INVITATION TO BID

Leon County School Board
Purchasing Department

Release Date: July 27, 2020
ITB No.: 5617-2021
ITB Title: Gilchrist Elementary School Building 9 HVAC Replacement
Contact: Nancy Scott / scottn@leonschools.net
Phone: 850-488-1206

The Leon County School Board ("School Board") solicits your company to submit a bid on the above referenced goods or services. All terms, specifications and conditions set forth in this request are incorporated by this reference into your response. This sealed bid must be submitted to The Leon County School Board, Purchasing Department, 3397 W. Tharpe St, Tallahassee, Florida 32303, no later than **2:00 P.M.** local time on **August 12, 2020** and plainly marked ITB No. **5617-2021**. Bids are due and will be opened at this time.

REQUIRED SUBMITTAL CHECKLIST - *For each item below, insert bidder Authorized Agent initials verifying that forms are accurately completed, signed by an officer of the business and returned with the bid.* ***Failure to provide all requested documents may result in your proposal being declared non-responsive.***

___ ITB – Bidder Acknowledgement Form
___ Dispute Contact – pg. 6, item 23
___ Bid Proposal Form – pg. 80 *Submit two (2) hard copies*
___ Conflict of Interest Certificate (Exhibit A)
___ Application for Vendor Status (Exhibit B)
___ Request for Taxpayer ID Number & Certification (Exhibit C)
___ Customer Reference (Exhibit D)
___ Vendor Questionnaire (Exhibit E)
___ Drug Free Workplace Certification (Exhibit F)
___ Certification Regarding Debarment (Exhibit G)
___ Sworn Statement / Jessica Lunsford Act (Exhibit H)
___ Affidavit For Claiming Local Purchasing Preference (Exhibit I)

THE FOLLOWING MUST BE COMPLETED, SIGNED AND RETURNED AS PART OF YOUR BID. BIDS WILL NOT BE ACCEPTED WITHOUT THIS FORM, SIGNED BY AN AUTHORIZED AGENT OF THE BIDDER.

Authorized Representative's Name/Title	Authorized Representative's Signature	Date

Company's Name	Telephone Number	FAX Number

Address	City	State	Zip Code

Area Representative	Telephone Number	FAX Number

Federal Employer's Identification Number (FEIN)	Email

Signature of Authorized Officer/Agent:	Typed or Printed Name

*(Bid **must** be signed by an officer or employee having authority to legally bind the bidder)*

I certify that I have not divulged, discussed, or compared this proposal with any other Proposers and have not colluded with any other proposer in the preparation of this proposal in order to gain an unfair advantage in the award of this contract. I acknowledge that all information contained herein is part of the public domain as defined in the Public Records Act, Chapter 119, FS.

By signing and submitting this proposal, I certify that I am authorized to sign this bid for this vendor and further certify unconditional acceptance of the contents of this ITB, all Attachments, Worksheets, Appendices, Supplemental Materials, and the contents of any Addendum released hereto.

NO RESPONSE – I HEREBY SUBMIT THIS AS A "NO RESPONSE" FOR THE REASON(S) CHECKED BELOW

☐ Remove our name from this bid list only
☐ Keep our company on bid list for future bids
☐ Insufficient time to respond to the ITB
☐ Could not meet specifications
☐ Could not meet insurance requirements
☐ Product schedule would not permit us to perform
☐ We do not offer the product or service requested.
☐ Other _____

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BID IDENTIFICATION LABEL

NOTICE TO ALL BIDDERS: A label has been provided to properly identify your bid. Place the bid in a sealed envelope, type the name and address of the bidder on the label and affix the label to the front of the envelope.

The summer hours for the School Board Purchasing office are from 8:00 a.m. - 4:30 p.m. Monday through Thursday. If you are hand delivering a proposal, a Purchasing representative will be available to time/date stamp your submittal during these hours.

Cut out the label below and attach it to your envelope.

Sealed Bid – DO NOT OPEN **Sealed Bid – DO NOT OPEN**

Bid Title: **Gilchrist Elementary School Building 9 HVAC Replacement**

Bid No.: **5617-2021**

Bids Due: **August 12, 2020 @ 2:00 P.M.**

From: _____

Address: _____

_____

Deliver To: Leon County Schools
Purchasing Department
3397 West Tharpe Street
Tallahassee, Florida 32303

Sealed Bid – DO NOT OPEN **Sealed Bid – DO NOT OPEN**

I. GENERAL TERMS AND CONDITIONS

1. INTRODUCTION: The purpose and intent of this Invitation to Bid (ITB) is to secure a firm price and to identify a qualified vendor to provide and install an Aaon HVAC replacement at Gilchrist Elementary School in building 9.

Pursuant to Board Policy 6334 interested firms must hold a Certificate of Prequalification from the Leon County School Board office of Construction & Facilities. Certificates will be valid for one year from the date of School Board approval and must be renewed annually. Instructions are available at: http://www.leonschools.net/Page/4815.

A Non-Mandatory pre-bid conference will be held at Gilchrist Elementary School, 1301 Timberlane Road, Tallahassee, Florida 32312 on **August 4, 2020 at 9:00 am**. All prospective bidders are to meet at the school site in the front office and document their attendance on the conference "sign-in" sheet. Attendees and District personnel will thoroughly inspect the site, further explain the service requirements and answer any questions at that time.

2. SCHOOL BOARD CONTACT: All questions for additional information regarding this ITB must be directed to the designated Purchasing Agent noted on the title page.

All contact and requests for clarifications should be submitted via e-mail to: **scottn@leonschools.net** no later than **August 5, 2020**. Responses will be distributed no later than **August 7, 2020.**

Prospective bidders shall not contact any member of the Leon County School Board, Superintendent or staff regarding this bid prior to posting of the final tabulation and award recommendation on the website and in the Purchasing Office. Any such contact shall be cause for rejection of your bid.

3. DEFINITIONS: The term "Bidder" as used within this Invitation to Bid (ITB) refers to the person, company or organization responding to this ITB. The Bidder is responsible for understanding and complying with the terms and conditions herein. The term "School Board" refers to the School Board of Leon County, Florida.

4. BIDDER'S RESPONSIBILITY: It is the responsibility of the bidder to obtain all pages of the ITB package and all attachments thereto, together with any addenda to the ITB package that may be issued prior to the ITB due date. ITB package and addenda as well as general information can be found at **www.leonschools.net/Page/4411**.

Before submitting their Bid, each bidder is required to carefully examine the ITB specifications and to completely familiarize themselves with all of the terms and conditions that are contained within this request. Ignorance on the part of the bidder will in no way relieve them of any of the obligations and responsibilities, which are a part of this ITB.

5. AWARD: In the event of contract award, this contract shall be awarded all or none to the responsible and responsive bidder(s) whose bid is determined to be the most advantageous to the District, taking into consideration price, product quality, and other requirements as set forth in this ITB. Any or all award(s) made as a result of this ITB shall conform to applicable School Board Rules, State Board Rules and State of Florida Statutes.

Once bids are evaluated, the Purchasing Department will post a Notice of Intent to Award by electronic posting at **www.leonschools.net/Page/4411** on or about **August 17, 2020** for a period of 72 hours or three business days, whichever is later. Failure to file a protest within the time prescribed in section 120.57 (3) , Florida Statutes, or failure to post the bond or other security required by law within the time allowed for filing a bond shall constitute a waiver of proceedings under chapter 120, Florida Statutes.

It is anticipated that a recommendation for award will be presented to the School Board for consideration at its **August 25, 2020** meeting.

6. ORIGINAL AND RENEWAL TERM: The award resulting from this bid shall be in effect upon Board approval, on or about August 26, 2020 with the on-site work to begin December 19, 2020 and be completed no later than December 31, 2020. The awardee will be notified when the recommendation has been acted upon by The School Board. The Bidder agrees to these conditions by signing its bid

7. RESERVATION FOR REJECTION OR AWARD: The School Board reserves the right to reject any or all bids, to waive irregularities or technicalities, and to request rebids. The School Board reserves the right to award on an individual item basis, any combination of items, total low bid or, if an alternate bid is accepted, on such terms as are specified for the alternate bid, whichever manner is in the best interest of the School Board.

8. CONTRACT: The submission of your bid constitutes a firm offer by the bidder. Upon acceptance by the School Board, the Purchasing Department will issue a notice of award and purchase order(s) for any supplies, equipment and/or services as a result of this ITB. The Invitation to Bid and the corresponding purchase order(s) will constitute the complete agreement between the successful bidder and the School Board. Unless otherwise stipulated in the bid documents or agreed to in writing by both parties, no other contract documents shall be issued or accepted.

9. FIRM OFFER: Any bid may be withdrawn until the date and time set for the opening of the bids. Any bid not so withdrawn shall constitute an irrevocable offer to provide the School Board the services/products set forth in this ITB. Such offer shall be held open for a period of sixty (60) days from ITB opening date or until one of the bids has been awarded by the School Board.

10. CONFIDENTIALITY: Bidders shall be aware that all submittals provided with a bid are subject to public disclosure and will not be afforded confidentiality with the exception of "sealed" financial statements.

11. PUBLIC RECORDS LAW: Pursuant to Florida Statutes Chapter 119.071(1), proposals received as a result of this ITB will not become public record until thirty (30) days after the date of opening or until posting of a recommendation for award, whichever occurs first. Thereafter, all proposal documents or other materials submitted by all bidders in response to this RFP will be open for inspection by any person and in accordance with Chapter 119, Florida Statutes. To the extent a Bidder asserts any portion of its proposal is exempt or confidential from disclosure under Florida's public records, the burden shall be on the bidder to obtain a protective order from a jurisdictional court protecting such information from disclosure under Florida's public records laws and also timely provide a certified copy of such protective order to the School Board prior to the School Board's release of such information into the public domain

12. AUDITS, RECORDS, AND RECORDS RETENTION: REQUIRED PUBLIC RECORDS ACKNOWLEDGEMENT

To the extent Contractor is required to comply with the Florida Public Records Law, Chapter 119, Florida Statutes, in the performance of its duties under this contract, Contractor will specifically:

- **A.** Keep and maintain public records required by LCSB to perform the service.
- **B.** Upon request from LCSB's custodian of public records, provide LCSB with a copy of the requested records or allow the records to be inspected or copied within a reasonable time at a cost that does not exceed the cost provided in the Chapter 119, Florida Statutes or as otherwise provided by law.
- **C.** Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the duration of the

contract term and following completion of the Agreement if Contractor does not transfer the records to LCSB.

D. Upon completion of the Agreement, transfer, at no cost to LCSB, all public records in possession of the Contractor or keep and maintain public records required by LCSB to perform the service. If Contractor transfers all public records to LCSB upon completion of the Agreement, Contractor shall destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. If Contractor keeps and maintains public records upon completion of the Agreement, Contractor shall meet all applicable requirements for retaining public records. All records stored electronically must be provided to LCSB, upon request of LCSB's custodian of public records, in a format that is compatible with the information technology systems of LCSB.

E. The failure of the Contractor to comply with the provisions set forth herein shall constitute a default and material breach of this Agreement, which may result in immediate termination, with no penalty to LCSB.

PUBLIC RECORDS NOTICE

IF CONTRACTOR HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO CONTRACTOR'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS AGREEMENT, CONTACT THE CUSTODIAN OF PUBLIC RECORDS, JULIE JERNIGAN, AT JERNIGANJ@LEONSCHOOLS.NET, (850)487-7177, 520 SOUTH APPLEYARD DRIVE, TALLAHASSEE, FLORIDA 32304.

13. USE OF OTHER CONTRACTS: The School Board reserve the right to utilize any other District contract, any State of Florida Contract, any contract awarded by any other City or County governmental agencies, any other School Board, any other Community College/State University system, any cooperative bid agreement, or to directly negotiate/purchase per School Board policy and/or State Board Rule 6A-1.012(6) in lieu of any offer received or award made as a result of this bid, If it is in the best interest to do so. The School Board also reserves the right to separately bid any single order or to purchase any item on this bid if it is in its best interest to do so.

14. JOINT-BIDDING, COOPERATIVE PURCHASING AGREEMENT: All bidders submitting a response to this ITB agree that such response also constitutes a bid to all State Agencies and Political Subdivisions of the State of Florida under the same conditions, for the same prices and for the same effective period as this bid, should the bidder(s) deem it in the best interest of their business to do so. This agreement in no way restricts or interferes with any state agency or political subdivision of the State of Florida to rebid any or all items.

State agencies wishing to make purchases from this agreement are required to follow the provisions of s. 287.042(16) (a), F.S. This statute requires the Department of Management Services to determine that the requestor's use of the contract is cost-effective and in the best interest of the State.

Pursuant to their own governing laws, and subject to the agreement of the Contractor, other entities may be permitted to make purchases at the terms and conditions contained herein. Non-Customer purchases are independent of the agreement between Customer and Contractor, and Customer shall not be a party to any transaction between the Contractor and any other purchaser.

The purchasing agreements and state term contracts available under s. 287.056 have been reviewed.

15. BID PREPARATION COSTS: Neither the School Board nor its representatives shall be liable for any expenses incurred in connection with the preparation of a response to this ITB.

16. BID BONDS AND PERFORMANCE BONDS: Bid bonds, **when required** shall be submitted with the bid in the amount specified in the detailed specifications. Bid bonds will be returned to unsuccessful bidders. After Acceptance of a bid, the School Board will notify the successful bidder to submit a recorded payment and performance bond in the amount specified in the detailed specifications**.**

17. BID OPENING AND FORM: Bid openings will be public on the date and time specified on the Bidder's Acknowledgement Form. All Bids received after the time indicated will be rejected as non-responsive and returned unopened to sender. Bids by Email, fax, telegram, or verbally by telephone or in person will not be accepted. The School Board is not responsible for lost or late delivery of Bids by the U.S. Postal Service or other delivery services used by the Bidder.

18. CLARIFICATIONS AND INTERPRETATIONS: The School Board reserves the right to allow for clarification of questionable entries, and for the bidder to withdraw items with obvious mistakes. In the event of a conflict between the General Bid Terms and Conditions and any Special terms and Conditions attached hereto, the Special Terms and Conditions shall have precedence. Any questions concerning terms, conditions or specifications will be directed to the designated Purchasing Agent referenced on the ITB Acknowledgement. Any ambiguities or inconsistencies shall be brought to the attention of the designated Purchasing Agent in writing at least seven workdays prior to the opening date of the Bid. Failure to do so, on the part of the bidder will constitute an acceptance by the bidder of consequent decision. An addendum to the ITB shall be issued and posted for those interpretations that may affect the eventual outcome of this bid. It is the bidder's responsibility to assure the receipt of all addendum issued. No person is authorized to give oral interpretations of, or make oral changes to the Bid. Therefore oral statements given before the bid opening date will not be binding. The School Board will consider no interpretations binding unless provided for by issuance of an addendum. Addenda will be made available at least five workdays prior to the opening date at http://www.leonschools.net/Domain/195. The bidder shall acknowledge receipt of all addenda by signing and enclosing said addenda with their proposal.

19. EVALUATION CRITERIA: Primary factors used to decide the award hereunder will be price, availability and responsiveness. Other factors that may be used in the evaluation of this bid will be: (1.) administrative costs incurred by the School Board in association with the discharge of any subsequent award; (2.) alternative payment terms; (3.) Bidder's past performance. The School Board reserves the right to evaluate by lot, by partial lot, or by item, and to accept or reject any bid in its entirety or in part, and to waive minor irregularities if the bid is otherwise valid. In the event of a price extension error, the unit price will be accepted as correct. The School Board has sole discretion in determining testing and evaluation methods.

20. DEFAULT: In the event that the awarded bidder should breach this contract, the School Board reserves the right to seek all remedies in law and/or in equity.

21. FUNDING OUT/CANCELATION OR TERMINATION WITH OR WITHOUT CAUSE:

A. WITH CAUSE: In the event any of the provisions of the Contract are violated by the bidder, the Superintendent or designee shall give written notice to the bidder stating the deficiencies and unless the deficiencies are corrected within ten days, recommendation will be made to the School Board or its designee for immediate

cancellation. Upon cancellation, hereunder the School Board may pursue any and all legal remedies as provided herein and by law. In the event that it is subsequently determined that a cancellation under this paragraph was incorrect, the termination shall be converted to a termination for convenience pursuant to the next paragraph.

B. WITHOUT CAUSE: The School Board or its designee reserves the right to terminate any contract resulting from this Invitation to Bid at any time and for no reason whatsoever, upon giving 30 days prior written notice to the bidder. If the Contract should be terminated for convenience as provided herein, the School Board shall be relieved of all obligations under said Contract. The School Board or its designee shall only be required to pay to the successful bidder that amount of the Contract actually performed to the date of termination.

C. FUNDING OUT: Florida School Laws prohibit the School Board or its designee from creating obligations on anticipation of budgeted revenues from one fiscal year to another without year-to-year extension provisions in the contracts. It is necessary that fiscal funding out provisions be included in all bids in which the terms are for periods of longer than one year. Therefore, the following funding out provisions are an integral part of this Invitation to Bid and must be agreed to by all bidders:

The School Board or its designee may, during the contract period, terminate or discontinue the items covered in this bid for lack of appropriated funds upon the same terms and conditions.

Such prior written notice will state:

1. That the lack of appropriated funds is the reason for termination, and
2. School Board agrees not to replace the equipment or services being terminated with equipment and services with functions similar to those performed by the equipment covered in this bid from another vendor in the succeeding funding period.

"This written notification will thereafter release the School Board of Leon County, Florida of all further obligations in any way related to such equipment covered herein".

22. TIE BID: According to FS 287.087, tie bid preference shall be awarded to Bidders with Drug Free Work Place programs. Whenever two or more are equal with regard to price, quality, and service, a bid received from a business that certifies that it has implemented a Drug Free Work Place program shall be given preference in the award process. In the event both Bidders have a Drug Free Work Place, preference shall be awarded in the following order: Local Vendors as specified in School Board Policy 6450, SBE certified as specified in School Board Policy 6325. If both Bidders meet all requirements, according to standard purchasing practice, the Director of Purchasing will flip a coin to break the tie. Bidder's company name closest to the letter "A" will always be assigned heads in the coin toss.

23. DISPUTE: In case of any doubt or difference of opinion as to the items to be furnished hereunder, the decision of the School Board shall be final and binding on both parties. In the event a dispute occurs, or a clarification of contract terms becomes necessary, ***please indicate your company representative for arbitration proceedings.***

Representative's Name: _____

Telephone Number: _____

Our School Board Representatives will be:

Mrs. Opal McKinney-Williams
Ausley & McMullen
(850) 224-9115

24. PROTESTING BID SPECIFICATIONS: Any person desiring to protest the conditions/specifications in this Bid or any Addenda thereto, shall file a written notice of protest within 72 hours after receipt of the Bid or Addendum and shall file a formal written protest within ten days after the date the notice of protest was filed. Saturdays, Sundays and legal holidays or days during which the School Board administration is closed shall be excluded in the computation of the 72 hour period. If the tenth calendar day falls on a Saturday, Sunday or legal holiday, the formal written protest must be received on or before 4:30 p.m. of the next calendar day that is not a Saturday, Sunday, legal holiday, or day during which the School Board administration is closed.

Failure to file a protest within the time prescribed in section 120.57 (3), Florida Statutes, or failure to post the bond or other security required by law within the time allowed for filing a bond shall constitute a waiver of proceedings under chapter 120, Florida Statutes and School Board Policy 6326. Failure to follow any other requirements in the bid protest procedures established by the School Board of Leon County, Florida shall constitute a waiver of all protest rights.

25. PROTESTS TO CONTRACT AWARD: The School Board shall provide notice of a decision or intended decision concerning a solicitation, contract award, or exceptional purchase by electronic posting which can be accessed at the Purchasing Department's website at **www.leonschools.net/Domain/195**. Any person desiring to protest the intended decision shall file a written notice of protest, within 72 hours after the official posting in the Purchasing Department office of the Notice of Intent to Award concerning this ITB, and shall file a formal written protest within ten days after filing the notice of protest. Saturdays, Sundays, legal holidays and days during which the School Board administration is closed shall be excluded in the computation of the 72-hour period. If the tenth calendar day falls on a Saturday, Sunday or legal holiday, the formal written protest must be received on or before 4:30 p.m. of the next calendar day that is not a Saturday, Sunday, legal holiday or day during which the School Board administration is closed. Section 120.57(3) (b), Florida Statutes, states that "the formal written protest shall state with particularity the facts and law upon which the protest is based."

Any person who files an action protesting an intended award shall post with the Purchasing Department, at the time of filing the formal written protest, a bond payable to the Leon County School Board consistent with F.A.C. Rule 28-110.005(2), and School Board Policy 6326. The bond shall be conditioned upon the payment of all costs which may be adjudged against protester in an Administrative hearing in which the action is brought and any subsequent appellate court proceeding. Failure to file a notice of protest within the time prescribed by Section 120.57(3), Florida Statutes, shall constitute a waiver of proceedings under Chapter 120, Florida Statutes and School Board Policy 6326.

26. GOVERNING LAW AND VENUE: All legal proceedings brought in connection with this contract shall only be brought in a state or federal court located in the state of Florida. Venue in state court shall be in Leon County, Florida. Venue in federal court shall be in the United States District Court, Northern District of Florida Tallahassee Division. Each party hereby agrees to submit to the personal jurisdiction of these courts for any lawsuits filed there against such party arising under or in connection with this contract. In the event that a legal proceeding is brought for the enforcement of any term of the contract, or any right arising there from, the parties expressly waive their respective rights to have such action tried by jury trial and hereby consent to the use of non-jury trial for the adjudication of such suit. All questions concerning the validity, operation, interpretation, construction and enforcement of any terms, covenants or conditions of this contract shall in all respects be governed by and determined in accordance with the laws of the State of Florida without giving effect to the choice of law principles thereof and unless otherwise preempted by federal law.

27. COMPLIANCE WITH STATE/FEDERAL REGULATIONS: All contracts involving federal funds will contain certain provisions required by applicable sections of CFR 34, Section 80.36(I) and Part 85.510, Florida Statute 257.36, or Florida Administrative Code Chapter 1B. The bidder certifies by signing the bid that the bidder and his/her principals are not presently debarred, suspended, proposed for debarment, declared ineligible or voluntarily excluded from participation in federally funded transactions and may, in certain instances, be required to provide a separate written certification to this effect.

During the term of any contract with the School Board, in the event of debarment, suspension, proposed debarment, declared ineligible or voluntarily excluded from participation in federally funded transactions, the Bidder shall immediately notify the Director of Purchasing, in writing. Bidders will also be required to provide access to records, which are directly pertinent to the contract and retain all required records for three (3) years after the School Board makes final payment.

For all contracts involving Federal funds in excess of $10,000, the School Board reserves the right to terminate the contract for cause, as well as for convenience, by issuing a certified notice to the Bidder.

28. COMPLIANCE WITH SCHOOL CODE: Bidder agrees to comply with all sections of the Florida K-20 Education Code, Title XLVIII, Florida Statutes as it presently exists and further as it may be amended from time to time. Further, Contractor agrees that failure to comply with the Florida K-20 Education Code shall constitute a material breach of this Contract and may result in the termination of this Contract by the School Board.

29. NONDISCRIMINATION NOTIFICATION AND CONTACT INFORMATION: "No person shall on the basis of sex (including transgender, gender nonconforming and gender identity), marital status, sexual orientation, race, religion, ethnicity, national origin, age, color, pregnancy, disability, military status or genetic information be denied employment, receipt of services, access to or participation in school activities or programs if qualified to receive such services, or otherwise be discriminated against or placed in a hostile environment in any educational program or activity including those receiving federal financial assistance, except as provided by law." No person shall deny equal access or a fair opportunity to meet to, or discriminate against, any group officially affiliated with the Boy Scouts of America, or any other youth group listed in Title 36 of the United States Code as a patriotic society.

An employee, student, parent or applicant alleging discrimination with respect to employment, or any educational program or activity may contact:

Dr. Kathleen L. Rodgers, Assistant Superintendent
Equity Coordinator (Students) and
Title IX Compliance Officer
Leon County School District
2757 West Pensacola Street
Tallahassee, Florida 32304
(850) 487-7306
rodgersk@leonschools.net

Deana McAllister, Assistant Superintendent
Labor and Relations, Equity Coordinator (Employees)
(850) 487-7207
mcallisterd@leonschools.net

A student or parent alleging discrimination as it relates to Section 504 of the Rehabilitation Act may contact:

Karin Gerold, 504 Specialist
(850) 487-7160
geroldk@leonschools.net

30. SBDO PROGRAM: The School Board established the Small Business Development Office to support innovative race and gender neutral strategies to promote qualified small business participation as specified in School Board Policy 6325.

31. LOCAL PREFERENCE: This ITB is subject to the local preference provisions as specified in School Board Policy 6450.

32. FLORIDA PREFERENCE: This ITB is subject to §287.084 Florida Statutes, which requires, among other things, the following: "A vendor whose principal place of business is outside this state must accompany any written bid, proposal, or reply documents with a written opinion of an attorney at law licensed to practice law in that foreign state, as to the preferences, if any or none, granted by the law of that state to its own business entities whose principal places of business are in that foreign state in the letting of any or all public contracts." Any bidder, regardless of whether its principal place of business is located inside or outside of this state, who submits any written bid, proposal or reply documents is responsible for understanding and complying with the requirements of §287.084 Florida Statutes.

33. CHARTER SCHOOLS: Items or services awarded under this contract shall be made available to Charter Schools approved by the School Board. The School Board is not responsible or liable for purchases that may be made by Charter Schools.

II. LICENSURE, INSURANCE AND LIABILITY

1. OCCUPATIONAL LICENSE: The contractor shall be responsible for obtaining and maintaining throughout the contract period any required occupational license and other licenses required pursuant to the laws of Leon County, the City of Tallahassee, or the State of Florida.

2. WORKER'S COMPENSATION: Bidders shall obtain and maintain during the life of the contract Workers' Compensation Insurance in compliance with Chapter 440, Florida Statutes for all of his employees employed on the project. In case any work is sublet, bidder shall require subcontractors similarly to provide Workers' Compensation Insurance.

3. LIABILITY: Where bidders are required to enter or go onto School Board property to deliver materials, perform work or provide services as a result of a bid award, the bidder assumes full duty, obligation and expense of obtaining all necessary licenses, permits and insurance, and shall be fully responsible for its own negligent or willful acts or omissions.

4. INSURANCE AND INDEMNIFICATION: ***This General Condition is NOT subject to negotiation and any bid that fails to accept these conditions will be rejected as "non-responsive", unless bidder is entitled to sovereign immunity by action of the Florida Legislature.*** Each party agrees to be fully responsible for its acts of negligence, or its agents' acts of negligence when acting within the scope of their employment and agrees to be liable for any damages resulting from said negligence to the extent allowable pursuant to Section 768.28, Florida Statutes. Nothing herein is intended to serve as a waiver of sovereign immunity by the School Board. Nothing herein shall be construed as consent by the School Board to be sued by third parties in any matter arising out of any contract. Bidder shall hold harmless and defend the School Board and its agents and employees from all suits and actions, including attorney's fees and all costs of litigation and judgments of any name and description arising out of or incidental to the performance of this contract or work performed there under. This provision shall also pertain to any claims brought against the School Board by an employee of the named Bidder, any Subcontractor, or anyone directly or indirectly employed by any of them. The bidder's obligation under this provision shall not be limited in any way by the agreed upon contract price as shown in this Contract or the bidder's limit of, or lack of, sufficient insurance protection.

5. RISK OF LOSS: The bidder assumes the following risks: (1.) all risks of loss or damage to all goods, work in process, materials and equipment until the delivery thereof as herein provided; (2.) all risks of loss or damage to third persons and their property until delivery of all goods as herein provided; (3.) all risks of loss or damage to any property received by the bidder or held by the bidder or its suppliers for the account of the School Board, until such property has been delivered to the School Board; (4) all risks of loss or damage to any of the goods or part thereof rejected by the School Board, from the time of shipment thereof to bidder until redelivery thereof to the School Board.

6. PUBLIC ENTITY CRIMES: Pursuant to Florida Statute 287.133 a Bidder, person, or affiliate who has been placed on the convicted Vendors list following a conviction for a public entity crime may not submit a bid on a contract to provide any goods or services to a public entity for the construction or repair of a public building or public work, may not submit bids on leases of real property to a public entity, may not be awarded or perform work as a contractor, supplier, subcontractor, or consultant under a contract with any public entity, and may not transact business with any public entity in excess of the threshold amount provided in Florida State Statute, Section 287.017, for CATEGORY TWO for a period of 36 months from the date of being placed on the convicted vendor list.

7. PATENTS AND COPYRIGHTS: Bidders agree to indemnify and save harmless the School Board, its officers, employees, agents, or representatives using the goods specified herein from any loss, damage or injury arising out of a claim or suit at law or equity for actual or alleged infringement of letters of patent by reason of the buying, selling or using the goods supplied under this bid, and will assume the defense of any and all suits and will pay all costs and expenses thereto.

8. AUDITS, RECORDS, AND RECORDS RETENTION: The School Board or its representative reserves the right to inspect and/or audit all the Bidder's documents and records as they pertain to the products and services delivered under this agreement. Such rights will be exercised with notice to the bidder to determine compliance with and performance of the terms, conditions and specifications on all matters, rights and duties, and obligations established by this agreement. Documents/records in any form shall be open to the School Board's representative and may include but are not limited to all correspondence, ordering, payment, inspection and receiving records, and contracts or sub-contracts that directly or indirectly pertain to the transactions between the School Board and the Bidder.

A. To establish and maintain books, records, and documents (including electronic storage media) in accordance with generally accepted accounting procedures and practices, which sufficiently and properly reflect all revenues and expenditures of funds provided by the School Board under this contract.

B. To retain all contractor records, financial records, supporting documents, statistical records, and any other documents (including electronic storage media) pertinent to this contract for a period of five (5) years after termination of the contract, or if an audit has been initiated and audit findings have not been resolved at the end of five (5) years, the records shall be retained until resolution of the audit findings or any litigation which may be based on the terms of this contract.

C. Upon completion or termination of the contract and at the request of the School Board, the Contractor will cooperate with the School Board to facilitate the duplication and transfer of any said records or documents during the required retention period as specified in paragraph 1 above.

D. To assure that these records shall be subject at all reasonable times to inspection, review, or audit by Federal, state, or other personnel duly authorized by the School Board.

E. Persons duly authorized by the School Board and Federal auditors, pursuant to Title 45, Code of Federal Regulations, Part 92.36 (I) (10), and Title 34, Section 80.36(i), shall have full access to and the right to examine any of provider's contract and related records and documents, regardless of the form in which kept, at all reasonable times for as long as records are retained.

F. To include these aforementioned audit and record keeping requirements in all approved subcontracts and assignments.

III. GOODS AND SERVICES

1. WARRANTY: All goods and services furnished by the bidder, relating to and pursuant to this ITB will be warranted to meet or exceed the Specifications contained herein. In the event of breach, the bidder will take all necessary action, at bidder's expense, to correct such breach in the most expeditious manner possible.

2. PRICING: All pricing submitted will include all packaging, handling, shipping charges and delivery to any point within Leon County, Florida to a secure area or inside delivery. **The School Board is exempt and does not pay Federal Excise and State of Florida sales taxes.**

3. PRICE ESCALATION: In the event of unforeseen circumstances that directly impact the pricing and/or servicing of this contract, the School Board reserves the right to negotiate the established bid price with the contractor at any time during the duration of this contract after completion of the initial contract term. Price negotiations will be at the sole discretion of the School Board.

The School Board may consider pricing increases of the bid item(s) if the following conditions occur:

A. There is a verifiable price increase of the bid item(s) to the contract supplier.

B. The contractor submits to the School Board, in writing, notification of price increases.

C. The price increase shall be comparable to documented manufacturers' or distributors' price changes or changes in industry related indices.

D. The contractor shall submit the above information to the Director of Purchasing thirty (30) calendar days prior to the effective date of the price increase. Requests for price increases may only be made after the first term of the contract.

When the contractor complies with the abovementioned conditions, the Director of Purchasing will review the information to determine if it is in the best interest of the School Board to adjust the pricing on the products bid, in conjunction with the contractor's effective date of price increase. The School Board reserves the right to deny any requests for price increases. The contractor must receive written notification from the Director of Purchasing that the School Board is in acceptance of the new prices before processing any orders with the new costs.

4. QUANTITIES: Quantities listed in the bid are estimates provided for bidder information purposes only. No guarantee is given or implied as to the exact quantities, which will be purchased from this bid. The School Board reserves the right to increase or decrease all estimated quantities during the term of this contract or to delete any item or items as it deems appropriate, without affecting the bid pricing or the terms and conditions of the bid.

5. MOST FAVORED CUSTOMER STATUS: The awarded bidder shall afford the School Board the most favored customer status for all items herein. Accordingly, if during the term of this contract, the contractor offers more favorable promotional or contract pricing to another entity for the same specification with similar quantities and conditions, the price under this contract shall be immediately reduced to the lower price. Additionally, if a current state of Florida contract, or other viable piggyback contract contains more favorable pricing for the same specification with similar quantities and conditions, the contractor will be afforded an opportunity to adjust its contract price to match that of the state of Florida contract. Should the contractor decline, LCSB reserves the right to purchase the item(s) from the state of Florida or alternate piggyback contract.

6. TERMS OF PAYMENT / INVOICING: The normal terms of payment will be Net 30 Days from receipt and acceptance of goods or services and contractor's invoice. Itemized invoices, each bearing the Purchase Order Number must be mailed on the day of shipment. Invoicing subject to cash discounts will be mailed on the day that they are dated.

7. PURCHASING CARDS: The School Board may choose to use a "Purchasing Card" for ordering of goods and materials or payment of invoices under this contract. The bidder, by submitting a proposal, agrees to accept this manner of payment and may not add additional handling charges or service fees to purchases made with the School Board's Purchasing Card(s). Refusal to accept this condition may cause the proposal to be declared non-responsive, or result in revocation of the contract, if already awarded. No third party payment, i.e. Pay pal will be considered.

8. TRANSPORTATION AND TITLE: (1) Title to the goods will pass to the School Board upon receipt and acceptance at the destination indicated herein. Until acceptance, the Bidder retains the sole insurable interest in the goods. (2) The shipper will prepay all transportation charges. The School Board will not accept collect freight charges. (3) No premium carriers will be used for the School Board's account without prior written consent of the Director of Purchasing.

IV. BIDDER REQUIREMENTS

1. REFERENCES: Each Bidder is required to submit a list of three (3) customer references using the format on the attached "Customer Reference Form" Exhibit D**.** The Bidder must be the prime contractor for each customer/contract referenced. All references shall be for work performed over the last year at commercial, multi-residential developments and/or institutional complexes for contracts of comparable size. Newly formed companies, corporations, joint ventures; etc. may use an incorporator as a referenced entity. At least one contract/customer shall have been serviced for a minimum of one year. Failure to provide verifiable references may result in the bidder not being considered for award. Unsatisfactory references may result in the bidder not being considered for award.

2. LEVEL 2 SCREENING REQUIREMENTS: The following provisions, which implement the requirements of School Board Policy 8475, Florida Statute Sections 1012.315, 1012.32, 1012.465 (Jessica Lunsford Act), 1012.467 and 1012.468 are included as additional terms and conditions of the contract:

Finger Printing and Background Check:

The bidder/contractor agrees to comply with all requirements of School Board Policy 8475 and Florida Statute Sections 1012.315, 1012.32, 1012.465 (Jessica Lunsford Act), 1012.467 and 1012.468 by certifying that any/all employees have completed the mandatory background screenings as required by the referenced policy and statutes and shall provide the School Board with proof of compliance. These certifications will be provided to the Leon County School Board, Safety & Security Department in advance of the Bidder/contractor providing any/all services as required herein. The Bidder/contractor will bear the cost of acquiring the background screening required and any/all fees imposed by the Florida Department of Law Enforcement and or the School Board to maintain the fingerprints provided with respect to Bidder/contractor and its employees. Contractor agrees to indemnify and hold harmless the School Board, its officers, agents and employees from any liability in the form of physical injury, death, or property damage resulting from the Contractor's failure to comply with the requirements of these cited policies and statutes. The Bidder/contractor will follow procedures for obtaining employees background screening as established by the Leon County School Board, Safety & Security Department.

Where: Leon County School Board –Safety & Security Department
2757 W. Pensacola St.
Tallahassee, Florida 32304

When: Monday-Friday
8:00 a.m. – 5:00 p.m.

Point of Contact: Donald Kimbler @ 850-487-7293

LCSB Policy 8475 is subject to review and change. As a provision of this contract, if awarded, any changes made to this policy will automatically become a part of and be incorporated in this contract. It is the responsibility of the awardee(s) to be aware of any changes that may occur.

3. RECIPROCITY OF FLORIDA SCHOOL I.D. BADGES: If contractor has a Level II clearance registered with another Florida School Board, they may be able to obtain a Leon County School Board vendor I.D. badge. Contractor should check with the Safety & Security Department Fingerprint Services office to verify clearance and obtain a vendor I.D. badge.

4. IDENTIFICATION: All personnel employed by the bidder, including any subcontractor and subcontractor's employees when applicable, shall display at all times an identification badge which shall include the employee's name, the employer's name and either a physical description or a photograph of the employee. Employees without proper identification shall not be permitted to work under the terms of this Agreement.

5. CONTACT WITH STUDENTS: No employees or independent contractors, material men, suppliers or anyone involved in any manner with projects resulting from this proposal shall have direct or indirect contact with students at project sites. A violation of this provision shall result in immediate termination of the offender and issuance of a trespass notice from the School Board. Bidder/Proposer shall be responsible for insuring compliance by all employees, independent contractors and sub-contractors or other persons involved in any manner with projects resulting from this proposal.

6. WEAPONS AND FIREARMS: The School Board prohibits any contractor from possessing, storing, making, or using a weapon, including a concealed weapon, on School Board property and any setting that is under the control and supervision of the School Board as specified in School Board Policy 7217. Violations will be subject to the immediate termination of the contract.

7. SMOKING AND TOBACCO PRODUCTS: Smoking and the use of tobacco products are prohibited on school property, including all buildings and grounds. A fine of $500.00 may be assessed for the first offense and termination of the Agreement may be imposed for any second or additional offense.

8. ATTIRE: Proper attire shall be worn at all times.

- **A.** Shirts shall be worn awhile on school property at all times. (No tank tops or undershirts will be permitted).
- **B.** Clothing displaying nudity, obscene language, obscene symbols or pro-drug slogans is prohibited.
- **C.** Proper shoes to insure the individual's safety shall be worn at all times.

9. INSPECTIONS AND TESTING: The School Board will have the right to inspect and test any of the goods or services covered by this ITB. All goods or services are subject to the School Board's inspection and approval upon arrival or completion. If rejected, goods will be held for disposal at the bidder's risk. Such inspection, or the waiver thereof, however, will not relieve the bidder from full responsibility for furnishing goods or services conforming to the requirements of this Bid or the Bid Specifications, and will not prejudice any claim, right, or privilege the School Board may have because of the use of defective or unsatisfactory goods or service. All deficiencies noted by the School Board will be

submitted to the contractor for correction within ten (10) calendar days after submission of deficiencies to the contractor. An additional inspection of the goods or service may be conducted to insure corrective action was taken.

10. STOP WORK ORDER: The School Board may at any time, by written notice to the Bidder stop all or any part of the work for this Bid award. Upon receiving such notice, the bidder will take all reasonable steps to minimize additional costs during the period of work stoppage. The School Board may subsequently either cancel the stop work order resulting in an equitable adjustment in the delivery schedule and/or the price, or terminate the work in accordance with the provisions of the Bid terms and conditions.

- **A.** Materials or work are not in conformance with applicable codes, standards, School Board specifications and/or accepted practices.
- **B.** The contractor's activities result in damage to School board property.
- **C.** The contractor's activities interfere with the normal operation of the facility.
- **D.** Contractor's personnel are not properly licensed to perform the work or as it pertains to school facilities, the contractor's personnel have not received their Level II background clearances.
- **E.** Any other condition, situation, or circumstance, which in the opinion of the School Board Authorized Representative would be a detriment to the best interests of the School Board if allowed to persist.

11. SAFETY: The bidder shall be responsible for instructing their employees in all safety measures. All equipment used by the bidder shall be free from defects or wear that may in any way constitute a hazard to any person or persons on School Board property. At no time shall equipment be operated without guards, shields, or other manufactures recommended safety accessories in place and functioning as intended by the manufacturer. All current OSHA safety standards shall be reinforced including, but not limited to, the following rules:

- **A.** All OSHA and Federal required safety equipment shall be installed and functioning on all equipment.
- **B.** All equipment shall be in sound working condition and must meet all OSHA Safety Standards. All workers shall be aware of and trained in the operation of all safety equipment required for this project.
- **C.** The Bidder shall ensure that employees are equipped with proper safety items such as glasses, hard hats, gloves, etc.
- **D.** All incidents on campus involving School Board property or personnel shall be reported to the Director of Maintenance Services Department and the Campus Administrator immediately upon occurrence.
- **E.** All debris shall be removed to an environmentally approved landfill or recycling center.

12. EMERGENCIES: In any emergency affecting the safety of persons and property, the awarded contractor shall act immediately to prevent threatened damage, injury or loss. Any emergency must be reported to an authorized School Board representative immediately and no later than twenty-four (24) hours from the time that the emergency is discovered by the contractor

13. DAMAGE TO SCHOOL BOARD OWNED PROPERTY: Any damage to property, equipment, grounds, buildings, etc. that is caused by the awarded contractor will be reported to the School Board within twenty-four (24) hours of discovery. The awarded contractor will have ten (10) working days after report to present its written response to the claimed damages. The awarded contractor, upon approval by an authorized School Board representative, may make repairs that are deemed within its capability. The School Board reserves the right to make immediate repairs to correct damages that are safety hazards or that pose a detrimental effect to the School Board's operations. Costs of any replacement or repairs made by the School Board for damages caused by the awarded contractor shall be deducted from any monies due to the contractor. This shall not prevent the School Board from seeking damages should replacement/repair costs exceed the amount of monies owed to the awarded contractor. When requested, Bidder shall cooperate with any ongoing School Board investigation involving personal injury, economic loss or damage to The School Board's facilities or personal property therein.

14. SUBCONTRACTING: The awarded contractor(s) shall be the primary service provider(s) and shall perform all requested inspections and repairs. Subcontracting for these base services is not allowed.

- **A.** The School Board, for work where the contractor(s) are requested to perform additional services, may allow subcontracting.
- **B.** Any work or service to be performed by a subcontractor must have the prior approval of the School Board. The School Board reserves the right to reject any subcontractor. Rejection of any subcontractor shall not entitle the contractor to adjustment of bid prices. The contractor shall inform the School Board Authorized Representative prior to scheduling any subcontractor's visit to any School Board facility.
- **C.** Failure by the contractor to have a subcontractor approved by the School Board will not relieve the contractor of the responsibility to meet, comply with, and fulfill all of the terms and conditions of this Agreement.
- **D.** The contractor(s) shall be held fully responsible and liable for the supervision and performance of all work performed by subcontractors. The School Board shall not be responsible for resolution of disputes between the Bidder and any subcontractor.
- **E.** The personnel of all subcontractors shall meet all of the requirements as stated herein to include, but not limited to LCSB Policy 2.021 and the Jessica Lunsford Act.

15. ON-CAMPUS DIRECTIVES

- **A.** Upon arrival and departure onto any School Board school campus, the contractor's employees shall enter their company information into the School Log Book provided in the Administrative office of each campus.
- **B.** Contractor shall strictly limit its operations to the designated work areas and shall not permit any employees to enter any other portions of School Board property without School Board's expressed prior written consent.
- **C.** All employees shall enter and leave School Board facilities only through the ingress and egress points designated, from time to time, by The School Board.
- **D.** The contractor shall be responsible for the removal of all trash and debris occasioned by this contract. Failure to adhere to this requirement will result in the costs of the performance of this work by others being charged to the contractor.
- **E.** Any existing surface or subsurface improvements, including, but not limited to, pavements, curbs, sidewalks, pipes, utilities, footings, structures, trees and shrubbery, not indicated in the contract documents to be removed or altered, shall be protected by contractor from damage during the prosecution of any project. Any such improvements so damaged shall be restored by contractor to condition at least equal to that existing at the time of contractor's commencement of any project.
- **F.** Proper safety barricades, protective, and covering devices shall be used to divert traffic and protect personnel. Normal safety signs, necessary lighting and temporary fencing/barricades around work areas shall be installed and maintained in accordance with OSHA requirements while the work is in progress. Materials must be secured in accordance with OSHA regulations when not in use.

16. BIDDER ACCESSIBLITY: The successful bidder shall provide a liable and responsible representative to be accessible by a Leon County toll free local telephone call during regular business hours. Local off-hours answering service for emergencies shall be available for bidder notification twenty-four (24) hours a day, seven (7) days per week, all year, including holidays.

17. CONTACT PERSON: The successful Bidder shall be notified of the name and phone number of the School Board contact person. Only the School Board contact person may authorize changes to the scope of work.

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V. INSTRUCTION TO BIDDERS

A. GENERAL: The purpose and intent of this Invitation to Bid (ITB) is to secure a firm price and to identify a qualified vendor to provide and install an Aaon HVAC replacement at Gilchrist Elementary School in building 9.

B. DRAWINGS AND SPECIFICATIONS: Work will be in accordance with the Drawings and Specifications prepared by H2Engineering, Inc. A digital version of the drawings & specifications are available at no cost by contacting H2Engineering, Inc. @ 850-224-7922.

C. PRE-BID CONFERENCE: A Non-Mandatory pre-bid conference will be held at Gilchrist Elementary School 1301 Timberlane Road, Tallahassee, Florida 32312 **August 4, 2020 at 9:00 am**. All prospective bidders are to meet at the school site in the front office and document attendance on the conference "sign-in" sheet. Attendees and the District personnel will thoroughly inspect the site and further explain the service requirements and answer any questions at that time.

D. PREQUALIFICATION OF CONTRACTORS FOR EDUCATIONAL FACILITIES CONSTRUCTION: On April 14, 2015, the Leon County School Board revised and adopted Policy 6334, Prequalification of Contractors for Educational Facilities & Construction. Instructions for completion and submission of the Qualifications Statement may be obtained on our website at http://www.leonschools.net/Page/4233 or request assistance from Leon County School Board, Facilities and Construction, 3420 West Tharpe Street, Suite 100, Tallahassee, Florida 32303, 850- 617-5900.

Certificates must be renewed annually. **Proposals from firms not prequalified at the time of submittal will be deemed non-responsive and will not be considered.**

E. OWNER RESPONSIBILITIES: Owner will provide the electrical, BAS controls, and test and balance services.

F. BIDDER RESPONSIBILITIES: It is the bidder's responsibility to become fully informed as to the nature and extent of the work required and its relation to any work in the area, including but not limited to quantity, size, weight, gauge and or type of materials required, as well as accessibility to the site and or possible interference from academics or other school activities. Each bidder is required to carefully examine the Invitation to Bid delivery schedule, bid prices and extensions, insurance requirements, licensing requirements, bid closing date and time and to completely familiarize itself with all of the terms and conditions that are contained within the Invitation to Bid. Failure to do so on the part of the bidder will in no way relieve it of any of the obligations and responsibilities which are a part of the Invitation to Bid.

G. REFERENCES: Each Bidder is required to submit a list of three (3) customer references using the format on the attached "Customer Reference Form" page83. The Bidder must be the prime contractor for each customer/contract referenced. All references shall be for work performed over the last year at commercial, multi-residential developments and/or institutional complexes for contracts of comparable size.

Newly formed companies, corporations, joint ventures; etc. may use an incorporator as a referenced entity. At least one contract/customer shall have been serviced for a minimum of one year. Failure to provide verifiable references will result in the Bidder not being considered for award. Unsatisfactory references may result in the Bidder not being considered for award.

H. CONTACT PERSON: The successful vendor shall be notified of the name and phone number of the District contact person. Only the District contact person may authorize changes to the scope of work**.**

All questions pertaining to these general specifications should be submitted in writing to:

Nancy Scott, Purchasing Agent II
3397 W. Tharpe St., Tallahassee, Florida, 32304
850-488-1206 / scottn@leonschools.net

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VI. SCOPE OF WORK

SECTION 230100 - GENERAL PROVISIONS FOR HVAC

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.

B. Applicable provisions of this section apply to all sections of Division 23, Heating, Ventilating and Air Conditioning

1.2 INFORMATIONAL SUBMITTALS

A. Furnish a copy of the installer's warranty.

B. Furnish a copy of the manufacturer's warranty for each piece of equipment.

1.3 QUALITY ASSURANCE

A. General:

1. It is the intent of the plans and specifications to obtain a complete, operable and satisfactory installation.

2. All materials shall be new, be properly labeled and/or identified and be in full compliance with the contract documents.

3. All work shall comply with applicable Codes and Standards.

4. Manufacturer's model names and numbers used in these specifications are subject to change per manufacturer's action. Contractor shall therefore verify them with manufacturer's representative before ordering any product or equipment

B. Furnish new and unused materials and equipment manufactured in the U.S.A. Where two or more units of the same type or class of equipment are required provide units of a single manufacturer.

1.4 CODE REQUIREMENTS

A. Perform work in accordance with the following codes and any applicable statutes, ordinances, codes, and regulations of governmental authorities having jurisdiction.

1. ASHRAE

a. Standard 15 Safety Standard for Refrigeration Systems

b. Standard 55 Thermal Environmental Conditions for Human Occupancy

c. Standard 62 Ventilation Standard for Acceptable Indoor air Quality

d. Standard 90.1 Energy Standard for Buildings Except Low Rise Residential Buildings

2. ASME Boiler and Pressure Vessel Code 2004 Edition w/ 2005 & 2006 Addenda Section VIII Rules for Construction of Pressure Vessels

3. Occupational Safety and Health Regulations (OSHA).

4. National Fire Codes

a. NFPA 1 Uniform Fire Code

b. NFPA 54 National Fuel Gas Code

c. NFPA 70 National Electrical Code

d. NFPA 90A Standard for the Installation of Air Conditioning and Ventilation Systems

e. NFPA 90B Standard for the Installation of Warm Air Heating and Air Conditioning Systems

f. NFPA 91 Standard for the Installation of Blower and Exhaust Systems

g. NFPA 101 Life Safety Code

5. Florida Building Codes 2010 Edition

a. Building Code - Chapter 11 Florida Accessibility Code

b. Building Code - Chapter 13 Energy Efficiency Code

c. Mechanical Code

d. Fuel Gas Code

6. Florida Administrative Code

a. Chapter 6A–2 Educational Facilities

b. Chapter 9B-7 Florida Building Commission Handicapped Accessibility Standards

c. Chapter 61G15-34 Responsibility Rules of Professional Engineers Concerning the Design of Mechanical Systems

d. Chapter 69A-3 Fire Prevention – General Provisions

e. Chapter 69A-47 Uniform Fire Safety Standards for Elevators

f. Chapter 69A–58 Fire Safety in Educational Facilities

g. Chapter 69A-60 The Florida Fire Prevention Code

7. ADA Accessibility Guidelines for Buildings (ADAAG)

B. Resolve, in writing, any code violation discovered in contract documents with the Engineer prior to bidding. After award of the contract, make any correction or addition necessary for compliance with applicable codes at no additional cost to Owner.

C. The installer shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus and drawings required to comply with all applicable laws, ordinances, rules and regulations.

D. The installer shall include in his work the completion of Florida Energy Code compliance documentation for method A as required for building permit. The installer may engage the Engineer of Record to complete said compliance documentation for mutual agreeable compensation.

1.5 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Specifications and standards are minimum requirements for all equipment, material and work. In instances where capacities, size or other feature of equipment, devices or materials exceed these minimums, meet listed or shown capacities.

B. Whenever a reference is made to a standard, installation and materials shall comply with the latest published edition of the standard at the time project is bid unless otherwise specified herein

1.6 PERMITS FEES AND INSPECTIONS

A. Obtain and pay for all permits, fees, tap fees, connection charges, demand charges, systems charges, impact fees and inspections.

B. Deliver all certificates of inspection issued by authorities having jurisdiction to the Engineer.

1.7 WARRANTY

A. Warranty work and equipment for one year from the date of final acceptance of the project. During the warranty period provide labor and materials to make good any faults or imperfections that may arise due to defects or omissions in materials or workmanship.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 CONTRACT DOCUMENTS

A. Examine all drawings and specifications carefully before submitting a bid. Architectural drawings take precedence over mechanical or electrical drawings with reference to building construction. If discrepancies or conflicts occur between drawings, or between drawings and specifications, notify the Engineer in writing prior to bid date; however, the most stringent requirement shall govern.

B. For purposes of clearness and legibility, drawings are essentially diagrammatic and, although size and location of equipment are drawn to scale wherever possible, Contractor shall make use of all data in all of the contract documents and shall verify this information at the building site.

C. The drawings indicate required size and points of termination of pipes, conduits and ducts and suggest proper routes to

conform to structure avoid obstructions and preserve clearances. However, it is not intended that drawings indicate all necessary offsets, and it shall be the responsibility of the Contractor to make the installation in such a manner as to conform to structure, avoid obstructions, preserve headroom and keep openings and passageways clear, without further instructions or cost to the Owner.

D. Furnish, install and/or connect with appropriate services all items shown on any drawing without additional compensation.

E. Consider the terms "provide" and "install" as synonymous with "furnish and install".

F. Any and all questions about a subcontractor's scope of work responsibility shall be addressed to and answered by the Construction Manager.

G. Questions About Construction Documents: Any and all questions shall be submitted through the proper channels IN WRITING and, in turn, shall be answered by the Engineer in writing. All telephone conversations shall be considered unofficial and, as such, shall not be considered official or binding responses to Contractor's questions.

H. Drawings, specifications or other documents issued by the Engineer in electronic format and/or electronic media are provided for convenience only and are not intended for use as Contract Documents. The electronic files are provided merely as a convenience to the Recipient. The electronic files do not replace or supplement the paper copies of any drawings, specifications, or other documents included in the Contract Documents for use on the project. The Engineer makes no representation, warranty or guarantee that electronic files: (1) are suitable for any other usage or purpose, or (2) have any particular, durability, or (3) will not damage or impair the Recipient's computer or software, or (4) contain no errors or mechanical flaws or other discrepancies that may render them unsuitable for the purpose intended by the Recipient. Due to the unsecured nature of the electronic files and the inability of Engineer or the Recipient to establish controls over their use, the Engineer assumes no responsibility for any consequences arising out of the use of the data. It is the sole responsibility of the Recipient to check the validity of all information contained therein. The Recipient shall at all times refer to the signed and sealed drawings, specification or other documents for the project during all phases of the project. The Recipient shall assume all risks and liabilities resulting from the use of the electronic files.

3.2 INSTALLATION

A. Install materials and equipment in a professional manner. The Engineer may direct replacement of items which, in his opinion, do not present a professional appearance. Replace or reinstall items at the expense of the Contractor.

B. Obstructions

1. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.

2. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided. Verify locations given.

3. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

4. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

C. Where "rated" walls, floor, roofs and ceilings are penetrated or cut to install equipment, materials, devices, etc. the Contractor shall provide and install all materials required to re-establish the rating of the wall, floor, roof or ceiling to the satisfaction of the authority having jurisdiction.

D. Space Requirements: Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material which is not suitable in this respect.

E. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions without cost to the Owner.

F. Wiring Method: Install cables in raceways and cable trays except low voltage network cable above accessible ceilings. Conceal raceway and cables except in unfinished spaces.

1. Comply with requirements for cable trays specified in Division 26 Section "Cable Trays for Electrical Systems."

2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceways and Boxes for Electrical Systems."

G. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

H. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 FIELD QUALITY CONTROL

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

B. Furnish a letter from the control manufacturer stating that all controls have been checked for operation and calibration, and the system is operating as designed.

C. Furnish a letter from an authorized factory representative of the air conditioning unit manufacturer stating that the complete refrigeration installation including pipe sizing and routing and operating and safety controls has been checked and is operating properly.

D. Tests

1. Include all tests specified and/or required under laws, rules and regulations of all departments having jurisdiction. Tests shall also be performed as indicated herein and other sections of the specifications.

2. After all mechanical systems have been completed and put into operation, subject each system to an operating test under design conditions to insure proper sequence and operation throughout the range of operation. Make adjustments as required to insure proper functioning of all systems.

3. All parts of the work and associated equipment shall be tested and adjusted to work properly and be left in perfect operating condition.

4. Correct defects disclosed by these tests without any additional cost to the Owner. Repeat tests on repaired or replaced work.

5. Maintain a log of all tests being conducted and have it available for review by the Engineer. Log to indicate date, type of tests, duration, and defects noted and when corrected.

6. Special tests on individual systems are specified under individual sections.

7. Mechanical Contractor shall provide personnel, tools and equipment and assist the Test and Balance Contractor in making any adjustments necessary to meet the test and balance requirements.

END OF SECTION 230100

SECTION 230120 - SUBMITTAL PROCEDURES

PART 4 - GENERAL

4.1 RELATED DOCUMENTS

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

4.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

4.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

4.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Engineer's Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided by Engineer for Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.

3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

3. Resubmittal Review: Allow 15 days for review of each resubmittal.

4. Sequential Review: Where sequential review of submittals by Engineer's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.

2. Name file with submittal number or other unique identifier, including revision identifier.

a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Engineer.

4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner**,** containing the following information:

a. Project name.

b. Date.

c. Name and address of Engineer.

d. Name of Construction Manager.

e. Name of Contractor.

f. Name of firm or entity that prepared submittal.

g. Names of subcontractor, manufacturer, and supplier.

h. Category and type of submittal.

i. Submittal purpose and description.

j. Specification Section number and title.

k. Specification paragraph number or drawing designation and generic name for each of multiple items.

l. Drawing number and detail references, as appropriate.

m. Location(s) where product is to be installed, as appropriate.

n. Related physical samples submitted directly.

o. Indication of full or partial submittal.

p. Transmittal number, numbered consecutively.

q. Submittal and transmittal distribution record.

r. Other necessary identification.

s. Remarks.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:

a. Project name.

b. Number and title of appropriate Specification Section.

c. Manufacturer name.

d. Product name.

E. Options: Identify options requiring selection by Engineer.

F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.

2. Note date and content of revision in label or title block and clearly indicate extent of revision.

3. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.

H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer's action stamp.

PART 5 - PRODUCTS

5.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Post electronic submittals as PDF electronic files directly to Engineer's FTP site specifically established for Project.

a. Engineer will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.

2. Mark each copy of each submittal to show which products and options are applicable.

3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.

b. Manufacturer's product specifications.

c. Standard color charts.

d. Statement of compliance with specified referenced standards.

e. Testing by recognized testing agency.

f. Application of testing agency labels and seals.

g. Notation of coordination requirements.

h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams showing factory-installed wiring.

b. Printed performance curves.

c. Operational range diagrams.

d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.

6. Submit Product Data in the following format:

a. PDF electronic file.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.

b. Schedules.

c. Compliance with specified standards.

d. Notation of coordination requirements.

e. Notation of dimensions established by field measurement.

f. Relationship and attachment to adjoining construction clearly indicated.

g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm) .

3. Submit Shop Drawings in the following format:

a. PDF electronic file.

D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of Engineers and owners, and other information specified.

E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

F. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

G. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

5.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Engineer.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit four paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 6 - EXECUTION

6.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

6.2 ENGINEER'S ACTION

A. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may be returned by the Engineer without action.

F. Submittals on any particular phase of Work will receive only one review and one re-review (if required). If additional reviews are required beyond these two, the Contractor will be charged $100.00 per hour for review time. This fee shall be paid to the Engineer prior to Submittal release.

END OF SECTION 230120

SECTION 230130 - QUALITY REQUIREMENTS

PART 7 - GENERAL

7.1 RELATED DOCUMENTS

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

7.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.

3. Requirements for Contractor to provide quality-assurance and -control services required by Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

4. Specific test and inspection requirements are not specified in this Section.

7.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Engineer.

C. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

D. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

E. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

F. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

G. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

7.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

7.5 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

F. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

7.6 QUALITY CONTROL

A. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections.

B. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

C. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

E. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Engineer, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 8 - PRODUCTS (Not Used)

PART 9 - EXECUTION

9.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.

2. Description of the Work tested or inspected.

3. Date test or inspection results were transmitted to Engineer.

4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Engineer's reference during normal working hours.

9.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 230130

SECTION 230160 - EXECUTION

PART 10 - GENERAL

10.1 RELATED DOCUMENTS

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

10.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Installation of the Work.

2. Cutting and patching.

3. Coordination of Owner-installed products.

4. Progress cleaning.

5. Starting and adjusting.

6. Protection of installed construction.

7. Correction of the Work.

10.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

C. Concealed Work: Work hidden from view, including inside chases, furred spaces, or above ceilings.

D. Exposed Work: Work open to view, including inside mechanical and equipment rooms or on mezzanines

10.4 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Engineer of locations and details of cutting and await directions from Engineer before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

a. Primary operational systems and equipment.

b. Fire separation assemblies.

c. Air or smoke barriers.

d. Mechanical systems piping and ducts.

e. Control systems.

f. Communication systems.

g. Fire-detection and -alarm systems.

h. Conveying systems.

i. Electrical wiring systems.

j. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

a. Water, moisture, or vapor barriers.

b. Membranes and flashings.

c. Exterior curtain-wall construction.

d. Sprayed fire-resistive material.

e. Equipment supports.

f. Piping, ductwork, vessels, and equipment.

g. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 11 - PRODUCTS

11.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials.

PART 12 - EXECUTION

12.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.

2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.

2. List of detrimental conditions, including substrates.

3. List of unacceptable installation tolerances.

4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

12.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Engineer.

12.3 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.

2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.

3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer.

2. Allow for building movement, including thermal expansion and contraction.

3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

12.4 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

6. Proceed with patching after construction operations requiring cutting are complete.

G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

a. Clean piping, conduit, and similar features before applying paint or other finishing materials.

b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

12.5 OWNER-INSTALLED PRODUCTS

A. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

12.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.

2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

a. Use containers intended for holding waste materials of type to be stored.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.

2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

H. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

I. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

12.7 FINAL CLEANING

A. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Remove tools, construction equipment, machinery, and surplus material from Project site.

b. Remove labels that are not permanent.

c. Wipe surfaces of equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

d. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

e. Clean ducts, blowers, and coils if units were operated during construction or that display contamination with particulate matter on inspection.

1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

12.8 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Provide complete and working charge of proper refrigerant, free of contaminants, into each refrigerant system. After each system has been in operation long enough to insure completely balanced conditions, check the charge and modify it for proper operation as required.

E. Provide a complete charge of special oil for refrigeration use, suitable for operation with refrigerant, in each compressor.

F. Manufacturer's Field Service: Comply with qualification requirements in Section 230130 "Quality Requirements."

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

12.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

12.10 EQUIPMENT INFORMATION FORM

A. For each piece of mechanical equipment labeled per specification 230553 “Identification for HVAC Piping and Equipment,” complete and submit to Owner at substantial completion a separate “HVAC Unit Information” form. Sample form is included at end of this section.

END OF SECTION 230160

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 13 - GENERAL

13.1 RELATED DOCUMENTS

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

13.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

13.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.

2. Torque, speed, and horsepower requirements of the load.

3. Ratings and characteristics of supply circuit and required control sequence.

4. Ambient and environmental conditions of installation location.

PART 14 - PRODUCTS

14.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

14.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

14.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Power Factor: 0.80.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F .

I. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.

2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T .

14.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers:

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

14.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

B. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

C. Motors 1/20 HP and Smaller: Shaded-pole type.

D. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 15 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 16 - GENERAL

16.1 RELATED DOCUMENTS

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

16.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.

2. Trapeze pipe hangers.

3. Metal framing systems.

4. Fastener systems.

5. Equipment supports.

B. Related Sections:

1. Section 230516 "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.

2. Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.

3. Section 233113 "Metal Ducts" and Section 233116 "Nonmetal Ducts" for duct hangers and supports.

16.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

16.4 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. Trapeze pipe hangers.

2. Metal framing systems.

3. Equipment supports.

PART 17 - PRODUCTS

17.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

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

2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.

3. Nonmetallic Coatings: Plastic coating, jacket, or liner.

4. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

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

2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

17.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

17.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cooper B-Line, Inc.

b. Flex-Strut Inc.

c. Unistrut Corporation; Tyco International, Ltd.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.

3. Standard: MFMA-4.

4. Channels: Continuous slotted steel channel with inturned lips.

5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

7. Metallic Coating: Electroplated zinc indoors and Hot-dipped galvanized outdoors.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.

2. Standard: Comply with MFMA-4.

3. Channels: Continuous slotted steel channel with in-turned lips.

4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

6. Coating: Paint.

17.4 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, zinc-coated 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.

17.5 EQUIPMENT SUPPORTS

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

17.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

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

1. Properties: Non-staining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 18 - EXECUTION

18.1 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. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) 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.

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

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

G. Install hangers and supports to allow controlled thermal 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.

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

I. 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 (DN 65) 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.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Install MSS SP-58, Type 40, protective shields on piping. Shields shall span an arc of 180 degrees.

2. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.

   b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.

   c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.

18.2 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.

18.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangersandequipment 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.

18.4 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 (40 mm).

18.5 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 (0.05 mm).

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

18.6 HANGER AND SUPPORT SCHEDULE

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

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

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

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).

2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.

3. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).

I. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

J. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

K. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

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

END OF SECTION 230529

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 19 - GENERAL

19.1 RELATED DOCUMENTS

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

19.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Valve tags.
5. Warning tags.
6. Control system diagrams and descriptions.

19.3 ACTION SUBMITTALS

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

B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

C. Valve numbering scheme.

D. Valve Schedules: For each piping system to include in maintenance manuals.

E. Control System Diagrams and Descriptions: For each control system to include in maintenance manuals.

19.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 20 - PRODUCTS

20.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.

3. Background Color: Black.

4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

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

B. Label Content: Include equipment's Drawing designation or unique equipment number.Equipment Label Schedule: For each item of equipment to be labeled, tabulate equipment label content and include in operation and maintenance data.

C. Equipment Information Sticker: For each item of equipment labeled, provide printed vinyl with contact-type, permanent-adhesive backing.

D. Equipment Information Sticker Content: Include equipment's Drawing designation, manufacturer, model number, serial number, warranty period end date, and contact information for warranty issues.

1. Sample:

HVAC UNIT INFORMTION

UNIT ID: WSHP – 1.1

MANUFACTURER: TRANE

MODEL #: TOV064L1

SERIAL #: T11M39408

WARRANTY PERIOD ENDS: AUGUST 01, 2015

FOR WARRANTY ISSUES PLEASE CONTACT: NAME, CONTACT #

20.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

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

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

20.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

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

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, 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: At least 1-1/2 inches (38 mm)high.

20.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2. Valve-tag schedule shall be displayed in mechanical room.

20.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches (75 by 133 mm) minimum.

2. Fasteners: Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."

4. Color: Yellow background with black lettering.

20.6 CONTROL SYSTEM DIAGRAMS AND DESCRIPTIONS

A. For each major piece of mechanical equipment (air handling units, chilled water systems, heating hot water systems, etc.), provide:

1. Operating Sequence Description: Verbal description of the sequence of operation on 11-by-17-inch bond paper, laminated or framed with transparent cover.

2. Control / Wiring Diagram: 11-by-17-inch bond paper, laminated or framed with transparent cover. Two-dimension schematic of control system components, including valves, dampers, sensors, switches, etc. Mark normal-operating position (open, closed, modulating).

PART 21 - EXECUTION

21.1 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.

21.2 EQUIPMENT LABEL INSTALLATION

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

B. Locate equipment labels where accessible and visible.

21.3 PIPE LABEL INSTALLATION

A. 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 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 (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.

7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:

1. Chilled-Water Piping:

a. Background Color: Blue.

b. Letter Color: White.

2. Heating Water Piping:

a. Background Color: Red.

b. Letter Color: White.

3. Refrigerant Piping:

a. Background Color: White.

b. Letter Color: Black.

4. Gas Piping:

a. Background Color: Yellow.

b. Letter Color: Black.

21.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. Chilled Water: 1-1/2 inches (38 mm), round.

b. Refrigerant: 1-1/2 inches (38 mm), round.

c. Hot Water: 1-1/2 inches (38 mm), round.

d. Gas: 1-1/2 inches (38 mm), round

2. Valve-Tag Color:

a. Chilled Water: Natural.

b. Refrigerant: Natural.

c. Hot Water: Natural.

d. Gas: Natural.

21.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

21.6 CONTROL SYSTEM DIAGRAMS AND DESCRIPTIONS INSTALLATION

A. Install control system diagrams and description charts on wall inside the associated equipment room where required. Mount in a conspicuous location.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 22 - GENERAL

22.1 RELATED DOCUMENTS

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

22.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:
    a. Variable-air-volume systems.
2. Testing, Adjusting, and Balancing Equipment:
    a. Condensing units.
3. Testing, adjusting, and balancing existing systems and equipment.
4. Duct leakage tests.
5. Control system verification.

22.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

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

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

22.4 PREINSTALLATION MEETINGS

A. TAB Conference: Conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.

1. Minimum Agenda Items:
    a. The Contract Documents examination report.
    b. The TAB plan.
    c. Needs for coordination and cooperation of trades and subcontractors.
    d. Proposed procedures for documentation and communication flow.

22.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 60 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

E. Certified TAB reports.

F. Sample report forms.

G. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

22.6 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."

22.7 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 23 - PRODUCTS (Not Applicable)

PART 24 - EXECUTION

24.1 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 ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. 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.

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

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

I. 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.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

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

L. 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.

24.2 PREPARATION

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.

2. Strategies and step-by-step procedures for balancing the systems.

3. Instrumentation to be used.

4. Sample forms with specific identification for all equipment.

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. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.

b. Duct systems are complete with terminals installed.

c. Volume, smoke, and fire dampers are open and functional.

d. Clean filters are installed.

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

f. Variable-frequency controllers' startup is complete and safeties are verified.

g. Automatic temperature-control systems are operational.

h. Ceilings are installed.

i. Windows and doors are installed.

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

24.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in ASHRAE 111, 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, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."

2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," and 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.

24.4 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. For variable-air-volume systems, develop a plan to simulate diversity.

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

E. 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.

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

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

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

24.5 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Adjust the variable-air-volume systems as follows:

1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge.

2. Verify that the system is under static pressure control.

3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control set point so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.

4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:

   a. Adjust controls so that terminal is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.

   b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.

   c. When maximum airflow is correct, balance the air outlets downstream from terminal units.

   d. Adjust controls so that terminal is calling for minimum airflow.

   e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.

   f. When in full cooling or full heating, ensure that there is no mixing of hot-deck and cold-deck airstreams unless so designed.

   g. On constant volume terminals, in critical areas where room pressure is to be maintained, verify that the airflow remains constant over the full range of full cooling to full heating. Note any deviation from design airflow or room pressure.

5. After terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.

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

   b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow so that connected total matches fan selection and simulates actual load in the building.

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

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

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

   f. Obtain approval from Engineer before adjustment of fan speed higher or lower than indicated speed. Determine and make appropriate modifications for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.

   g. 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 will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

6. 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 any artificial loading of filters at the time static pressures are measured.

7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

   a. Balance the return-air ducts and inlets the same as described for constant-volume air systems.

   b. Verify that terminal units are meeting design airflow under system maximum flow.

8. Re-measure the inlet static pressure at the most critical terminal unit and adjust the system static pressure set point to the most energy-efficient set point to maintain the optimum system static pressure. Record set point and give to controls contractor.

9. Verify final system conditions as follows:

   a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.

   b. Re-measure and confirm that total airflow is within design.

   c. Re-measure final fan operating data, rpms, volts, amps, and static profile.

   d. Mark final settings.

   e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.

   f. Verify tracking between supply and return fans.

24.6 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.

2. Motor horsepower rating.

3. Motor rpm.

4. Phase and hertz.

5. Nameplate and measured voltage, each phase.

6. Nameplate and measured amperage, each phase.

7. Starter size and thermal-protection-element rating.

8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

24.7 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record fan and motor operating data.

24.8 DUCT LEAKAGE TESTS

A. Witness the duct pressure testing performed by Installer.

B. Verify that proper test methods are used and that leakage rates are within specified tolerances.

C. Report deficiencies observed.

24.9 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.

2. Confirm that the sequences of operation are in compliance with Contract Documents.

3. Verify that controllers are calibrated and function as intended.

4. Verify that controller set points are as indicated.

5. Verify the operation of lockout or interlock systems.

6. Verify the operation of valve and damper actuators.

7. Verify that controlled devices are properly installed and connected to correct controller.

8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.

9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

24.10 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.

2. Measure motor voltage and amperage. Compare the values to motor nameplate information.

3. Check the refrigerant charge.

4. Check the condition of filters.

5. Check the condition of coils.

6. Check the operation of the drain pan and condensate-drain trap.

7. Check bearings and other lubricated parts for proper lubrication.

8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:

1. New filters are installed.

2. Coils are clean and fins combed.

3. Drain pans are clean.

4. Fans are clean.

5. Bearings and other parts are properly lubricated.

6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.

2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.

3. If calculations increase or decrease the airflow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.

4. Balance each air outlet.

24.11 TOLERANCES

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

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.

2. Air Outlets and Inlets: Plus or minus 10 percent.

3. Smoke Control Systems: Plus or minus 5 percent.

4. Heating-Water Flow Rate: Plus or minus 10 percent.

5. Cooling-Water Flow Rate: Plus or minus 10 percent.

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

24.12 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

24.13 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 and pump 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. Fan drive settings including settings and percentage of maximum pitch diameter.

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

f. 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 outdoor, supply, return, and exhaust airflows.

2. Duct, outlet, and inlet sizes.

3. Terminal units.
4. Balancing stations.
5. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:
   a. Unit identification.
   b. Location.
   c. Make and type.
   d. Model number and unit size.
   e. Manufacturer's serial number.
   f. Unit arrangement and class.
   g. Discharge arrangement.
   h. Sheave make, size in inches (mm), and bore.
   i. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
   j. Number, make, and size of belts.
   k. Number, type, and size of filters.
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 (mm), and bore.
   f. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
3. Test Data (Indicated and Actual Values):
   a. Total airflow rate in cfm (L/s).
   b. Total system static pressure in inches wg (Pa).
   c. Fan rpm.
   d. Discharge static pressure in inches wg (Pa).
   e. Filter static-pressure differential in inches wg (Pa).
   f. Cooling-coil static-pressure differential in inches wg (Pa).
   g. Heating-coil static-pressure differential in inches wg (Pa).
   h. Outdoor airflow in cfm (L/s).
   i. Return airflow in cfm (L/s).
   j. Outdoor-air damper position.
   k. Return-air damper position.

F. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:
   a. System identification.
   b. Location.
   c. Coil identification.

d. Capacity in Btu/h (kW).

e. Number of stages.

f. Connected volts, phase, and hertz.

g. Rated amperage.

h. Airflow rate in cfm (L/s).

i. Face area in sq. ft. (sq. m).

j. Minimum face velocity in fpm (m/s).

2. Test Data (Indicated and Actual Values):

a. Heat output in Btu/h (kW).

b. Airflow rate in cfm (L/s).

c. Air velocity in fpm (m/s).

d. Entering-air temperature in deg F (deg C).

e. Leaving-air temperature in deg F (deg C).

f. Voltage at each connection.

g. Amperage for each phase.

G. 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 (mm), and bore.

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

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 (mm), and bore.

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

g. Number, make, and size of belts.

h. Belt tension in lbs.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm (L/s).

b. Total system static pressure in inches wg (Pa).

c. Fan rpm.

d. Discharge static pressure in inches wg (Pa).

e. Suction static pressure in inches wg (Pa).

H. Round, Flat-Oval, and 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 (deg C).

d. Duct static pressure in inches wg (Pa).

e. Duct size in inches (mm).

f. Duct area in sq. ft. (sq. m).

g. Indicated airflow rate in cfm (L/s).

h. Indicated velocity in fpm (m/s).

i. Actual airflow rate in cfm (L/s).

j. Actual average velocity in fpm (m/s).

k. Barometric pressure in psig (Pa).

I. 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. (sq. m).

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm (L/s).

b. Air velocity in fpm (m/s).

c. Preliminary airflow rate as needed in cfm (L/s).

d. Preliminary velocity as needed in fpm (m/s).

e. Final airflow rate in cfm (L/s).

f. Final velocity in fpm (m/s).

g. Space temperature in deg F (deg C).

J. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling-unit identification.

b. Location and zone.

c. Room or riser served.

d. Coil make and size.

e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm (L/s).

b. Entering-air temperature in deg F (deg C).

c. Leaving-air temperature in deg F (deg C).

K. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.

b. Serial number.

c. Application.

d. Dates of use.

e. Dates of calibration.

24.14 VERIFICATION OF TAB REPORT

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

B. Engineer 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.

24.15 ADDITIONAL TESTS

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

B. 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 230593

SECTION 230713 - DUCT INSULATION

PART 25 - GENERAL

25.1 RELATED DOCUMENTS

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

25.2 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply, return and outdoor air.

2. Indoor, exposed supply, return and outdoor air.

3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

4. Indoor, exposed exhaust between isolation damper and penetration of building exterior.

5. Outdoor, concealed supply and return.

6. Outdoor, exposed supply and return.

B. Related Sections:

1. Section 230716 "HVAC Equipment Insulation."

2. Section 230719 "HVAC Piping Insulation."

3. Section 233113 "Metal Ducts" for duct liners.

25.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

25.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing 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.

25.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

25.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

25.7 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 26 - PRODUCTS

26.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

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

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following :

a. Aeroflex USA, Inc.; Aerocel.

b. Armacell LLC; AP Armaflex.

c. K-Flex USA; Insul-Sheet, K-Flex Gray Duct Liner, and K-FLEX LS.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket . Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following :

a. CertainTeed Corp.; SoftTouch Duct Wrap.

b. Johns Manville; Microlite.

c. Knauf Insulation; Friendly Feel Duct Wrap.

d. Owens Corning; SOFTR All-Service Duct Wrap.

H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following :

a. CertainTeed Corp.; Commercial Board.

b. Johns Manville; 800 Series Spin-Glas.

c. Knauf Insulation; Insulation Board.

d. Owens Corning; Fiberglas 700 Series.

I. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following :

a. CertainTeed Corp.; CrimpWrap.

b. Johns Manville; MicroFlex.

c. Knauf Insulation; Pipe and Tank Insulation.

d. Owens Corning; Fiberglas Pipe and Tank Insulation.

26.2 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. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following :

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.

b. Eagle Bridges - Marathon Industries; 225.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.

d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive 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."

C. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following :

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.

b. Eagle Bridges - Marathon Industries; 225.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive 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."

26.3 MASTICS

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

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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

1. Products: Subject to compliance with requirements, provide one of the following :

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.

b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).

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

5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following :

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.

b. Eagle Bridges - Marathon Industries; 570.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.

3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).

4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.

5. Color: White.

26.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following :

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.Eagle Bridges - Marathon Industries; 405.

b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.

c. Mon-Eco Industries, Inc.; 44-05.

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

3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).

5. Color: Aluminum.

6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

7. Sealants 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."

26.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

26.6 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following :

   a. ABI, Ideal Tape Division; 491 AWF FSK.

   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.

   c. Compac Corporation; 110 and 111.

   d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 5 inches (125 mm).

3. Thickness: 6.5 mils (0.16 mm).

4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.

5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.

7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

26.7 SECUREMENTS

A. Bands:

1. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing seal .

2. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.

3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

   a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

PART 27 - EXECUTION

27.1 EXAMINATION

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

1. Verify that systems to be insulated have been tested and are free of defects.

2. Verify that surfaces to be insulated are clean and dry.

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

27.2 PREPARATION

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

27.3 GENERAL INSTALLATION REQUIREMENTS

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

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct 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. Keep insulation materials dry during application and finishing.

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

H. Install insulation with least number of joints practical.

I. 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.

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

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

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) 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 duct flanges and fittings.

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

M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

27.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof 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 roof flashing at least 2 inches (50 mm) below top of roof flashing.

4. Seal jacket to roof 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.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

27.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.

2. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.

   b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

   d. Do not overcompress insulation during installation.

   e. Impale insulation over pins and attach speed washers.

   f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

3. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Tape joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

   b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).

4. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

5. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.

2. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.

   b. On duct sides with dimensions larger than 18 inches (450 mm), space pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

d. Do not overcompress insulation during installation.

e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

3. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Tape joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).

4. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

5. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

27.6 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply, return and outdoor air.

2. Indoor, exposed supply, return and outdoor air.

3. Outdoor, concealed supply and return.

4. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.

2. Factory-insulated flexible ducts.

3. Factory-insulated plenums and casings.

4. Flexible connectors.

5. Vibration-control devices.

6. Factory-insulated access panels and doors.

27.7 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply, return and outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches (50 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

B. Concealed, round and flat-oval, exhaust-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches (50 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

C. Concealed, rectangular, supply, return and outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches (50 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

D. Concealed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be the following:

1. Mineral-Fiber Blanket: 2 inches (50 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

E. Concealed, supply, return and outdoor-air plenum insulation shall be the following:

1. Mineral-Fiber Board: 2 inches (50 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

F. Exposed, round and flat-oval, supply, return and outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.

G. Exposed, round and flat-oval, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be the following:

1. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.

H. Exposed, rectangular, supply, return and outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Board: 2 inches (50 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

I. Exposed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be the following:

1. Mineral-Fiber Board: 2 inches (50 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

J. Exposed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket; thickness as required to achieve 2-hour fire rating.

K. Exposed, supply, return and outdoor-air plenum insulation shall be the following:

1. Mineral-Fiber Board: 2 inches (50 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

L. Exposed, exhaust-air plenum insulation shall be the following:

1. Mineral-Fiber Board: 2 inches (50 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

27.8 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

B. Exposed, rectangular, supply and return-air duct insulation shall be the following:

1. Flexible Elastomeric: 2 inch (50 mm) thick.

27.9 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. Ducts and Plenums, Exposed, up to 48 Inches (1200 mm) in Diameter or with Flat Surfaces up to 72 Inches (1800 mm):

1. Self adhesive outdoor jacket; thickness as indicated on drawings.

END OF SECTION 230713

SECTION 232300 - REFRIGERANT PIPING

PART 28 - GENERAL

28.1 RELATED DOCUMENTS

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

28.2 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

28.3 PERFORMANCE REQUIREMENTS

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

1. Suction Lines for Air-Conditioning Applications: 300 psig (2068 kPa).

2. Suction Lines for Heat-Pump Applications: 535 psig (3689 kPa).

3. Hot-Gas and Liquid Lines: 535 psig (3689 kPa).

28.4 ACTION SUBMITTALS

28.5 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

28.6 QUALITY ASSURANCE

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

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

28.7 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 29 - PRODUCTS

29.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or L (ASTM B 88M, Type A or B) .

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.

29.2 VALVES AND SPECIALTIES

A. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.

2. Core: Removable ball-type check valve with stainless-steel spring.

3. Seat: Polytetrafluoroethylene.

4. End Connections: Copper spring.

5. Working Pressure Rating: 500 psig (3450 kPa).

B. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.

2. Piston, Closing Spring, and Seat Insert: Stainless steel.

3. Seat Disc: Polytetrafluoroethylene.

4. End Connections: Threaded.

5. Working Pressure Rating: 400 psig (2760 kPa).

6. Maximum Operating Temperature: 240 deg F (116 deg C).

C. Moisture/Liquid Indicators:

1. Body: Forged brass.

2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.

3. Indicator: Color coded to show moisture content in ppm.

4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.

5. End Connections: Socket or flare.

6. Working Pressure Rating: 500 psig (3450 kPa).

7. Maximum Operating Temperature: 240 deg F (116 deg C).

29.3 REFRIGERANTS

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

PART 30 - EXECUTION

30.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines NPS 4 (DN 100) and Smaller for Conventional Air-Conditioning Applications: Copper, Type L (B), drawn-temper tubing and wrought-copper fittings with soldered joints.

B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type L (B), drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

C. Safety-Relief-Valve Discharge Piping: Copper, Type L (B), drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

30.2 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 above accessible ceilings to allow sufficient space for ceiling panel removal.

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

G. Install piping free of sags and bends.

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

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

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

K. Install refrigerant piping in protective conduit where installed belowground.

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

M. 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. Liquid lines may be installed level.

N. 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.

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

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

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

30.3 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes 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. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

30.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. 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 sizes:

1. NPS 1/2 (DN 15): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).

2. NPS 5/8 (DN 18): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
3. NPS 1 (DN 25): Maximum span, 72 inches (1800 mm); minimum rod size, 1/4 inch (6.4 mm).
4. NPS 1-1/4 (DN 32): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
5. NPS 1-1/2 (DN 40): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).

30.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. 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 Part 1 "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.

30.6 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 (67 Pa). 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 (14 kPa).
4. Charge system with a new filter-dryer core in charging line.

END OF SECTION 232300

SECTION 233113 - METAL DUCTS

PART 31 - GENERAL

31.1 RELATED DOCUMENTS

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

31.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. 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.

31.3 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"

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

31.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.

2. Sealants and gaskets.

B. Delegated-Design Submittal:

1. Sheet metal thicknesses.

2. Joint and seam construction and sealing.

3. Reinforcement details and spacing.

4. Materials, fabrication, assembly, and spacing of hangers and supports.

31.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to 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 System Start-up."

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

PART 32 - PRODUCTS

32.1 SINGLE-WALL 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."

32.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. Basis of Design: Subject to compliance with requirements, provide SEMCO; SL95/SM95 or comparable product by one of the following:

1. Lindab Inc.

2. McGill AirFlow LLC.

3. SEMCO Incorporated.

B. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Construction: Spiral seam duct manufactured from G-60 galvanized steel meeting ASTM A924 and A653.

2. Take-Offs: Branch connections shall be made with 90□ conical and 45□ straight taps as shown on the drawings. All branch connections shall be made as a separate fitting. Factory or field installation of taps into spiral duct shall not be allowed.

3. Elbows: 90□ and 45□ elbows in diameters 3" round through 10" round shall be stamped or pleated elbows. All other elbows shall be of the gored type.

4. Circumferential and Longitudinal Seams: Fitting seams shall be a continuous weld or spot welded and sealed with mastic. All welds shall be painted to prevent corrosion.

5. Transverse Joints: All field joints for round ducts up to and including 36" diameter and oval ducts up to and including 41" major axis shall be made with a 2" slip-fit or slip coupling. Diameters 38" round and larger shall be provided with AccuFlange, or equal, flanged connections. AccuFlange, or equal, flanged connections may also be used in lieu of slip connections on smaller sizes.

32.3 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.

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

1. Galvanized Coating Designation: G60 (Z180).

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

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 (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

32.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Basis-of-Design Product: Subject to compliance with requirements, provide CertainTeed; ToughGuardT or comparable product by one of the following:

a. CertainTeed Corporation; Insulation Group.

b. Johns Manville.

c. Knauf Insulation.

d. Owens Corning.

2. Maximum Thermal Conductivity:

a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K)at 75 deg F (24 deg C) mean temperature.

b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F (0.033 W/m x K) at 75 deg F (24 deg C) mean temperature.

3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

a. Basis-of-Design Product: Subject to compliance with requirements, provide Foster; 40-25 or comparable product by one of the following:

1) Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company.

2) Eagle Bridges - Marathon Industries.

3) Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company.

4) Mon-Eco Industries, Inc..

b. For indoor applications, coating shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

b. Adhesive 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."

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-)diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

3. Butt transverse joints without gaps, and coat joint with adhesive.

4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.

6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm (12.7 m/s).

7. Secure liner with mechanical fasteners 4 inches (100 mm) from corners and at intervals not exceeding 12 inches (300 mm) transversely; at 3 inches (75 mm) from transverse joints and at intervals not exceeding 18 inches (450 mm) longitudinally.

8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

a. Fan discharges.

b. Intervals of lined duct preceding unlined duct.

c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm (12.7 m/s) or where indicated.

9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

32.5 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. 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 (2500 Pa), 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.

C. 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. 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).
7. 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."

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

E. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for10-inch wg (2500-Pa) static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.

32.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

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

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

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. 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.

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

H. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

PART 33 - EXECUTION

33.1 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 round 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.

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 (25 mm), 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 (38 mm).

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. 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."

33.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

33.3 DUCT LINER

A. Create new openings and install access panels appropriate for duct static-pressure class minimum 8-feet on center for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.

B. 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.

C. Coat duct liner with antimicrobial erosion-resistant coating per manufacturer’s installation instructions. Do not dilute coating.

33.4 DUCT SEALING

A. Seal ducts to Seal Class A according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

33.5 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, powder-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 (100 mm) thick.

4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "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 (610 mm) of each elbow and within 48 inches (1200 mm) 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 (5 m).

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.

33.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

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

33.7 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

33.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.

2. Test the following systems:

a. Supply Ducts with a Pressure Class of 3-Inch wg (750 Pa)or Higher: Test representative duct sections, selected by Engineerfrom sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.

b. Exhaust Ducts with a Pressure Class of 3-Inch wg (750 Pa)or Higher: Test representative duct sections, selected by Engineer from sections installed, totaling no less than100 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

4. Test for leaks before applying external insulation.

5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.

6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.

D. Prepare test and inspection reports.

33.9 START UP

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

33.10 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units :

a. Pressure Class: Positive 2-inch wg (500 Pa).

2. Ducts Connected to Air-Handling Units :

a. Pressure Class: Positive 3-inch wg (750 Pa).

b. SMACNA Leakage Class for Rectangular: 6.

c. SMACNA Leakage Class for Round and Flat Oval: 6.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive 2-inch wg (500 Pa).

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 2-inch wg (500 Pa).

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 2-inch wg (500 Pa).

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg (500 Pa).

D. Exhaust Ducts:

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

a. Pressure Class: Negative 2-inch wg (500 Pa).

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 2-inch wg (500 Pa).

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg (500 Pa).

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units :

a. Pressure Class: Positive or negative 2-inch wg (500 Pa).

2. Ducts Connected to Air-Handling Units :

a. Pressure Class: Positive or negative 2-inch wg (500 Pa).

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg (500 Pa).

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.

G. Liner:

1. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 2 inches (51 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

2. Transfer Ducts: Fibrous glass, Type I,2 inches (51 mm)thick and 1-1/2-lb/cu. ft. (24-kg/cu. m) nominal density.

H. Elbow Configuration:

1. 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. 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."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches (305 mm) and Smaller in Diameter: Stamped or pleated.

c. Round Elbows, 14 Inches (356 mm) and Larger in Diameter: Welded.

I. 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: 45-degree side take-off.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm (5 m/s) or Lower: Conical tap.

b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.

c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 236200 - PACKAGED COMPRESSOR AND CONDENSER UNITS

PART 34 - GENERAL

34.1 RELATED DOCUMENTS

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

34.2 SUMMARY

A. Section includes packaged, refrigerant compressor and condenser units capable of supplying up to 100 percent outdoor air and providing cooling and heating.

B. Related Sections

34.3 **Section 237313** "Modular Indoor Central Station Air-Handling Units" for modular air handling units and controls to match with packaged compressor and condensing unit. ACTION SUBMITTALS

A. Product Data: For each compressor and condenser unit. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include equipment dimensions, weights and structural loads, required clearances, method of field assembly, components, and location and size of each field connection.

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

1. Wiring Diagrams: For power, signal, and control wiring.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

34.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Warranty: Sample of special warranty.

34.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For compressor and condenser units to include in emergency, operation, and maintenance manuals.

34.6 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. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Standard for Refrigeration Systems."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6, "Heating, Ventilating, and Air-Conditioning."

D. ASME Compliance: Fabricate and label water-cooled compressor and condenser units to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

34.7 COORDINATION

A. Coordinate sizes and locations of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033053.1 "Miscellaneous Cast-In-Place Concrete for Mechanical and Electrical Systems."

B. Coordinate location of piping and electrical rough-ins.

34.8 DELIVERY, STORAGE, AND HANDLING

A. Unit shall be shipped with doors bolted shut and wrapped in plastic prior to shipment to prevent damage during transport and thereafter while in storage awaiting installation.

B. Unit shall be stored in a clean, dry place protected from weather and construction traffic in accordance with Installation, Operation, and Maintenance manual instructions.

34.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to provide labor, materials, refrigerant, and oil to replace/repair inadequate and defective materials and workmanship, including leakage, breakage, improper assembly, and failure to perform. Provide warranty signed by the manufacturer's representative.

1. Warranty shall cover unit operation under normal conditions and use, where installed, operated, and maintained in accordance with manufacturer's instructions.

2. Extended warranties include, but are not limited to, the following:

a. Complete packaged unit including refrigerant and oil charge.

b. Parts and labor.

c. Loss of refrigerant charge for any reason.

3. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty: Manufacturer agrees to replace components of units that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Five years from date of Substantial Completion.

PART 35 - PRODUCTS

35.1 COMPRESSOR AND CONDENSER UNITS, AIR COOLED

A. Basis-of-Design Product: Subject to compliance with requirements, provide Aaon products as indicated on Drawings.

B. General Description:

1. Factory assembled and tested, air cooled; consisting of casing, compressors, condenser coils, condenser fans and motors, suction and liquid connection valves, and unit controls.

2. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.

3. Unit components shall be labeled, including pipe stub outs, refrigeration system components and electrical and controls components.

4. Installation, Operation and Maintenance manual shall be supplied within the unit.

5. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's access door.

C. Construction:

1. Unit shall be completely factory assembled, piped, and wired and shipped in one section.

2. Unit shall be specifically designed for outdoor application.

3. The condenser coil shall be mechanically protected from physical damage by painted galvanized steel louvers covering the full area of the coil.

4. Access to condenser coils, condenser fans, compressors, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles.

5. Exterior paint finish shall be capable of withstanding at least 1,000 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.

6. Unit shall include a forkliftable base.

D. Refrigeration System:

1. Unit shall include a variable capacity scroll compressor on the lead refrigeration circuit which shall be capable of modulation from 10-100% of its capacity.

2. Each compressor shall be furnished with crankcase heater.

3. Compressors shall be mounted in an isolated service compartment, which can be accessed without affecting unit operation. Lockable hinged access doors shall provide access to the compressors.

4. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber isolators, to reduce any transmission of noise from the compressors into the building area.

5. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides, and service valves for liquid and suction connections. Liquid line filter driers shall be factory provided. Finished field installed refrigerant circuits shall include the low side cooling components, refrigerant, thermal expansion valve, liquid line, insulated hot gas line and insulated suction line.

6. Unit shall include a factory holding charge of R-410A refrigerant and oil.

7. Lead refrigeration circuit shall be provided with modulating hot gas reheat coil in the matching air handler, modulating valves, electronic controller, supply air temperature sensor and a dehumidification control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.

8. Each refrigeration circuit shall each be equipped with a liquid line filter drier with check valve, reversing valve, accumulator, and thermal expansion valves on both the indoor and outdoor coils. Condensing unit shall be provided with modulating condenser fan head pressure controls and adjustable compressor lockout to allow cooling operation down to 35°F.

9. Units shall be provided with a suction pressure transducer on the lead refrigeration circuit.

E. Electrical:

1. Unit shall be provided with standard power block for connecting power to the unit.

2. Control circuit transformer and wiring shall provide 24 VAC control voltage from the line voltage provided to the unit.

3. Unit shall be provided with factory installed and factory wired 115V, 15 amp GFI outlet with outlet disconnect switch in the unit control panel.

4. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more that 10% out of balance on voltage, the voltage is more that 10% under design voltage, or on phase reversal.

F. Condenser:

1. Condenser fans shall be vertical discharge, axial flow, direct drive fans.

2. Fan motor shall be weather protected, single phase, direct drive, and open drip proof with inherent overload protection.

3. Coils shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and aluminum end casings.

4. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.

5. Coils shall be helium leak tested.

G. Controls: Unit shall be provided with a terminal block for field installation of controls.

35.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

PART 36 - EXECUTION

36.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of compressor and condenser units.

B. Examine roughing-in for refrigerant piping systems to verify actual locations of piping connections before equipment installation.

C. Examine walls, floors, and roofs for suitable conditions where compressor and condenser units will be installed.

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

36.2 INSTALLATION

A. Install units level and plumb, firmly anchored in locations indicated.

B. Equipment Mounting:

1. Install compressor and condenser units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033053.1 "Miscellaneous Cast-in-Place Concrete for Mechanical and Electrical Systems."

2. Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration Controls for HVAC."

C. Maintain manufacturer's recommended clearances for service and maintenance.

D. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

36.3 CONNECTIONS

A. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

B. Connect precharged refrigerant tubing to unit's quick-connect fittings. Install tubing so it does not interfere with access to unit. Install furnished accessories.

C. Connect refrigerant piping to air-cooled compressor and condenser units; maintain required access to unit. Install furnished field-mounted accessories. Refrigerant piping and specialties are specified in Section 232300 "Refrigerant Piping."

36.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

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

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.

2. Leak Test: After installation, charge system with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor operation and unit operation, product capability, and compliance with requirements.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

5. Verify proper airflow over coils.

C. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

D. Compressor and condenser units will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

36.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

a. Inspect for physical damage to unit casing.

b. Verify that access doors move freely and are weathertight.

c. Clean units and inspect for construction debris.

d. Verify that all bolts and screws are tight.

e. Adjust vibration isolation and flexible connections.

f. Verify that controls are connected and operational.

B. Lubricate bearings on fan motors.

C. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.

D. Adjust fan belts to proper alignment and tension.

E. Start unit according to manufacturer's written instructions and complete manufacturer's startup checklist.

F. Measure and record airflow and air temperature rise over coils.

G. Verify proper operation of condenser capacity control device.

H. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

I. After startup and performance test, lubricate bearings.

36.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain compressor and condenser units.

END OF SECTION 236200

SECTION 237313 - MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 37 - GENERAL

37.1 RELATED DOCUMENTS

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

37.2 SUMMARY

A. Related Sections

1. Section 236200 "Packaged Compressor and Condenser Units" for packaged, refrigerant compressor and condenser units capable of supplying up to 100 percent outdoor air and providing cooling and heating.

37.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Casing panels shall be self-supporting and capable of withstanding the greater of 8-inches wg or 133 percent of internal static pressures indicated, without panel joints exceeding a deflection of L/200 where "L" is the unsupported span length within completed casings.

B. Acoustical Performance: Sound power levels (dB) for the unit shall not exceed specified levels. The manufacturer shall provide necessary sound treatment to meet these levels if required.

C. Leakage: The casing leakage rate shall not exceed 0.5 cfm per square foot of cabinet area at 6-inches of negative static pressure or 5-inches of positive static pressure (0.0025 m/s per square meter of cabinet area at 1.24 kPA static pressure).

D. Condensation: During first year guarantee period, if condensation forms on any section of air handler when unit is operating at design conditions, contractor shall replace or repair unit to correct the situation. Repairs shall not impair unit or component accessibility and future repair ability and inherent access for maintenance. All repairs shall be subject to Engineer's approval.

37.4 ACTION SUBMITTALS

A. Product Data: For each air-handling unit indicated.

1. Unit dimensions and weight.

2. Cabinet material, metal thickness, finishes, insulation, and accessories.

3. Fans:

a. Certified fan-performance curves with system operating conditions indicated.

b. Certified fan-sound power ratings for discharge, radiated and return positions by octave band.

c. Fan construction and accessories.

d. Motor ratings, electrical characteristics, and motor accessories.

4. Certified coil-performance ratings with system operating conditions indicated. Psychometric chart for each cooling coil with design and final operating points.

5. Calculations for required base rail heights to satisfy condensate trapping requirements of cooling coil.

6. Installation instructions.

7. Dampers, including housings, linkages, and operators.

8. Filters with performance characteristics.

37.5 INFORMATIONAL SUBMITTALS

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

1. Mechanical-room layout and relationships between components and adjacent structural and mechanical elements.

2. Support location, type, and weight.

3. Field measurements.

4. Required clearances.

B. Field quality-control reports.

37.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-handling units to include in emergency, operation, and maintenance manuals.

37.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) for each air-handling unit.

2. Gaskets: One set(s) for each access door.

3. Fan Belts: One set(s) for each air-handling unit fan.

37.8 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. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

C. ARI Certification: Air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

E. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. Comply with NFPA 70.

37.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate sizes and locations of structural-steel support members, if any, with actual equipment provided.

C. The Contractor and the air handling unit manufacturer shall be responsible for insuring that the unit will not exceed the allocated space shown on the drawings, including required clearances for service and future overhaul or removal of unit

components. All structural, piping, wiring and ductwork alterations of units which are dimensionally different than those specified shall be the responsibility of the contractor at no additional cost to the Owner.

PART 38 - PRODUCTS

38.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide Aaon products.

38.2 UNIT CASINGS

A. General Fabrication Requirements for Casings:

1. Forming: Fabricate with channel posts and panels. Form walls, roofs, and floors with at least two breaks at each joint. Panels and access doors shall be constructed as 2-inch (50 mm) nominal thick; thermal broke double wall assembly.

2. Casing Joints: Mechanical fasteners.

3. Sealing: All panels and ship sections shall be sealed with permanently applied bulb-type gaskets. Shipped loose gasketing is not allowed. Module to module assembly shall be accomplished with an overlapping, full perimeter, insulated, internal splice joint sealed with bulb type gasketing on both mating modules.

4. Factory Finish for Galvanized-Steel Casings: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on enamel finish, consisting of prime coat and thermosetting topcoat.

5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

6. Blank Offs: Provide where required to insure no air bypass between sections, through perforated panels or around coils or filters.

B. Casing Insulation and Adhesive:

1. Materials: ASTM C 1071, injected foam insulation with a composite minimum R-value of R-13.

2. Location and Application: Encased between outside and inside casing.

C. Inspection and Access Panels and Access Doors:

1. Panel and Door Fabrication: Formed and reinforced, double-wall and insulated panels of same materials and thicknesses as casing.

2. Access Doors:

a. Hinges: A minimum of two ball-bearing hinges or minimum 6 inch (150 mm) stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.

b. Gasket: Permanently applied neoprene bulb-type gaskets, applied around entire perimeters of panel frames. Shipped loose gasketing is not allowed.

c. Size: At least 18 inches (450 mm) wide by full height of unit casing up to a maximum height of 60 inches (1500 mm).

3. Locations and Applications:

a. Fan Section: Doors and inspection and access panels.

b. Controls Section: Doors.

c. Coil Section: Removable Doors

d. Filter Section: Doors large enough to allow periodic removal and installation of filters.

e. Mixing Section: Doors.

4. Service Light: Factory wired LED service light in control panel compartment.

D. Condensate Drain Pans:

1. 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 from humidifiers and to direct water toward drain connection.

a. Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.

b. Depth: A minimum of 2 inches (50 mm) deep.

2. Formed sections.

3. Double-wall, 304 stainless-steel sheet with space between walls filled with foam insulation and moisture-tight seal.

4. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on both ends of pan.

   a. Minimum Connection Size: NPS 2 (DN 50).

5. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

E. Air-Handling-Unit Mounting Frame: 10-inch high full perimeter formed galvanized-steel channel or structural channel supports, designed for low deflection, welded with integral lifting lugs. Welded or bolted cross members shall be provided as required for lateral stability.

38.3 FAN, DRIVE, AND MOTOR SECTION

A. Fan and Drive Assemblies: Statically and dynamically balanced on all three planes and at all bearing points and designed for continuous operation at maximum-rated fan speed and motor horsepower.

1. Shafts: Designed for continuous operation at maximum-rated fan speed and motor horsepower, and with field-adjustable alignment.

   a. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.

   b. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

B. Plenum Fan Type: Single width, non-overloading, with backward-inclined or airfoil blades.

1. Fan Wheel Material: Aluminum; attached directly to motor shaft.

2. Fan Wheel Drive and Arrangement: Direct drive, AMCA Arrangement 4.

3. Fan Panel and Frame Material: Powder-coated steel, stainless steel, or aluminum.

4. Fan Enclosure: Easily removable enclosure around rotating parts.

5. Fan Balance: Precision balance fan below 0.08 inch/s (2.0 mm/s) at design speed with filter in.

C. Internal Vibration Isolation: Fans shall be factory mounted with restrained spring vibration isolation mounting devices having a minimum static deflection of 2 inches (50 mm) .

D. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Enclosure Type: Totally enclosed, fan cooled.

2. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.

3. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

4. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

E. Variable Frequency Controllers:

1. Description: NEMA ICS 2, IGBT, PWM, VFC; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, 3-phase induction motor by adjusting output voltage and frequency.

2. Output Rating: 3-phase; 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.

3. Unit Operating Requirements:

   a. Input ac voltage tolerance of 208 V, plus or minus 5 percent.

   b. Input frequency tolerance of 60 Hz, plus or minus 6 percent.

   c. Minimum Efficiency: 96 percent at 60 Hz, full load.

   d. Minimum Displacement Primary-Side Power Factor: 96 percent.

   e. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.

   f. Starting Torque: 100 percent of rated torque or as indicated.

g. Speed Regulation: Plus or minus 1 percent.

4. Isolated control interface to allow controller to follow control signal over an 11:1 speed range.

5. Internal Adjustability Capabilities:

a. Minimum Speed: 5 to 25 percent of maximum rpm.

b. Maximum Speed: 80 to 100 percent of maximum rpm.

c. Acceleration: 2 to a minimum of 22 seconds.

d. Deceleration: 2 to a minimum of 22 seconds.

e. Current Limit: 50 to a minimum of 110 percent of maximum rating.

6. Self-Protection and Reliability Features:

a. Undervoltage and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.

b. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.

c. Instantaneous line-to-line and line-to-ground overcurrent trips.

d. Loss-of-phase protection.

e. Reverse-phase protection.

f. Short-circuit protection.

g. Motor overtemperature fault.

7. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.

8. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped.

9. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

10. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

11. Control Signal Interface:

a. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.

b. Remote signal inputs capable of accepting any of the following speed-setting input signals from the control system:

1) 0-20 or 4-20 mA.

2) RS485.

3) Keypad display for local hand operation.

c. Output signal interface with a minimum of 1 analog output signal (0/4-20 mA), which can be programmed to any of the following:

1) Output frequency (Hertz).

2) Output current (load).

3) DC-link voltage (volts direct current).

4) Motor torque (percent).

5) Motor speed (rpm).

6) Set-point frequency (Hertz).

d. Remote indication interface with a minimum of 2 dry circuit relay outputs (120-V ac, 1 A) for remote indication of the following:

1) Motor running.

2) Set-point speed reached.

3) Fault and warning indication (overtemperature or overcurrent).

4) High- or low-speed limits reached.

12. Communications: RS485 interface allows VFC to be used with an external system within a multidrop LAN configuration. Interface shall allow all parameter settings of VFC to be programmed via BAS control. Provide capability for VFC to retain these settings within the nonvolatile memory.

13. Disconnecting Means: NEMA KS 1, non-fusible switch with lockable handle.

14. Accessories:

a. Devices shall be factory installed in controller enclosure unless otherwise indicated.

b. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.

c. Standard Displays:

1) Output frequency (Hertz).

2) Set-point frequency (Hertz).

3) Motor current (amperes).

4) DC-link voltage (volts direct current).

5) Motor torque (percent).

6) Motor speed (rpm).

7) Motor output voltage (volts).

38.4 COIL SECTION

A. General Requirements for Coil Section:

1. Comply with ARI 410.

2. Fabricate coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).

3. Coils shall not act as structural component of unit and shall be removable through side and/or top panels of unit without need to remove and disassemble the entire section from the unit.

4. Enclose coil headers and return bends completely within unit casing.

5. Coil connections shall be factory sealed with grommets on interior and exterior and gasket sleeve between outer wall and liner to minimize air leakage and condensation inside panel assembly. If not factory packaged; contractor shall supply all coil connection grommets and sleeves.

B. Electric-Resistance Heating Elements:

1. Open-Coil Resistance Wire: 80 percent nickel and 20 percent chromium.

2. Supports and Insulation: Floating ceramic bushings recessed into casing openings; fastened to supporting brackets and mounted in galvanized-steel frame.

3. Heating Capacity: Low density 35 W per sq. in. (54 kW per sq. m), factory wired for single-point wiring connection; with overcurrent- and overheat-protection devices.

4. Capacity Control: Silicon Controlled Rectifier (SCR).

5. Safety Controls:

a. Blower-motor interlock, air-pressure switch.

b. Integral, non-fused power disconnect switch.

38.5 AIR FILTRATION SECTION

A. General Requirements for Air Filtration Section:

1. Comply with NFPA 90A.

2. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

3. Provide 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.

4. Provide filter types indicated. Comply with requirements in Section 234100 "Particulate Air Filtration".

38.6 ADDITIONAL SECTIONS

A. Custom Section(s): Provided by the air handler manufacturer as an integral section of the unit for field installation of special components.

B. Combination Filter and Mixing Section:

1. Cabinet support members shall hold 2-inch thick, pleated, flat, permanent or throwaway filters.

38.7 CAPACITIES AND CHARACTERISTICS

A. Casing:

1. Outside Casing: G90 galvanized steel.

2. Inside Casing: G90 galvanized steel.

3. Floor Plate: G90 galvanized steel.

4. Insulation Thickness: 2 inches (50 mm).

5. Static-Pressure Classifications for Unit Sections before Fans: 8-inch wg (2000 Pa) .

6. Static-Pressure Classifications for Unit Sections after Fans: 8-inch wg (2000 Pa) .

B. Supply Fan:

1. Class II : AMCA 99-2408.

2. Drive: V-belt.

3. Type: Aluminum, airfoil or backward inclined plenum.

C. Cooling (Evaporator) Coil:

1. Maximum Face Velocity: 500 fpm (152 m/s).

2. Maximum Air-Side, Static-Pressure Drop: 1.0 inches wg (249 Pa).

3. Piping Connections: Sweat connection, same end of coil.

4. Tube Material: Copper.

5. Fin Material: Aluminum.

6. Maximum Fin Spacing: 12 fins per inch (2.1 fins per mm).

7. Fin and Tube Joint: Mechanical bond.

8. Headers: Seamless copper tube with brazed joints, prime coated.

9. Frames: Channel frame, 0.0625-inch (- 1.58-mm-) thick galvanized.

10. Refrigerant Type: Coils shall be uniformly circuited in a counterflow manner for interlaced capacity reduction.

11. Coil shall be helium leak tested.

12. Coil shall be furnished with a factory installed thermostatic expansion valves. The sensing bulbs shall be field installed on the suction line immediately outside the cabinet.

38.8 REFRIGERATION SYSTEM

A. Air handling unit and matching condensing unit shall be capable of operation as an R-410A split system heat pump.

B. Each refrigeration circuit shall be equipped with thermostatic expansion valve type refrigerant flow control.

a. Modulating hot gas reheat shall be provided on the lead refrigeration circuit. Refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a dehumidification control signal terminal that allow the unit to have a dehumidification mode of operation and includes supply air temperature control to prevent supply air temperature swings and overcooling of the space. Modulating reheat valves shall be factory installed in the matching Aaon condensing unit. Reheat line connections shall be labeled, extend beyond the unit casing and be located near the suction and liquid line connections for ease of field connection. Connections shall be factory sealed on both the interior and exterior of the unit casing to minimize air leakage.

b. Refrigeration circuit shall be equipped with thermal expansion and check valve on the indoor coil.

38.9 ELECTRICAL

A. Unit shall be provided with standard power block for connecting power to the unit.

38.10 CONTROLS

A. Factory Installed and Factory Provided Controller

1. Controller shall have a BAS interface that will communicate all points listed in the controls points list.

2. Controller shall include non-volatile memory to retain all programmed values, without the use of an external battery, in the event of a power failure.

3. With the modulating hot gas reheat, a space humidity sensor and supply air temperature sensor shall be furnished with the unit for field installation. Supply air temperature and space humidity setpoints, for the dehumidification mode of operation, shall be adjustable.

38.11 SOURCE QUALITY CONTROL

A. Fan Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.

B. Fan Performance Rating: Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency. Rate performance according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating."

C. Refrigerant Coils: Factory tested to 450 psig (3105 kPa) according to ARI 410 and ASHRAE 33.

PART 39 - EXECUTION

39.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine casing insulation materials and filter media before air-handling unit installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for steam, hydronic, and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.

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

39.2 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site.

B. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids. Inspect for damage.

C. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish

39.3 INSTALLATION

A. Equipment Mounting: Install air-handling unit using elastomeric pads . Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration Controls for HVAC Piping and Equipment."

1. Minimum Deflection: 1 inch (25 mm) .

B. Arrange installation of units to provide access space around air-handling units for service and maintenance.

C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with new, clean filters.

39.4 CONNECTIONS

A. Comply with requirements for piping specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to air-handling unit to allow service and maintenance.

C. Connect piping to air-handling units mounted on vibration isolators with flexible connectors.

D. Connect condensate drain pans using ASTM B 88, Type L copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

E. Refrigerant Piping: Comply with applicable requirements in Section 232300 "Refrigerant Piping." Install shutoff valve and union or flange at each supply and return connection.

F. Connect duct to air-handling units with flexible connections. Comply with requirements in Section 233300 "Air Duct Accessories."

39.5 FIELD QUALITY CONTROL

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

B. 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

C. Tests and Inspections:

1. Charge refrigerant coils with refrigerant and test for leaks.

2. Fan 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.

D. Air-handling unit or components will be considered defective if unit or components do not pass tests and inspections.

E. Prepare test and inspection reports.

39.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Verify that shipping, blocking, and bracing are removed.

3. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.

4. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.

5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.

6. Verify that outdoor- and return-air mixing dampers open and close, and maintain minimum outdoor-air setting.

7. Comb coil fins for parallel orientation.

8. Verify that proper thermal-overload protection is installed for electric coils.

9. Install new, clean filters.

10. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.

B. Starting procedures for air-handling units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace fan and motor pulleys as required to achieve design conditions.

2. Measure and record motor electrical values for voltage and amperage.

3. Manually operate dampers from fully closed to fully open position and record fan performance.

39.7 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

39.8 CLEANING

A. After completing system installation and testing, adjusting, and balancing air-handling unit and air-distribution systems and after completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils and filter housings, and install new, clean filters.

39.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-handling units.

END OF SECTION 237313

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LEON COUNTY SCHOOLS

BUILDING THE FUTURE TOGETHER

Bid Proposal Form

Bid No. 5617-2021 – Gilchrist Elementary School Building 9 HVAC Replacement

Vendor Acknowledgment and Approval

I certify that this bid is made without prior understanding, agreement or connection with any corporation, firm, or person submitting a bid for the same materials, supplies or equipment, and in all respects fair and without collusion or fraud. The following information, including an authorized representative signature is required to be submitted with your bid in order to be considered for evaluation and award. The person signing below acknowledges and agrees with all proposed information as submitted and has the authorization of the said company to enter into a contractual agreement with the School Board of Leon County for the purposes as proposed and as described herein. Please print and sign below where required.

Authorized Representative's Name/Title	Authorized Representative's Signature	Date

Company's Name	Telephone Number	FAX Number

Address	City	State	Zip Code

Area Representative	Telephone Number	FAX Number

PURCHASE AND INSTALLATION OF BUILDING 9 HVAC REPLACEMENT

TOTAL BASE BID **$** _____

ADDENDA ACKNOWLEDGMENT: The undersigned also acknowledges the receipt of the following Addenda:

ADDENDUM NO. _____ **DATED** _____ ***ADDENDUM NO.*** _____ **DATED** _____

ADDENDUM NO. _____ **DATED** _____ ***ADDENDUM NO.*** _____ **DATED** _____

EXHIBIT A

CONFLICT OF INTEREST CERTIFICATE

Bidder **must** execute either Section I or Section II hereunder relative to Florida Statute 112.313(12). Failure to execute either section may result in rejection of this bid proposal.

SECTION I

I hereby certify that no official or employee of the School Board requiring the goods or services described in these specifications has a material financial interest in this company.

Signature	*Company Name*
Name of Official (Type or print)	*Business Address*
	City, State, Zip Code

SECTION II

I hereby certify that the following named Leon County School Board official(s) and employee(s) having material financial interest(s) (in excess of 5 %) in this company have filed Conflict of Interest Statements with the Supervisor of Elections, 315 South Calhoun Street, Tallahassee, Leon County, FL prior to bid opening.

Name	**Title or Position**	**Date of Filing**

Signature	*Company Name*
Name of Official (Type or print)	*Business Address*
	City, State, Zip Code

EXHIBIT B

LEON COUNTY SCHOOLS
2757 West Pensacola Street – Tallahassee, FL 32304-2998
FAX FORM TO: (850) 487-7869

APPLICATION FOR VENDOR STATUS

(IRS W-9 Facsimile)

NEW VENDOR ☐
UPDATE ☐

COMPANY NAME:_____ **LEON CO. SCHOOLS EMPLOYEE?**

CONTACT PERSON:_____ ☐ **YES** ☐ **NO**

PHONE NUMBER: (___) _____ **FAX NUMBER:** (___)_____

CORRESPONDENCE ADDRESS: _____

CITY:_____ **STATE:** _____

ZIP + 4: _____ - _____ _____ _____ _____

REMITTANCE: NAME (if different from above): _____

ADDRESS: _____

CITY: _____ **STATE:** _____

ZIP + 4: _____ - _____ _____ _____ _____

EMAIL ADDRESS: _____ **WEBSITE:** _____

PLEASE CHECK APPROPRIATE BOX: ☐ Individual/Sole Proprietor ☐ S Corporation ☐ C Corporation ☐ Partnership
☐ Other_____ ☐ LLC – Type (Check one) ☐ C ☐ S ☐ P

TAX IDENTIFICATION NUMBER:_____ - _____ OR _____ - _____ - _____
Federal Employer Identification Number Social Security Number

Section 6109 of the Internal Revenue Service Code requires you to provide your correct TIN to persons, businesses, or agencies that are required to file information returns with the IRS. Purchase orders will not be issued to vendors who fail to provide a TIN.

PLEASE INDICATE THE FOLLOWING: ***Minority Vendor?** ☐ Yes ☐ No Male ☐ Female ☐

**If yes, certification required – (Please submit with form)*

Race: Caucasian: ☐ Hispanic: ☐ African American: ☐ Asian: ☐
American Indian: ☐ Other: _____

By: _____ _____ _____
Signature Printed Name Date

LCSB site contact requesting vendor:_____ _____
Name Phone/Email

Form **W-9**
(Rev. December 2014)
Department of the Treasury
Internal Revenue Service

Request for Taxpayer Identification Number and Certification

Give Form to the requester. Do not send to the IRS.

Print or type
See Specific Instructions on page 2.

1 Name (as shown on your income tax return). Name is required on this line; do not leave this line blank.

2 Business name/disregarded entity name, if different from above

3 Check appropriate box for federal tax classification; check only one of the following seven boxes:
☐ Individual/sole proprietor or single-member LLC ☐ C Corporation ☐ S Corporation ☐ Partnership ☐ Trust/estate
☐ Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=partnership) ▶ _____
Note. For a single-member LLC that is disregarded, do not check LLC; check the appropriate box in the line above for the tax classification of the single-member owner.
☐ Other (see instructions) ▶

4 Exemptions (codes apply only to certain entities, not individuals; see instructions on page 3):
Exempt payee code (if any) _____
Exemption from FATCA reporting code (if any) _____
(Applies to accounts maintained outside the U.S.)

5 Address (number, street, and apt. or suite no.) | Requester's name and address (optional)

6 City, state, and ZIP code

7 List account number(s) here (optional)

Part I Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on line 1 to avoid backup withholding. For individuals, this is generally your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the Part I instructions on page 3. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN* on page 3.

Note. If the account is in more than one name, see the instructions for line 1 and the chart on page 4 for guidelines on whose number to enter.

Social security number
___ – ___ – ____

or

Employer identification number
___ – _____

Part II Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me); and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding; and
3. I am a U.S. citizen or other U.S. person (defined below); and
4. The FATCA code(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct.

Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions on page 3.

Sign Here | **Signature of U.S. person** ▶ | **Date** ▶

General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Future developments. Information about developments affecting Form W-9 (such as legislation enacted after we release it) is at www.irs.gov/fw9.

Purpose of Form

An individual or entity (Form W-9 requester) who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) which may be your social security number (SSN), individual taxpayer identification number (ITIN), adoption taxpayer identification number (ATIN), or employer identification number (EIN), to report on an information return the amount paid to you, or other amount reportable on an information return. Examples of information returns include, but are not limited to, the following:

- Form 1099-INT (interest earned or paid)
- Form 1099-DIV (dividends, including those from stocks or mutual funds)
- Form 1099-MISC (various types of income, prizes, awards, or gross proceeds)
- Form 1099-B (stock or mutual fund sales and certain other transactions by brokers)
- Form 1099-S (proceeds from real estate transactions)
- Form 1099-K (merchant card and third party network transactions)
- Form 1098 (home mortgage interest), 1098-E (student loan interest), 1098-T (tuition)
- Form 1099-C (canceled debt)
- Form 1099-A (acquisition or abandonment of secured property)

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN.

If you do not return Form W-9 to the requester with a TIN, you might be subject to backup withholding. See *What is backup withholding?* on page 2.

By signing the filled-out form, you:

1. Certify that the TIN you are giving is correct (or you are waiting for a number to be issued),
2. Certify that you are not subject to backup withholding, or
3. Claim exemption from backup withholding if you are a U.S. exempt payee. If applicable, you are also certifying that as a U.S. person, your allocable share of any partnership income from a U.S. trade or business is not subject to the withholding tax on foreign partners' share of effectively connected income, and
4. Certify that FATCA code(s) entered on this form (if any) indicating that you are exempt from the FATCA reporting, is correct. See *What is FATCA reporting?* on page 2 for further information.

Cat. No. 10231X | Form **W-9** (Rev. 12-2014)

EXHIBIT D

LEON COUNTY SCHOOLS

BUILDING THE FUTURE TOGETHER

CUSTOMER REFERENCE FORM

Bid No. 5617-2021 - Gilchrist Elementary School Building 9 HVAC Replacement

Please provide all requested information for each reference.

Company Name: _____

Business Type: _____

Contact Person: _____

Telephone: _____

Email: _____

Date Last Supplied Products or Services: _____

Company Name: _____

Business Type: _____

Contact Person: _____

Telephone: _____

Email: _____

Date Last Supplied Products or Services: _____

Company Name: _____

Business Type: _____

Contact Person: _____

Telephone: _____

Email: _____

Date Last Supplied Products or Services: _____

EXHIBIT E

LEON COUNTY SCHOOLS
BUILDING THE FUTURE TOGETHER

VENDOR QUESTIONNAIRE

Bid No. 5617-2021 - Gilchrist Elementary School Building 9 HVAC Replacement

Please provide written responses to the following questions. If the answer to any of the questions is `Yes`, Vendor shall describe fully the circumstances, reasons therefore, the current status, and ultimate disposition of each matter that is the subject of this inquiry.

1. Has Vendor been declared in default of any contract?
☐ Yes ☐ No

2. Has Vendor forfeited any payment of performance bond issued by a surety company on any contract?
☐ Yes ☐ No

3. Has an uncompleted contract been assigned by Vendor's surety company on any payment of performance bond issued to Vendor arising from its failure to fully discharge all contractual obligations there under?
☐ Yes ☐ No

4. Within the past three years, has Vendor filed for reorganization, protection from creditors, or dissolution under the bankruptcy statutes?
☐ Yes ☐ No

5. Is Vendor now the subject of any litigation in which an adverse decision might result in a material change in the firm's financial position or future viability?
☐ Yes ☐ No

6. Is Vendor currently involved in any state of a fact-finding, negotiations, or resistance to a merger, friendly acquisition, or hostile take-over, either as a target or as a pursuer?
☐ Yes ☐ No

7. Within the next year, does Vendor plan any personnel reductions? If so, explain by attachment.
☐ Yes ☐ No

8. Within the next year, does Vendor plan any divestments? If so, explain by attachment.
☐ Yes ☐ No

EXHIBIT F

LEON COUNTY SCHOOLS

BUILDING THE FUTURE TOGETHER

DRUG FREE WORKPLACE

Preference shall be given to vendors submitting a certification with their bid/proposal certifying they have a drug-free workplace in accordance with Section 287.087, Florida Statutes. Whenever two or more bids that are equal with respect to price, quality, and service are received by the State or by any political subdivision for the procurement of commodities or contractual services, a bid received from a business that certifies that it has implemented a drug-free workplace program shall be given preference in the award process. Established procedures for processing tie bids will be followed if none of the tied vendors have a drug-free workplace program. In order to have a drug-free workplace program, a business shall:

IDENTICAL TIE BIDS – Preference shall be given to businesses with drug-free workplace programs. Whenever two or more bids, which are equal with respect to price, quality, and service, are received by the State or any political subdivision for the procurement of commodities or contractual services, a bid received from a business that certifies that it has implemented a drug-free workplace program shall be given preference in the award process. Established procedure for processing tie bids shall be followed if none of the tied vendors have a drug-free workplace program.

A business shall:

1) Publish a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the workplace and specifying the actions that will be taken against employees for violations of such prohibition.

2) Inform employees about the dangers of drug abuse in the workplace, the business's policy of maintaining a drug-free workplace, any available drug counseling, rehabilitation, and employee assistance programs, and the penalties that may be imposed upon employees for drug abuse violations.

3) Give each employee engaged in providing the commodities or contractual services that are under bid a copy of the statement specified in subsection (1).

4) In the statement specified in subsection (1), notify the employees that, as a condition of working on the commodities or contractual services that are under bid, the employee s will abide by the terms of the statement and will notify the employer of any conviction of, or plea of guilty or nolo contendere to, any violation of Chapter 893 or of any controlled substance law of the United States or any state, for a violation occur ring in the workplace no later than five (5) days after such conviction.

5) Impose a sanction on, or require the satisfactory participation in a drug abuse assistance or rehabilitation program if such is available in the employee's community, by any employee who is so convicted.

6) Make a good faith effort to continue to maintain a drug-free workplace through implementation of this section.

As the person authorized to sign the statement, I certify that this firm complies fully with the above requirements.

VENDOR'S SIGNATURE: _____

EXHIBIT G

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION -LOWER TIER COVERED TRANSACTIONS

(BEFORE COMPLETING CERTIFICATION, READ INSTRUCTIONS ON THE FOLLOWING PAGE)

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.
2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Organization Name	PR/Award Number or Project Name
Name(s) of Authorized Representative(s)	Title(s) of Authorized Representative(s)
Signature(s)	Date

Form AD-1048 (1/92)

INSTRUCTIONS FOR CERTIFICATION OF DEBARMENT

1. By signing and submitting this form, the prospective lower tier participant is providing the certification set out on the reverse side in accordance with these instructions.

2. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

3. The prospective lower tier participant shall provide immediate written notice to the person to whom this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

4. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.

5. The prospective lower tier participant agrees by submitting this form that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

6. The prospective lower tier participant further agrees by submitting this form that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion -Lower Tier Covered Transactions," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

7. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that it is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Nonprocurement List.

8. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

9. Except for transactions authorized under paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

Form AD-IO48 (1/92) U. S. GPO: 1996-757-776/201 07

EXHIBIT H

LEON COUNTY SCHOOLS
BUILDING THE FUTURE TOGETHER

SWORN STATEMENT – NEW CONTRACTS
SWORN STATEMENT PURSUANT TO SECTION 1012.465, FLORIDA STATUTES AS AMENDED BY HB 1877, THE JESSICA LUNSFORD ACT

THIS FORM MUST BE SIGNED AND SWORN TO IN THE PRESENCE OF A NOTARY PUBLIC OR OTHER OFFICIAL AUTHORIZED TO ADMINISTER OATHS.

1. This sworn statement is submitted to The School Board of Leon County, Florida *(hereinafter "Board" or "School Board")* by _____
(Print individual's name and title)

for _____
(Print name of entity submitting sworn statement)

whose business address is _____

_____

and its Federal Employer Identification Number (FEIN) is _____
If the entity has no FEIN, include the Social Security Number (SSN) of the individual signing this sworn statement and so indicate.

2. I, _____ am duly authorized to make this sworn statement
(Print individual's name and title)

on behalf of: _____

_____

_____
(Print name of entity submitting sworn statement)

3. I understand that during the 2005 Legislative Session, House Bill 1877, The Jessica Lunsford Act (hereinafter "The Act" or "Act") was passed and approved by Governor Bush on May 2, 2005, with an effective date of September 1, 2005.

4. I understand that the Act amends the background screening requirements of section 1012.465, Florida Statutes (2004) for all non-instructional school district employees or **"contractual personnel"** by requiring all non-instructional school district employees or contractual personnel who are permitted access on school grounds when students are present to undergo and pass "level 2 background screening," and further I understand the Act defines **"contractual personnel"** to include any vendor, individual, or entity under contract with the Board.

5. I understand that pursuant to section 1012.465, Florida Statutes as amended by the Act, non-instructional school district employees or contractual personnel who are permitted access on school grounds when students are present, who have direct contact with students or who have access to or control of school funds must meet level 2 screening requirements as described in sections 1012.32 and 435.04, Florida Statutes.

6. I understand that as a _____ *(e.g. a charter bus company)*
(Type of entity)
all contractual personnel, as defined in section 1012.465, Florida Statutes, must meet Level 2 screening requirements as outlined in sections 1012.32 and 435.04, Florida Statutes in order to do business with the School Board.

7. I understand that "level 2 screening requirements" as defined in sections 1012.32 and 435.04, Florida Statutes means that fingerprints of all contractual personnel must be obtained and submitted to the Florida Department of Law Enforcement for state processing and to the Federal Bureau of Investigation for federal processing.

8. I understand that the School Board has implemented Board Policy 2.021 to comply with level 2 screening requirements, as defined in sections 1012.32 and 435.04, Florida Statutes. I understand that my company must comply with these local procedures as they are developed or amended from time to time.

9. I understand that any costs and fees associated with the required background screening will be borne by my company.

10. I understand that any personnel of the contractor found through fingerprint processing and subsequent level 2 background screening to have been found guilty of, regardless of adjudication, or entered a plea of nolo contendere or guilty to any offense outlined in Section 435.04, Florida Statutes (or any similar statute of another jurisdiction), **shall not be permitted** to come onto school grounds or any leased premises where school-sponsored activities are taking place when students are present, shall not be permitted direct contact with students, and shall not be permitted to have access to school district funds.

11. I understand that the failure of any of the company's or my affected personnel to meet level 2 screening standards as required by section 1012.465, Florida Statutes, may disqualify my company from doing business with the School Board.

12. I hereby certify that the foregoing statement is true and correct in relation to the company for which I am submitting this sworn statement. I further certify that this statement is being given knowingly and voluntarily by me on behalf of my company.

The company submitting this sworn statement agrees to be bound by the provisions of SECTIONS 1012.32, 1012.465, AND 435.04 OF THE FLORIDA STATUTES AS AMENDED BY HB 1877, THE JESSICA LUNSFORD ACT 2005.

I CERTIFY THAT THE SUBMISSION OF THIS FORM TO THE SCHOOL BOARD OF LEON COUNTY, FLORIDA ON BEHALF OF THE COMPANY IDENTIFIED IN PARAGRAPH ONE (1) ABOVE BINDS THE COMPANY TO FULLY COMPLY WITH THE BACKGROUND SCREENING REQUIREMENTS OF SECTIONS 1012.32, AND 435.04, FLORIDA STATUTES.

_____

(Signature)

Sworn to and subscribed before me this _____ day of _____ 20_____

_____ is personally known to me ☐ OR produced identification ☐

by showing _____

(Type of Identification)

Notary Public – State of _____ My commission expires on: _____

_____ _____

Signature of Notary Public *(Printed, typed or stamped commissioned name of Notary Public)*

EXHIBIT I

AFFIDAVIT FOR CLAIMING LOCAL PURCHASING PREFERENCE

Bid No. 5617-2021 - Gilchrist Elementary School Building 9 HVAC Replacement

Proposer/Bidder/Quoter/Supplier affirms that it is a local or adjacent county business as defined by Policy #6450 of Leon County Schools and the regulations thereto.

A Leon/adjacent county vendor is a private independent vendor that has been licensed for at least six (6) months preceding the bid or proposal opening, as required by local, State, and Federal law to provide the goods, services, or construction to be purchased. The vendor must have a physical business address, staffed by at least one (1) person, in the geographical boundaries of Leon County or in the adjacent counties of Gadsden, Jefferson, or Wakulla, Florida. The vendor, on a day-to-day basis, should provide to the School Board the needed goods and/or services substantially from the local business address. Post Office boxes are not verifiable and shall not be used for the purpose of establishing said physical address.

Please complete the following in support of the self-certification:

Business Name: _____

Address: _____

_____

_____ _____ _____

Phone *Fax* *Email*

County: _____ Length of time at this location: _____ # of employees at this location ____

Is your business certified as a small business through Leon County Schools? _____

_____ _____

Signature of Authorized Representative *Date*

State of FLORIDA

County of _____

Sworn to and subscribed before me, a Notary Public for the above State and County, on this _____ day of

_____, 20 _____.

_____ _____

Notary Public *My Commission Expires*

EXHIBIT J
INDEMNIFICATION AND INSURANCE

In consideration of this Contract, if awarded, the Vendor agrees without reservation to the indemnification and insurance clauses contained herein. These clauses are attached to and form a part of **Bid No. 5617-2021 - Gilchrist Elementary School Building 9 HVAC Replacement.**

Each party agrees to be fully responsible for its acts of negligence or its agents' acts of negligence when acting within the scope of their employment and agrees to be liable for any damages resulting from said negligence to the extent allowable pursuant to **Section 768.28, Florida Statutes**. Nothing herein is intended to serve as a waiver of sovereign immunity by the School Board. Nothing herein shall be construed as consent by the School Board to be sued by third parties in any matter arising out of any contract. Bidder shall hold harmless and defend the School Board and its agents and employees from all suits and actions, including attorney's fees and all costs of litigation and judgments of any name and description arising out of or incidental to the performance of this contract or work performed there under. This provision shall also pertain to any claims brought against the School Board by an employee of the named Bidder, any Subcontractor, or anyone directly or indirectly employed by any of them. The bidder's obligation under this provision shall not be limited in any way by the agreed upon contract price as shown in this Contract or the bidder's limit of, or lack of, sufficient insurance protection.

INSURANCE

Prior to being recommended for award, the Vendor has five business days after notification to submit proof of insurance as required herein. Failure to submit a fully completed certificate of insurance signed by an authorized representative of the insurer providing such insurance coverage's may cause the Vendor to be considered non-responsive and not eligible for award of the Contract. The insurance coverage's and limits shall meet, at a minimum, the following requirements:

1. **Commercial General Liability Insurance in an amount not less than $1,000,000 combined single limit per occurrence for bodily injury and property damage.**
2. **Automobile Liability Insurance covering all owned, non-owned and hired vehicles used in connection with the operation of the Vendor, in an amount not less than $1,000,000 combined single limit per occurrence for bodily injury and property damage.**
3. **Workers' Compensation Insurance for all employees of the Vendor as required by Florida Statutes.**
4. **The School Board of Leon County, Florida" must be listed as additional insured on all liability coverage's except Workers' Compensation.**

The insurance coverage required shall include those classifications, as listed in standard liability insurance manuals, which most nearly reflect the operations of the Vendor.

All insurance policies shall be issued by companies with either of the following qualifications:

1. The company must be:
   - **a.** authorized by subsisting certificates of authority by the Department of Insurance of the State of Florida or
   - **b.** an eligible surplus lines insurer under Florida Statutes. In addition, the insurer must have a Best's Rating of "A" or better and a Financial Size Category of "IV" or better according to the latest edition of Best's Key Rating Guide, published by A.M. Best Company.

or

2. With respect only to the Workers' Compensation insurance, the company must be:
   - **a.** authorized as a group self-insurer pursuant to Florida Statutes or
   - **b.** authorized as a commercial self-insurance fund pursuant to Florida Statutes

Neither approval nor failure to disapprove the insurance furnished by the Vendor to the School Board shall relieve the Vendor of the Vendor's full responsibility to provide insurance as required by this Contract.

The Vendor shall be responsible for assuring that the insurance remains in force for the duration of the contractual period; including any and all option years that may be granted to the Vendor. The certificate of insurance shall contain the provision that the School Board be given no less than thirty (30) days written notice of cancellation. If the insurance is scheduled to expire during the contractual period, the Vendor shall be responsible for submitting new or renewed certificates of insurance to the School Board at a minimum of thirty (30) calendar days in advance of such expiration.

Unless otherwise notified, the **certificate of insurance *must be delivered to* the following address**:

Leon County School Board
Purchasing Department
Attn: June Kail, Director of Purchasing
3397 W. Tharpe St.
Tallahassee, Florida 32303

The name and address of the Leon County School Board, as shown directly below,
must be listed as Certificate Holder on the Certificate of Insurance as well as clearly noted as "Additional Insured".

Leon County School Board
2757 W. Pensacola St.
Tallahassee, FL 32304

The Vendor may be in default of this Contract for failure to maintain the insurance as required by this Contract.
Any questions and/or inquiries should be directed to Janet Heath at (850) 487-7113.

HVAC UNIT INFORMATION

USE THIS FORM TO ADD/REMOVE HVAC UNITS OR TO TRANSFER TO ANOTHER SITE
ONE ACTION PER FORM

PLEASE CHECK ACTION: INSTALL NEW UNIT _____ REMOVE UNIT _____TRANSFER UNIT _____

TRANSFER UNIT FROM _____ TO_____

UNIT INFORMATION

SITE: _____ UNIT ID (BARCODE): _____

LOCATION OF UNIT: _____ FISH #: _____

PLEASE MARK (X) FOR LOCATION:

WALL HUNG	CEILING HUNG	ABOVE CEILING	MECHANICAL ROOM
MEZZANINE	FLOOR MOUNT	CEILING SURFACE	ROOF TOP

BRAND NAME: _____

MODEL #: _____

SERIAL #: _____

PLEASE MARK (X) FOR TYPE OF UNIT:

AIR HANDLER – AH	CONDENSER – CD	PACKAGE – PK	FRESH AIR – FA
WINDOW – WU	HEAT PUMP – HP	HYDRONIC –HW	

NOTE: Do not complete this section for removal or transfer of unit.

FILTER SIZES:

A) _____X_____ X _____

B) _____X_____ X _____

C) _____X_____ X _____

NUMBER OF FILTERS:

A) _____

B) _____

C) _____

BELT SIZE: _____

MOTOR SIZE: _____

FREON TYPE: _____

FREON AMOUNT: _____

GILCHRIST HIGH PERCENTAGE OUTSIDE AIR UNIT BID PACKAGE

ORIGINAL PROJECT:

GILCHRIST ELEMENTARY SCHOOL

LCSB RFQ 328-2015

NEW CONSTRUCTION, REMODELING, RENOVATIONS
and SITE IMPROVEMENTS
1301 TIMBERLANE ROAD
TALLAHASSEE, FLORIDA 32312

GENERAL UNIT REPLACEMENT SCOPE NOTES:

1. SEE ATTACHED ORIGINAL DRAWINGS FOR REFERENCE.
2. CONTRACTOR SHALL PURGE AND REUSE EXISTING REFRIGERANT CIRCUITS, PRESSURE TEST TO ENSURE NO LEAKS.
3. CONTRACTOR SHALL CONNECT EXISTING DUCTWORK TO NEW UNIT, PROVIDE ANY ADDITIONAL SHEET METAL, INSULATION OR TRANSITIONS AS NECESSARY.
4. CONTRACTOR SHALL CONNECT NEW UNIT CONTROLS TO EXISTING BAS.
5. CONTRACTOR SHALL COORDINATE SHIPPING SPLIT DIMENSIONS WITH MANUFACTURER FOR EASE OF INSTALLATION.
6. CONTRACTOR SHALL PERFORM COMPLETE TEST & BALANCE OF THE SYSTEM ONCE NEW UNIT IS INSTALLED.

ENGINEERING
114 EAST 9th AVENUE TALLAHASSEE, FL
32303 PHONE: 850.224.7922
www.E2Engineering.com

DRAWING PHASE
CONTRACT DOCUMENTS

DRAWING TITLE
General Notes

SHEET NO.
M001

19 MAY 2020

MAKEUP AIR UNIT - SPLIT SYSTEM

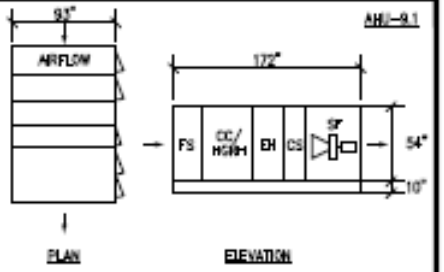
INDOOR UNIT DESIGNATION			AHU-9.1
OUTDOOR UNIT DESIGNATION			CU-9.1
AIR FLOW RATES			
	TOTAL SUPPLY AIR	CFM	10,200
	OUTSIDE AIR	CFM	3,200
	MINIMUM SUPPLY FAN SPEED SETTING	%	42
FILTER SECTION			
	DAMPERS		NONE
	FILTER ORIENTATION		ANGLED
	TYPE OF FILTER		2" THICK PLEATED
COOLING DATA			
	TOTAL COOLING CAPACITY	MBTUH	535.4
	SENSIBLE COOLING CAPACITY	MBTUH	311.8
	AIR ENTERING COOLING COIL	°Fdb - °Fwb	81.7 - 66.5
	AIR LEAVING COOLING COIL	°Fdb - °Fwb	53.4 - 52.8
	CONDENSATE DRAIN SIZE	IN.	2
HOT GAS REHEAT DATA			
	TYPE		MODULATING
	HEATING CAPACITY	MBTUH	183.7
	AIR ENTERING HOT GAS REHEAT COIL	°F	50
	AIR LEAVING HOT GAS REHEAT COIL	°F	72
HEATING DATA - ELECTRIC			
	HEATING CAPACITY - # OF STAGES	kW - #	28 - SCR
	AIR ENTERING HEATING COIL	°F	32.7
	AIR LEAVING HEATING COIL	°F	50
SUPPLY FAN SECTION			
	FAN TYPE		PLENUM
	DRIVE TYPE		DIRECT
	FAN QUANTITY	#	1
	EXTERNAL STATIC PRESSURE	IN. WG	3
	MAXIMUM TOTAL STATIC PRESSURE (INCLUDING DIRTY FILTER)	IN. WG	4.1
	DIRTY FILTER ALLOWANCE	IN. WG	1
	FAN MOTOR HORSEPOWER (PER FAN)	HP - BHP	15 - 12.2
	FAN MOTOR HORSEPOWER (UNIT TOTAL)	HP - BHP	15 - 12.2
	VARIABLE FREQUENCY DRIVE		1 PER UNIT
INDOOR UNIT DATA			
	WEIGHT	LBS	3,962
	ELECTRICAL CHARACTERISTICS	V / PH	208 / 3
	MCA / MOCP	AMPS	139 / 177

OUTDOOR UNIT DATA			
	COMPRESSOR QUANTITY - # OF CIRCUITS	#-#	4 - 2
	WEIGHT	LBS	2,547
	REFRIGERANT TYPE		R410A
	ELECTRICAL CHARACTERISTICS	V / PH	208 / 3
	MCA / MOCP	AMPS	233 / 250
MANUFACTURER			AAON
MODEL NUMBER (INDOOR UNIT)			M2HI-022-L-B-B-B-A-D-X
MODEL NUMBER (OUTDOOR UNIT)			CFA-050-D-A-8-DC00T
DETAIL REFERENCE			A/B M-007

NOTES:

1. CLEAN AND PURGE EXISTING REFRIGERANT LINES FOR REUSE.
2. PROVIDE ONE (1) MODULATING COMPRESSOR.
3. PROVIDE SUPPLY AIR TEMPERATURE AND DEWPOINT CONTROL.
4. PROVIDE SUPPLY AIR TEMPERATURE SENSOR.
5. PROVIDE OUTSIDE AIR TEMPERATURE AND HUMIDITY SENSORS.
6. PROVIDE SUCTION PRESSURE TRANSDUCER.
7. PROVIDE TERMINAL BLOCK WITH 2 DIGITAL RELAY OUTPUTS.
8. PROVIDE MODULATING HEAD PRESSURE CONTROL.
9. PROVIDE BAS INTERFACE.
10. PROVIDE CONVENIENCE ELECTRICAL OUTLET.
11. REUSE EXISTING DISCONNECT SWITCH.

AIR HANDLING UNIT LAYOUT



ABBREVIATIONS:

CC	COOLING COIL (DX)
CS	CONTROL SECTION
EH	ELECTRIC HEATING COIL
FS	FILTER SECTION
HGRH	HOT GAS REHEAT
SF	SUPPLY FAN

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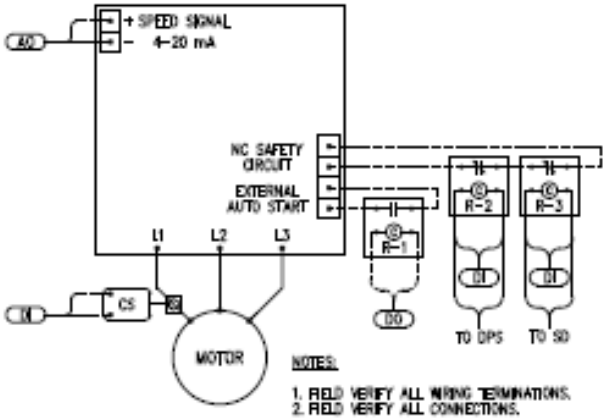
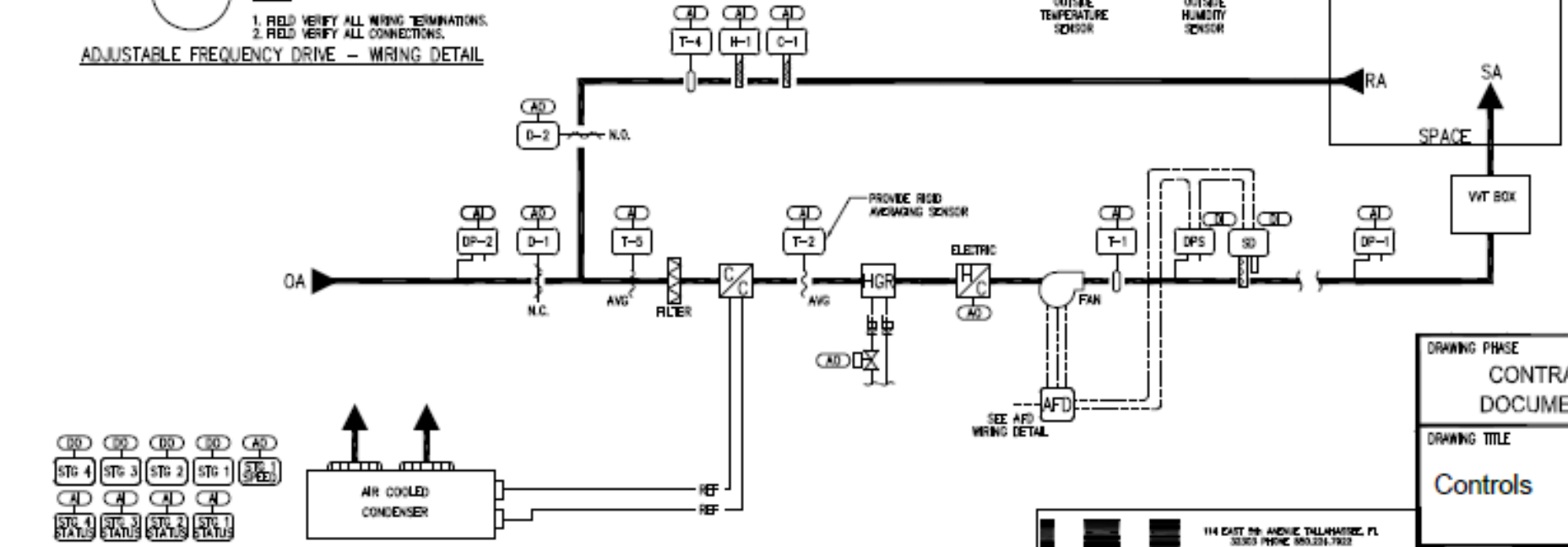
CONTROLS - HIGH PERCENTAGE OUTSIDE AIR SPLIT SYSTEM AIR CONDITIONER



ADJUSTABLE FREQUENCY DRIVE – WIRING DETAIL

FAN:

1. FAN (EF-9.1): ENABLE FAN BASED ON OCCUPIED SCHEDULE.
2. ALARM: IF STATUS IS NOT PROVEN AFTER A TIME DELAY, THEN PROVIDE ALARM MESSAGE AT OPERATOR INTERFACE AND CHANGE STATUS TO 'FAILED'.



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CONTROLS - HIGH PERCENTAGE OUTSIDE AIR SPLIT SYSTEM AIR CONDITIONER

AHUs#1				POINT TYPE							SETPOINTS			ALARM CONDITION			SCHEM. DESIG.	NOTES
SHORT NAME	POINT DESCRIPTION		UNITS	ANALOG IN	ANALOG OUT	DIGITAL IN	DIGITAL OUT	VIRT	INTEG POINT	ACU	INIT	HIGH	LOW	EQUIP ALARM	HIGH LIMIT	LOW LIMIT		
bbb_AHUxx_OCC_MODE	OCCUPIED MODE STATUS		ON/OFF					X										
bbb_AHUxx_OPT_MODE	OPTIMAL START STATUS		ON/OFF					X										
bbb_AHUxx_UNO_MODE	UNOCCUPIED MODE STATUS		ON/OFF					X										
bbb_AHUxx_DEH_MODE	DEHUMIDIFICATION MODE STATUS		ON/OFF					X										
bbb_AHUxx_SF_SS	SUPPLY FAN START/STOP		ON/OFF				X											
bbb_AHUxx_SF_S	SUPPLY STATUS		ON/OFF			X												
bbb_AHUxx_SF_SPD	SUPPLY FAN SPEED		%		X													
bbb_AHUxx_SF_SPD_MIN	SUPPLY FAN MINIMUM SPEED SETPOINT		%					X		X	30							
bbb_AHUxx_SF_AL	SUPPLY FAN STATUS ALARM		ON/OFF					X						X				
bbb_AHUxx_SF_HND	SUPPLY FAN IN HAND		ON/OFF					X						X				
bbb_AHUxx_SF_HZ	SUPPLY FAN AFD HERTZ		HZ						X									
bbb_AHUxx_SF_KW	SUPPLY FAN AFD DEMAND		KW						X									
bbb_AHUxx_SF_AL_AFD	SUPPLY FAN AFD ALARM		ON/OFF						X					X				
bbb_AHUxx_SF_DP	SUPPLY DISCHARGE STATIC PRESSURE		INWG	X													DP-1	
bbb_AHUxx_SF_DP_SP	SUPPLY DISCHARGE STATIC PRESSURE SETPOINT		INWG					X		X	0.9	1.5	0.5					
bbb_AHUxx_VAV_D_P_SP	MAX VAV DAMPER POSITION		%					X										(2)
bbb_AHUxx_VAV_D_P_SP	MAX VAV DAMPER POSITION SETPOINT		%					X		X	99							
bbb_AHUxx_VAV_TD	MAX VAV TIME DELAY		MIN					X		X	5							
bbb_AHUxx_VAV_2D_P_SP	2ND MAX VAV DAMPER POSITION SETPOINT		%					X		X	75							
bbb_AHUxx_RA_T	SUPPLY AIR TEMPERATURE		DEG F	X							55						T-1	
bbb_AHUxx_HPS_S	HIGH PRESSURE SWITCH STATUS		ON/OFF			X								X			DPS	
bbb_AHUxx_SD_S	SMOKE DETECTOR STATUS		ON/OFF			X								X			SD	
bbb_AHUxx_RA_T	RETURN AIR TEMPERATURE		DEG F	X													T-4	
bbb_AHUxx_RA_T_SP	RETURN AIR TEMPERATURE SETPOINT		DEG F					X		X	72							
bbb_AHUxx_RA_H	RETURN AIR RELATIVE HUMIDITY		%RH	X													H-1	
bbb_AHUxx_RA_C	RETURN AIR CO2		PPM	X													C-1	
bbb_AHUxx_OA_D	OUTSIDE AIR DAMPER		%OPEN		X												D-1	
bbb_AHUxx_RA_D	RETURN AIR DAMPER		%OPEN		X												D-2	
bbb_AHUxx_MA_T	MIXED AIR TEMPERATURE		DEG F	X													T-5	AVERAGING
bbb_AHUxx_OA_FLO_DP	OUTDOOR AIR FLOW STATIC PRESSURE		INWG	X										X	+20%	-20%	DP-2	
bbb_AHUxx_OA_FLO_DP_SP	OUTDOOR AIR FLOW STATIC PRESSURE SETPOINT		INWG					X		X	NOTE							(3)
bbb_AHUxx_CC_T	COOLING COIL LEAVING AIR TEMPERATURE		DEG F	X													T-2	AVERAGING
bbb_AHUxx_CC_T_SP	COOLING COIL LEAVING AIR TEMPERATURE SETPOINT		DEG F					X		X	55							
bbb_AHUxx_C_SS	COMPRESSOR 1 START/STOP		ON/OFF				X							X				
bbb_AHUxx_C_S	COMPRESSOR 1 STATUS		ON/OFF	X														
bbb_AHUxx_C_SPD	COMPRESSOR 1 SPEED		%		X													
bbb_AHUxx_C2_SS	COMPRESSOR 2 START/STOP		ON/OFF				X							X				
bbb_AHUxx_C2_S	COMPRESSOR 2 STATUS		ON/OFF	X														
bbb_AHUxx_C3_SS	COMPRESSOR 3 START/STOP		ON/OFF				X							X				
bbb_AHUxx_C3_S	COMPRESSOR 3 STATUS		ON/OFF	X														
bbb_AHUxx_C4_SS	COMPRESSOR 4 START/STOP		ON/OFF				X							X				
bbb_AHUxx_C4_S	COMPRESSOR 4 STATUS		ON/OFF	X														
bbb_AHUxx_HGR_V	HOT GAS REHEAT VALVE		%OPEN		X													
bbb_AHUxx_HGR_V_SP	HOT GAS REHEAT VALVE SETPOINT		DEG F					X		X	72						T-1	
bbb_AHUxx_EH	ELECTRIC HEAT START/STOP		ON/OFF				X											
bbb_AHUxx_EH_C	ELECTRIC HEAT CONTROLLER (SCR)		%		X													
bbb_AHUxx_EH_SP	HEATING SETPOINT DEADBAND		DEG F					X		X	5						T-1	
bbb_AHUxx_OA_T	OUTSIDE AIR TEMPERATURE SENSOR		DEG F	X													T-3	
bbb_AHUxx_OA_H	OUTSIDE AIR HUMIDITY SENSOR		%RH	X													H-2	
bbb_AHUx_EF_SS	EXHAUST FAN START/STOP		ON/OFF				X											
bbb_AHUx_EF_S	EXHAUST FAN STATUS		ON/OFF			X								X				

NOTES:

(1) REPLACE "bbb" IN SHORT NAME WITH BUILDING NUMBER AND "x" WITH RTU NUMBER

(2) SLIDING AVERAGE - 5MIN. SAMPLE EVERY 1 MIN.

(3) COORDINATE WITH TEST AND BALANCE CONTRACTOR FOR STATIC PRESSURE SETPOINT AT SCHEDULE OUTSIDE AIR FLOW.

ABBREVIATIONS

AI	ANALOG INPUT
AO	ANALOG OUTPUT
AVG	AVERAGING SENSOR
C	RELAY COIL
C/C	COOLING COIL
CWP	CONDENSER WATER PUMP
CNT	CONTACTOR
CS	CURRENT SWITCH
D	DAMPER
DI	DIGITAL INPUT
DO	DIGITAL OUTPUT
DP	DIFFERENTIAL PRESSURE SENSOR / TRANSMITTER
EA	EXHAUST AIR
EF	EXHAUST FAN
ES	END SWITCH
F	FLOW SENSOR / TRANSMITTER
FS	FLOW SWITCH
H/C	HEATING COIL
H	HUMIDITY SENSOR
LAN	LOCAL AREA NETWORK
M	ELECTRIC MOTOR
N.C.	NORMALLY CLOSED
N.O.	NORMALLY OPEN
OA	OUTSIDE AIR
R	RELAY
RA	RETURN AIR
SA	SUPPLY AIR
SD	SMOKE DETECTOR
SF	SUPPLY FAN
S/S	START / STOP
T	TEMPERATURE SENSOR / TRANSMITTER
CV	VALVE
----	24V CONTROL WIRING
——	120V CONTROL WIRING

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SEQUENCE OF OPERATION (AHU-9.1):

1. GENERAL

   a. THE UNIT SHALL BE CONTROLLED BY A STAND-ALONE BUILDING OR ADVANCED APPLICATION CONTROLLER. SEQUENCE OF OPERATION SHALL NOT RELY ON A COMMUNICATION INTERFACE WITH A REMOTE PANEL; ALL CONTROL LOGIC SHALL RESIDE IN CONTROL PANEL SERVING EQUIPMENT. THE CONTROLLER SHALL BE MOUNTED INSIDE THE UNIT AND SHALL HAVE A VISUAL DISPLAY.

   b. THE UNIT CONTROLLER SHALL RESIDE ON A PEER-TO-PEER BUILDING LEVEL NETWORK AS DEFINED IN ARTICLE 2.2 'COMMUNICATIONS' OF SPECIFICATION 230900.

2. RUN CONDITIONS

   a. OCCUPIED MODE: ENABLE THE SPLIT SYSTEM BASED ON A USER DEFINABLE OCCUPIED TIME SCHEDULE.

   b. UNOCCUPIED MODE: WHEN ENABLED IN UNOCCUPIED MODE, OUTSIDE AIR DAMPER SHALL REMAIN CLOSED AND ASSOCIATED EXHAUST FANS SHALL BE DISABLED.

      1) TEMPERATURE CONTROL: IF UNOCCUPIED COOLING MODE OF OPERATION IS INITIATED FROM ANY TERMINAL UNIT ASC; THEN ENABLE THE SUPPLY FAN AND TEMPERATURE CONTROL. THE OUTSIDE AIR DAMPER SHALL REMAIN CLOSED.

      2) HUMIDITY CONTROL: IF AVERAGE SPACE HUMIDITY RISES ABOVE SETPOINT DURING UNOCCUPIED HOURS; THEN ENABLE UNIT UNTIL SPACE HUMIDITY IS BELOW SETPOINT MINUS A DEADBAND. THE OUTSIDE AIR DAMPER SHALL REMAIN CLOSED.

      3) OPTIMAL START: THE BAS SHALL CALCULATE THE DURATION OF OPERATION PRIOR TO OCCUPIED SCHEDULE TO START THE UNIT SO SPACE TEMPERATURES REACH SETPOINT BY SCHEDULED START TIME. OUTSIDE AIR DAMPERS AND ASSOCIATED EXHAUST FANS SHALL REMAIN CLOSED/OFF DURING OPTIMAL START MODE.

3. SUPPLY FAN

   c. START/STOP: START/STOP OF THE SUPPLY FAN SHALL BE CONTROLLED THROUGH THE H-O-A SWITCH ON THE ADJUSTABLE FREQUENCY DRIVE (AFD). ENABLE THE SUPPLY FAN BASED ON AN OCCUPIED TIME SCHEDULE, INTERLOCKS OR UNOCCUPIED OVERRIDES.

   d. STATUS: SUPPLY FAN OPERATION SHALL BE PROVED THROUGH A CURRENT SWITCH. UPON FAILURE, THE BAS SHALL ANNUNCIATE ONE OF THE FOLLOWING ALARMS (MANUAL RESET):

      1) SUPPLY FAN FAILURE: IF THE FAN IS COMMANDED ON, BUT THE STATUS IS OFF.

      2) SUPPLY FAN IN HAND MODE: IF THE FAN IS COMMANDED OFF, BUT THE STATUS IS ON.

   f. SPEED: ONCE ENABLED; THE AFD SHALL RAMP THE SUPPLY FAN SPEED TO OPERATING SETPOINT OVER A 60 SECOND TIME DELAY (PROGRAM RAMP TIME IN AFD).

      1) SUPPLY AIR STATIC PRESSURE CONTROL: MODULATE SUPPLY FAN SPEED TO MAINTAIN A DUCT STATIC PRESSURE SETPOINT. STATIC PRESSURE SHALL BE MEASURED BY A SENSOR LOCATED APPROXIMATELY 2/3 DOWN THE LONGEST DUCT RUN OR AS INDICATED ON THE DRAWINGS. WHERE MULTIPLE SENSORS ARE INDICATED, POLL ALL SENSORS AND CONTROL TO THE MINIMUM READING.

         d) STATIC PRESSURE RESET: CONTINUOUSLY POLL ALL OF THE VARIABLE VOLUME TERMINALS SERVED BY THE AIR HANDLING UNIT AND CALCULATE SEPARATE SLIDING WINDOW AVERAGES FOR THE MAXIMUM 3 DAMPER POSITIONS. RESET THE STATIC PRESSURE SETPOINT BASED ON THE MAXIMUM DAMPER POSITION. IF THE MAXIMUM DAMPER POSITION IS GREATER THAN SETPOINT FOR A MINIMUM TIME DELAY WHILE THE 2ND MAXIMUM DAMPER POSITION IS LESS THAN THE 2ND MAXIMUM SETPOINT, THEN REMOVE THE MAXIMUM DAMPER READING FROM THE CALCULATION. IF COMMUNICATION BETWEEN THE TERMINAL UNIT ASCS AND THE AIR HANDLING UNIT AAC IS FAILED, THEN REVERT TO A DEFAULT VALUE.

4. OUTSIDE AIR DAMPER:

   a. ENABLE/DISABLE: IF THE SUPPLY FAN IS ENABLED DURING OCCUPIED HOURS; THEN MODULATE THE OUTSIDE AIR DAMPER TO MAINTAIN THE OUTSIDE AIR FLOW STATIC SETPOINT. IF THE SUPPLY FAN IS ENABLED DURING UNOCCUPIED HOURS OR IS SHUT DOWN; THEN CLOSE THE OUTSIDE AIR DAMPER. COORDINATE STATIC PRESSURE SETPOINT WITH TEST AND BALANCE CONTRACTOR.

5. RETURN AIR DAMPER:

   a. ENABLE/DISABLE: IF THE OUTSIDE AIR DAMPER POSITION IS GREATER THAN 95% OPEN FOR A MINIMUM TIME DELAY AND IF OUTSIDE AIR FLOW STATIC IS BELOW SETPOINT; THEN MODULATE RETURN AIR DAMPER TO MAINTAIN OUTSIDE AIR FLOW STATIC SETPOINT.

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6. COMPRESSORS
   a. ENABLE/DISABLE: IF THE SUPPLY FAN IS ON; THEN ENABLE THE COMPRESSORS. IF THE SUPPLY FAN IS OFF; THEN DISABLE THE COMPRESSORS.
   b. TEMPERATURE CONTROL: MODULATE THE VARIABLE SPEED COMPRESSOR TO MAINTAIN COOLING COIL LEAVING AIR TEMPERATURE SETPOINT.
   c. COMPRESSOR SEQUENCING: COMPRESSORS SHALL BE SEQUENCED TO MAINTAIN TEMPERATURE SETPOINT (BASED ON OPERATING MODE).
      1) COMPRESSOR ADD: IF THE VARIABLE SPEED COMPRESSOR IS OPERATING AT MAXIMUM SPEED AND THE TEMPERATURE IS ABOVE OR BELOW SETPOINT (BASED ON OPERATING MODE), THEN STAGE THE LAG COMPRESSOR ON. MODULATE THE VARIABLE SPEED COMPRESSOR TO MAINTAIN THE TEMPERATURE SETPOINT.
      2) COMPRESSOR SUBTRACT: IF MORE THAN ONE COMPRESSOR IS OPERATING, THE VARIABLE SPEED COMPRESSOR IS AT MINIMUM SPEED, AND THE TEMPERATURE IS ABOVE OR BELOW SETPOINT, THEN STAGE THE LAG COMPRESSOR OFF. MODULATE THE VARIABLE SPEED COMPRESSOR TO MAINTAIN THE TEMPERATURE SETPOINT.
7. ELECTRIC REHEAT
   a. ENABLE/DISABLE: IF THE SUPPLY FAN IS ENABLED; THEN ENABLE ELECTRIC HEAT.
   b. TEMPERATURE CONTROL: MODULATE ELECTRIC HEATING COIL TO MAINTAIN A LEAVING AIR TEMPERATURE SETPOINT MINUS A DEADBAND.
8. HOT GAS REHEAT
   a. ENABLE/DISABLE: IF THE SUPPLY FAN IS ON AND AT A MINIMUM SPEED; THEN ENABLE HOT GAS REHEAT VALVE. IF THE SUPPLY FAN IS OFF; THEN DISABLE HOT GAS HEAT VALVE.
   b. TEMPERATURE CONTROL: MODULATE HOT GAS REHEAT VALVE TO MAINTAIN A RETURN AIR TEMPERATURE SETPOINT.
9. SAFTIES
   a. SMOKE DETECTOR(S): SMOKE DETECTOR(S) ARE PROVIDED BY OTHERS BUT SHALL BE WIRED TO AN AUXILIARY CONTACT ON THE AFD TO SHUT DOWN THE AIR HANDLER FAN(S) UPON DETECTION OF SMOKE.
   b. HIGH PRESSURE LIMIT: PROVIDE A PRESSURE SWITCH AT THE SUPPLY FAN DISCHARGE, WIRED TO AN AUXILIARY CONTACT ON THE AFD. IF STATIC PRESSURE EXCEEDS 3.0 IN. W.G, THE SWITCH SHALL OVERRIDE ALL CONTROLS AND SHUT DOWN THE UNIT.

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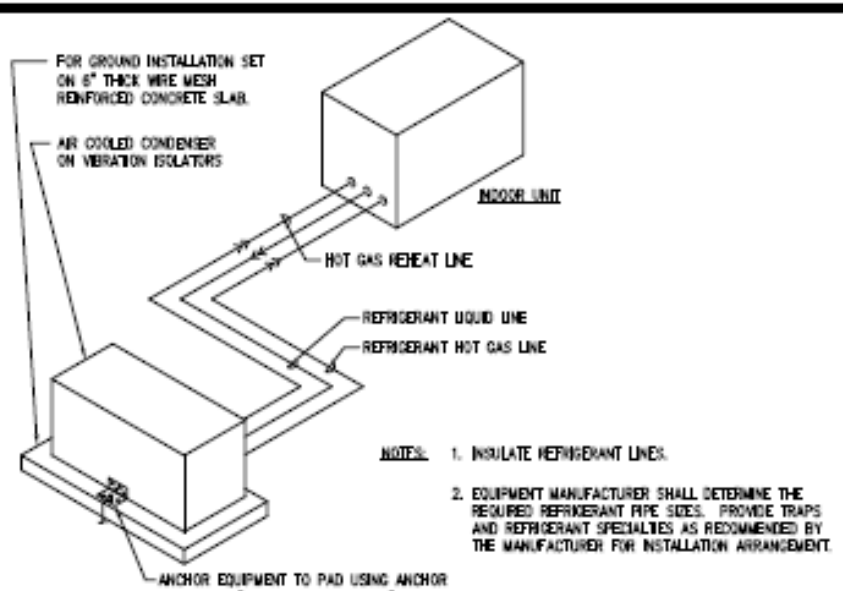
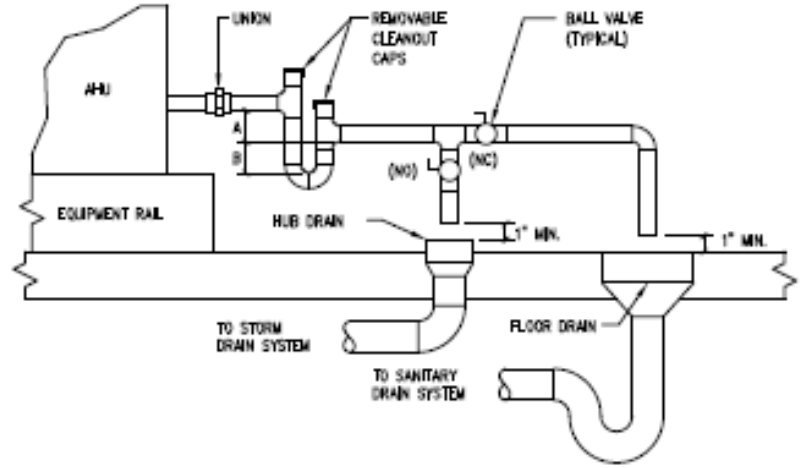


B REFRIGERANT PIPING SCHEMATIC



NOTES:

1. DRAIN LINE SHALL BE AT LEAST THE SAME SIZE AS THE CONNECTION ON THE DRAIN PAN (1" MIN.)
2. DRAIN LINE SHALL SLOPE 1/8" PER FOOT (MIN.)
3. SEE SPECIFICATIONS FOR PIPE AND INSULATION MATERIALS.

UNIT TYPE	A	B
DRAW-THRU	X PLUS 2"	X
BLOW-THRU	1" MIN.	2X

WHERE X=STATIC PRESSURE IN PAN

A CONDENSATE DRAIN

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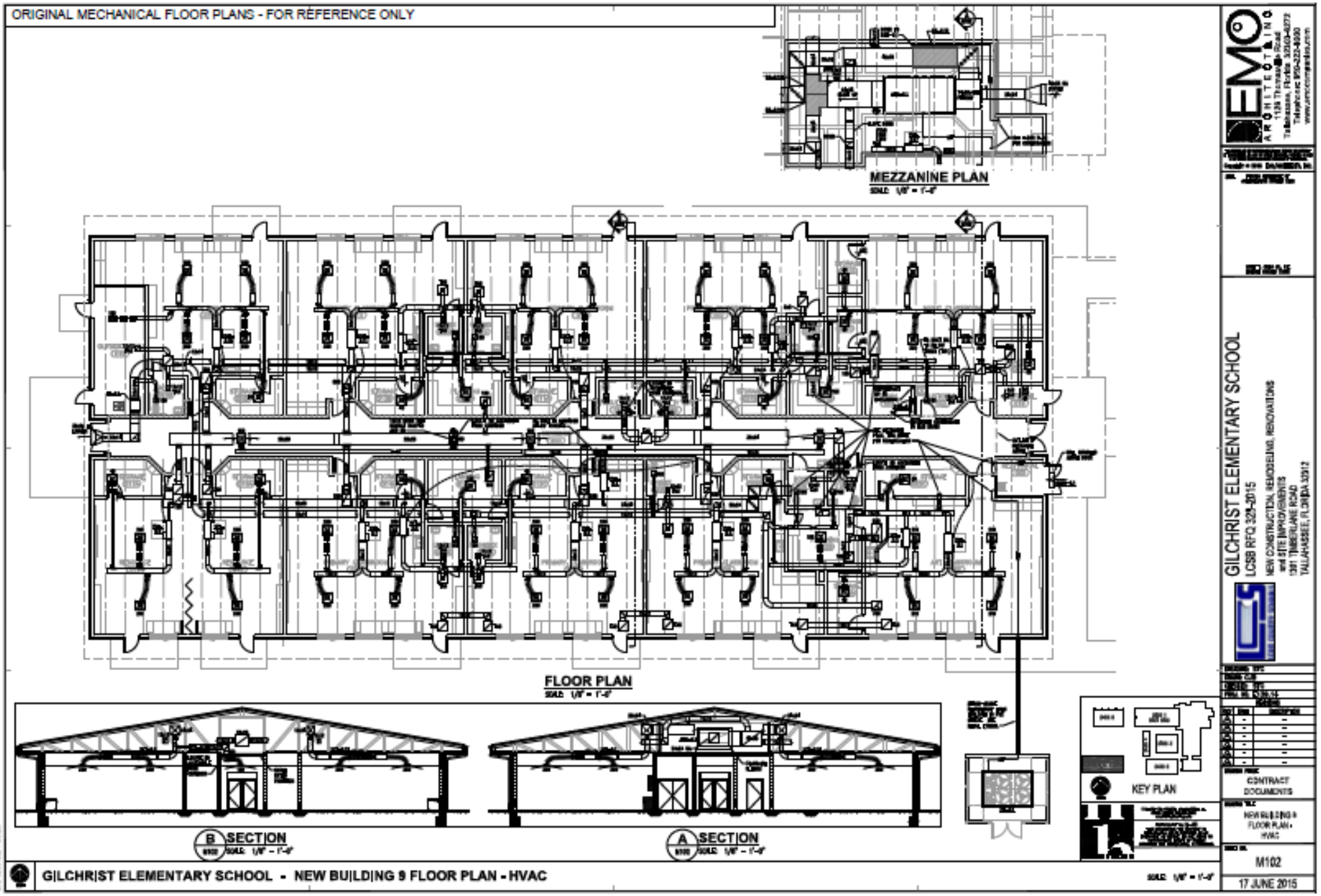
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MEZZANINE PLAN
FLOOR PLAN
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A SECTION
KEY PLAN
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