Louver shall be constructed of a flame retardant vinyl ester based substance.~~
~~7. Screen:~~
~~a. PVC coated bird screen .5" mesh 19 gauge.~~

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PART 3 EXECUTION

3.01 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

3.02 ADJUSTING

A. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

END OF SECTION

SECTION 233713.13 - AIR TERMINALS DIFFUSERS

TIPS:

To view non-printing **Editor's Notes** that provide guidance for editing, click on MasterWorks/Single-File Formatting/Toggle/Editor's Notes.

To read **detailed research, technical information about products and materials, and coordination checklists**, click on MasterWorks/Supporting Information.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Round ceiling diffusers.
1. Rectangular and square ceiling diffusers.
2. Rectangular supply grilles.
2.3. Rectangular and square return grilles.
3. Perforated diffusers.
4. Louver face diffusers.
5. Linear bar diffusers.
6. Linear slot diffusers.
7. Ceiling-integral continuous slot diffusers.
8. Light troffer diffusers.
9. Round induction underfloor air distribution diffusers.
10. Linear underfloor air-distribution diffuser plenums.
11. High-capacity drum louver diffusers.
12. High-capacity, modular core supply grille diffusers.

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B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
2. Section 233713.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.
3. Section 233713.43 "Security Registers and Grilles" for security registers and security grilles.
4. Section 233716 "Fabric Air Diffusion Devices" for continuous tubular diffusers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples: For each exposed product and for each color and texture specified. Actual size of smallest diffuser indicated.

C. Samples for Initial Selection: For diffusers with factory-applied color finishes. Actual size of smallest diffuser indicated.

D. Samples for Verification: For diffusers, in manufacturer's standard sizes to verify color selected. Actual size of smallest diffuser indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 ROUND CEILING DIFFUSERS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Devices shall be specifically designed for variable-air-volume flows.

C. Material: **[Steel] [Aluminum]**.

D. Finish: **[Baked enamel, white] [Baked enamel, color selected by Architect] [Anodized aluminum] <Insert finish>**.

E. Face Style: **[Four] [Three] [Two]** cone.

F. Mounting: Duct connection.

~~G. Pattern: [**Fully adjustable**] [**Two-position horizontal**].~~

~~H. Dampers: [**Radial opposed blade**] [**Butterfly**] [**Combination damper and grid**].~~

~~I. Accessories:~~

~~1. Equalizing grid.~~
~~2. Plaster ring.~~
~~3. Safety chain.~~
~~4. Wire guard.~~
~~5. Sectorizing baffles.~~
~~6. Operating rod extension.~~

2.1 RECTANGULAR AND SQUARE CEILING DIFFUSERS

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A. Ceiling and side wall diffusers shall be aluminum of the sizes and mounting types shown on the plans and outlet schedule. Diffuser shall have curved deflectors, which are individually adjustable from the face of diffuser to regulate air volume and angle of discharge. Diffusers shall be built in one-, two-, three- or four-Way discharge patterns. The diffusers shall be constructed of 0.051 aluminum.

B. Optional opposed blade damper shall be installed on the neck of the diffuser. Damper must be operable from the face of the diffuser by placing a standard screwdriver between the curved deflectors.

C. The manufacturer shall provide published performance data for the c~~A~~eiling/side wall diffuser. The diffuser shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

2.2 RECTANGULAR SUPPLY GRILLES

A. Aluminum supply grilles shall be the sizes and mounting types as shown on the plans and outlet schedule. The deflection blades shall be available parallel to the long dimension of the grille. All supply grilles shall be constructed with heavy aluminum border having a minimum thickness of 0.040-0.050 inch. Outer borders shall be assembled and interlocked at the four corners and mechanically staked to form a rigid frame. Screw holes shall be countersunk for a neat appearance.

B. Blades shall be constructed of heavy duty aluminum and shall be contoured to a specifically designed airfoil cross-section to meet published performance data. Hollow blades are not acceptable. Blades must be solid. Blades shall be spaced ¾-inch apart. Blades shall extend completely through the side frame on each side to ensure stability throughout the complete cfm operating range of the grille. Blades shall be individually adjustable without loosening or rattling and shall be securely held in place with tension wire.

C. Optional opposed-blade volume damper shall be constructed of aluminum. Damper must be operable from the face of the grille.

D. The manufacturer shall provide published performance data for the grille. The grille shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

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2.3 RECTANGULAR AND SQUARE RETURN GRILLES

A. Aluminum return grilles shall have fixed deflection blades available parallel to the long dimension of the grille. Construction shall be of extruded aluminum and shall be interlocked at the four corners and mechanically staked to form a rigid frame. Minimum border thickness shall be 0.040 to 0.050 inch. Screw holes shall be countersunk for a neat appearance.

B. Blades shall be contoured to a specifically designed and tested cross-section to meet published performance data. Blades shall be firmly held in place by mullions from behind the grille and fixed in place by crimping or welding. Blade shall have a fixed deflection angle of 45°.

C. Optional opposed-blade volume damper shall be constructed of aluminum. Damper must be operable from the face of the grille.

2.2D. The manufacturer shall provide published performance data for the grille. The grille shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

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A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Devices shall be specifically designed for variable-air-volume flows.

C. Material: **[Steel] [Aluminum]**.

D. Finish: **[Baked enamel, white] [Baked enamel, color selected by Architect] [Anodized aluminum] <Insert finish>.**

E. Face Size: **[24 by 24 inches (600 by 600 mm)] [20 by 20 inches (500 by 500 mm)] [12 by 12 inches (300 by 300 mm)] <Insert dimensions>.**

F. Face Style: **[Three cone] [Four cone] [Plaque]**.

G. Mounting: **[Surface] [T-bar] [Snap-in] [Spline] [Mounting panel]**.

H. Pattern: **[Fixed] [Two position] [Adjustable]**.

I. Dampers: **[Radial opposed blade] [Butterfly] [Combination damper and grid]**.

J. Accessories:

1. Equalizing grid.
2. Plaster ring.
3. Safety chain.
4. Wire guard.
5. Sectorizing baffles.
6. Operating rod extension.

2.3 PERFORATED DIFFUSERS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Devices shall be specifically designed for variable-air-volume flows.

C. Material: Steel backpan and pattern controllers, with [**steel**] [**aluminum**] face.

D. Finish: [**Baked enamel, white**] [**Baked enamel, color selected by Architect**] [**Anodized aluminum**] <**Insert finish**>.

E. Face Size: [**12 by 12 inches (300 by 300 mm)**] [**24 by 12 inches (600 by 300 mm)**] [**36 by 12 inches (900 by 300 mm)**] [**48 by 12 inches (1200 by 300 mm)**] [**16 by 16 inches (400 by 400 mm)**] [**20 by 20 inches (500 by 500 mm)**] [**24 by 24 inches (600 by 600 mm)**] [**36 by 24 inches (900 by 600 mm)**] [**48 by 24 inches (1200 by 600 mm)**] <**Insert dimensions**>.

F. Duct Inlet: [**Round**] [**Square**].

G. Face Style: [**Flush**] [**Drop extended**].

H. Mounting: [**Surface**] [**T-bar**] [**Snap-in**] [**Spline**] [**Mounting panel**].

I. Pattern Controller: [**Four louvered deflector patches**] [**Fixed with curved blades at inlet**] [**Adjustable with louvered pattern modules at inlet**] [**None**].

J. Dampers: [**Opposed blade**] [**Radial opposed blade**] [**Butterfly**] [**Combination damper and grid**] [**Combination volume and fire**].

K. Accessories:

1. Equalizing grid.
2. Plaster ring.
3. Safety chain.
4. Wire guard.
5. Sectorizing baffles.
6. Operating rod extension.

2.4 LOUVER FACE DIFFUSERS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Devices shall be specifically designed for variable-air-volume flows.

C. Material: [**Steel**] [**Aluminum**].

D. Finish: [**Baked enamel, white**] [**Baked enamel, color selected by Architect**] [**Anodized aluminum**] <**Insert finish**>.

E. Face Size: <**Insert inches (mm)**>.

F. Mounting: [**Surface**] [**Surface with beveled frame**] [**T-bar**] [**Snap-in**] [**Spline**] [**Mounting panel**].

G. Pattern: [**One way**] [**Two way**] [**Two way corner**] [**Three way**] [**Four way**] [**Adjustable**] <**Insert pattern**> core style.

H. Dampers: [**Radial opposed blade**] [**Butterfly**] [**Combination damper and grid**].

I. Accessories:

1. Square to round neck adaptor.
2. Adjustable pattern vanes.
3. Throw reducing vanes.
4. Equalizing grid.
5. Plaster ring.
6. Safety chain.
7. Wire guard.
8. Sectorizing baffles.
9. Operating rod extension.

2.5 LINEAR BAR DIFFUSERS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Devices shall be specifically designed for variable air volume flows.

C. Material: [**Steel**] [**Aluminum**] [**Stainless steel**].

D. Finish: [**Baked enamel, white**] [**Baked enamel, color selected by Architect**] <**Insert finish**>.

E. Narrow Core Spacing Arrangement: 1/8 inch (3 mm) thick blades spaced 1/4 inch (6 mm) apart; [**zero**] [**15**] degree deflection.

F. Wide Core Spacing Arrangement: 1/8 inch (3 mm) thick blades spaced 1/2 inch (13 mm) apart; [**zero**] [**15**] degree deflection.

G. Wide Core Spacing Arrangement: 3/16 inch (5 mm) thick blades spaced 1/2 inch (13 mm) apart; [**zero**] [**15**] [**30**] degree deflection.

H. Pencil Proof Core Spacing Arrangement: 3/16 inch (5 mm) thick blades spaced 7/16 inch (11 mm) apart; [**zero**] [**15**] [**30**] degree deflection.

I. [**One**] [**Two**] Way Deflection Vanes: Extruded construction [**fixed**] [**adjustable**] louvers with removable core.

J. Frame: [**1-1/4 inches (32 mm)**] [**1 inch (25 mm)**] [**3/4 inch (19 mm)**] [**1/2 inch (13 mm)**] [**3/16 inch (5 mm)**] wide.

K. Mounting Frame: [**Filter**] <**Insert frame size and style**>.

L. Mounting: [**Countersunk screw**] [**Concealed bracket**] [**Spring clip**].

M. Damper Type: [**Adjustable opposed blade assembly**] [**Hinged single blade**].

N. Accessories: [**Plaster frame**] [**Directional vanes**] [**Alignment pins**] [**Core clips**] [**Blank off strips**].

2.6 LINEAR SLOT DIFFUSERS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Devices shall be specifically designed for variable air volume flows.

C. Material - Shell: [**Steel**] [**Aluminum**], [**insulated**] [**noninsulated**].

D. Material - Pattern Controller and Tees: Aluminum.

E. Finish - Face and Shell: [**Baked enamel, black**] <**Insert finish**>.

F. Finish - Pattern Controller: [**Baked enamel, black**] <**Insert finish**>.

G. Finish - Tees: [**Baked enamel, white**] [**Baked enamel, color selected by Architect**] <**Insert finish**>.

H. Slot Width: [**1/2 inch (13 mm)**] [**3/4 inch (19 mm)**] [**1 inch (25 mm)**] [**1 1/2 inches (38 mm)**].

I. Number of Slots: [**One**] [**Two**] [**Three**] [**Four**] <**Insert number**>.

J. Length: [**24 inches (600 mm)**] [**30 inches (750 mm)**] [**36 inches (900 mm)**] [**48 inches (1200 mm)**] [**60 inches (1500 mm)**].

K. Accessories: [**Plaster frame**] [**T-bar slot**] [**Center notch**] [**T-bar on inlet side**] [**T-bar on both sides**] [**T-bar clip on one side**] [**T-bar clips on both sides**].

2.7 CEILING INTEGRAL CONTINUOUS DIFFUSERS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Slot Width: [**1 inch (25 mm)**] [**1 1/2 inches (38 mm)**] [**2 inches (50 mm)**] [**2 1/2 inches (63 mm)**] [**3 inches (76 mm)**].

C. Section Length: [**12 feet (3.7 m)**] <**Insert dimension**>.

D. Straight and curved sections as required to accommodate layout.

E. Mitered tees and corners.

F. Pattern Controllers: [**24 inches (600 mm)**] <**Insert dimension**> o.c.

G. Material: Aluminum, extruded, heavy wall.

H. Finishes:

1. Exterior: Standard white.
2. Interior: Standard black.

I. Throw: [**Standard**] [**High**].

J. Mounting: [**Ceiling**] [**Sidewall**].

K. Plenum: [**Noninsulated**] [**Insulated**].

L. Other Features:

1. Painted interior.
2. Blank-offs.

2.8 LIGHT TROFFER DIFFUSERS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Devices shall be specifically designed for variable-air-volume flows.

C. Material: Steel[**with external insulation**].

D. Finish: [**None**] [**Black enamel on visible surfaces**] <**Insert finish**>.

E. Slot Width: [**1/2 inch (13 mm)**] [**3/4 inch (19 mm)**] [**1 inch (25 mm)**] [**1-1/2 inches (38 mm)**].

F. Number of Sides: [**One**] [**Two**].

G. Length: [**24 inches (600 mm)**] [**36 inches (900 mm)**] [**48 inches (1200 mm)**].

H. Pattern: [**Fixed**] [**Adjustable**].

I. Inlet: [**Top**] [**Side**].

J. Inlet Size: [**5 inches (125 mm)**] [**6 inches (150 mm)**] [**8 inches (200 mm)**].

2.9 ROUND INDUCTION UNDERFLOOR AIR-DISTRIBUTION DIFFUSERS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Airflow Principle: Swirl-pattern induction.

C. Material: Plastic, high impact, and resistant to cart and foot traffic.

D. Color: [**Gray**] [**Black**].

E. Components:

1. Diffuser core.
2. Flow regulator.
3. Dirt and liquid catch pan.
4. Spacer flange.
5. Gasketed, underfloor compression ring.

2.10 LINEAR UNDERFLOOR AIR DISTRIBUTION DIFFUSER PLENUMS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Material: Steel.

C. Finish: White baked acrylic.

D. Deflection: [**Zero**] [**15**] degrees.

E. Components:

1. Aluminum diffuser core.
2. Diffuser frame.
3. Plenum, 0.034 inch (0.85 mm) steel.

2.11 HIGH CAPACITY DRUM LOUVER DIFFUSERS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Airflow Principle: Extended distance for high airflow rates.

C. Material: Aluminum, heavy gage extruded.

D. Finish: White baked acrylic.

E. Border: 1 1/4 inch (32 mm) width with countersunk screw holes.

F. Gasket between drum and border.

G. Body: Drum shaped; adjustable vertically.

H. Blades: Individually adjustable horizontally.

I. Mounting: Surface to [**duct**] [**wall**].

J. Inlet Width: [**6 inches (150 mm)**] [**10 inches (250 mm)**] [**12 inches (300 mm)**] [**15 inches (380 mm)**] <**Insert dimension**>.

K. Inlet Length: [**12 inches (300 mm)**] [**24 inches (600 mm)**] [**36 inches (900 mm)**] [**60 inches (1500 mm)**] <**Insert dimension**>.

L. Accessories:

1. Opposed blade steel damper.
2. Duct mounting collars with countersunk screw holes.

2.12 HIGH CAPACITY, MODULAR CORE SUPPLY GRILLE DIFFUSERS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Throw: Extended distance for airflow rates.

C. Material: Steel.

D. Grilles per Unit: [**One**] [**Two**] [**Three**] [**Four**].

E. Finish: White baked acrylic.

F. Border: 1-1/2-inch (38-mm) width with countersunk screw holes.

G. Blades:

1. Airfoil, individually adjustable horizontally.
2. Double deflection.
3. Set in modules.

H. Modules: Removable; rotatable.

I. Mounting: Surface.

J. Accessory: Opposed-blade steel damper.

2.13 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.13

SECTION 238126

SPLIT-SYSTEM AIR CONDITIONERS

PART 1 GENERAL

1.01. SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.02. ACTION SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.03. INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.04. CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.05. QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."

2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.06. WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: One year(s) from date of Substantial Completion.

b. For Parts: One year(s) from date of Substantial Completion.

c. For Labor: One year(s) from date of Substantial Completion.

PART 2 PRODUCTS

2.01. MANUFACTURERS

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

1. Daikin.

2. Trane.

3. YORK; a Johnson Controls company.

2.02. AIR HANDLER (5 TONS OR LESS)

A. Wall-Mounted, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends, and discharge drain pans with drain connection.

2. Refrigerant Coil:

a. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
b. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
c. The coil shall be a 3 row cross fin copper evaporator coil with 13 fpi design completely factory tested.
d. The refrigerant connections shall be flare connections and the condensate will be 1-5/16 inch outside diameter PVC.
e. A thermistor will be located on the liquid and gas line.

3. Fan:

a. The fan shall be direct-drive Sirocco type fan, statically and dynamically balanced impeller with high and low fan speeds available.
b. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz, with a motor output of 0.51 HP.
c. The airflow rate shall be available in high and low settings.
d. The fan motor shall be thermally protected.
e. The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings.
f. Fan motor external static pressure for nominal airflow.

4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

5. Condensate Drain Pans:

   a. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
      1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
      2) Depth: A minimum of 1 inch deep.
   b. Single-wall, stainless-steel sheet.
   c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
      1) Minimum Connection Size: NPS1.
   d. Pan-Top Surface Coating: Asphaltic waterproofing compound.

6. Air Filtration Section:

   a. General Requirements for Air Filtration Section:
      1) Comply with NFPA 90A.
      2) Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
      3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.
   b. Disposable Panel Filters:
      1) Factory-fabricated, viscous-coated, flat-panel type.
      2) Thickness: 1 inch.
      3) Arrestance according to ASHRAE 52.1: 80.
      4) Merv according to ASHRAE 52.2: 5
      5) Media: Interlaced glass fibers sprayed with nonflammable adhesive.
      6) Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged: with pull and retaining handles.

2.03. CONDENSER UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

   a. Compressor Type: Scroll.
   b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
   c. Refrigerant Charge: R-410A.

d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.

3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.

4. Fan: Aluminum-propeller type, directly connected to motor.

5. Motor: Permanently lubricated, with integral thermal-overload protection.

6. Low Ambient Kit: Permits operation down to 45 deg F.

7. Mounting Base: Polyethylene.

2.04. ACCESSORIES

A. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

B. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:

1. Compressor time delay.

2. 24-hour time control of system stop and start.

3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.

4. Fan-speed selection including auto setting.

C. Automatic-reset timer to prevent rapid cycling of compressor.

D. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

E. Drain Hose: For condensate.

PART 3 EXECUTION

3.01. INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.02. CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.03. FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.04 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

~~Daikin North America LLC~~

~~HVAC Guide Specifications~~
~~Multiple Evaporator, Direct Expansion (DX), Air-Cooled, Variable Capacity, Split System~~
SECTION 238127

INDOOR AIR CONDITIONING UNITS

~~Section 15700 – Mechanical HVAC~~

~~Size Range:~~
~~0.6 to 8 Tons Nominal~~

~~Daikin Model Number:~~
~~FXFQ INDOOR UNIT – ROUND FLOW SENSING CEILING CASSETTE UNIT~~
~~FXZQ INDOOR UNIT – 4 WAY CEILING CASSETTE UNIT (2'x2')~~
~~FXMQ INDOOR UNIT – CONCEALED CEILING DUCTED UNIT (Med. Static)~~
~~FXSQ INDOOR UNIT – CONCEALED CEILING DUCTED UNIT (Med. Static)~~
~~FXDQ INDOOR UNIT – SLIM DUCT CONCEALED CEILING UNIT~~
~~FXHQ INDOOR UNIT – CEILING SUSPENDED CASSETTE UNIT~~
~~FXAQ INDOOR UNIT – WALL MOUNTED UNIT~~
~~FXLQ INDOOR UNIT – FLOOR CONSOLE UNIT~~
~~FXNQ INDOOR UNIT – FLOOR CONSOLE CONCEALED UNIT~~
~~FXTQ INDOOR UNIT – MULTI POSITION AIR HANDLING UNIT~~
~~FXUQ 4 WAY CEILING SUSPENDED CASSETTE UNIT~~
~~FXEQ ONE WAY BLOW CASSETTE~~

PART 1 GENERAL

1.01. SUMMARY

A. ~~A.~~ Section includes:

1. ~~Variable Refrigerant Volume (VRV) Indoor Air Conditioning~~Ceiling Cassette Units

2. Concealed Ceiling Ducted Units

3. Wall Mounted Units

~~Units with Heat Recovery/Heat Pump~~

1.02 ~~1.02~~ ACTION SUBMITTALS

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

A.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

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1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.03. INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.04. CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

~~**Part 1 GENERAL**~~

~~VARIABLE REFRIGERANT VOLUME (VRV / VRV-S) AIR CONDITIONING SPECIFICATION Heat Recovery/Heat Pump Indoor Units~~

1.05 QUALITY ASSURANCE
~~1.01~~

A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995/CAN/CSA-C22.2 No. 236-05 (R2009) – Heating and Cooling Equipment and bear the Listed Mark.
B. All wiring shall be in accordance with the National Electric Code (NEC)/Canadian Electrical Code (CEC).
C. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.
D. The outdoor unit will be factory charged with R-410A.

1.06. WARRANTY

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

~~For Compressor: One year(s) from date of Substantial Completion.~~

a. For Parts: One year(s) from date of Substantial Completion.

b. For Labor: One year(s) from date of Substantial Completion.

~~D.~~

1.07 DELIVERY, STORAGE AND HANDLING
~~1.02~~

A. Unit shall be stored and handled according to the manufacturer's recommendations.

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Part 2 WARRANTY

STANDARD LIMITED WARRANTY

Daikin North America LLC warrants original owner of the non-residential building, multifamily residence or residence in which the Daikin products are installed that under normal use and maintenance for comfort cooling and conditioning applications such products (the "Products") will be free from defects in material and workmanship. This warranty applies to compressor and all parts and is limited in duration to ten (10) years starting from the ''installation date'' which is one of the two dates below:

a. The installation date is the date that the unit is originally commissioned, but no later than 18 months after the manufacture date noted on the unit's rating plate.
b. If the date the unit is originally commissioned cannot be verified, the installation date is three months after the manufacture date.

Complete warranty details available from your local Daikin representative or at www.daikincomfort.com

Part 3 PERFORMANCE

3.01 DESIGN BASIS

The HVAC equipment basis of design is Daikin. All bidders shall furnish the minimum system standards as defined by the base bid model numbers, model families or as otherwise specified herein (see Key General Specifications Alternate Supplier Checklist). In any event the contractor shall be responsible for all specified items and intents of this document without further compensation.

Part 24 –PRODUCTS

2.01. MANUFACTURERS

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

1. Daikin.

2. Trane.

3. YORK; a Johnson Controls company.

4.01 FXFQ_T ROUND FLOW SENSING CEILING CASSETTE UNIT

A. General: Daikin indoor unit model FXFQ_T shall be a round flow ceiling cassette fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, direct drive DC (ECM) type fan, for installation into the ceiling cavity equipped with an air panel grill. It shall be available in capacities from 7,500 Btu/h to 48,000 Btu/h. Model numbers are FXFQ07TVJU, FXFQ09TVJU, FXFQ12TVJU, FXFQ15TVJU, FXFQ18TVJU, FXFQ24TVJU, FXFQ30TVJU, FXFQ36TVJU, FXFQ48TVJU to be connected to outdoor unit model RXYQ / RXYMQ / RWEYQ heat pump and REYQ / RWEYQ heat recovery model. It shall be a round flow air distribution type, fresh white, impact

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resistant decoration panel, or optional self-cleaning filter panel. The supply air is distributed via four individually motorized louvers. To save energy and optimize occupancy comfort, the indoor unit shall be equipped with built in occupancy sensor and surface temperature sensor. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73, BRC2A71 and BRC1E52B7. The indoor units sound pressure shall range from 30 dB(A) to 45 dB(A) at High speed measured at 5 feet below the unit.

B. Performance: Each unit's performance is based on nominal operating conditions:

Model Number	Cooling (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	Heating (Indoor 70°F DB Outdoor 47F / 43F, 25 ft pipe length)
FXFQ07TVJU	7,500	8,500
FXFQ09TVJU	9,500	10,500
FXFQ12TVJU	12,000	13,500
FXFQ15TVJU	15,000	16,500
FXFQ18TVJU	18,000	20,000
FXFQ24TVJU	24,000	27,000
FXFQ30TVJU	30,000	34,000
FXFQ36TVJU	36,000	40,000
FXFQ48TVJU	48,000	54,000

C. Indoor Unit:
1. The Daikin indoor unit FXFQ_T shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be insulated from the outdoor unit.
4. The round flow supply air flow can be field modified to 23 different airflow patterns to accommodate various installation configurations including corner installations.
5. Return air shall be through the concentric panel, which includes a resin net, mold resistant, antibacterial filter.
6. The indoor units shall be equipped with a condensate pan with antibacterial treatment and condensate pump. The condensate pump provides up to 33-1/2" of lift from bottom of unit to top of drain piping and has a built in safety shutoff and alarm.
7. The indoor units shall be equipped with a return air thermistor.
8. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
9. The voltage range will be 253 volts maximum and 187 volts minimum.
10. To save energy and optimize occupancy comfort, the indoor unit shall be equipped with built in occupancy sensor and surface temperature sensor.
11. Supplied air shall be directed automatically by four individually controlled louvers.

D. Unit Cabinet:
1. The cabinet shall be space saving and shall be located into the ceiling.

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2. Four auto-adjusted louvers shall be available to choose, which include standard, draft prevention and ceiling stain prevention.
3. The airflow of the unit shall have the ability to shut down outlets with multiple patterns allowing for simpler installation in irregular spaces.
4. Fresh air intake shall be possible by way of Daikin's optional fresh air intake kit.
5. A branch duct knockout shall exist for branch ducting of supply air.
6. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.
7. Optional high efficiency air filters are available for each model unit.

A. Fan:

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1. The fan shall be direct drive DC (ECM) type fan, statically and dynamically balanced impeller with three fan speeds available.
2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range from 0.08 to 0.16 HP.
3. The airflow rate shall be available in three manual settings.
4. The DC fan shall be able to automatically adjust the fan speed in 5 speeds based on the space load.

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5. The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings to allow operation with the high efficiency air filter options.

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6. The fan motor shall be thermally protected.

B. Filter:

1. The return air shall be filtered by means of a washable long life filter with mildew proof resin and antibacterial treatment.

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2. Optional high efficiency disposable air filters shall be available.
3. Optional Self-Cleaning Filter Panel, which performs automatic filter cleaning up to once a day, with dust collection box that indicates when to be emptied.

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C. Coil:

1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.

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2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 2, or 3 row cross fin copper evaporator coil with up to 21 FPI design completely factory tested.
4. The refrigerant connections shall be flare connections and the condensate will be 1-1/4 inch outside diameter PVC.

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5. A condensate pan with antibacterial treatment shall be located under the coil.
6. A thermistor will be located on the liquid and gas line.

D. Electrical:

1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.

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2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

E. Control:

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1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.

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2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
3. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

1. For the Sensing functions and the optional Self-Cleaning Filter functions, Remote controller BRC1E73/BRC1E52B7 shall be used. Consult with Daikin prior to applying controls.

F. Optional Accessories Available:
1. A high efficiency disposable air filter kit
2. Air intake kit
3. Self-Cleaning Filter Panel, which performs automatic filter cleaning up to once a day, with dust collection box that indicates when to be emptied.
4. Remote "in-room" sensor kit (KRCS01-4B).
   i. The Daikin wall mounted, hard wired remote sensor kit is recommended for when a NAV controller is not used or when the NAV controller is not located in the space that is being controlled. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).

2.024.02 FXZQ-TAVJU VISTA™ 2x2 CEILING CASSETTE UNIT (note: obsolete)

A. General: Daikin indoor Uunit model FXZQ-TAVJU shall be a ceiling cassette fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation into the ceiling cavity equipped with a decoration panel grille. It shall be available in capacities from 5,800 Btu/h to 18,000 Btu/h. Model numbers are FXZQ05TAVJU, FXZQ07TAVJU, FXZQ09TAVJU, FXZQ12TAVJU, FXZQ15TAVJU, FXZQ18TAVJU to be connected to outdoor unit model RXYQ / RXYMQ / RWEYQ / RWEQ heat pump and REYQ / RELQ / RWEYQ / RWEQ heat recovery model. The decoration panel shall be a four-way air distribution type, with fresh white (Munsell N9.5) or Daikin Silver color, impact resistant with a washable decoration panel. The supply air is distributed via motorized louvers which can be horizontally and vertically adjusted from 0° to 90°. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote controls. The indoor units sound pressure shall range from 25.5 dB(A) to 33 dB(A) at low speed measured at 5 feet below the unit.

A.

Model Number	Cooling (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	Heating (Indoor 70°F DB / 60°F WB, Outdoor 47°F DB, 25 ft pipe length)
FXZQ05TAVJU	5,800	6,500
FXZQ07TAVJU	7,500	8,500
FXZQ09TAVJU	9,500	10,500
FXZQ12TAVJU	12,000	13,500
FXZQ15TAVJU	15,000	17,000
FXZQ18TAVJU	18,000	20,000

A. Performance: Each unit's performance is based on nominal operating conditions:

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B. Indoor Unit:
1. U~~The Daikin indoor u~~nit ~~FXZQ-TAVJU~~ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be fully insulated from the outdoor unit or nearest branch connection into the refrigerant network.
4. The 4-way supply air flow can be field modified to 3-way and 2-way airflow to accommodate various installation configurations including corner installations.
5. Return air shall be through the concentric panel, which includes a resin net mold resistant filter.
6. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 24-13/16" of lift, measured from the drain outlet, and has a built in safety shutoff and alarm.
7. The indoor units shall be equipped with a return air thermistor.
8. The indoor unit will be powered with 208~230V/1-phase/60Hz.

~~9. The voltage range will be 253 volts maximum and 187 volts minimum.~~

C. Unit Cabinet:
1. The cabinet ~~shall be space saving and~~ shall be located into the ceiling.

~~2. Three auto-swing positions shall be available to choose from via field setting.~~
~~3. The airflow of the unit shall have the ability to shut down one or two sides allowing for simpler corner installation.~~

~~4.~~2. Fresh air intake shall be possible by way of direct duct installation to the side of the indoor unit cabinet.
~~5.~~3. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

~~D. Decoration Panel:~~
~~The FXZQ-TAVJU series shall be compatible with three optional decoration panels:~~
~~1. VISTA Decoration panel – white (BYFQ60C3W1W).~~
~~i. The decoration panel shall be a four-way air distribution type and constructed of impact resistant polymer.~~
~~ii. The decoration panel dimensions shall measure 24-7/16" x 24-7/16" and shall fit into a standard 2x2 ceiling grid with no overlap of adjacent tiles.~~
~~iii. The four air discharge outlet louvers shall be independently motorized and controllable. Each louver shall have a visual indicator to easily identify the louver and simplify the airflow configuration.~~
~~iv. The louver outlets shall be capable of closure to allow for 3-way and 2-way air distribution.~~
~~v. The decoration panel shall be a low profile design, extending 5/16" below the ceiling.~~
~~vi. The decoration panel shall be compatible with the optional space and presence sensor kit, model BRYQ60A2W.~~
~~vii. The decoration panel color shall be fresh white (Munsell N9.5).~~
~~2. VISTA Decoration panel – silver and white (BYFQ60C3W1S).~~

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~~i. The decoration panel shall be a four-way air distribution type and constructed of impact resistant polymer.~~
~~ii. The decoration panel dimensions shall measure 24-7/16" x 24-7/16" and shall fit into a standard 2x2 ceiling grid with no overlap of adjacent tiles.~~
~~iii. The four air discharge outlet louvers shall be independently motorized and controllable. Each louver shall have a visual indicator to easily identify the louver and simplify the airflow configuration.~~
~~iv. The louver outlets shall be capable of closure to allow for 3-way and 2-way air distribution.~~
~~v. The decoration panel shall be a low profile design, extending 5/16" below the ceiling.~~
~~vi. The decoration panel shall be compatible with the optional space and presence sensor kit, model BRYQ60A2S.~~
~~vii. The decoration panel color shall be fresh white (Munsell N9.5) and a specialty Daikin Silver color.~~

~~3. Legacy FXZQ-MVJU9 decoration panel (BYFQ60B3W1).~~
~~i. The FXZQ-TAVJU cassette body shall be compatible with the legacy 2x2 decoration panel BYFQ60B3W1.~~

~~E. Optional Space and Presence sensor kit:~~
~~1. The space and presence sensor shall be color matched to the decoration panel.~~
~~2. The sensor kit shall be capable of sensing occupancy within the space and automatically controlling the indoor unit set point in response to the detection of occupancy.~~
~~3. The sensor kit shall be capable of automatically adjusting the direction of individual air discharge outlet louvers in response to the detection of occupants in the vicinity of the unit.~~
~~4. The sensor kit shall be capable of automatically adjusting the direction of individual air discharge outlet louvers in response to the sensed floor temperature.~~

~~F.~~D. Fan:
1. The fan shall be driven by a direct-drive DC motor with statically and dynamically balanced impeller and shall have three user-selectable speeds available: high, medium, and low.
2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz ~~with a motor output of 50W.~~
3. The airflow rate shall be available in high, medium, and low settings.

~~4. When FXZQ-TAVJU is connected with either the BRC1E73 Navigation Remote Controller or the DCM601A71 I-Touch Manager, the Auto fan mode shall be selectable.~~

~~G.~~E. Filter:
1. The return air shall be filtered by means of a washable long-life filter with mildew proof resin.

~~H.~~F. Coil:
1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 2-row cross fin copper evaporator coil with 22 FPI design completely factory tested.
4. The refrigerant connections shall be flare connections and the condensate will be 1 -1/32 inch outside diameter PVC.
5. A condensate pan shall be located under the coil.

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6. A condensate pump with a 24-13/16" lift, measured from the drain outlet, shall be located below the coil in the condensate pan with a built in safety alarm.
7. A thermistor will be located on the liquid and gas line.

I.G. Electrical:

1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

J.H. Control:

1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
2. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

K. Optional Accessories Available:

1. VISTA Decoration panel – white (BYFQ60C3W1W)
2. VISTA Decoration panel – silver & white (BYFQ60C3W1S)
3. Legacy FXZQ decoration panel (BYFQ60B3W1)
4. Space and Presence sensor kit – white (BRYQ60A2W)
   a. Sensor kit shall be color matched to pair with the VISTA decoration panel BYFQ60C3W1W. Space and presence sensor kit is not compatible with BYFQ60B3W1.
5. Space and Presence sensor kit – silver (BRYQ60A2S)
   a. Sensor kit shall be color matched to pair with the VISTA decoration panel BYFQ60C3W1S. Space and presence sensor kit is not compatible with BYFQ60B3W1.
6. Sealing member of air discharge outlet (BDBHQ44C60)
7. Panel spacer (KDBQ44BA60A)
   a. Panel spacer is compatible only with BYFQ60B3W1.
8. Direct fresh air intake kit (KDDQ44XA60).
9. Infrared remote controller and receiver – white (BRC082A42W)
   a. Receiver shall be color matched
10. Infrared remote controller and receiver – silver (BRC082A42S)
11. Infrared remote controller and receiver (BRC082A41W)
12. Wired remote controller (BRC1E73)
13. Adaptor for wiring (KRP1C75)
14. Wiring adaptor for electrical appendices (KRP4A74)
15. Installation box for adaptor PCB (KRP1BA101)
16. Remote "in-room" sensor kit (KRCS01-4B).
    i. The Daikin wall mounted, hard-wired remote sensor kit is recommended for ceiling-embedded type fan coils, which often result in a difference between set temperature and actual temperature. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).

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L. General: Daikin indoor unit model FXZQ-TBVJU shall be a ceiling cassette fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation into the ceiling cavity equipped with a decoration panel grille. It shall be available in capacities from 5,800 Btu/h to 18,000 Btu/h. Model numbers are FXZQ05TBVJU, FXZQ07TBVJU, FXZQ09TBVJU, FXZQ12TBVJU, FXZQ15TBVJU, FXZQ18TBVJU to be connected to outdoor unit model RXYQ / RXYMQ / RWEYQ / RWEQ heat pump and REYQ / RELQ / RWEYQ / RWEQ heat recovery model. The decoration panel shall be a four-way air distribution type, with fresh white (Munsell N9.5) color, impact resistant with a washable decoration panel. The supply air is distributed via motorized louvers which can be horizontally and vertically adjusted from 0° to 90°. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote controls. The indoor units sound pressure shall range from 25.5 dB(A) to 33 dB(A) at low speed measured at 5 feet below the unit.

M. Performance: Each unit's performance is based on nominal operating conditions:

Model Number	Cooling (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	Heating (Indoor 70°F DB / 60°F WB, Outdoor 47°F DB, 25 ft pipe length)
FXZQ05TBVJU	5,800	6,500
FXZQ07TBVJU	7,500	8,500
FXZQ09TBVJU	9,500	10,500
FXZQ12TBVJU	12,000	13,500
FXZQ15TBVJU	15,000	17,000
FXZQ18TBVJU	18,000	20,000

N. Indoor Unit:

10. The Daikin indoor unit FXZQ-TBVJU shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
11. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
12. Both refrigerant lines shall be fully insulated from the outdoor unit or nearest branch connection into the refrigerant network.
13. The 4-way supply air flow can be field modified to 3-way and 2-way airflow to accommodate various installation configurations including corner installations.
14. Return air shall be through the concentric panel, which includes a resin net mold resistant filter.
15. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 24-13/16" of lift, measured from the drain outlet, and has a built in safety shutoff and alarm.

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16. The indoor units shall be equipped with a return air thermistor.
17. The indoor unit will be powered with 208-230V/1-phase/60Hz.
18. The voltage range will be 253 volts maximum and 187 volts minimum.

O. Unit Cabinet:
6. The cabinet shall be space saving and shall be located into the ceiling.
7. Three auto-swing positions shall be available to choose from via field setting.
8. The airflow of the unit shall have the ability to shut down one or two sides allowing for simpler corner installation.
9. Fresh air intake shall be possible by way of direct duct installation to the side of the indoor unit cabinet.
10. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

P. Decoration Panel:
The FXZQ-TBVJU series shall be compatible with three optional decoration panels:
4. VISTA Decoration panel – white (BYFQ60C3W2W).
i. The decoration panel shall be a four-way air distribution type and constructed of impact resistant polymer.
ii. The decoration panel dimensions shall measure 24-7/16" x 24-7/16" and shall fit into a standard 2x2 ceiling grid with no overlap of adjacent tiles.
iii. The four air discharge outlet louvers shall be independently motorized and controllable. Each louver shall have a visual indicator to easily identify the louver and simplify the airflow configuration.
iv. The louver outlets shall be capable of closure to allow for 3-way and 2-way air distribution.
v. The decoration panel shall be a low profile design, extending 5/16" below the ceiling.
vi. The decoration panel shall be compatible with the optional space and presence sensor kit, model BRYQ60AAW.
vii. The decoration panel color shall be fresh white (Munsell N9.5).
5. Legacy FXZQ-MVJU9 decoration panel (BYFQ60B3W1).
i. The FXZQ-TBVJU cassette body shall compatible with the legacy 2x2 decoration panel BYFQ60B3W1W via relay harness adapter WHZQ-W1W-TBV.

Q. Optional Space and Presence sensor kit:
5. The space and presence sensor shall be color matched to the decoration panel.
6. The sensor kit shall be capable of sensing occupancy within the space and automatically controlling the indoor unit set point in response to the detection of occupancy.
7. The sensor kit shall be capable of automatically adjusting the direction of individual air discharge outlet louvers in response to the detection of occupants in the vicinity of the unit.
8. The sensor kit shall be capable of automatically adjusting the direction of individual air discharge outlet louvers in response to the sensed floor temperature.

R. Fan:
5. The fan shall be driven by a direct-drive DC motor with statically and dynamically balanced impeller and shall have three user-selectable speeds available: high, medium, and low. The power input required at the three field selectable speeds shall be made available as standard.
6. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output of 50W.

7. The airflow rate shall be available in high, medium, and low settings.
8. When FXZQ-TBVJU is connected with either the BRC1E73 Navigation Remote Controller or the DCM601A71 I-Touch Manager, the Auto fan mode shall be selectable.

S. Filter:
2. The return air shall be filtered by means of a washable long-life filter with mildew proof resin.

T. Coil:
8. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
9. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
10. The coil shall be a 2-row cross fin copper evaporator coil with 22 FPI design completely factory tested.
11. The refrigerant connections shall be flare connections and the condensate will be 1-1/32 inch outside diameter PVC.
12. A condensate pan shall be located under the coil.
13. A condensate pump with a 24-13/16" lift, measured from the drain outlet, shall be located below the coil in the condensate pan with a built in safety alarm.
14. A thermistor will be located on the liquid and gas line.

U. Electrical:
4. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
5. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
6. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

V. Control:
3. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
4. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

W. Optional Accessories Available:
17. VISTA Decoration panel – white (BYFQ60C3W2W)
18. VISTA Decoration panel – white (BYFQ60C3W2W)
19. Legacy FXZQ decoration panel (BYFQ60B3W1)
20. Space and Presence sensor kit – white (BRYQ60AAW)
    a. Sensor kit shall be color matched to pair with the VISTA decoration panel BYFQ60C3W2W. Space and presence sensor kit is not compatible with BYFQ60B3W1.
21. Sealing member of air discharge outlet (BDBHQ44C60)
22. Panel spacer (KDBQ44BA60A)
    a. Panel spacer is compatible only with BYFQ60B3W1.
23. Direct fresh air intake kit (KDDQ44XA60).
24. Infrared remote controller and receiver – white (BRC082A42W)
    a. Receiver shall be color matched
25. Infrared remote controller and receiver (BRC082A41W)
26. Wired remote controller (BRC1E73)
27. Adaptor for wiring (KRP1C75)
28. Wiring adaptor for electrical appendices (KRP4A74)
29. Installation box for adaptor PCB (KRP1BA101)

30. Remote "in-room" sensor kit (KRCS01-6B).
    i. The Daikin wall mounted, hard-wired remote sensor kit is recommended for ceiling-embedded type fan coils, which often result in a difference between set temperature and actual temperature. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).

4.04 FXZQ 4 WAY CEILING CASSETTE UNIT (2'x2') *(note: obsolete)*

X. General: Daikin indoor unit model FXZQ shall be a ceiling cassette fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation into the ceiling cavity equipped with an air panel grill. It shall be available in capacities from 7,500 Btu/h to 18,000 Btu/h. Model numbers are FXZQ07MVJU9, FXZQ09MVJU9, FXZQ12MVJU9, FXZQ15MVJU9, FXZQ18MVJU9 to be connected to outdoor unit model RXYQ / RXYMQ / RWEYQ heat pump and REYQ / RWEYQ heat recovery model. It shall be a four-way air distribution type, white (RAL9010), impact resistant with a washable decoration panel. The supply air is distributed via motorized louvers which can be horizontally and vertically adjusted from 0° to 90°. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73 and BRC2A71. The indoor units sound pressure shall range from 29 dB(A) to 34 dB(A) at low speed measured at 5 feet below the unit.

Y. Performance: Each unit's performance is based on nominal operating conditions:

Z. Indoor Unit:

19. The Daikin indoor unit FXZQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections,

Model Number	**Cooling** (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	**Heating** (Indoor 70°F DB Outdoor 47F / 43F, 25 ft pipe length)
FXZQ07MVJU9	7,500	8,700
FXZQ09MVJU9	9,500	11,100
FXZQ12MVJU9	12,000	14,000
FXZQ15MVJU9	15000	17,500
FXZQ18MVJU9	18,000	21,000

condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.

20. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
21. Both refrigerant lines shall be insulated from the outdoor unit.
22. The 4-way supply air flow can be field modified to 3-way and 2-way airflow to accommodate various installation configurations including corner installations.

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23. Return air shall be through the concentric panel, which includes a resin net mold resistant filter.
24. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 21" of lift and has a built in safety shutoff and alarm.
25. The indoor units shall be equipped with a return air thermistor.
26. All electrical components are reached through the decoration panel, which reduces the required side service access.
27. The indoor unit will be separately powered with 208- 230V/1 phase/60Hz.
28. The voltage range will be 253 volts maximum and 187 volts minimum.

AA. Unit Cabinet:

11. The cabinet shall be space saving and shall be located into the ceiling.
12. Three auto-swing positions shall be available to choose, which include standard, draft prevention and ceiling stain prevention.
13. The airflow of the unit shall have the ability to shut down one or two sides allowing for simpler corner installation.
14. Fresh air intake shall be possible by way of direct duct installation to the side of the indoor unit cabinet.
15. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

BB. Fan:

9. The fan shall be direct drive turbo fan type with statically and dynamically balanced impeller with high and low fan speeds available.
10. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range from 0.06 to 0.12 HP.
11. The airflow rate shall be available in high and low settings.
12. The fan motor shall be thermally protected.

CC. Filter:

3. The return air shall be filtered by means of a washable long-life filter with mildew proof resin.

DD. Coil:

15. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
16. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
17. The coil shall be a 2 row cross fin copper evaporator coil with 17 FPI design completely factory tested.
18. The refrigerant connections shall be flare connections and the condensate will be 1 1/32 inch outside diameter PVC.
19. A condensate pan shall be located under the coil.
20. A condensate pump with a 21 inch lift shall be located below the coil in the condensate pan with a built in safety alarm.
21. A thermistor will be located on the liquid and gas line.

EE. Electrical:

7. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
8. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
9. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

FF. Control:

5. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
6. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
7. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

GG. Optional Accessories Available:

31. Direct fresh air intake kit (KDDQ44X60).
32. Supply air duct connections.
33. Remote "in-room" sensor kit (KRCS01-1B).
    i. The Daikin wall mounted, hard-wired remote sensor kit is recommended for ceiling-embedded type fan coils, which often result in a difference between set temperature and actual temperature. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).

4.052.03 FXMQ_M CONCEALED CEILING DUCTED UNIT (Med. Static)

A. General: UDaikin indoor unit FXMQ_M shall be a built-in ceiling concealed fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, for installation into the ceiling cavity. It is constructed of a galvanized steel casing. It shall be available in capacities from 72,000 Btu/h to 96,000 Btu/h. Model numbers are FXMQ72MVJU and FXMQ96MVJU to be connected to outdoor unit model RXYQ / RWEYQ heat pump and REYQ / RWEYQ heat recovery model. It shall be a horizontal discharge air with horizontal return air configuration. All models feature a low height cabinet making them applicable to ceiling pockets that tend to be shallow. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73 and BRC2A71. The indoor units sound pressure shall be 48 dB(A) at low speed measured 5 feet below the ducted unit.

B. Performance: Each unit's performance is based on nominal operating conditions:

Model Number	Cooling (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	Heating (Indoor 70°F DB Outdoor 47F / 43F, 25 ft pipe length)
FXMQ72MVJU	72,000	96,000
FXMQ96MVJU	96,000	108,000

C.B. Indoor Unit:

1. The IDaikin indoor unit FXMQ_M shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, self-diagnostics, auto-restart function, 3-minute fused time delay,

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and test run switch. The unit shall have an adjustable external static pressure switch.

2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be insulated from the outdoor unit.
4. The indoor units shall be equipped with a return air thermistor.
5. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
6. The voltage range will be 253 volts maximum and 187 volts minimum.

D. Unit Cabinet:
   1. The cabinet shall be located into the ceiling and ducted to the supply and return openings.
   2. The cabinet shall be constructed with sound absorbing foamed fiber-less closed cell polystyrene and polyethylene insulation.

E. Fan:
   1. The fan shall be direct-drive Sirocco type fan, statically and dynamically balanced impeller with high and low fan speeds available.
   2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz, with a motor output of 0.51 HP.
   3. The airflow rate shall be available in high and low settings.
   4. The fan motor shall be thermally protected.
   5. The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings.
   6. Fan motor external static pressure for nominal airflow:

Model Number	Fan ESP (in. WG)
FXMQ72MVJU	0.95 – 0.72
FXMQ96MVJU	0.95 – 0.8

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F. Coil:
   1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
   2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
   3. The coil shall be a 3 row cross fin copper evaporator coil with 13 fpi design completely factory tested.
   4. The refrigerant connections shall be flare connections and the condensate will be 1-5/16 inch outside diameter PVC.
   5. A thermistor will be located on the liquid and gas line.

G. Electrical:
   1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
   2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
   3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

H. Control:

   1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
   2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.

3. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

I. Optional Accessories Available:

1. Remote "in-room" sensor kit KRCS01-1B (recommended).

i. The Daikin wall mounted, hard-wired remote sensor kit is recommended for ceiling-embedded type fan coils, which often result in a difference between set temperature and actual temperature. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).

4.06 FXMQ_PA CONCEALED CEILING DUCTED UNIT (Med. Static)

A. General: Daikin indoor unit FXMQ_PA shall be a built-in ceiling concealed fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, direct-drive DC (ECM) type fan with auto CFM adjustment at commissioning, for installation into the ceiling cavity. It is constructed of a galvanized steel casing. It shall be available in capacities from 7,500 Btu/h to 48,000 Btu/h. Model numbers are FXMQ07PAVJU, FXMQ09PAVJU, FXMQ12PAVJU, FXMQ15PAVJU, FXMQ18PAVJU, FXMQ24PAVJU, FXMQ30PAVJU, FXMQ36PAVJU, FXMQ48PAVJU, and FXMQ54PAVJU to be connected to outdoor unit model RXYQ / RXYMQ / RWEYQ heat pump and REYQ / RWEYQ heat recovery model. It shall be a horizontal discharge air with horizontal return air configuration. All models feature a low height cabinet making them applicable to ceiling pockets that tend to be shallow. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73 and BRC2A71. Included as standard equipment, a condensate drain pan and drain pump kit that pumps to 18 3/8" from the drain pipe opening. The indoor units sound pressure shall range from 29 dB(A) to 43 dB(A) at low speed measured 5 feet below the ducted unit.

B. Performance: Each unit's performance is based on nominal operating conditions:

Model Number	Cooling (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	Heating (Indoor 70°F DB Outdoor 47F / 43F, 25 ft pipe length)
FXMQ07PAVJU	7,500	8,500
FXMQ09PAVJU	9,500	10,500
FXMQ12PAVJU	12,000	13,500
FXMQ15PAVJU	15,000	16,500
FXMQ18PAVJU	18,000	20,000
FXMQ24PAVJU	24,000	27,000
FXMQ30PAVJU	30,000	34,000
FXMQ36PAVJU	36,000	40,000
FXMQ48PAVJU	48,000	54,000
FXMQ54PAVJU	54,000	60,000

C. Indoor Unit:

1. The Daikin indoor unit FXMQ_PA shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare

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connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall be equipment with automatically adjusting external static pressure logic that is selectable during commissioning. This adjusts the airflow based on the installed external static pressure.

2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be insulated from the outdoor unit.
4. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 18-3/8" of lift from the center of the drain outlet and has a built in safety shutoff and alarm.
5. The indoor units shall be equipped with a return air thermistor.
6. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
7. The voltage range will be 253 volts maximum and 187 volts minimum.

D. Unit Cabinet:

1. The cabinet shall be located into the ceiling and ducted to the supply and return openings.
2. The cabinet shall be constructed with sound absorbing foamed fiber-less closed cell polystyrene and polyethylene insulation.

E. Fan:

1. The fan shall be direct-drive DC (ECM) type fan, statically and dynamically balanced impeller with three fan speeds available.
2. The unit shall be equipment with automatically adjusting external static pressure logic selectable during commissioning.
3. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range of 0.12 to 0.47 HP respectively.
4. The airflow rate shall be available in three settings.
5. The fan motor shall be thermally protected.
6. The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings.
7. Fan motor external static pressure range for nominal airflow:

Model Number	Fan ESP (in. WG)
FXMQ07PAVJU	0.40 – 0.12
FXMQ09PAVJU	0.40 – 0.12
FXMQ12PAVJU	0.40 – 0.12
FXMQ15PAVJU	0.80 – 0.20
FXMQ18PAVJU	0.80 – 0.20
FXMQ24PAVJU	0.80 – 0.20
FXMQ30PAVJU	0.80 – 0.20
FXMQ36PAVJU	0.80 – 0.20
FXMQ48PAVJU	0.80 – 0.20
FXMQ54PAVJU	0.56 – 0.20

F. Coil:

1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.

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3. The coil shall be a 3 row cross fin copper evaporator coil with 15 fpi design completely factory tested.
4. The refrigerant connections shall be flare connections and the condensate will be 1-1/4" outside diameter PVC.
5. A condensate pan shall be located under the coil.
6. A condensate pump with an 18-3/8" lift shall be located below the coil in the condensate pan with a built in safety alarm.
7. A thermistor will be located on the liquid and gas line.

G. Electrical:
1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

H. Control:
1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
3. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

I. Optional Accessories Available:
1. Remote "in-room" sensor kit KRCS01-4B (recommended).
    i. The Daikin wall mounted, hard-wired remote sensor kit is recommended for when a NAV controller is not used or when the NAV controller is not located in the space that is being controlled. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).
2. MERV 13 Filter kit. Can be configured for right or left access. Filters replaceable without tools.
3. Air side Economizer designed for connection to the rear of FXMQ30-54PAVJU.

4.07 FXMQ_PB - CONCEALED CEILING DUCTED UNIT (Med. Static)

A. General: Daikin indoor unit FXMQ_PB shall be a built-in ceiling concealed fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, direct drive DC (ECM) type fan with auto CFM adjustment at commissioning, for installation into the ceiling cavity. It is constructed of a galvanized steel casing. It shall be available in capacities from 7,500 Btu/h to 48,000 Btu/h. Model numbers are FXMQ07PBVJU, FXMQ09PBVJU, FXMQ12PBVJU, FXMQ15PBVJU, FXMQ18PBVJU, FXMQ24PBVJU, FXMQ30PBVJU, FXMQ36PBVJU, FXMQ48PBVJU, and FXMQ54PBVJU to be connected to outdoor unit model RXYQ / RXYMQ / RWEYQ heat pump and REYQ / RWEYQ heat recovery model. It shall be a horizontal discharge air with horizontal return air configuration. All models feature a low height cabinet making them applicable to ceiling pockets that tend to be shallow. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73 and BRC2A71. Included as standard equipment, a condensate drain pan and drain pump kit that pumps to 18-3/8" from the drain pipe opening. The indoor units sound pressure shall range from 29 dB(A) to 43 dB(A) at low speed measured 5 feet below the ducted unit.

B. Performance: Each unit's performance is based on nominal operating conditions:

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Model Number	Cooling (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	Heating (Indoor 70°F DB Outdoor 47F / 43F, 25 ft pipe length)
FXMQ07PBVJU	7,500	8,500
FXMQ09PBVJU	9,500	10,500
FXMQ12PBVJU	12,000	13,500
FXMQ15PBVJU	15,000	16,500
FXMQ18PBVJU	18,000	20,000
FXMQ24PBVJU	24,000	27,000
FXMQ30PBVJU	30,000	34,000
FXMQ36PBVJU	36,000	40,000
FXMQ48PBVJU	48,000	54,000
FXMQ54PBVJU	54,000	60,000

C. Indoor Unit:

1. The Daikin indoor unit FXMQ_PB shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall be equipment with automatically adjusting external static pressure logic that is selectable during commissioning. This adjusts the airflow based on the installed external static pressure.
2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be insulated from the outdoor unit.
4. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 18-3/8" of lift from the center of the drain outlet and has a built in safety shutoff and alarm.
5. The indoor units shall be equipped with a return air thermistor.
6. The indoor unit will be separately powered with 208-230V/1-phase/60Hz.
7. The voltage range will be 253 volts maximum and 187 volts minimum.

D. Unit Cabinet:

1. The cabinet shall be located into the ceiling and ducted to the supply and return openings.
2. The cabinet shall be constructed with sound absorbing foamed fiber-less closed cell polystyrene and polyethylene insulation.

E. Fan:

1. The fan shall be direct-drive DC (ECM) type fan, statically and dynamically balanced impeller with three fan speeds available.
2. The unit shall be equipment with automatically adjusting external static pressure logic selectable during commissioning.
3. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range of 0.12 to 0.47 HP respectively.
4. The airflow rate shall be available in three settings.
5. The fan motor shall be thermally protected.

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6. The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings.
7. Fan motor external static pressure range for nominal airflow:

Model Number	Fan ESP (in. WG)
FXMQ07PBVJU	0.40 – 0.12
FXMQ09PBVJU	0.40 – 0.12
FXMQ12PBVJU	0.40 – 0.12
FXMQ15PBVJU	0.80 – 0.20
FXMQ18PBVJU	0.80 – 0.20
FXMQ24PBVJU	0.80 – 0.20
FXMQ30PBVJU	0.80 – 0.20
FXMQ36PBVJU	0.80 – 0.20
FXMQ48PBVJU	0.80 – 0.20
FXMQ54PBVJU	0.56 – 0.20

F. Coil:
1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 3 row cross fin copper evaporator coil with 15 fpi design completely factory tested.
4. The refrigerant connections shall be flare connections and the condensate will be 1-1/4" outside diameter PVC.
5. A condensate pan shall be located under the coil.
6. A condensate pump with an 18-3/8" lift shall be located below the coil in the condensate pan with a built in safety alarm.
7. A thermistor will be located on the liquid and gas line.

G. Electrical:
1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

H. Control:
1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
3. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

I. Optional Accessories Available:
1. Remote "in-room" sensor kit KRCS01-4B (recommended).
i. The Daikin wall mounted, hard wired remote sensor kit is recommended for when a NAV controller is not used or when the NAV controller is not located in the space that is being controlled. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).
2. MERV 13 Filter kit. Can be configured for right or left access. Filters replaceable without tools.
3. Air side Economizer designed for connection to the rear of FXMQ30-54PBVJU.

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4.08 FXMQ_TB CONCEALED CEILING DUCTED UNIT (High Static)

A. General Requirements:

a. All indoor/evaporator units shall be factory assembled and tested DX fan coil units, operable with refrigerant R-410a.

b. All units shall be completely factory assembled and tested, and shall be charged with dehydrated air prior to shipment from the factory.

c. All units shall be equipped with an electronic expansion valve controlled using a PID loop to automatically adjust the refrigerant flow rate through the unit.

d. All units shall be equipped with a programmed drying operation that dehumidifies while limiting changes in room temperature when used with Daikin remote controllers BRC1E73 and BRC2A71.

e. All units shall feature self diagnostics, auto restart functionality, 3 minute fused time delay, and a test run switch.

f. All refrigerant piping, both liquid and suction, shall be fully insulated from the outdoor unit.

B. Performance: Each unit's performance is based on nominal operating conditions:

Model Number	**Cooling (Btu/h)** (Indoor 80°FDB / 67°FWB, Outdoor 95°FDB, 25 ft pipe length)	**Heating (Btu/h)** (Indoor 70°FDB, Outdoor 47°FDB / 43°FWB, 25 ft pipe length)
FXMQ15TBVJU	15,000	17,000
FXMQ18TBVJU	18,000	20,000
FXMQ24TBVJU	24,000	27,000
FXMQ30TBVJU	30,000	34,000
FXMQ36TBVJU	36,000	40,000
FXMQ48TBVJU	48,000	54,000
FXMQ54TBVJU	57,000	63,000

C. Indoor Unit:

a) The Daikin indoor unit FXMQ_TB shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self diagnostics, auto restart function, 3 minute fused time delay, and test run switch. The unit shall be equipment with automatically adjusting external static pressure logic that is selectable during commissioning. This adjusts the airflow based on the installed external static pressure.

b) Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.

c) Both refrigerant lines shall be insulated from the outdoor unit.

d) The indoor units shall be equipped with a return air thermistor.

e) The indoor unit will be separately powered with 208-230V/1 phase/60Hz.

f) The voltage range will be 253 volts maximum and 187 volts minimum.

D. Unit Cabinet:

a. The unit cabinet shall be constructed of heavy gauge galvanized steel.

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b. The unit shall be internally insulated and shall be capable of installation in indoor environments up to 80% relative humidity without requiring additional field installed insulation.
c. The unit shall ship from the factory in a rear return configuration and shall be field-convertible to a bottom return configuration.
d. The unit shall be equipped with a return air thermistor.
e. The cabinet shall be constructed with sound absorbing foamed fiber less closed cell polystyrene and polyethylene insulation.

E. Fan:
a. The fan shall be a direct drive, brushless DC fan motor with (3) user selectable fan speeds (H, M, L).
b. The unit shall be equipment with automatically adjusting external static pressure logic selectable during commissioning.
c. The unit shall be equipped with internal controls to allow the fan to automatically select the operating fan curve to deliver nominal airflow CFM (within +/- 10%) when the connect ductwork has been designed with a total external static within the range of the FXMQ_TB. This setting shall be accessible as a setting to be used during startup and commissioning of the system
d. The fan motor shall be capable of Auto fan speed control when the unit is connected to the BRC1E73 Navigation Remote Control, BRC1H73W Madoka Controller or the DCM601A71 Intelligent Touch Manager centralized control. The Auto fan speed control shall automatically adjust the unit's fan speed in response to the difference between the indoor unit's current set point and the current room temperature measurement. The Auto fan speed control shall utilize (5) fan speeds.
e. The fan motor shall be internally isolated using rubber grommets to reduce transmission of vibrations to the unit.
f) The airflow rate shall be available in three settings.
g) The fan motor shall be thermally protected.
h) Fan motor external static pressure range for nominal airflow:

Model Number	Fan ESP (in. w.g.)
FXMQ15TBVJU	0.20—0.80
FXMQ18TBVJU	0.20—0.80
FXMQ24TBVJU	0.20—0.80
FXMQ30TBVJU	0.20—0.80
FXMQ36TBVJU	0.20—0.80
FXMQ48TBVJU	0.20—0.80
FXMQ54TBVJU	0.20—0.56

G. Fan Blade
a. The fan blade shall be constructed of lightweight polymer.
b. The fan blade shall be statically and dynamically balanced to minimize vibration.

H. Coil:
a. Coils shall be of the direct expansion type, constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
b. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
c. The coil shall be 2 or 3 row cross fin copper evaporator coil with 18 fpi design, completely factory tested.
d. The refrigerant connections shall be flare connections.

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e. Factory mounted thermistors shall be installed on the liquid and gas lines.

I. Condensate Drainage
a. The unit shall be equipped with a condensate drain pan under the coil.
b. The condensate drain outlet shall be of PVC construction and VP25 (1" ID, 1-1/4" OD).
c. The unit shall be equipped with a factory-integral condensate pump capable of 25-5/16" lift from the condensate drain outlet. The condensate pump shall be equipped with a float switch to automatically stop unit operation and provide a system error code in the event drain pan water level rises too high.

H. Electrical:
a. Provide a separate power supply connection of 208/230V, 1 phase, 60 hertz. The allowable voltage range shall be 187 to 253 volts.
b. Refer to the engineering data book for all other electrical data including MCA, MOCP, and FLA values.
c. The transmission (control) wiring distance between the indoor unit and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
d. The transmission (control) wiring between the indoor unit and the remote controller shall be a maximum distance of 1,640 feet.

I. Control:
a. The unit shall be controlled with a Daikin remote controller to perform input functions necessary to operate the system.
b. The unit shall be compatible with interfacing with a building management system (BMS) via optional BACnet or LonWorks gateways.
c. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

J. Optional Accessories Available:
a. BRC1E73 Navigation Remote Controller (wired)
b. BRC2A71 Simplified Wired Remote Controller (wired)
c. BRC1H71W Madoka Remote Controller (wired)
d. DTST-ONE-ADA-A Daikin One Controller (wired)
e. BRC4C82 Infrared Remote Controller (wireless)
f. KRP1C74 Wiring Adaptor PCB
g. KRP4A71 Wiring Adaptor For Electrical Appendices
h. KRP4A98 Installation Box For Adaptor PCB Board
i. KRCS01-4B Remote Sensor
j. DCM601A71 Intelligent Touch Manager

4.09 FXMQ_MF OUTSIDE AIR PROCESSING UNIT

A. General: Daikin indoor unit FXMQ_MF shall be a built-in ceiling concealed fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, for installation into the ceiling cavity. The unit shall be capable of introducing up to 100% outside air controlled to a fixed discharge air temperature. It is constructed of a galvanized steel casing. It shall be available in capacities from 48,000 Btu/h to 96,000 Btu/h. Model numbers are FXMQ48MFVJU, FXMQ72MFVJU and FXMQ96MVJU to be connected to outdoor unit model RXYQ / RXYMQ / RWEYQ heat pump and REYQ / RWEYQ heat recovery model. It shall be a horizontal discharge air with horizontal return air configuration. All models feature a low height cabinet making them applicable to ceiling pockets that tend to be shallow. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The indoor units sound pressure shall range from 42 dB(A) to 47 dB(A).

B. Performance: Each unit's performance is based on nominal operating conditions:

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C. Indoor Unit:

1. The Daikin indoor unit FXMQ_MF shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, self-diagnostics, auto-restart function, 3-minute fused time delay and test run switch.

Model Number	Cooling (Outdoor 91°F DB / 82°F WB, Discharge 64°F DB, 25 ft pipe length)	Heating (Outdoor 32°F DB / 27°F WB, Discharge 77°F DB, 25 ft pipe length)
FXMQ48MFVJU	48,000	30,000
FXMQ72MFVJU	72,000	47,000
FXMQ96MFVJU	96,000	59,000

2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be insulated from the outdoor unit.
4. The indoor units shall be equipped with a discharge air thermistor.
5. The indoor unit will be separately powered with 208-230V/1-phase/60Hz.
6. The voltage range will be 253 volts maximum and 187 volts minimum.

D. Unit Cabinet:

1. The cabinet shall be located into the ceiling and ducted to the supply and return openings.
2. The cabinet shall be constructed with sound absorbing foamed fiber-less closed cell polystyrene and polyethylene insulation.

E. Fan:

1. The fan shall be direct drive Sirocco type fan, statically and dynamically balanced impeller.
2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz, with a motor output of 0.51 HP.
3. The fan motor shall be thermally protected.
4. Fan motor external static pressure for nominal airflow:

Model Number	Fan ESP (in. WG)
FXMQ48MFVJU	0.88
FXMQ72MFVJU	0.96
FXMQ96MFVJU	1.03

F. Coil:

1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 3 row cross fin copper evaporator coil with 13 fpi design completely factory tested.
4. The refrigerant connections shall be flare connections and the condensate will be 1-5/16 inch outside diameter PVC.
5. A thermistor will be located on the liquid and gas line.

G. Electrical:

1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).

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3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

H. Control:

1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.

2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.

3. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

4.10 FX SQ_T CONCEALED CEILING DUCTED UNIT (Med. Static)

D. General Requirements:

a. All indoor/evaporator units shall be factory assembled and tested DX fan coil units, operable with refrigerant R-410a.

b. All units shall be completely factory assembled and tested, and shall be charged with dehydrated air prior to shipment from the factory.

c. All units shall be equipped with an electronic expansion valve controlled using a PID loop to automatically adjust the refrigerant flow rate through the unit.

d. All units shall be equipped with a programmed drying operation that dehumidifies while limiting changes in room temperature when used with Daikin remote controllers BRC1E73 and BRC2A71.

e. All units shall feature self-diagnostics, auto-restart functionality, 3-minute fused time delay, and a test run switch.

f. All refrigerant piping, both liquid and suction, shall be fully insulated from the outdoor unit.

E. Performance: Each unit's performance is based on nominal operating conditions:

Model Number	**Cooling (Btu/h)** (Indoor 80°FDB / 67°FWB, Outdoor 95°FDB, 25 ft pipe length)	**Heating (Btu/h)** (Indoor 70°FDB, Outdoor 47°FDB / 43°FWB, 25 ft pipe length)
FXSQ05T-VJU	5,800	6,500
FXSQ07T-VJU	7,500	8,500
FXSQ09T-VJU	9,500	10,500
FXSQ12T-VJU	12,000	13,500
FXSQ15T-VJU	15,000	16,500
FXSQ18T-VJU	18,000	20,000
FXSQ24T-VJU	24,000	27,000
FXSQ30T-VJU	30,000	34,000
FXSQ36T-VJU	36,000	40,000
FXSQ48T-VJU	48,000	54,000
FXSQ54T-VJU	54,000	60,000

F. Indoor Unit:

g) The Daikin indoor unit FXSQ_T shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time

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delay, and test run switch. The unit shall be equipment with automatically adjusting external static pressure logic that is selectable during commissioning. This adjusts the airflow based on the installed external static pressure.

h) Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
i) Both refrigerant lines shall be insulated from the outdoor unit.
j) The indoor units shall be equipped with a return air thermistor.
k) The indoor unit will be separately powered with 208~230V/1 phase/60Hz.
l) The voltage range will be 253 volts maximum and 187 volts minimum.

E. Unit Cabinet:
a. The unit cabinet shall be constructed of heavy gauge galvanized steel.
b. The unit shall be internally insulated and shall be capable of installation in indoor environments up to 80% relative humidity without requiring additional field installed insulation.
c. The unit shall ship from the factory in a rear return configuration, and shall be field convertible to a bottom return configuration.
d. The unit shall be equipped with a return air thermistor.
e. The cabinet shall be constructed with sound absorbing foamed fiber less closed cell polystyrene and polyethylene insulation.

F. Fan:
a. The fan shall be a direct drive, brushless DC fan motor with (3) user selectable fan speeds (H, M, L).
b. The unit shall be equipment with automatically adjusting external static pressure logic selectable during commissioning.
c. The unit shall be equipped with internal controls to allow the fan to automatically select the operating fan curve to deliver nominal airflow CFM (within +/- 10%) when the connect ductwork has been designed with a total external static within the range of the FXSQ_T. This setting shall be accessible as a setting to be used during startup and commissioning of the system
d. The fan motor shall be capable of Auto fan speed control when the unit is connected to the BRC1E73 Navigation Remote Control, BRC1H71W Madoka Control or the DCM601A71 Intelligent Touch Manager centralized control. The Auto fan speed control shall automatically adjust the unit's fan speed in response to the difference between the indoor unit's current set point and the current room temperature measurement. The Auto fan speed control shall utilize (5) fan speeds.
e. The fan motor shall be internally isolated using rubber grommets to reduce transmission of vibrations to the unit.
i) The airflow rate shall be available in three settings.
j) The fan motor shall be thermally protected.
k) Fan motor external static pressure range for nominal airflow:

Model Number	Fan ESP (in. w.g.)
FXSQ05T-VJU	0.12 – 0.60
FXSQ07T-VJU	0.12 – 0.60
FXSQ09T-VJU	0.12 – 0.60
FXSQ12T-VJU	0.12 – 0.60
FXSQ15T-VJU	0.12 – 0.60
FXSQ18T-VJU	0.20 – 0.60
FXSQ24T-VJU	0.20 – 0.60

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FXSQ30T-VJU	0.20—0.60
FXSQ36T-VJU	0.20—0.60
FXSQ48T-VJU	0.20—0.60
FXSQ54T-VJU	0.20—0.54

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J. Fan Blade
   a. The fan blade shall be constructed of lightweight polymer.
   b. The fan blade shall be statically and dynamically balanced to minimize vibration.

K. Coil:
   a. Coils shall be of the direct expansion type, constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
   b. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
   c. The coil shall be 2 or 3 row cross fin copper evaporator coil with 18 fpi design, completely factory tested.
   d. The refrigerant connections shall be flare connections.
   e. Factory mounted thermistors shall be installed on the liquid and gas lines.

L. Condensate Drainage
   a. The unit shall be equipped with a condensate drain pan under the coil.
   b. The condensate drain outlet shall be of PVC construction and VP25 (1" ID, 1-1/4" OD).
   c. The unit shall be equipped with a factory integral condensate pump capable of 25-5/16" lift from the condensate drain outlet. The condensate pump shall be equipped with a float switch to automatically stop unit operation and provide a system error code in the event drain pan water level rises too high.

I. Electrical:
   a. Provide a separate power supply connection of 208/230V, 1 phase, 60 hertz. The allowable voltage range shall be 187 to 253 volts.
   b. Refer to the engineering data book for all other electrical data including MCA, MOCP, and FLA values.
   c. The transmission (control) wiring distance between the indoor unit and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
   d. The transmission (control) wiring between the indoor unit and the remote controller shall be a maximum distance of 1,640 feet.

J. Control:
   a. The unit shall be controlled with a Daikin remote controller to perform input functions necessary to operate the system.
   b. The unit shall be compatible with interfacing with a building management system (BMS) via optional BACnet or LonWorks gateways.
   c. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

K. Optional Accessories Available:
   a. BRC1E73 Navigation Remote Controller (wired)
   b. BRC2A71 Simplified Wired Remote Controller (wired)
   c. BRC1H71W Madoka Remote Controller (wired)
   d. DTST-ADA-A Daikin One Controller (wired)
   e. BRC4C82 Infrared Remote Controller (wireless)
   f. KRP1C74 Wiring Adaptor PCB
   g. KRP4A71 Wiring Adaptor For Electrical Appendices
   h. KRP4A98 Installation Box For Adaptor PCB Board
   i. KRCS01-4B Remote Sensor

j. DCM601A71 Intelligent Touch Manager

4.11 FXDQ SLIM DUCT CONCEALED CEILING UNIT

A. General: Daikin indoor unit model FXDQ shall be a Slim, built-in ceiling concealed fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation into the ceiling cavity. The unit shall be constructed of a galvanized steel casing. It shall be available in capacities from 7,000 Btu/h to 24,000 Btu/h. Model numbers are FXDQ07MVJU, FXDQ09MVJU, FXDQ12MVJU, FXDQ18MVJU, and FXDQ24MVJU to be connected to outdoor unit model RXYQ / RXYMQ / RWEYQ heat pump and REYQ / RWEYQ heat recovery model. It shall be a horizontal discharge air with horizontal return air or bottom return air configuration. All models feature a very low height (7-7/8") making them applicable to ceiling pockets that tend to be shallow. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73 and BRC2A71. Included as standard equipment, a long-life filter that is mold resistant and a condensate drain pan and drain pump kit that pumps to 23-5/8" from the drain pipe opening. The indoor units sound pressure level shall range from 29 dB(A) to 32 dB(A) at low speed and 33 dB(A) to 36 dB(A) at high speed 5 feet below the suction grille.

B. Performance: Each unit's performance is based on nominal operating conditions:

C. Indoor Unit:

1. The Daikin indoor unit FXDQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have adjustable external static pressure capabilities.

Model Number	Cooling (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	Heating (Indoor 70°F DB Outdoor 47F / 43F, 25 ft pipe length)
FXDQ07MVJU	7,500	8,500
FXDQ09MVJU	9,500	10,500
FXDQ12MVJU	12,000	13,500
FXDQ18MVJU	18,000	20,000
FXDQ24MVJU	24,000	27,000

2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be insulated from the outdoor unit.
4. Return air shall be through a resin net mold resistant filter.

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5. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 23-5/8" of lift from the center of the drain outlet and has a built in safety shutoff and alarm.
6. The indoor units shall be equipped with a return air thermistor.
7. The indoor unit will be separately powered with 208-230V/1-phase/60Hz.
8. The voltage range will be 253 volts maximum and 187 volts minimum.
9. Switch box shall be reached from the side or bottom for ease of service and maintenance.

D. Unit Cabinet:

1. The cabinet shall be located into the ceiling and ducted to the supply and return openings.
2. The cabinet shall be constructed with sound absorbing foamed fiber-less closed cell polystyrene and polyethylene insulation.

E. Fan:

1. The fan shall be direct drive Sirocco type fan, statically and dynamically balanced impeller with high and low fan speeds available.
2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range from 62W to 130W.
3. The airflow rate shall be available in high and low settings.
4. The fan motor shall be thermally protected.
5. The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings.
6. Fan motor external static pressure range for nominal airflow:

Model Number	Fan ESP (in. WG)
FXDQ07MVJU	0.12 – 0.04
FXDQ09MVJU	0.12 – 0.04
FXDQ12MVJU	0.12 – 0.04
FXDQ18MVJU	0.17 – 0.06
FXDQ24MVJU	0.17 – 0.06

F. Filter:

1. The return air shall be filtered by means of a washable long-life filter with mildew proof resin.

G. Coil:

1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 2 or 3 row cross fin copper evaporator coil with 14 FPI design completely factory tested.
4. The refrigerant connections shall be flare connections and the condensate will be 1-1/32" outside diameter PVC.
5. A condensate pan shall be located under the coil.
6. A condensate pump with a 23-5/8" lift shall be located below the coil in the condensate pan with a built in safety alarm.
7. A thermistor will be located on the liquid and gas line.

H. Electrical:

1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).

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3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

l. Control:

1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.

2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.

3. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

J. Optional Accessories Available:

1. Remote "in-room" sensor kit KRCS01-1B (recommended).

i. The Daikin wall mounted, hard-wired remote sensor kit is recommended for ceiling-embedded type fan coils, which often result in a difference between set temperature and actual temperature. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).

4.12 FXHQ – CEILING SUSPENDED CASSETTE UNIT

Model Number	**Cooling** (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	**Heating** (Indoor 70°F DB Outdoor 47F / 43F, 25 ft pipe length)
FXHQ12MVJU	12,000	13,500

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FXHQ24MVJU	24,000	27,000
FXHQ36MVJU	36,000	40,000

A. General: Daikin indoor unit FXHQ shall be a ceiling suspended fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, for installation onto a wall or ceiling within a conditioned space. This compact design with finished white casing shall be available in capacities from 12,000 Btu/h to 36,000 Btu/h. Model numbers are FXHQ12MVJU, FXHQ24MVJU and FXHQ36MVJU to be connected to outdoor unit model RXYQ / RXYMQ / RWEYQ heat pump and REYQ / RWEYQ heat recovery model. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73 and BRC2A71. A mildew-proof, polystyrene condensate drain pan and resin net mold resistant filter shall be included as standard equipment. The indoor units sound pressure shall range from 32 dB(A) to 38 dB(A) at low speed measured at 3.3 feet below and from the unit.

B. Performance: Each unit's performance is based on nominal operating conditions:

C. Indoor Unit:

1. The Daikin indoor unit FXHQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an auto-swing louver which ensures efficient air distribution, which closes automatically when the unit stops. The remote controller shall be able to set five (5) steps of discharge angle. The front grille shall be easily removed for washing. The discharge angle shall automatically set at the same angle as the previous operation upon restart. The drain pipe can be fitted to from the rear, top or left and right sides of the unit.
2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be insulated from the outdoor unit.
4. Return air shall be through a resin net mold resistant filter.
5. The indoor units shall be equipped with a condensate pan.
6. The indoor units shall be equipped with a return air thermistor.
7. The indoor unit will be separately powered with 208- 230V/1-phase/60Hz.
8. The voltage range will be 253 volts maximum and 187 volts minimum.

D. Unit Cabinet:

1. The cabinet shall be affixed to a factory supplied wall/ceiling hanging brackets and located in the conditioned space.
2. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

E. Fan:

1. The fan shall be a direct-drive cross-flow fan, statically and dynamically balanced impeller with high and low fan speeds available.
2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range 62W to 130W.

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3. The airflow rate shall be available in high and low settings.
4. The fan motor shall be thermally protected.

F. Coil:
1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 2 row cross fin copper evaporator coil with 15 fpi design completely factory tested.
4. The refrigerant connections shall be flare connections and the condensate will be 1 inch outside diameter PVC.
5. A thermistor will be located on the liquid and gas line.
6. A condensate pan shall be located in the unit.

G. Electrical:
1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

H. Control:
1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
3. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

I. Optional Accessories Available:
1. Remote "in-room" sensor kit KRCS01-1B.
2. A condensate pump (DACA-CP3-1).

4.132.04 FXAQ WALL MOUNTED UNIT

A. General: IDaikin indoor unit FXAQ shall be a wall mounted fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, for installation onto a wall within a conditioned space. This compact design with finished white casing shall be available in capacities from 7,500 Btu/h to 24,000 Btu/h. Model numbers are FXAQ07PVJU, FXAQ09PVJU, FXAQ12PVJU, FXAQ18PVJU and FXAQ24PVJU to be connected to outdoor unit model RXYQ / RXYMQ / RWEYQ heat pump and REYQ / RWEYQ heat recovery model. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73 and BRC2A71. A mildew-proof, polystyrene condensate drain pan and resin net mold resistant filter shall be included as standard equipment. The indoor units sound pressure shall range from 31 dB(A) to 41 dB(A) at low speed measured at 3.3 feet below and from the unit.

B. Performance: Each unit's performance is based on nominal operating conditions:

Model Number	Cooling	Heating (Indoor 70°F DB

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	(Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	Outdoor 47F / 43F, 25 ft pipe length)
FXAQ07PVJU	7,500	8,500
FXAQ09PVJU	9,500	10,500
FXAQ12PVJU	12,000	13,500
FXAQ18PVJU	18,000	20,000
FXAQ24PVJU	24,000	26,500

C.B. Indoor Unit:

1. The Daikin indoor unit FXAQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an auto-swing louver which ensures efficient air distribution, which closes automatically when the unit stops. The remote controller shall be able to set five (5) steps of discharge angle. The front grille shall be easily removed for washing. The discharge angle shall automatically set at the same angle as the previous operation upon restart. The drain pipe can be fitted to from either left or right sides.
2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be insulated from the outdoor unit.
4. Return air shall be through a resin net mold resistant filter.
5. The indoor units shall be equipped with a condensate pan.
6. The indoor units shall be equipped with a return air thermistor.
7. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
8. The voltage range will be 253 volts maximum and 187 volts minimum.

D. Unit Cabinet:

1. The cabinet shall be affixed to a factory supplied wall mounting template and located in the conditioned space.
2. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

E. Fan:

1. The fan shall be a direct-drive cross-flow fan, statically and dynamically balanced impeller with high and low fan speeds available.
2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range 0.054 to 0.058 HP.
3. The airflow rate shall be available in high and low settings.
4. The fan motor shall be thermally protected.

F. Coil:

1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 2-row cross fin copper evaporator coil with 14 fpi design completely factory tested.
4. The refrigerant connections shall be flare connections and the condensate will be 11/16 inch outside diameter PVC.

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5. A thermistor will be located on the liquid and gas line.
6. A condensate pan shall be located in the unit.

G. Electrical:
1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

H. Control:
1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
1.

The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.

2. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

I. Optional Accessories Available:
1. Remote "in-room" sensor kit KRCS01-1B.
2. A condensate pump (DACA-CP3-1)

4.14

Model Number	Cooling (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	Heating (Indoor 70°F DB Outdoor 47F / 43F, 25 ft pipe length)
FXLQ07MVJU9	7,500	8,500
FXLQ09MVJU9	9,500	10,500
FXLQ12MVJU9	12,000	13,500
FXLQ18MVJU9	18,000	20,000
FXLQ24MVJU9	24,000	27,000

FXLQ – FLOOR CONSOLE UNIT

A. General: Daikin indoor unit FXLQ shall be a floor or low wall mounted console fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, for installation within a conditioned space. It shall have a top discharge air grill and resin net mold resistant filtered bottom return air. This compact design with finished ivory white casing shall be available in capacities from 7,500 Btu/h to 24,000 Btu/h. Model numbers are FXLQ07MVJU9, FXLQ09MVJU9, FXLQ12MVJU9, FXLQ18MVJU9 and FXLQ24MVJU9 to be connected to outdoor unit model RXYQ / RXYMQ / RWEYQ heat pump and REYQ / RWEYQ heat recovery model. The cabinets can be mounted on the floor with refrigerant and condensate lines directed downward or affixed to the wall with horizontal refrigerant and condensate knockouts. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73 and BRC2A71. A mold-resistant, resin net air filter shall be included as standard equipment. The indoor units sound pressure shall range from 35 dB(A) to 40 dB(A) at high speed measured at 5 feet away and 5 feet high.

B. Performance: Each unit's performance is based on nominal operating conditions:

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C. Indoor Unit:
1. The Daikin indoor unit FXLQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an auto-swing louver which ensures efficient air distribution, which closes automatically when the unit stops.
2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be insulated from the outdoor unit.
4. Return air shall be through a resin net mold resistant filter.
5. Condensate draining shall be made via gravity or external condensate pump.
6. The indoor units shall be equipped with a return air thermistor.
7. The indoor unit will be separately powered with 208-230V/1-phase/60Hz.
8. The voltage range will be 253 volts maximum and 187 volts minimum.

D. Unit Cabinet:
1. The cabinet shall be affixed to a factory-supplied wall mounting template and located in the conditioned space.
2. The cabinet shall be constructed with sound absorbing fiberglass urethane foam insulation.
3. Maintenance access shall be a minimum of ¾ inch in the rear, 4 inches on the right and left sides.

E. Fan:
1. The fan shall be a direct-drive Sirocco type fan, statically and dynamically balanced impeller with high and low fan speeds available.
2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range 0.034 to 0.047 HP.
3. The airflow rate shall be available in high and low settings.
4. The fan motor shall be thermally protected.

F. Filter:
1. The return air shall be filtered by means of a washable long-life filter with mildew proof resin.

G. Coil:
1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 3-row cross fin copper evaporator coil with 17 fpi design completely factory tested.
4. The refrigerant connections shall be flare connections and the condensate will be 27/32 inch outside diameter PVC.
5. A thermistor will be located on the liquid and gas line.

H. Electrical:
1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

I. Control:

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1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
3. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

J. Optional Accessories Available:
1. Remote "in-room" sensor kit KRCS01-1B
2. Condensate pump (DACA-CP1-3)

4.15 FXNQ – FLOOR CONSOLE CONCEALED UNIT

A. General: Daikin indoor unit FXNQ shall be a floor or wall mounted console fan coil unit,

Model Number	Cooling (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	Heating (Indoor 70°F DB Outdoor 47F / 43F, 25 ft pipe length)
FXNQ07MVJU9	7,500	8,500
FXNQ09MVJU9	9,500	10,500
FXNQ12MVJU9	12,000	13,500
FXNQ18MVJU9	18,000	20,000
FXNQ24MVJU9	24,000	27,000

operable with refrigerant R-410A, equipped with an electronic expansion valve, for installation within a conditioned space. It shall have a top discharge air grill and filtered bottom return air. This compact design unfinished casing shall be available in capacities from 7,500 Btu/h to 24,000 Btu/h. Model numbers are FXNQ07MVJU9, FXNQ09MVJU9, FXNQ12MVJU9, FXNQ18MVJU9 and FXNQ24MVJU9 to be connected to outdoor unit model RXYQ / RXYMQ / RWEYQ heat pump and REYQ / RWEYQ heat recovery model. The cabinets can be mounted on the floor with refrigerant and condensate lines directed downward or affixed to the wall with horizontal refrigerant and condensate knockouts. Computerized PID control shall be used to control superheat to deliver a comfortable room

B. temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73 and BRC2A71. A mold-resistant, resin net air filter shall be included as standard equipment. The indoor units sound pressure shall range from 35 dB(A) to 40 dB(A) at high speed measured at 5 feet away and 5 feet high.

C. Performance: Each unit's performance is based on nominal operating conditions:

D. Indoor Unit:
1. The Daikin indoor unit FXNQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, self-diagnostics, auto-restart function, 3-minute

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fused time delay, and test run switch. The unit shall have an auto-swing louver which ensures efficient air distribution, which closes automatically when the unit stops.

2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.

3. Both refrigerant lines shall be insulated from the outdoor unit.

4. Return air shall be through a resin net mold resistant filter.

5. Condensate draining shall be made via gravity or external condensate pump.

6. The indoor units shall be equipped with a return air thermistor.

7. The indoor unit will be separately powered with 208- 230V/1 phase/60Hz.

8. The voltage range will be 253 volts maximum and 187 volts minimum.

D. Unit Cabinet:

1. The cabinet shall be affixed to a factory supplied wall mounting template and located in the conditioned space.

2. The cabinet shall be constructed with sound absorbing fiberglass urethane foam insulation.

3. Maintenance access shall be a minimum of ¾ inch in the rear, 4 inches on the right and left sides.

E. Fan:

1. The fan shall be a direct drive Sirocco type fan, statically and dynamically balanced impeller with high and low fan speeds available.

2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range 0.034 to 0.047 HP.

3. The airflow rate shall be available in high and low settings.

4. The fan motor shall be thermally protected.

F. Filter:

1. The return air shall be filtered by means of a washable long life filter with mildew proof resin.

G. Coil:

1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.

2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.

3. The coil shall be a 3 row cross fin copper evaporator coil with 17 fpi design completely factory tested.

4. The refrigerant connections shall be flare connections and the condensate will be 27/32 inch outside diameter PVC.

5. A thermistor will be located on the liquid and gas line.

H. Electrical:

1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.

2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).

3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

I. Control:

1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.

2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.

3. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

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J. Optional Accessories Available:
1. Remote "in-room" sensor kit KRCS01-1B
2. Condensate pump (DACA-CP1-3)

4.16 FXTQ_TA MULTI POSITION AIR HANDLING UNIT
A. General: Daikin indoor unit FXTQ_TA shall be a floor mounted vertical, horizontal left, horizontal right, or downflow air handling unit, operable with refrigerant R-410A, equipped with an electronic expansion valve and direct drive ECM type fan with constant CFM programming, for installation within a conditioned space. When installed in a vertical configuration it shall have top discharge air and bottom return air. When installed in a horizontal right or horizontal left

Model Number	**Cooling** (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	**Heating** (Indoor 70°F DB Outdoor 47F / 43F, 25 ft pipe length)
FXTQ09TAVJUA(D)	9,500	10,500
FXTQ12TAVJUA(D)	12,000	13,500
FXTQ18TAVJUA(D)	18,000	20,000
FXTQ24TAVJUA(D)	24,000	27,000
FXTQ30TAVJUA(D)	30,000	34,000
FXTQ36TAVJUA(D)	36,000	40,000
FXTQ42TAVJUA(D)	42,000	47,500
FXTQ48TAVJUA(D)	48,000	54,000
FXTQ54TAVJUA(D)	54,000	61,000
FXTQ60TAVJUA(D)	60,000	68,000

configuration, it shall have a horizontal discharge air and horizontal return air. When installed in a downflow configuration it shall have bottom discharge and top return air. This compact design with pre-painted heavy-gauge steel casing shall be available in capacities from 9,500 Btu/h to 60,000 Btu/h. Model numbers are FXTQ09TAVJUA, FXTQ12TAVJUA, FXTQ18TAVJUA, FXTQ24TAVJUA, FXTQ30TAVJUA, FXTQ36TAVJUA, FXTQ42TAVJUA, FXTQ48TAVJUA , FXTQ54TAVJUA, and FXTQ60TAVJUA to be connected to outdoor unit model RXYQ / RXYMQ / RWEYQ heat pump and REYQ / RWEYQ heat recovery model. The FXTQ_TA series may also be specified to utilize a factory integral disconnect switch. Model numbers including the factory disconnect are FXTQ09TAVJUD, FXTQ12TAVJUD, FXTQ18TAVJUD, FXTQ24TAVJUD, FXTQ30TAVJUD, FXTQ36TAVJUD, FXTQ42TAVJUD, FXTQ48TAVJUD , FXTQ54TAVJUD, and FXTQ60TAVJUD. A KRCS01-2UA remote temperature sensor kit shall be required for all FXTQ indoor units not utilizing the thermistor in the Daikin remote controller BRC1E73. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E73 and BRC2A71.
B. Performance: Each unit's performance is based on nominal operating conditions:

C. Indoor Unit:
1. The Daikin indoor unit FXTQ_TA components shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, brazed connections, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.

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2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be insulated from the outdoor unit.
4. Return air shall be through an optional or field supplied filter.
5. Condensate draining shall be made via gravity or external condensate pump.
6. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
7. The voltage range will be 253 volts maximum and 187 volts minimum.

D. Unit Cabinet:
1. The cabinet shall be constructed with sound absorbing, foil-faced insulation to control air leakage.
2. Select an installation location with adequate structural support, space for service access and clearance for air return and supply duct connections.
3. A field supplied secondary drain pan shall be installed where required by national, state, or local code.

E. Fan:
1. The fan shall be a direct-drive Sirocco type fan, statically and dynamically balanced impeller with high and low fan speeds available.
2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range 0.2 to 1.0. HP.
3. The airflow rate shall be available in high setting.
4. The fan motor shall be thermally protected.
5. Fan motor external static pressure for nominal airflow:

Model Number	**Fan ESP (in. WG)**
FXTQ09TAVJUA(D)	Up to 0.9
FXTQ12TAVJUA(D)	Up to 0.9
FXTQ18TAVJUA(D)	Up to 0.9
FXTQ24TAVJUA(D)	Up to 0.9
FXTQ30TAVJUA(D)	Up to 0.9
FXTQ36TAVJUA(D)	Up to 0.9
FXTQ42TAVJUA(D)	Up to 0.9
FXTQ48TAVJUA(D)	Up to 0.9
FXTQ54TAVJUA(D)	Up to 0.9
FXTQ60TAVJUA(D)	Up to 0.9

F. Filter:
1. The return air shall be filtered by means of an optional or field supplied filter.

G. Coil:
1. Coils shall be of the direct expansion type constructed from aluminum tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coils shall be a 2- to 4-row cross fin copper evaporator coil with 14 to 16 fpi design completely factory tested.
4. The refrigerant connections shall be brazed connections and the condensate will be 3/4 inch outside diameter PVC.
5. A thermistor will be located on the liquid and gas line.

H. Electrical:
1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).

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3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

l. Control:

1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
3. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

J. Optional Accessories Available:

1. Field installed 3-25kW electric heaters (HKS-03, HKS-05, HKS-06, HKS-08, HKS-10, HKS-15, HKS-19, HKS-20, HKS-25).
2. Air filter (ALFH1620, ALFH1912201E, ALFH20231E).
3. Downflow kit: DFK-B, DFK-C, DFK-D.
4. BRC4C84 wireless controller.

4.17 FXUQ – 4 WAY CEILING SUSPENDED CASSETTE UNIT

Model Number	**Cooling** (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	**Heating** (Indoor 70°F DB Outdoor 47F / 43F, 25 ft pipe length)
FXUQ18PVJU	18,000	20,000
FXUQ24PVJU	24,000	27,000
FXUQ30PVJU	30,000	34,000
FXUQ36PVJU	36,000	40,000

A. General: Daikin indoor unit model FXUQ shall be a ceiling suspended cassette fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation onto a ceiling within a conditioned space. It shall be available in capacities from 18,000 Btu/h to 36,000 Btu/h. Model numbers are FXUQ18PVJU, FXUQ24PVJU, FXUQ30PVJU, FXUQ36PVJU to be connected to outdoor unit model RXYQ / RXYMQ / RWEYQ heat pump and REYQ / RWEYQ heat recovery model. It shall be a four-way air distribution type, fresh white, impact resistant with a washable panel. The supply air is distributed via motorized louvers which can be horizontally and vertically adjusted from 0° to 60°. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E73. The indoor units sound pressure shall range from 36 dB(A) to 40 dB(A) at low speed measured at 5 feet below the unit.

B. Performance: Each unit's performance is based on nominal operating conditions:

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C. Indoor Unit:
1. The Daikin indoor unit FXUQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be insulated from the outdoor unit.
4. The 4-way supply air flow can be field modified to 3-way and 2-way airflow to accommodate various installation configurations including corner installations.
5. Return air shall be through the concentric panel, which includes a resin net mold resistant filter.
6. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 23-5/8" of lift and has a built in safety shutoff and alarm.
7. The indoor units shall be equipped with a return air thermistor.
8. All electrical components are reached through the decoration panel, which reduces the required side service access.
9. The indoor unit will be separately powered with 208-230V/1-phase/60Hz.
10. The voltage range will be 253 volts maximum and 187 volts minimum.
D. Unit Cabinet:
1. The cabinet shall be space saving and shall be located into the ceiling.
2. Three auto-swing positions shall be available to choose, which include standard, draft prevention and ceiling stain prevention.
3. The airflow of the unit shall have the ability to shut down outlets with multiple patterns allowing for simpler installation in irregular spaces.
4. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.
E. Fan:
1. The fan shall be direct-drive turbo fan type with statically and dynamically balanced impeller with three fan speeds available.
2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range from 0.06 to 0.14 HP.
3. The airflow rate shall be available in three settings.
4. The fan motor shall be thermally protected.
F. Filter:
1. The return air shall be filtered by means of a washable long-life filter with mildew-proof resin.
G. Coil:
1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 3-row cross fin copper evaporator coil with 21 FPI design completely factory tested.
4. The refrigerant connections shall be flare connections and the condensate will be 1-inch outside diameter PVC.
5. A condensate pan with antibacterial treatment shall be located under the coil.
6. A condensate pump with a 23-5/8-inch lift shall be located below the coil in the condensate pan with a built-in safety alarm.
7. A thermistor will be located on the liquid and gas line.
H. Electrical:

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1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

I. Control:

1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
3. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

J. Optional Accessories Available:

1. Remote "in-room" sensor kit (KRCS01-4B).

i. The Daikin wall mounted, hard wired remote sensor kit is recommended for ceiling-embedded type fan coils, which often result in a difference between set temperature and actual temperature. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).

2. Sensor Kit (BRE49B1F)

i. The infrared presence sensor can detect human presence and adjust the airflow direction automatically to prevent drafts. Optional and configurable energy saving occupancy control can be performed when no presence is detected

ii. The infrared floor sensor can detect the floor temperature and automatically adjust operation of the indoor unit to provide an improved and even temperature distribution

3. Air Outlet Blocking Decoration Panel (KDBTP49B140)
4. Blocking Material Kit for 2-way Discharge (KDBHP49B140)

4.18 FXEQ ONE WAY BLOW CASSETTE UNIT

A. General: Daikin indoor unit model FXEQ shall be a ceiling suspended cassette fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation onto a ceiling within a conditioned space. It shall be available in capacities from 7,500 Btu/h to 24,000 Btu/h. Model numbers are FXEQ07PVJU, FXEQ09PVJU, FXEQ12PVJU, FXEQ15PVJU, FXEQ18PVJU, FXEQ24PVJU to be connected to outdoor unit model RXYQ / RXYMQ / RWEYQ heat pump and REYQ / RWEYQ heat recovery model. It shall be a one-way air distribution type, fresh white, impact resistant with a washable panel. The supply air is distributed via motorized vertical and horizontal louvers which can be adjusted from 0° to 45° and 20° to 70° respectively. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E73. The indoor units sound pressure shall range from 26 dB(A) to 38 dB(A) at low speed measured at 3.3 feet below the unit.

B. Performance: Each unit's performance is based on nominal operating conditions:

Model Number	**Cooling** (Indoor 80°F DB / 67°F WB,	**Heating** (Indoor 70°F DB Outdoor 47F / 43F, 25 ft pipe length)

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	Outdoor 95°F DB, 25 ft pipe length)	
FXEQ07PVJU	7,500	8,500
FXEQ09PVJU	9,500	10,500
FXEQ12PVJU	12,000	13,500
FXEQ15PVJU	15,000	17,000
FXEQ18PVJU	18,000	20,000
FXEQ24PVJU	24,000	27,000

PART 3 EXECUTION

3.01. INSTALLATION

A. Install units level and plumb.

B. Install components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.02. CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.03. FIELD QUALITY CONTROL

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Remove and replace malfunctioning units and retest as specified above.

F. Prepare test and inspection reports.

3.04 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

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END OF SECTION

C. Indoor Unit:
1. The Daikin indoor unit FXEQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate lift pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
2. The indoor unit shall be able to process up to 15% fresh air
3. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
4. Both refrigerant lines shall be insulated from the outdoor unit.
5. Return air shall be through the flat back panel, which includes a white resin net mold resistant filter.
6. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 33-7/16" of lift and has a built in safety shutoff and alarm.
7. The indoor units shall be equipped with a return air thermistor.
8. Motor and some of the electrical components shall be reachable through the decoration panel.
9. The indoor unit will be separately powered with 208- 230V/1-phase/60Hz.
10. The voltage range will be 253 volts maximum and 187 volts minimum.

D. Unit Cabinet:
1. The cabinet shall be space saving and shall be located into the ceiling.
2. The cabinet shall have a built in 4" knock-out to connect fresh air intake
3. The cabinet shall be constructed with sound absorbing foamed polyurethane noise insulation.
4. The cabinet shall be equipped with foamed polystyrene and foamed polyethylene heat insulation.

E. Fan:
1. The fan shall be direct-drive Sirocco fan type with statically and dynamically balanced impeller with five selectable fan speeds available.
2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range from 0.11 to 0.15 HP.
3. The airflow rate shall be available in five settings.
4. The fan motor shall be thermally protected.

F. Filter:
1. The return air shall be filtered by means of a mold resistant Resin net filter.
2. The filter shall be accessible from the decoration panel

G. Coil:
1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coils for units up to 1 ton shall be a 2-row cross fin copper evaporator coil with 20.5 FPI design completely factory tested for the
4. The coils for units from 1.25 ton to 2.0 ton shall be 2-row cross fin copper evaporator coil with 20.5 FPI and an additional row with 15.9 FPI.
5. The refrigerant connections shall be flare connections and the condensate will be 1-1/32 inch outside diameter PVC.

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6. A condensate pan with antibacterial treatment shall be located under the coil.
7. A condensate pump with a 33-7/16 inch lift shall be located below the coil in the condensate pan with a built-in safety alarm.
8. A thermistor will be located on the liquid and gas line.

H. Electrical:

1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

I. Control:

1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
3. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

J. Standard Accessories Required:

1. Decoration panel BYEP40AW1 shall be required for operation of FXEQ07 PVJU thru FXEQ15PVJU
2. Decoration panel BYEP63AW1 shall be required for operation of FXEQ18PVJU and FXEQ24PVJU.

K. Optional Accessories Available:

1. Remote controller wire type (BRC1E73)
2. Simplified remote controller (BRC2A71)
3. Remote "in-room" sensor kit (KRCS01-4B).

i. The Daikin wall mounted, hard-wired remote sensor kit is recommended for ceiling-embedded type fan coils, which often result in a difference between set temperature and actual temperature. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).

4. Central remote controller (DCS302C71)
5. Electrical box (KJB311AA)
6. Unified ON/OFF controller (DCS301C71)
7. Electrical box (KJB212AA)
8. Scheduled timer (DST301BA61)
9. Intelligent Touch controller (DCS601C71)
10. DIII-NET expander adaptor (DTA109A51)
11. Wiring adaptor printed circuit board (KRP1C75)
12. Group control adaptor printed circuit board (KRP4A74)
13. Adaptor mounting box (KRP1B101)

Part 5 HVAC EQUIPMENT ALTERNATE (GENERAL INFORMATION)

5.01 The alternate equipment supplier shall provide to the bidding mechanical contractor a complete equipment data package. This package shall include, but is not limited to, equipment capacities at the design condition, power requirements, indoor units CFM/static pressures, fan curves, installation requirements, and physical dimensions. Nominal performance data is not acceptable.

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The mechanical contractor shall request and receive the equipment data package 15 days prior to bid date and submit this package with the alternate bid.

The mechanical contractor shall list the equipment supplier and submit the required data package with the bid detailing a complete comparison of the proposed alternate equipment to the specified equipment and the associated cost reduction of the alternate equipment. The contractor bids an alternate manufacturer with full knowledge that that manufactures product may not be acceptable or approved.

5.02 The alternate equipment supplier shall furnish a complete drawing package to the mechanical contractor 15 days prior to bid day for bidding and installation. The drawing format shall be .dxf or equivalent, on 30"x42" sheets. The HVAC and electrical series design documents will be made available in electronic format for use by the equipment supplier in preparing their drawings. The alternate equipment supplier shall prepare the following drawings:

XXX HVAC Floor Plan
XXX HVAC Refrigerant Piping Plan
XXX HVAC Refrigerant Piping/Controls Details
XXX HVAC Details
XXX HVAC Schedules

The alternate equipment supplier shall draft all piping circuits, components, overall building control schematic, detailed control wiring diagrams, system details and schedules for their system. The drawings shall convey all requirements to successfully install the alternate equipment suppliers system.

Provide (2) drawing package sets plotted on 20 lb. vellum. Provide (1) drawing package in electronic format (.dxf files) on CD.

The submitted documents shall be complete system designs and show no less information than the HVAC equipment/controls contract bid documents.

5.03 The equipment supplier shall submit as part of the equipment data package outdoor unit data sheets. Data sheets to include the following:

Capacities at project design conditions: Cooling
Cooling (Btu/h)

Cooling Input Power
(kW)

Capacities at project design conditions: Heating
Heating (Btu/h)

Heating Input Power
(kW)

The submitted capacity and efficiency performance must meet or exceed the listed performance on the schedule at the designed outdoor ambient, and indoor space temperature conditions including de-rate factors for defrost and refrigerant piping lengths.

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Operating Temperature Range:
Cooling
Heating

Power Supply:
Maximum Circuit Amps (MCA)
Maximum Overcurrent Protection Amps (MOP)
Maximum Starting Current (MSC)
Outdoor Fan Motor

Refrigerant:
Refrigerant Type/Charge
Control

Unit Data:
Max. Number of Indoor Units
Sound Pressure Level at 3ft. (dBA)
Weight (lbs)
Dimensions

5.04 The equipment supplier shall guarantee the performance of their system and all published data submitted. Performance shall be based on the design criteria below.

Room Temperature (Cooling):
Room Temperature (Heating):
Ambient Temperature (Summer):
Ambient Temperature (Winter):
Defrost De-rate Factor:
Refrigerant Piping Loss in cooling (correction factor):
Refrigerant Piping Loss in heating (correction factor):

5.05 The alternate equipment supplier shall submit with bid, indoor unit data sheets. Data sheets to include the following:

Capacities:
Cooling (Btu/h)
Heating (Btu/h)
Air Flow (CFM)

External Static Pressure (ESP)
Electrical Data (MCA, MOP, MSC)
Weight (lbs)
Dimensions

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VARIABLE REFRIGERANT VOLUME HVAC SYSTEM

PART 1 GENERAL

1.01. SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.02. ACTION SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.03. INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.04. CLOSEOUT SUBMITTALS

Operation and maintenance data.

PART 1A.

1.01 SECTION INCLUDES

A. Variable refrigerant volume HVAC system includes:

1. Outdoor/Condensing unit(s):

a. Size Range: 6 to 40 Tons Nominal

b. Daikin Model Numbers:

REYQ72AATJ*

REYQ96AATJ*

REYQ120AATJ*

REYQ144AATJ*

REYQ168AATJ*

REYQ192AATJ*

REYQ216AATJ*

REYQ240AATJ*

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REYQ264AATJ* (REYQ144AATJ* + REYQ120AATJ*)

REYQ288AATJ* (REYQ144AATJ* + REYQ144AATJ*)

REYQ312AATJ* (REYQ168AATJ* + REYQ144AATJ*)

REYQ336AATJ* (REYQ168AATJ* + REYQ168AATJ*)

REYQ360AATJ* (REYQ168AATJ* + REYQ192AATJ*)

REYQ384AATJ* (REYQ192AATJ* + REYQ192AATJ*)

REYQ408AATJ* (REYQ192AATJ* + REYQ216AATJ*)

REYQ432AATJ* (REYQ216AATJ* + REYQ216AATJ*)

REYQ456AATJ* (REYQ216AATJ* + REYQ240AATJ*)

REYQ480AATJ* (REYQ240AATJ* + REYQ240AATJ*)

2. 1.05. Branch Selector Boxes

a. *Input information as required*

3. Indoor Units

a. *Input information as required*

1.02 RELATED REQUIREMENTS

A. N/A

1.03 REFERENCES

A. N/A

1.04 SUBMITTALS

A. N/A

1.05 QUALITY ASSURANCE

A. MANUFACTURER QUALIFICATIONS:

1. The units shall be tested by a National Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995 – Heating and Cooling Equipment and bear the Listed Mark.
2. All wiring shall be in accordance with the National Electric Code (NEC).
3. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.
4. The condensing unit will be factory charged with R410A.

1.06 1.06 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled according to the manufacturer's recommendations.

1.07 WARRANTY

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A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: One year(s) from date of Substantial Completion.

b. For Parts: One year(s) from date of Substantial Completion.

c. For Labor: One year(s) from date of Substantial Completion.

~~A.~~

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1.07 WARRANTY

A. STANDARD LIMITED WARRANTY

1. Complete warranty details available from your local Daikin representative or at www.daikincomfort.com.

2. Daikin North America LLC warrants original owner of the non-residential building, multifamily residence or residence in which the Daikin products are installed that under normal use and maintenance for comfort cooling and conditioning applications such products (the "Products") will be free from defects in material and workmanship. This warranty applies to compressor and all parts and is limited in duration to ten (10) years starting from the ''installation date'' which is one of the two dates below:

a. The installation date is the date that the unit is originally commissioned, but no later than 18 months after the manufacture date noted on the unit's rating plate.

b. If the date the unit is originally commissioned cannot be verified, the installation date is three months after the manufacture date.

PART 2 PRODUCTS

2.01 MANUFACTURERS

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

1) Daikin.

2) Trane.

3) YORK; a Johnson Controls company.

A. DESIGN BASIS:

1. The HVAC equipment basis of design is Daikin North America. All bidders shall furnish the minimum system standards as defined by the base bid model numbers, model families or as otherwise specified herein (see Appendix A HVAC Equipment Alternate General Information). In any event, the contractor shall be responsible for all specified items and intents of this document without further compensation.

2.02 HVAC SYSTEM DESIGN

A. SYSTEM DESCRIPTION:

1. The variable capacity heat recovery air conditioning system shall be a ~~Daikin~~ Variable Refrigerant Volume Series (heat or cool model) system as specified.

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2. The system shall consist of multiple evaporators, branch selector boxes, REFNET™ joints and headers, a three-pipe refrigeration distribution system using PID control and Daikin VRV® condenser unit.
3. The condenser shall be a direct expansion (DX), air-cooled heat recovery, multi-zone air-conditioning system with variable speed inverter driven compressors using R-410A refrigerant.
4. The condensing unit may connect an indoor evaporator nominal capacity up to 200% of the condensing unit nominal capacity. All zones are each capable of operating separately with individual temperature control.
5. A dedicated hot gas pipe shall be required to ensure optimum heating operation performance.
    a. Two-pipe, heat recovery systems utilizing a lower temperature mixed liquid/gas refrigerant to perform heat recovery are not acceptable due to reduced heating capabilities.
6. The Daikin condensing unit shall be able to connect to indoor units models CXTQ, FXFQ, FXHQ, FXMQ, FXLQ, FXNQ, FXSQ, FXTQ, FXDQ, FXZQ, FXUQ, FXEQ, FXAQ and FXMQ_MF, and shall range in capacity from 5,800 Btu/h to 96,000 Btu/h in accordance with Daikin's engineering data book detailing each available indoor unit.
    a. The indoor units shall be connected to the condensing unit utilizing Daikin's REFNET™ specified piping joints and headers to ensure correct refrigerant flow and balancing. T style joints are not acceptable for a variable refrigerant system.
7. Operation of the system shall permit either individual cooling or heating of each indoor unit simultaneously or all of the indoor units associated with each branch of the cool/heat selector box (BSQ_T / BS_Q54T / BSF_Q54T). Each indoor unit or group of indoor units shall be able to provide set temperature independently via a local remote controller, an Intelligent Controller, an Intelligent Manager or a BMS interface.
8. Branch selector boxes:
    a. The branch selector boxes shall have the capacity to control up to 290 MBH (cooling) downstream of the branch selector box.
    b. Each branch of the branch selector box shall consist of three electronic expansion valves, refrigerant control piping and electronics to facilitate communications between the box and main processor and between the box and indoor units.

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c. The branch selector box shall control the operational mode of the subordinate indoor units. The use of three EEV's ensures continuous heating during defrost (multiple condenser systems), no heating impact during changeover and reduced sound levels.

d. The use of solenoid valves for changeover and pressure equalization shall not be acceptable due to refrigerant noise.

9. The REYQ_AA condensing unit model numbers and the associated number of connectable indoor units per REYQ_AA condensing unit is indicated in the following table. Each indoor unit or group of indoor units shall be independently controlled.

MODEL NUMBER	NOMINAL CAPACITY (Tons)	MAXIMUM NUMBER OF INDOOR UNITS
REYQ72AATJ*	6	12
REYQ96AATJ*	8	16
REYQ120AATJ*	10	20
REYQ144AATJ*	12	25
REYQ168AATJ*	14	29
REYQ192AATJ*	16	33
REYQ216AATJ*	18	37
REYQ240AATJ*	20	41
REYQ264AATJ*	22	45
REYQ288AATJ*	24	49
REYQ312AATJ*	26	54
REYQ336AATJ*	28	58
REYQ360AATJ*	30	64
REYQ384AATJ*	32	64
REYQ408AATJ*	34	64
REYQ432AATJ*	36	64
REYQ456AATJ*	38	64
REYQ480AATJ*	40	64

B. *VRV EMERION* FEATURES AND BENEFITS

1. Voltage Platform - The condensing units shall be available with a 208-230V/3ph/60 Hz power supply.

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2. Single-module outdoor units shall be available from 6 to 20 T in nominal cooling capacity and can be combined to offer up to 40 T in a dual-module configuration, which helps minimize the overall space required for mechanical equipment and optimize total project costs.
3. The condensing unit shall feature a sealed E-box with a minimum of IP55 rating to provide high dust and moisture protection for reliability
4. Gas Furnace Connectivity – Heat Pump condensing units shall be connectable to Daikin Communicating gas furnaces with AFUE ranging from 80% to 97%.
5. System shall be capable of connecting to multiple VRV A-coils (CXTQ) paired with Daikin Communicating gas furnaces allowing for options of gas or heat pump heating to optimize operational costs based on changing utility costs.
6. The system shall be able to switch between heat pump heating and gas furnace heating at a field selectable change-over temperature which can be configured via condensing unit field settings.
7. 4. Each system shall be able to enlarge from single to dual module without the need for installed main pipe size changes. The manufacturer shall provide predefined pipe sizes and design rules ensuring reliable system operation and offering design flexibility in phased installation applications.
8. 5. Stable Operation – System shall provide stable inverter operation at varied ambient conditions.
9. 6. No Drain Pan Heater – System shall be capable of heating operation without the need for a drain pan heater. If alternate manufacturer is chosen, an additional drain pan heater shall be provided by the manufacturer.
10. 7. Auto Changeover – System shall, below the field selected outdoor ambient temperature provide signal to initiate auxiliary or back up heat.
11. 8. Advanced Zoning – A single system shall provide for up to 64 zones.
12. 9. Independent Control – Each indoor unit shall use a dedicated electronic expansion valve with up to 2000 positions for independent control.
13. 10. VFD Inverter Control and Variable Refrigerant Temperature – Each condensing unit shall use high efficiency, variable speed all “inverter” based flash vapor injection compressor(s) coupled with inverter fan motors to optimize part load performance. The system capacity and refrigerant temperatures shall be modulated automatically to set suction and condensing pressures while varying the refrigerant volume for the needs of

the cooling or heating loads. The control will be automatic and customizable depending on load and weather conditions.

a. Indoor shall use PID to control superheat to deliver a comfortable room temperature condition and optimize efficiency.

14.11. Configurator software – Each system shall be available with configurator software package to allow for remote configuration of operational settings and also for assessment of operational data and error codes.

a. If this software is not provided by an alternate manufacturer, for each individual outdoor unit the contractor shall do the settings manually and keep detailed records for future maintenance purposes.

15.12. Each system shall include a built-in data recorder that can store up to 45 minutes of operational data which can help identify the issue in case of a product failure

16.13. Heating during Defrost and Oil Return– 16 T and above VRV systems shall maintain continuous heating during defrost and oil return operation. Reverse cycle (cooling mode) in these modes shall not be permitted due to the potential reduction in space temperature.

17.14. Low Ambient Cooling - Each system shall be capable of low ambient cooling operation to -4°FDB (-20°CDB).

18.15. Independent Control - Each indoor unit shall use a dedicated electronic expansion valve for independent control.

19.16. Flexible Design –

a. Systems shall be capable of up to 540ft ~~(165m) [623 ft. (190m) equivalent]~~ of linear piping between the condensing unit and furthest located indoor unit.

b. Systems shall be capable of up to 3,280ft ~~(1,000m)~~ total "one-way" piping in the piping network.

c. Systems shall have a vertical (height) separation of up to 361 ft between the condensing unit and the indoor units.

d. Systems shall be capable of up to 295ft ~~(90m)~~ from the first ~~REFNET™~~ / branch point.

e. The condensing unit shall have the ability to connect an indoor unit evaporator capacity of up to 200% of the condensing unit nominal capacity.

f. Systems shall be capable of 98ft ~~(30m)~~ vertical separation between indoor units.

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g. Condensing units shall be supported with a fan motor ESP up to 0.32" WG as standard to allow connection of discharge ductwork and to prevent discharge air short circuiting.

20.17. Oil return Each system shall be furnished with a centrifugal oil separator and active oil recovery cycle.

21.18. Simple wiring Systems shall use 16/18 AWG, 2 wire, stranded, non-shielded and non-polarized daisy chain control wiring.

22. Space saving – Each system shall not exceed the dimensions shown below

MODEL NUMBER	Dimensions in Inch (H x W x D)
REYQ72AATJ*	65-3/8 x 36-5/8 x 30-1/8
REYQ96AATJ*	65-3/8 x 48-13/16 x 30-1/8
REYQ120AATJ*	
REYQ144AATJ*	
REYQ168AATJ*	
REYQ192AATJ*	65-3/8 x 68-7/8 x 30-1/8
REYQ216AATJ*	
REYQ240AATJ*	
REYQ264AATJ*	(65-3/8 x 48-13/16 x 30-1/8) + (65-3/8 x 48-13/16 x 30-1/8)
REYQ288AATJ*	
REYQ312AATJ*	
REYQ336AATJ*	
REYQ360AATJ*	(65-3/8 x 48-13/16 x 30-1/8) + (65-3/8 x 68-7/8 x 30-1/8)
REYQ384AATJ*	(65-3/8 x 68-7/8 x 30-1/8) + (65-3/8 x 68-7/8 x 30-1/8)
REYQ408AATJ*	
REYQ432AATJ*	
REYQ456AATJ*	
REYQ480AATJ*	

23.19. Each condensing unit shall include a multi-functional digital display that can provide system operation status such as operating refrigerant temperatures, pressures, outdoor electronic expansion valve opening and compressor operation time.

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24.20. Each condensing unit shall include a service window that can provide easy access to system field settings and operation status without completely removing the condensing unit panel.

25.21. Advanced diagnostics – Systems shall include a self-diagnostic, auto-check function to detect a malfunction and display the type and location.

26.22. Each condensing unit shall incorporate contacts for electrical demand shedding with optional 3 stage demand control with 12 customizable demand settings.

27.23. Advanced controls – Each system shall have at least one remote controller capable of controlling up to 16 indoor units.

28.24. Each system shall be capable of integrating with open protocol BACnet, LonWorks and Modbus building management systems.

29.25. Low sound levels – Each system shall use indoor and condensing units with quiet operation as low as 27 dB(A).

30.26. The system shall be certified and listed in OSHPD directory for seismic certification

31. The condensing unit can be installed up to 200 ft above the ground without requiring any additional field modifications to the unit to comply with the Florida Miami Dade Wind code requirements.

32.27. The condensing unit shall be factory equipped with a Schrader valve for connection to a pressure relief kit for compliance with City of Chicago Pressure relief code.

C. PERFORMANCE:

1. The VRV REYQ_AA system shall perform as indicated below:

MODEL NUMBER	SYSTEM IEER (Ducted)	SYSTEM IEER (Non-Ducted)
REYQ72AATJ*	23.00	28.00
REYQ96AATJ*	25.30	30.00
REYQ120AATJ*	23.50	27.50
REYQ144AATJ*	22.50	26.50
REYQ168AATJ*	21.40	24.00
REYQ192AATJ*	21.00	24.00
REYQ216AATJ*	20.50	23.00

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REYQ240AATJ*	19.70	21.60
REYQ264AATJ*	19.20	23.90
REYQ288AATJ*	19.30	23.20
REYQ312AATJ*	19.20	22.80
REYQ336AATJ*	18.60	22.10
REYQ360AATJ*	18.20	21.00
REYQ384AATJ*	18.80	22.00
REYQ408AATJ*	18.40	21.50
REYQ432AATJ*	18.10	21.10
REYQ456AATJ*	17.50	20.20
REYQ480AATJ*	17.20	19.40

MODEL NUMBER	SYSTEM SCHE (Ducted)	SYSTEM SCHE (Non-Ducted)
REYQ72AATJ*	22.00	26.10
REYQ96AATJ*	21.10	26.10
REYQ120AATJ*	22.20	26.10
REYQ144AATJ*	22.10	25.60
REYQ168AATJ*	22.30	25.60
REYQ192AATJ*	22.80	26.60
REYQ216AATJ*	21.90	25.50
REYQ240AATJ*	21.80	25.60
REYQ264AATJ*	18.20	26.20
REYQ288AATJ*	20.00	23.40
REYQ312AATJ*	20.80	24.40
REYQ336AATJ*	19.80	23.40
REYQ360AATJ*	19.40	23.00
REYQ384AATJ*	17.00	22.00
REYQ408AATJ*	18.40	21.90
REYQ432AATJ*	18.20	20.30

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REYQ456AATJ*	18.00	18.90
REYQ480AATJ*	16.50	16.90

MODEL NUMBER	SYSTEM EER (Ducted)	SYSTEM EER (Non-Ducted)
REYQ72AATJ*	12.80	15.70
REYQ96AATJ*	12.80	14.60
REYQ120AATJ*	12.40	13.20
REYQ144AATJ*	12.00	12.50
REYQ168AATJ*	11.10	11.50
REYQ192AATJ*	11.50	12.30
REYQ216AATJ*	11.00	11.50
REYQ240AATJ*	10.80	11.00
REYQ264AATJ*	10.60	12.00
REYQ288AATJ*	11.00	12.00
REYQ312AATJ*	10.80	11.30
REYQ336AATJ*	10.60	10.50
REYQ360AATJ*	10.70	11.50
REYQ384AATJ*	10.50	10.70
REYQ408AATJ*	10.50	10.70
REYQ432AATJ*	10.10	10.70
REYQ456AATJ*	9.80	9.90
REYQ480AATJ*	9.60	9.70

MODEL NUMBER	SYSTEM COP@47°F (Ducted)	SYSTEM COP@47°F (Non-Ducted)
REYQ72AATJ*	3.58	4.35
REYQ96AATJ*	3.56	4.30
REYQ120AATJ*	3.48	4.00
REYQ144AATJ*	3.35	3.80
REYQ168AATJ*	3.20	3.50

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REYQ192AATJ*	3.45	3.85
REYQ216AATJ*	3.25	3.70
REYQ240AATJ*	3.20	3.45
REYQ264AATJ*	3.20	3.70
REYQ288AATJ*	3.27	3.60
REYQ312AATJ*	3.25	3.60
REYQ336AATJ*	3.23	3.60
REYQ360AATJ*	3.21	3.60
REYQ384AATJ*	3.25	3.40
REYQ408AATJ*	3.25	3.40
REYQ432AATJ*	3.25	3.40
REYQ456AATJ*	3.25	3.40
REYQ480AATJ*	3.25	3.40

MODEL NUMBER	SYSTEM COP@17°F (Ducted)	SYSTEM COP@17°F (Non-Ducted)
REYQ72AATJ*	2.40	2.50
REYQ96AATJ*	2.25	2.48
REYQ120AATJ*	2.25	2.38
REYQ144AATJ*	2.10	2.20
REYQ168AATJ*	2.10	2.10
REYQ192AATJ*	2.05	2.05
REYQ216AATJ*	2.05	2.05
REYQ240AATJ*	2.05	2.05
REYQ264AATJ*	2.10	2.35
REYQ288AATJ*	2.13	2.41
REYQ312AATJ*	2.10	2.35
REYQ336AATJ*	2.10	2.20
REYQ360AATJ*	2.05	2.05
REYQ384AATJ*	2.05	2.05
REYQ408AATJ*	2.05	2.05
REYQ432AATJ*	2.05	2.05

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REYQ456AATJ*	2.05	2.05
REYQ480AATJ*	2.05	2.05

1. Performance Conditions:
   a. Cooling: Indoor temperature of 80°FDB (26.7°CDB), 67°FWB (19.5°CWB) and outdoor temperature of 95°FDB (35°CDB).
   b. Heating: Indoor temperature of 70°FDB (21.1°CDB) and outdoor temperature of 47°FDB (8.3°CDB), 43°FWB (6.1°CDB).
   c. Equivalent piping length: 25ft (7.5m)
2. Cooling or Cooling Dominant Operation:
   a. The standard operating range in cooling or cooling dominant simultaneous cooling/heating will be 23°FDB (5°CDB) ~ 122°FDB (50°CDB).
   b. Cooling mode indoor room temperature range will be 57-77°FWB (13.8 - 25°CWB).
   c. Each system as standard shall be capable of onsite reprogramming to allow low ambient cooling operation down to -4°FDB (20°CDB).
3. Heating or Heating Dominant Operation:
   a. The standard operating range in heating or heating dominant simultaneous cooling/heating will be -13° – 61°FWB (-25 – 16°CWB).
      1) If an alternate equipment manufacturer is selected, the mechanical contractor shall provide, at their own risk and cost, all additional material and labor to meet low ambient operating condition and performance
   b. Heating mode indoor room temperature range will be 59°FDB - 80°F DB (15°CDB – 26.7°CDB).

2.03 EQUIPMENT

A. ELECTRICAL:

1. The power supply to the condensing unit shall be:

POWER SUPPLY VOLTAGE	VOLTAGE RANGE
208-230V / 3ph / 60 Hz	187V – 253V (±10%)

MODEL	MCA	MOP
REYQ72AATJ*	27.3 A	30 A
REYQ96AATJ*	34.1 A	35 A
REYQ120AATJ*	36.5 A	40 A

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REYQ144AATJ*	47.8 A	50 A
REYQ168AATJ*	54.9 A	60 A
REYQ192AATJ*	59.8 A	60 A
REYQ216AATJ*	67.2 A	70 A
REYQ240AATJ*	73.7 A	80 A
REYQ264AATJ*	36.5+47.8 A	40+50 A
REYQ288AATJ*	47.8+47.8 A	50+50 A
REYQ312AATJ*	47.8+54.9 A	50+60 A
REYQ336AATJ*	54.9+54.9 A	60+60 A
REYQ360AATJ*	54.9+59.8 A	60+60 A
REYQ384AATJ*	59.8+59.8 A	60+60 A
REYQ408AATJ*	59.8+67.2 A	60+70 A
REYQ432AATJ*	67.2+67.2 A	70+70 A
REYQ456AATJ*	67.2+73.7 A	70+80 A
REYQ480AATJ*	73.7+73.7	80 + 80 A

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B. WIRING:

1. The control voltage between the indoor and condensing unit shall be 16VDC non-shielded, stranded 2 conductor cable.
2. The control wiring shall be a two-wire multiplex transmission system, making it possible to connect multiple indoor units to one condensing unit with one 2-cable wire, thus simplifying the wiring installation.
3. The control wiring maximum lengths shall be as shown below:

	CONDENSER TO INDOOR UNIT	CONDENSER TO CENTRAL CONTROLLER	INDOOR UNIT TO REMOTE CONTROL
CONTROL WIRING LENGTH	6,560ft (2,000m)	3,280ft (1,000m)	1640 ft. (500m)
WIRE TYPE	16/18 AWG, 2 wire, non-polarity, non-shielded, stranded		

C.B. REFRIGERANT PIPING:

1. The system shall be capable of refrigerant piping up to 540ft (165m) actual or 623ft (190m) equivalent from the condensing unit to the furthest indoor unit, a total combined liquid line length of 3,280ft (1,000m) of piping between the condensing and indoor units, without any oil traps or additional components.
2. PREFNET™ piping joints and headers shall be used to ensure proper refrigerant balance and flow for optimum system capacity and performance.
   a. T style joints shall not be acceptable as this will negatively impact proper refrigerant balance and flow for optimum system capacity and performance.

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D. PAINT/CORROSION RESISTANCE:

1. Paint and corrosion resistance shall be at a minimum per the table below:

COMPONENT	VRV EMERION		
	BASE MATERIAL	SURFACE TREATMENT	COATING THICKNESS External & Internal Surface
EXTERNAL PANEL BASE	Galvanized steel	POLYESTER	≧1.5 mils
EXTERNAL FRONT PANEL	Galvanized steel	POLYESTER	≧1.5 mils
PILLAR	Galvanized steel	POLYESTER	≧1.5 mils
COMPRESSOR COVER	ASTM material	Resin Paint	≧0. 78 mils
FIN GUARD	Iron wire	Resin Paint	≧0. 79 mils
FAN GUARD AND DRUM	Polypropylene	No treatment required	N/A
FAN	Acrylonitrile - glass	No treatment required	N/A
FAN MOTOR FRAME	Resin	No treatment required	N/A
FAN MOTOR SHAFT	Carbon steel	No treatment required	N/A
FAN MOTOR SUPPORT	Galvanized steel	POLYESTER	≧1.5 mils
HEAT EXCHANGERS (FIN ONLY)	Aluminum	Polymer Anti-corrosion surface treatment	Salt Spray 1000 hours, blister rating 10
ELECTRICAL PARTS BOX	Hot-dip zinc-coated steel	No treatment required	N/A
ELECTRICAL PARTS BOARD	Glass cloth / Glass nonwoven cloth	Insulation Varnish	No specific thickness

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	material		
SCREWS	Carbon steel wire rods	High corrosion resistance treatment	≧0. 28 mils

2.04 OUTDOOR/CONDENSING UNIT

A. GENERAL:

1. The condensing unit is designed specifically for use with VRV series components.
2. The refrigeration circuit of the condensing unit shall consist of Daikin inverter scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports, liquid receiver and suction accumulator.
3. High/Low pressure gas line, liquid and suction lines must be individually insulated between the condensing and indoor units.
4. The condensing unit can be wired and piped with access from the left, right, rear or bottom.
5. The connection ratio of indoor units to condensing unit shall be permitted up to 200% of nominal capacity.
6. Each condensing system shall be able to support the connection of up to 64 indoor units dependent on the model of the condensing unit.
7. The sound pressure level standard shall be that value as listed in the Daikin engineering manual for the specified models at 3 feet from the front of the unit. The condensing unit shall be capable of operating automatically at further reduced noise during night time or via an external input.
8. The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for reprogramming.
9. The condensing unit shall be modular in design and should allow for side-by-side installation.
10. The following safety devices shall be included on the condensing unit; high pressure sensor and switch, low pressure sensor, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
11. To ensure the liquid refrigerant does not flash when supplying to the various indoor units, the circuit shall be provided with a sub-cooling feature.

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12. Oil recovery cycle shall be automatic occurring 2 hours after start of operation and then every 8 hours of operation.
13. The condensing unit shall be capable of heating operation at -13°F (-25°C) wet bulb ambient temperature without additional low ambient controls or an auxiliary heat source.
14. 16 T and above VRV systems shall continue to provide heat to the indoor units in heating operation while in the defrost mode.

B. UNIT CABINET:

1. The condensing unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed galvanized steel panels coated with a baked enamel finish.
2. Each condensing unit shall have a three-segment panel design which allows for direct access to outdoor fans, critical mechanical and electrical components separately for ease of installation and service.
3. Each outdoor unit shall have separate knock-outs for both refrigerant piping and wiring on the bottom panel

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2.05 FAN:

~~4. The condensing unit shall consist of one or more propeller type, direct-drive fan motors that have multiple speed operation via a DC (digitally commutating) inverter. Reference table below.~~

~~MODEL NUMBER~~	~~FAN MOTOR OUTPUT (W) & QUANTITY~~
~~REYQ72AATJ*~~	~~950 x 1~~
~~REYQ96AATJ*~~	~~650 x 2~~
~~REYQ120AATJ*~~	~~650 x 2~~
~~REYQ144AATJ*~~	~~650 x 2~~
~~REYQ168AATJ*~~	~~650 x 2~~
~~REYQ192AATJ*~~	~~950 x 2~~
~~REYQ216AATJ*~~	~~950 x 2~~
~~REYQ240AATJ*~~	~~950 x 2~~
~~REYQ264AATJ*~~	~~(650 x 2) + (650 x 2)~~
~~REYQ288AATJ*~~	~~(650 x 2) + (650 x 2)~~
~~REYQ312AATJ*~~	~~(650 x 2) + (650 x 2)~~
~~REYQ336AATJ*~~	~~(650 x 2) + (650 x 2)~~
~~REYQ360AATJ*~~	~~(650 x 2) + (950 x 2)~~
~~REYQ384AATJ*~~	~~(950 x 2) + (950 x 2)~~
~~REYQ408AATJ*~~	~~(950 x 2) + (950 x 2)~~
~~REYQ432AATJ*~~	~~(950 x 2) + (950 x 2)~~
~~REYQ456AATJ*~~	~~(950 x 2) + (950 x 2)~~

~~5.~~1. The condensing unit fan motor shall have multiple speed operation of the DC (digitally commutating) inverter type, and be of high external static pressure and shall be factory set as standard at 0.12 in. WG. A field setting switch to a maximum 0.32 in. WG pressure is available to accommodate field applied duct for indoor mounting of condensing units.

~~6.~~2. The condensing unit shall have configurable settings for intermittent fan operation to help minimize snow accumulation on fan blades when the system is off.

~~7.~~3. Each outdoor unit fan shall be a vertical discharge configuration and the nominal airflow rate for each module will range from 6,200CFM to 14,505 CFM dependent on model specified.

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8.4. The fan motor shall have inherent protection and permanently lubricated bearings and be mounted.

9.5. The fan motor shall be provided with a fan guard to prevent contact with moving parts.

C. SOUND:

1. Nominal sound pressure levels shall be as shown below.

MODEL NUMBER	SOUND PRESSURE LEVEL dB(A)
REYQ72AATJ*	58 dBA
REYQ96AATJ*	61 dBA
REYQ120AATJ*	61 dBA
REYQ144AATJ*	65 dBA
REYQ168AATJ*	65 dBA
REYQ192AATJ*	67 dBA
REYQ216AATJ*	68 dBA
REYQ240AATJ*	69 dBA
REYQ264AATJ*	67 dBA
REYQ288AATJ*	69 dBA
REYQ312AATJ*	69 dBA
REYQ336AATJ*	69 dBA
REYQ360AATJ*	70 dBA
REYQ384AATJ*	71 dBA
REYQ408AATJ*	71 dBA
REYQ432AATJ*	72 dBA
REYQ456AATJ*	72 dBA
REYQ480AATJ*	73 dBA

2. Night setback control of the fan motor for low noise operation by way of automatically limiting the maximum speed shall be a standard feature. Operation sound level shall be selectable from 3 steps.

OPERATION SOUND dB(A)	NIGHT MODE SOUND PRESSURE LEVEL dB(A) APPROX.
Level 1	55
Level 2	50
Level 3	45

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~~D.~~B. CONDENSER COIL:

1. The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design to ensure high efficiency performance.
3. The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tube with N-shape internal grooves mechanically bonded on to aluminum fins to an e-Pass Design.
4. The fins shall be coated with an anti-corrosion hydrophilic blue coating as standard from factory with a salt spray test rating of 1000hr per ASTM B117 test standards.
5. The outdoor coil shall have three-circuit heat exchanger design eliminating the need for a drain pan heater. The lower part of the coil shall be used for inverter cooling and be on or off during operation enhancing the defrost operation.
    a. An alternate manufacturer must provide a drain pan heater to enable adequate defrosting of the unit in defrost operation.
6. The condensing unit shall be factory equipped with condenser coil guards on all sides.

~~6.~~

~~E.~~C. COMPRESSOR:

1. The ~~Daikin~~ inverter scroll compressors shall be variable speed (PVM inverter) controlled which is capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure as measured in the condensing unit.
    a. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read every 20 seconds and calculated. With each reading, the compressor capacity (INV frequency) shall be controlled to eliminate deviation from target value.
        1) Non –inverter-driven compressors, which may cause starting motor current to exceed the nominal motor current (RLA) and require larger wire sizing, shall not be allowed.
2. The inverter driven compressors in the condensing unit shall be of highly efficient reluctance DC (digitally commutating), hermetically sealed scroll “P-type”.
3. Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type.

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a. At complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.

4. The capacity control range shall be as low as 1% to 100%.
5. The compressor's motor shall have a cooling system using discharge gas, to avoid sudden changes in temperature resulting in significant stresses on winding and bearings.
6. Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.
7. Oil separators shall be standard with the equipment together with an intelligent oil management system.
8. The compressor shall be mounted on vibration dampening rubber grommets to minimize the transmission of vibration, eliminating the standard need for external spring isolation.
9. In the event of compressor failure, the remaining compressors, if applicable, shall continue to operate and provide heating or cooling as required at a proportionally reduced capacity. The microprocessor and associated controls shall be manually activated to specifically address this condition for single module and manifold systems.
10. In the case of multiple condenser modules, combined operation hours of the compressors shall be balanced by means of the Duty Cycling Function, ensuring sequential starting of each module at each start/stop cycle, completion of oil return, completion of defrost or every 8 hours. When connected to a central control system sequential start is activated for all system on each DIII network.
11. Compressor configurations:

MODEL NUMBER	COMPRESSOR MOTOR OUTPUT (W)	QUANTITY	COMPRESSOR TYPES
REYQ72AATJ*	4390	1	Inverter controlled
REYQ96AATJ*	2740 + 2740	2	Inverter controlled
REYQ120AATJ*	3630 + 3630	2	Inverter controlled
REYQ144AATJ*	3360 + 5720	2	Inverter controlled
REYQ168AATJ*	4090 + 6960	2	Inverter controlled
REYQ192AATJ*	5820 + 5820	2	All inverter controlled
REYQ216AATJ*	6560 + 6560	2	All inverter controlled
REYQ240AATJ*	7580 + 7580	2	All inverter

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			controlled
REYQ264AATJ*	(3630 + 3630) + (3360 + 5720)	4	All inverter controlled
REYQ288AATJ*	(3360 + 5720) + (3360 + 5720)	4	All inverter controlled
REYQ312AATJ*	(3360 + 5720) + (4090 + 6960)	4	All inverter controlled
REYQ336AATJ*	(4090 + 6960) + (4090 + 6960)	4	All inverter controlled
REYQ360AATJ*	(4090 + 6960) + (5820 + 5820)	4	All inverter controlled
REYQ384AATJ*	(5820 + 5820) + (5820 + 5820)	4	All inverter controlled
REYQ408AATJ*	(5820 + 5820) + (6560 + 6560)	4	All inverter controlled
REYQ432AATJ*	(6560 + 6560) + (6560 + 6560)	4	All inverter controlled
REYQ456AATJ*	(6560 + 6560) + (7580 + 7580)	4	All inverter controlled
REYQ480AATJ*	(7580 + 7580) + (7580 + 7580)	4	All inverter controlled

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~~2.05~~ 2.06 BRANCH SELCTOR UNITS

A. GENERAL:

1. SINGLE-PORT BRANCH SELECTOR BOX

~~a. The BSQ36TVJ, BSQ60TVJ, and BSQ96TVJ, are designed specifically for use with VRV IV, VRV IV X, VRV EMERION VRV AURORA, and T series Water Cooled heat recovery system components.~~

~~b.~~a. The single port branch selector boxes ~~BSQ_T~~ shall provide individual control and changeover for one group of indoor units.

~~c.~~b. These ~~BSQ_T~~ branch controllers shall support low ambient cooling down to −4F° to connected indoor units.

~~d.~~c. These selector boxes shall be factory assembled, wired, and piped.

~~e.~~d. These branch selector boxes shall have a heat-by-pass control loop inside the units to prevent overheating of space during heating cycles

~~f.~~e. These selector boxes must be mounted indoors.

~~g.~~f. When simultaneously heating and cooling, the units in heating mode shall energize their subcooling electronic expansion valve.

2. STANDARD MULTI-PORT T-SERIES BRANCH SELECTOR BOX

~~a. The BS4Q54TVJ, BS6Q54TVJ, BS8Q54TVJ, BS10Q54TVJ and BS12Q54TVJ, are designed specifically for use with VRV IV, VRV IV X, VRV EMERION VRV AURORA, and T series Water Cooled heat recovery system components.~~

~~b.~~a. These branch selector boxes shall provide individual control and changeover for multiple groups of indoor units.

~~c.~~b. These selector boxes shall be factory assembled, wired, and piped.

~~d.~~c. These selector boxes must be mounted indoors.

~~e.~~d. When simultaneously heating and cooling, the units in heating mode shall energize their subcooling electronic expansion valve.

3. MULTI-PORT FLEX BRANCH SELECTOR BOX SERIES

~~a. The BSF4Q54TVJ, BSF6Q54TVJ, and BSF8Q54TVJ are designed specifically for use with VRV IV, VRV IV X, VRV EMERION VRV AURORA, and T series Water Cooled heat recovery system components.~~

~~b.~~a. These branch selector boxes shall provide individual control and changeover for multiple groups of indoor units.

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c.b. These branch selector boxes shall allow for Field selectable LEFT/RIGHT/PASS THROUGH piping configuration.

d.c. These branch selector boxes shall allow multiple branch selector boxes to be connected downstream of the first Branch selector box in series in series.

e.d. These Branch selector boxes when connected in series shall be able to support a total indoor load of up to 230MBH.

f.e. The EEV heads and motors used in the branch selector box shall be accessible via a quick access panel without disassembly of the electrical box.

g.f. The electrical box of the 4-port branch selector box shall be field re-locatable to left, right, and back side of the main cabinet.

h.g. These branch selector boxes shall allow connected indoor units to operate in cooling mode down to -4F without any additional field installed accessories

i.h. Labels shall be displayed close to the incoming 3 pipes to facilitate clear identification and eliminate cross piping.

j.i. The branch selector boxes shall employ EEV with the ability to control up to 6000 pulses

k.j. These selector boxes shall be factory assembled, wired, and piped.

l.k. These selector boxes must be mounted indoors.

m.l. When simultaneously heating and cooling, the units in heating mode shall energize their subcooling electronic expansion valve.

4. The number of connectable indoor units shall be in accordance with the table below:

BRANCH SELECTOR TYPE	MODEL NUMBER	MAXIMUM CONNECTABLE COOLING CAPACITY	MAXIMUM NUMBER OF CONNECTABLE INDOOR UNITS PER BRANCH
SINGLE PORT	BSQ36TVJ	36,000 Btu/h	4
	BSQ60TVJ	60,000 Btu/h	8
	BSQ96TVJ	96,000 Btu/h	8
MULTI PORT T SERIES	BS4Q54TVJ	144,000 Btu/h	5
	BS6Q54TVJ	216,000 Btu/h	5
	BS8Q54TVJ	290,000 Btu/h	5
	BS10Q54TVJ	290,000 Btu/h	5

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	BS12Q54TVJ	290,000 Btu/h	5
MULTI PORT FLEX SERIES	BSF4Q54TVJ	144,000 Btu/h*	5
	BSF6Q54TVJ	216,000 Btu/h*	5
	BSF8Q54TVJ	290,000 Btu/h*	5

* For multiple branch selector box connected in series, refer to the engineering manual for details.

B. UNIT CABINET

1. These units shall have a galvanized steel plate casing.
2. Each cabinet shall house 3 electronic expansion valves for refrigerant control per branch.
3. The cabinet shall contain one subcooling heat exchanger per branch.
4. The unit shall have sound absorption thermal insulation material made of flame and heat resistant foamed polyethylene.
5. Nominal sound pressure levels shall be measured and published on the submittals by the manufacturer. The sound levels must not exceed the values below.
   a. If an alternative manufacturer is selected, the mechanical contractor shall provide, at their own cost and expense, any additional material and labor to meet the below published sound levels

BRANCH SELECTOR TYPE	MODEL NUMBER	SOUND LEVEL dB(A) OPERATION
SINGLE PORT	BSQ36TVJ	35
	BSQ60TVJ	41
	BSQ96TVJ	41
MULTI PORT STANDARD T SERIES	BS4Q54TVJ	38
	BS6Q54TVJ	39
	BS8Q54TVJ	39
	BS10Q54TVJ	40
	BS12Q54TVJ	40
MULTI PORT	BSF4Q54TVJ	37
	BSF6Q54TVJ	40.5

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FLEX SERIES	BSF8Q54TVJ	40.5

DIMENSIONS:

b. The branch selector units shall not exceed dimensions stated in the table below.

BRANCH SELECTOR TYPE	MODEL NUMBER	HEIGHT Inches (mm)	WIDTH Inches (mm)	DEPTH Inches (mm)
SINGLE PORT	BSQ36TVJ	8-1/8 (207)	15-1/4 (388)	12-13/16 (326)
	BSQ60TVJ	8-1/8 (207)	15-1/4 (388)	12-13/16 (326)
	BSQ96TVJ	8-1/8 (207)	15-1/4 (388)	12-13/16 (326)
MULTI PORT STANDARD T-SERIES	BS4Q54TVJ	11-3/4 (298)	14-9/16 (370)	18-15/16 (480)
	BS6Q54TVJ	11-3/4 (298)	22-13/16 (580)	18-15/16 (480)
	BS8Q54TVJ	11-3/4 (298)	22-13/16 (580)	18-15/16 (480)
	BS10Q54TVJ	11-3/4 (298)	32-5/16 (820)	18-15/16 (480)
	BS12Q54TVJ	11-3/4 (298)	32-5/16 (820)	18-15/16 (480)
MULTI PORT FLEX SERIES	BSF4Q54TVJ	9-1/2 (241)	13-3/4 (348)	23-3/4 (603)
	BSF6Q54TVJ	9-1/2 (241)	23-3/8 (593)	23-3/4 (603)
	BSF8Q54TVJ	9-1/2 (241)	23-3/8 (593)	23-3/4 (603)

6.C. REFRIGERANT VALVES:

a.1. The unit shall be furnished with 3 electronic expansion valves per branch to control the direction of refrigerant flow. The use of solenoid valves for changeover and pressure equalization shall not be acceptable due to refrigerant noise.

b.2. The refrigerant connections must be of the braze type.

c.3. In multi-port units, each port shall have its own electronic expansion valves. If common expansion/solenoid valves are used, redundancy must be provided.

d.4. Multiple indoor units may be connected to a branch selector box with the use of a REFNET™ joint provided they are within the capacity range of the branch selector.

e. These branch selector boxes shall support up to the maximum capacity per port shown in the table below

BRANCH SELECTOR TYPE	MODEL NUMBER	MAXIMUM CAPACITY PER PORT
SINGLE PORT	BSQ36TVJ	36,000 Btu/h

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	BSQ60TVJ	60,000 Btu/h
	BSQ96TVJ	96,000 Btu/h
MULTI PORT T SERIES	BS4Q54TVJ	54,000 Btu/h
	BS6Q54TVJ	54,000 Btu/h
	BS8Q54TVJ	54,000 Btu/h
	BS10Q54TVJ	54,000 Btu/h
	BS12Q54TVJ	54,000 Btu/h
MULTI PORT FLEX SERIES	BSF4Q54TVJ	54,000 Btu/h
	BSF6Q54TVJ	54,000 Btu/h
	BSF8Q54TVJ	54,000 Btu/h

2.07 CONDENSTATE REMOVAL:

f.a. The unit shall be hermetically sealed to prevent condensation build up inside the unit, and not require use of a secondary condensate collection pan. A safety device or secondary drain pan shall be installed by the mechanical contractor to comply with the applicable mechanical code, if an alternate manufacturer is selected.

7.5. ELECTRICAL:

a. The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz.

b. The unit shall be capable of operation within the limits of 187 volts to 255 volts.

c.b. The minimum circuit amps (MCA) shall be 0.1 and the maximum overcurrent protection amps (MOP) shall be 15.

d.c. The control voltage between the indoor and condensing unit shall be 16VDC non-shielded 2 conductor cable.

PART 3 EXECUTION

3.01. INSTALLATION

A. Install units level and plumb.

B. Install evaporator fanbranch selector components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

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3.02. CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Retain first subparagraph below for units with hot-water coils.

C. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.03. FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.04 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

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2.06 INDOOR/EVAPOTATOR UNITS

*INSERT AS REQUIRED

PART 3 EXECUTION

*INSERT AS REQUIRED

END OF SECTION

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APPENDIX A

HVAC EQUIPMENT ALTERNATE (GENERAL INFORMATION)

1) The alternate equipment supplier shall provide to the bidding mechanical contractor a complete equipment data package.

a) This package shall include, but is not limited to, equipment capacities at the design condition, power requirements, indoor units CFM/static pressures, fan curves, installation requirements, and physical dimensions. Nominal performance data is not acceptable.

b) The mechanical contractor shall request and receive the equipment data package 15 days prior to bid date and submit this package with the alternate bid.

c) The mechanical contractor shall list the equipment supplier and submit the required data package with the bid detailing a complete comparison of the proposed alternate equipment to the specified equipment and the associated cost reduction of the alternate equipment. The contractor bids an alternate manufacturer with full knowledge that that manufactures product may not be acceptable or approved.

d) All equipment must have visible and permanent label clearly identifying the original manufacturer of the equipment. These labels shall have original manufacturer's name and contact information and be located both inside and outside the equipment and on all equipment related literature. Submittals shall include the above statement as confirmation by supplier that all conditions are agreed to and complied to. Failure to comply with these requirements shall be sufficient cause for rejection of the submittal and product with no further consideration.

2) The alternate equipment supplier shall furnish a complete drawing package to the mechanical contractor 15 days prior to bid day for bidding and installation.

a) The drawing format shall be .dxf or equivalent, on 30"x42" sheets.

b) The HVAC and electrical series design documents will be made available in electronic format for use by the equipment supplier in preparing their drawings.

c) The alternate equipment supplier shall prepare the following drawings:

i) XXX – HVAC Floor Plan

ii) XXX – HVAC Refrigerant Piping Plan

iii) XXX – HVAC Refrigerant Piping/Controls Details

iv) XXX – HVAC Details

v) XXX – HVAC Schedules

d) The alternate equipment supplier shall draft all piping circuits, components, overall building control schematic, detailed control wiring diagrams, system details and schedules for their system. The drawings shall convey all requirements to successfully install the alternate equipment suppliers system.

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e) Provide (2) drawing package sets plotted on 20 lb. vellum. Provide (1) drawing package in electronic format (.dxf files) on CD.

f) The submitted documents shall be complete system designs and show no less information than the HVAC equipment/controls contract bid documents.

3) The equipment supplier shall submit, as part of the equipment data package, condensing unit data sheets. Data sheets to include the following:

a) COOLING capacities at project design conditions:

i) Cooling (Btu/h)

ii) Cooling Input Power:

(1) Ducted (kW)

(2) Ductless (kW)

(3) Mixed (kW)

iii) Part Load IEER:

(1) Ducted

(2) Ductless

(3) Mixed

iv) SCHE

v) Full Load EER:

(1) Ducted

(2) Ductless

(3) Mixed

b) HEATING capacities at project design conditions:

i) Heating (Btu/h)

ii) Heating Input Power:

(1) Ducted (kW)

(2) Ductless (kW)

(3) Mixed (kW)

iii) Full Load COP @ 47°F:

(1) Ducted

(2) Ductless

(3) Mixed

iv) Full Load COP @ 17°F:

(1) Ducted

(2) Ductless

(3) Mixed

c) The submitted capacity and efficiency performance must meet or exceed the listed performance on the schedule at the designed space conditions including de-rate factors for defrost if applicable and refrigerant piping losses.

i) OPERATING TEMPERATURE RANGE:

(1) Cooling

(2) Heating

ii) POWER SUPPLY:

(1) Maximum Circuit Amps (MCA)

(2) Maximum Overcurrent Protection Amps (MOP)

(3) Maximum Starting Current (MSC)

(4) Condenser Fan Motor

iii) REFRIGERANT:

(1) Refrigerant type and charge details including field charge for piping to ensure code compliance.

(2) Control of refrigerant temperature based on weather and load or alternative function.

iv) UNIT DATA:

(1) Max. number of indoor units

(2) Sound pressure level at 3ft (dBA)

(3) Weight (lbs)

(4) Dimensions

(5) Demand limit function description

(6) Details on sequential start functionality

(7) Coil anticorrosion data

4) The equipment supplier shall guarantee the performance of their system and all published data submitted. Performance shall be based on the design criteria below.

a) Room Temperature (Cooling)

b) Room Temperature (Heating)

c) Ambient Temperature (Summer)

d) Ambient Temperature (Winter)

e) Defrost De-rate Factor

f) Refrigerant Piping Loss

5) The alternate equipment supplier shall submit with bid, indoor unit data sheets. Data sheets to include the following:

a) Capacities at project design conditions:

i) Cooling (Btu/h)

ii) Cooling Input Power (kW)

iii) Part Load IEER

iv) SCHE

v) Full Load EER

vi) Heating (Btu/h)

vii) Heating Input Power (kW)

viii) Full Load COP@47°F

ix) Full Load COP@17°F

x) Air Flow (CFM)

b) External Static Pressure (ESP)

c) Electrical Data (MAC, MOP, MSC, RLA)

d) Weight (lbs)

e) Dimensions

6) The equipment supplier shall provide a certificate which states that the equipment has a minimum salt spray resistance of 1000 hours.

7) The equipment supplier shall submit the warranty certificate to the mechanical contractor.

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SECTION 260500 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 GENERAL

A. Applicable provisions of the Information for Bidders, General and Special Clauses, General Requirements, and the Drawings govern the work of this section.

1.2 WORK INCLUDED

A. The work under this Division shall consist of all labor, materials, equipment and services necessary and required to complete all electrical as shown on the Drawings, as described in the specifications, or as inferable from the Drawings and Specifications. Where the words provide or install are used singularly or in combination, it shall mean to furnish and install complete for fully functioning and operational systems. The work shall include but not necessarily be limited to the following:
   1. Building mains and feeders in accordance with the drawing.
   2. Conduit, wiring, outlet boxes, switches, convenience receptacles, etc. for lighting, branches, and relays.
   3. Motor disconnect switches as required by Code as shown.
   4. Setting controllers furnished by other trades.
   5. Provide shop drawings for all work.

1.3 WORK NOT INCLUDED

A. The following related items will be covered in other sections of these specifications:
   1. Furnishing motors and controllers. (Only controllers shipped in manufactured control panels).
   2. HVAC equipment.

1.4 CODES AND STANDARDS

A. All materials furnished and all work installed shall comply, where applicable, with the requirements of the current New York State Building Code, Local Codes and the 2017 National Electrical Code. Whenever reference is made of “National Electrical Code” or “NEC,” it shall mean the 2017 National Electrical Code.
B. Material and work shall comply with other Codes and Standards as may be specified or referenced.
C. Where applicable or specified herein, all material and devices furnished shall meet requirements of Underwriters’ laboratories Inc., shall be U.L. listed and where further applicable, shall bear the U.L. listing mark.

1.5 POWER SHUTDOWN

A. The Contractor may be permitted power shutdowns during normal working hours of 8 a.m. to 3 p.m. Tuesday through Thursday only. Arrange for connections to existing systems as directed by the Engineer and Owner.

B. The Contractor shall include the cost of performing work during other than normal work hours at overtime or premium wage rates in the bid price. The Contractor will not receive any separate or additional payment for work during other than normal working hours above lump sum bid work included under this Contract.

1.6 FINAL TEST AND INSPECTION

A. The Contractor shall be required to demonstrate to the satisfaction of the Engineer that all the electrical systems, equipment and devices operate as specified.

B. The Contractor shall test the fire systems for proper operation to the satisfaction of the Engineer.

C. All existing systems shall first be tested by owner to insure total system functioning. The contractor shall adapt, connect to, or modify systems as required.

D. Provide fire underwriters certificate of inspection.

1.7 TEMPORARY ELECTRIC LIGHT AND POWER

A. The Electrical Contractor shall be responsible for furnishing, installing, maintaining, and upon completion removing, a system of temporary light and power for the use of all construction trades and contracts. Installation of cable, overcurrent devices shall be included in the electrical contractor's bid. This shall include all overtime required to complete work between Tuesday and Thursday.

1.8 CUTTING AND PATCHING

A. The Contractor shall provide all necessary cutting of the walls, floors, ceilings, etc. for installation of conduit, outlet boxes, etc. Cutting shall be kept to a minimum, all areas shall be spray painted for approval prior to any cutting.

B. All finished patching and painting to be by this Contractor. The Electrical Contractor shall completely fill all openings left by the removal of conduit, equipment, etc., with regard to floor openings, plywood shall be attached to the underside of the slab to facilitate the filling of the opening completely.

1.9 FIREPROOFING

A. All openings through fire proof barriers shall be fully resealed to maintain the fire rating with 3M CP25WB caulking or approved equal.

B. Fire rated barrier and non-flammable supports for floor openings to be KBS Sealbags or equal.

1.10 HEAT SCAN

A. Upon completion of all work under the contract, the Contractor shall perform a heat scan survey of all his work.

B. Scan shall be performed while the facility is under full operation, and equipment at full load.

C. Equipment shall be capable of taking pictures of all areas, especially problem locations.

D. Results shall be neatly assembled and labeled in three (3) binders for the Owner after the Engineer's approval.

1.11 PERFORMANCE REQUIREMENTS

A. The electrical contractor shall verify that all terminations on contract equipment is proper. Testing for phase rotation, continuity and full operation of the equipment shall be performed.

B. The electrical contractor shall render full assistance to all trades for control wiring sequence and unit operation testing.

1.12 ROOF PENETRATIONS

A. No conduit penetrations shall be made through roofs without prior permission of the Owner.

B. Any penetrations allowed will be performed using pitch pockets as approved by the Owner.

1.13 WALL PENTRATIONS

A. All wall penetrations for conduit shall be performed using pre-manufactured wall sleeves as manufactured by Link Seal, OZ Gedney or equal.

1.14 TORQUE REQUIREMENTS

A. All equipment and cable connections shall be tightened to the torque values determined by the manufacturer.

B. Assemble all information after the work is complete in a binder for the owner.

1.15 WORKMANSHIP

A. The Contractor shall perform all operations necessary for the proper installation and operation of all systems.

B. All work performed shall be first class work in every respect. The work shall be performed by mechanics skilled in their respective trades, who shall at all times be under the supervision of competent persons.

C. Work that is slipshod, poorly laid out, not perfectly aligned, or that is not consistent with the requirements generally accepted in the trade for "first class work" will not be acceptable.

D. In addition to the materials specified elsewhere, all other miscellaneous items be necessary for the completion of the work shall be furnished and installed by the Contractor to the extent that all system be complete and operative.

E. Electrical Contractor shall submit references for the foreman to run the project. Electrical Foreman shall have a minimum of five (5) years experience as a working foreman.

1.16 REGULATIONS AND CERTIFCATES

A. All work required by the Drawings and Specifications shall be installed to comply with all applicable building laws, regulations and ordinances of the State of New York, and local laws and regulations as may apply, except where these requirements are exceeded by the Drawings and Specifications in quality or quantity.

B. Any and all changes in the arrangement of the work, either before or after installation, to suit conditions in the building or the work of other trades, and any and all changes required by agencies having jurisdiction shall be made without extra charge, unless the charges are in consequence of changes made by the Owner.

1.17 OPENINGS

A. The admittance into the building of all equipment and materials furnished under this Contract shall be through finished openings. The Contractor shall refer to the Owner for specific requirements relative to the use of building freight elevator if exists and other existing facilities.

1.18 EXPEDITING THE WORK

A. The Contractor shall take all measurements at the job, verify all figured dimensions indicated on the construction drawings, familiarize himself to assure complete knowledge of code requirements and coordinate the work with other trades so as to cause no delay in the work and to eliminate wherever possible future cutting and patching. Any discrepancies or interference shall be reported immediately to the Owner.

1.19 PROTECTION OF THE WORK

A. The Contractor shall provide temporary covering and do all work required to protect work, materials, machinery and equipment from all damage from moisture.

B. After the work is completed, the Contractor shall clean all equipment and piping.

1.20 OPERATING AND MAINTENANCE INSTRUCTIONS

A. The Contractor shall furnish to the Owner one set for initial review and one set of final written operating, maintenance and lubrication instructions for all installed systems and equipment. Instructions shall include copies of all designated approved shop drawings, manufacturer’s descriptive data, control diagrams, wiring diagrams, performance test data, test and balance reports and installation and operating instructions as specified.

B. Operation and Maintenance Submittal Instructions

1. Organize all instructions as follows:
   a. All instructions shall be submitted in electronic format on USB drive in the formats described below.
   b. Information shall be organized and saved in separate data files, clearly named.
   c. USB drive submitted shall be clearly labeled, and shall be submitted with a table of contents referencing the specification section of the files contained on them.
   d. Text shall be submitted in Portable Document Format (PDF), Rich Text Format (RFT), or Microsoft Word (doc).
   e. All graphics shall be submitted in Joint Photographics Expert Group (jpeg or jpg) format.
   f. Text shall include written instruction on operating and maintaining the equipment, and at minimum shall include:
      1) Startup instructions
      2) Standard operation instructions
      3) Any emergency or non-standard operating instruction
      4) Design criteria for the equipment, in the table format. Information shall include standard size information, such as length, width, or diameter, and capacity information such as flow and head that is not included in the nameplate table.
      5) A description of the controls provided with the equipment.
      6) Troubleshooting in the table format as follows:

PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION

      7) Nameplate data for the equipment in table format. Nameplate information shall include data for the overall assembly and any major components such as motors, gear reducers, etc.
      8) Manufacturer and local vendor information, including address, phone numbers, email addresses, and web sites.
      9) Information needed for ordering new parts.
      10) Preventive maintenance and lubrication instructions and schedule including recommended lubricants, application points, and a list of special tools required for operation and maintenance.
      11) List of spare parts supplied with the equipment, identified by manufacturer's part number.
      12) Assembly and disassembly instruction for each preventative or corrective maintenance task.
   g. Graphics shall be provided in high resolution (75 dpi or greater) with a maximum width of 820 pixels, and shall include, at minimum:
      1) Complete electrical and control schematics with labeled terminations
      2) Parts diagrams with parts clearly identified with manufacturer's part numbers
      3) Diagrams required for maintenance including lubrication locations, pump packing arrangements, etc.
      4) Performance diagrams, such as pump curves, blower curves, etc.

C. The above instructions, charts, etc. shall be submitted to the Engineer as a rough draft and after the required corrections are made, six (6) sets in looseleaf, hardback binders, CDs, suitable indexed and identified, shall be furnished to the Owner.

D. The Owner's designated operating personnel shall be instructed in the proper operation and maintenance of the equipment as well as the operation and maintenance of the controls for the various systems by the vendor's representative. Informal or unwitnessed instructions, or instructions to non-designated personnel will not be acceptable. In addition to the instruction periods specified elsewhere, the Contractor shall furnish instruction for a minimum of two (2) working day straight time not necessarily consecutive. Prior arrangements for instruction periods shall be made with the Owner.

E. Final payment will not be granted until all manuals and training have been provided to the Owner/Owner's representative.

1.22 RECORD DRAWINGS

A. The Contractor shall maintain an accurate record set of reproducible as-built drawings of any deviations in work as actually installed from the work as indicated on the design drawings. The Contractor shall utilize the contract design drawings for marking up any deviations to the drawings. The record shall be kept current and available at the site for inspection.

B. As-built drawings shall be updated at the site as work progresses.

C. Final payment will not be granted until all final as-built drawings are delivered to the Owner/Owner's Representative.

D. Contractor shall furnish as-built drawings to Engineer at 100% of project completion. As-builts are to be submitted in AutoCAD computer format. Submit three sets of discs and three sets of blueprints.

1.23 GUARANTEE

A. The Contractor shall guarantee clean power throughout the new systems.

B. The Contractor shall guarantee that the capacity of all new equipment installed meets Specification requirements.

C. The Contractor shall guarantee that all new systems will operate without excessive noise and vibration.

D. The Contractor shall obtain from the various manufacturers or vendors standard guarantees or warranties for their particular equipment or components for a period of at least one year, and deliver them to the Owner.

1.24 EQUIPMENT GROUNDING

A. All equipment, panels and devices (except motors) which require electrical connections shall be furnished with a factory-welded (prior to finish painting) ground lug in a concealed and accessible location.

1.25 FINAL INSPECTION

A. The Contractor shall conduct a final inspection of all work installed under each Section of the Specification after the installation have been completed; the testing hereinafter specified has been performed; and test reports have been submitted.

B. During the conduct of the final inspection, the Contractor shall have present a representative of the various manufacturers and a representative of the manufacturers of other pertinent equipment as direct by the Owner.

C. The Contractor shall include in his bid a testing period of two (2) working days wherein all aspects of the electrical systems specified herein will be tested in accordance with detailed test procedures which will be issued by the Owner at a later date. The Contractor shall provide sufficient technical personnel and instruments to perform the tests as directed by the Owner. Personnel for each working day shall include one mechanic, one helper, manufacturer's representative as required, plus GC and HVAC supervisory personnel. The testing period specified herein is in addition to all other testing or instruction periods included in the specifications.

D. The Contractor shall demonstrate, to the satisfaction of the Owner, that the systems installed meet Specification requirements and that the capacities and performances of the equipment meets schedule requirements. The contractor shall make all changes, modifications and adjustments to the installed systems, as directed by the Owner, to meet Specifications requirements, at no additional cost to the Owner.

1.26 ALTERATION AND REMOVAL OF EXISTING WORK

A. The Contractor shall refer to the Contract Documents, for specific requirements relative to the existing facilities and the Sequence of work.

B. All existing systems shall be maintained in operation during the construction period as directed by the Owner. Existing systems shall not be shut down nor shall connec tions be made thereto without prior approval of the Owner.

C. The Contractor shall relocate all existing conduit hangers and supports, as re quired to accommodate the new installation at no additional costs to the Owner. This includes all work in spaces where new work is specified under this Contract.

D. Unless otherwise specified or indicated on the Drawings, all equipment, piping, ap purtenances, etc. are indicated to be removed from the site when directed by the Owner.

1.27 SHOP DRAWINGS

A. The Contractor shall submit copies of manufacturer's shop drawings and descriptive literature together with the manufacturer's installation, operating and maintenance in-

structions, for all equipment to be incorporated in the work including all required wiring diagrams and shall obtain approval before proceeding with the installation.

B. The Contractor shall submit copies of shop drawings at ¼ inch scale or larger showing all conduit mains, including connections to equipment, and all equipment layouts and shall obtain approval before proceeding with the work. Shop drawings shall be accurately dimensioned so that conduit clears all structural members and other work incorporated in the project. The Contractor shall take all shop drawing measurements at the building.

C. The Contractor shall submit the following shop drawings, manufacturer's brochures, manufacturer's installation and operating instructions, etc. for approval before proceeding with the work:
   1. Wire
   2. Raceways
   3. Wiring Devices
   4. Disconnects

D. Acceptance of shop drawings does not absolve the Contractor to provide specified materials and function in the intended manner.

1.28 SHOP DRAWING SUBMISSION

A. All shop drawings submitted shall be in electronic portable document file (PDF) format, and identified by transmittal.

B. The transmittal shall have all appropriate information including, project name, date, specification section, submission number, and item description. It is recommended that the attached transmittal form be used to expedient turn over.

C. If this format is not followed, the Engineer reserves the right to reject any submission.

D. Facsimiles will not be accepted for shop drawings.

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