SPECIFICATIONS

FOR

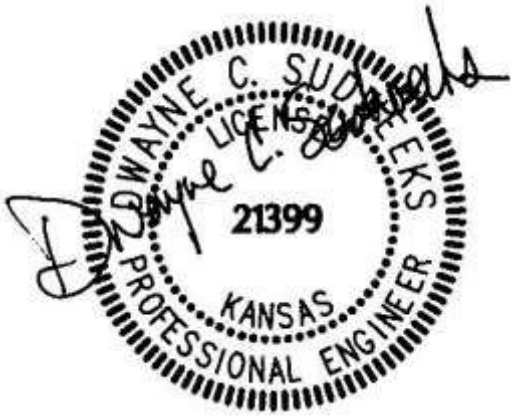
HVAC UPGRADES FOR

LDS ARKANSAS CITY KS BRANCH

Derby Kansas Stake

Property #502-7845
6582 322nd Rd.
Arkansas City, Kansas 67005

April 2016



Prepared
by

Engineered Systems Associates, Inc.
1355 East Center
Pocatello, Idaho 83201
208-233-0501

INDEX

INVITATION TO BID

1. CONTRACTORS INVITED TO BID THE PROJECT:

- Even Temp
- Hanna Heating & A/C
- Waldorf-Riley Heating and Cooling

2. PROJECT:

LDS Arkansas City, KS 2016 HVAC

3. LOCATION:

6582 322nd Rd
Arkansas City, Kansas 67005

4. OWNER:

Corporation of the Presiding Bishop of
The Church of Jesus Christ of Latter-day Saints,
A Utah Corporation Sole
50 East North Temple Street
Salt Lake City, Utah 84150

5. CONSULTANT:

Dwayne Sudweeks
Engineered Systems Associates, Inc.
1355 East Center
Pocatello, Idaho 83201

6. DESCRIPTION OF PROJECT:

A. Replace existing 80% gas furnace and duct furnace with new, replace existing R22 condensing units and cooling coils with new, and associated work.

7. TYPE OF BID: Bids will be on a lump-sum basis. Segregated bids will not be accepted.

8. TIME OF SUBSTANTIAL COMPLETION: The time limit for substantial completion of this Work will be 60 calendar days and will be as noted in the Agreement.

9. PRE-BID WALK-THRU: There will be a walk-thru of the project on April 7, 2016 at 9:00am. Attendance is mandatory.

10. BID OPENING: Sealed bids must be received no later than April 21, 2016 at 1:00pm at the Wichita FM Group Office (1201 Grand View Ave., Newton, KS) which time the sealed bids will be opened and read. (Please submit proposals by mail or in person. Faxed proposals cannot be considered.)

11. BIDDING DOCUMENTS:

A. Bidding Documents are available to invited Contractors.

12. BIDDER'S QUALIFICATIONS: Bidding by the Contractors will be by invitation only.

13. OWNER'S RIGHT TO REJECT BIDS: Owner reserves the right to reject any or all bids and to waive any irregularity therein.

END OF DOCUMENT

INSTRUCTIONS TO BIDDERS

1. DOCUMENTS:

A. Bidding Documents include Bidding Requirements and proposed Contract Documents. Proposed Contract Documents consist of:
   1. Contractor's Bid Proposal and Maintenance Project Agreement
   2. Other documents included by reference
   3. Addenda.

B. Bidding Requirements are those documents identified as such in proposed Project Manual.

C. Addenda are written or graphic documents issued prior to execution of the Contract which modify or interpret the Bidding Documents. They become part of the Contract Documents as noted in the Contractor's Bid Proposal and Maintenance Project Agreement upon execution of the Agreement by Owner.

2. BIDDER'S REPRESENTATIONS:

A. By submitting a bid proposal, bidder represents that
   1. Bidder has carefully studied and compared Bidding Documents with each other. Bidder understands the Bidding Documents and the bid is fully in accordance with the requirements of those documents,
   2. Bidder has thoroughly examined the site and any building located thereon, has become familiar with local conditions which might directly or indirectly affect contract work, and has correlated its personal observations with requirements of proposed Contract Documents, and
   3. Bid is based on materials, equipment, and systems required by Bidding Documents without exception.

3. BIDDING DOCUMENTS:

A. Copies
   1. Owner will provide the Bidding Documents as set forth in the Invitation to Bid.
   2. Partial sets of Bidding Documents will not be issued.

B. Interpretation Or Correction Of Bidding Documents
   1. Bidders will request interpretation or correction of any apparent errors, discrepancies, and omissions in the Bidding Documents.
   2. Corrections or changes to Bidding Documents will be made by written Addenda.

C. Substitutions And Equal Products
   1. Equal products may be approved upon compliance with Contract Document requirements.
   2. Base bid only on materials, equipment, systems, suppliers or performance qualities specified in the Bidding documents.
   3. Where a specified product is identified as a "quality standard", products of other manufacturers that meet the performance, properties, and characteristics of the specified "quality standard" may be used without specific approval as a substitute.

D. Addenda. Addenda will be sent to bidders and to locations where Bidding Documents are on file no later than one week prior to bid opening or by fax no later than 48 hours prior to bid opening.

4. BIDDING PROCEDURES:

A. Form And Style Of Bids
   1. Use Owner's Bid Form titled "Contractor's Bid Proposal And Maintenance Project Agreement".

2. Bid will be complete and executed by authorized representative of Bidder.
3. Do not delete from or add to the information requested on bid form.

B. Submission of Bids
1. Submit bid in sealed opaque envelope containing only bid form.
2. It is bidder's sole responsibility to see that its bid is received at or before the specified time. Bids received after specified bid opening time may be returned to bidders unopened.
3. No oral, facsimile transmitted, telegraphic, or telephonic bids, modifications, or cancellations will be considered.

D. Modification Or Withdrawal Of Bid
1. Bidder guarantees there will be no revisions or withdrawal of bid amount for 45 days after bid opening.
2. Prior to bid opening, bidders may withdraw bid by written request or by reclaiming bid envelope.
3. Prior to bid opening, bidder may mark and sign on the sealed envelope that bidder acknowledges any or all Addenda.

5. CONSIDERATION OF BIDS:

A. Opening Of Bids - Sealed bids shall be received no later than 1:00PM on April 21, 2016 at the Wichita FM Group Office (1201 Grand View Ave., Newton, KS) at which time they will be opened and read out loud.

B. Acceptance Of Bid
1. No bidder will consider itself under contract after opening and reading of bids until Owner accepts Contractor's Bid Proposal by executing same.
2. Bidder's past performance, organization, subcontractor selection, equipment, and ability to perform and complete its contract in manner and within time specified, together with amount of bid, will be elements considered in award of contract.

6. FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR:

A. Agreement form will be "Contractor's Bid Proposal and Maintenance Project Agreement" provided by Owner.

7. MISCELLANEOUS:

A. Pre-Bid Conference. There will be a walk-thru of the project on April 7, 2016 at 9:00am. Attendance is mandatory.

END OF DOCUMENT

SUBCONTRACTORS AND MAJOR MATERIALS SUPPLIERS LIST

Project Name: _____ Date:_____

Stake: _____ Project No: _____

General Contractor: _____

General Contractor is to provide the names of the following subcontractors and suppliers to the Church Project Manager immediately following the bid opening:

VMR SUBCONTRACTORS

Roofing _____

Doors, Frames & Hardware _____

Storefronts _____

Wood Flooring _____

Other _____

Other _____

SUBCONTRACTORS AND SUPPLIERS

Grading / Site work _____

Site Utilities _____

Demolition _____

Paving _____

Termite Control _____

Site Concrete _____

Fencing _____

Irrigation System _____

Landscaping _____

Building Concrete _____

Masonry _____

Structural Steel _____

Framing _____

Trusses _____

Insulation _____

EIFS _____

Soffit / Fascia _____

Steeple _____

Millwork _____

Drywall _____

Ceramic Tile _____

Acoustical Tile _____

Painting _____

Wall Coverings _____

Elevators / Lifts _____

Draperies _____

Fire Sprinklers _____

Plumbing _____

HVAC _____

Electrical _____

Controls _____

Sound / Satellite _____

EQUAL PRODUCT APPROVAL REQUEST FORM

Project Name: LDS Arkansas City, KS 2016 HVAC Number: #502-7845

TO: _____

FROM: _____

BID DATE: _____

A proposed product is not legally approved and cannot legally be included in a bid or used in the Work until it appears in an Addendum or other Contract Modification as defined in the General Conditions. See Instructions To Bidders Paragraph 3,C, General Conditions, and Section 016000.

PROPOSED EQUAL PRODUCT:

Specification Section: _____

Specified Products: _____

Proposed Product: _____

The Undersigned certifies:

1. Proposed equal product has been fully investigated and determined to be equal or superior in all respects to specified products.
2. Same warranty will be furnished for proposed equal product as for specified products.
3. Same maintenance service and source of replacement parts, as applicable, is available.
4. Proposed equal product will have no adverse effect on other trades and will not affect or delay progress schedule.
5. Proposed equal product does not affect dimensions and functional clearances.

ATTACHMENTS:

Include the following attachments -

1. Copy of the Project Manual Section where the proposed equal product would be specified, rewritten or red-lined to include any changes necessary to correctly specify the proposed equal product. Identify completely changes necessary to the original Project Manual Section.
2. Copies of details, elevations, cross-sections, and other elements of the Project Drawings redone as necessary to show changes necessary to accommodate proposed equal product. Identify completely the changes from the original Drawings.
3. Complete product literature and technical data, installation and maintenance instructions, test results, and other information required to show complete conformance with requirements of the Contract Documents.

SIGNED: _____

Company _____

Address _____

City, State, Zip _____

Telephone _____ FAX _____

REVIEW COMMENTS:

_____ Accepted. See Addenda Number _____.

_____ Submission Not In Compliance With Instructions. Respond to attached comments and resubmit.

_____ Proposed Equal Product Not Acceptable. Use specified products.

_____ Not Reviewed. Submission received too late. Use specified products.

ADDITIONAL COMMENTS:

BY: _____ **DATE:** _____

CONSTRUCTION MATERIAL ASBESTOS STATEMENT (U.S.)

Project Name: LDS Arkansas City, KS 2016 HVAC

Project Type: HVAC

Building Address: 6582 322nd Rd, Arkansas City, KS 67005

Owner: Corporation of the Presiding Bishop of the Church of Jesus Christ of Latter-days Saints, a Utah corporation sole

Property Number: #502-7845

Completion Date: _____

As CONSULTANT and principal in charge; based on my best knowledge, information, inspection, and belief; I certify that on the above referenced Project, no asbestos containing building materials were specified in the construction documents or given approval in shop drawings or submittals.

Date _____ Consultant and Principal in charge

_____
Company Name

As GENERAL CONTRACTOR in charge of construction; based on my best knowledge, information, inspection, and belief; I certify that on the above referenced building, no asbestos containing building materials were used in the construction.

Date _____ General Contractor in charge

_____
Company Name

S U P P L E M E N T A R Y C O N D I T I O N S

MAINTENANCE PROJECT AGREEMENT (U.S.)

ITEM 1 - GENERAL

1. Conditions of the Contract apply to each Division of the Specifications.
2. Provisions contained in Division 01 apply to all other Divisions of the Specifications.

ITEM 2 - LIQUIDATED DAMAGES PAYABLE TO OWNER:

Delay in Completion of the Work. For each day after the expiration of the designated Time of Completion that Contractor has not completed the Work, Contractor will pay Owner the amount of FIFTY dollars ($50.^{00}$) per day as liquidated damages for Owner's loss of use and the added administrative expense to Owner to administer the Project during the period of delay. In addition, Contractor will reimburse Owner for any additional Architect's fees, attorneys' fees, expert fees, consultant fees, copy costs, and other expenses incurred by Owner as a result of the delay. Owner may deduct any liquidated damages or reimbursable expenses from any money due or to become due to Contractor. If the amount of liquidated damages and reimbursable expenses exceeds any amounts due to Contractor, Contractor will pay the difference to Owner within ten (10) days after receipt of a written request from Owner for payment.

ITEM 3 - KANSAS STATE SALES TAX:

Exemption from State Sales Tax.

a. Upon obtaining a certificate of tax exemption for the project, an exemption from Kansas state sales tax should be allowed for tangible personal property and services purchased by Contractor for the project. Purchases of construction machinery, equipment or tools for the project are not exempt but rather are subject to state sales tax.
b. Prior to beginning work on the project, Contractor will assist Owner in making a timely application to the State for a certificate of tax exemption for the project. After the certificate of tax exemption is obtained from the State, Contractor will furnish the number of the certificate to all suppliers from whom it makes purchases; and all such suppliers shall execute invoices covering the items purchased bearing the number of such certificate. In addition, upon completion of the project, Contractor will timely furnish to Owner a sworn statement (on the form provided by the Kansas Director of Taxation) that all purchases made under such exemption certificate were entitled to the tax exemption. All invoices for such tax exempt purchases shall be held by Contractor for a period of five years.

END OF DOCUMENT

CONTRACTOR BID PROPOSAL AND MAINTENANCE PROJECT AGREEMENT

Corporation of the Presiding Bishop of The Church of Jesus Christ of Latter-day Saints, a Utah corporation sole, ("Owner") and the undersigned Contractor ("Contractor") hereby agree as follows:

1. **Project Site.**

   Property Number: 502-7845
   Address: 6582 322nd Rd., Arkansas City, KS 67005
   Project Type: HVAC
   Project Name: LDS Arkansas City, KS 2016 HVAC

2. **Scope of the Work.** Contractor will furnish all labor, materials, and equipment necessary to complete the Work in accordance with the Contract Documents. The Work is all labor, materials, equipment, construction, and services required by the Contract Documents.

3. **Contract Documents.** Contract Documents consist of:
   a. This Agreement;
   b. The Specifications (Division 01, 07, 23, and 26)
      c. Drawings entitled ME-1, ME-2, ME-3 dated April 2016.
   d. Addendum No. _____ dated _____; and
   e. All written Field Changes, written Construction Change Directives and written Change Orders when prepared and signed by Owner and Contractor.

4. **Compensation.** Owner will pay Contractor for performance of Contractor's obligations under the Contract Documents the sum of
   _____ Dollars

   ($)_____. This is the Contractor's Bid Proposal Amount.

5. **Payment.**
   a. If the Contractor's Bid Proposal Amount is over $50,000.00, Contractor will submit to Owner a schedule of values which allocates the Contractor's Bid Proposal Amount to various portions of the Work. This schedule, when accepted by Owner will be used as a basis for reviewing Contractor's payment requests.
   b. Not more than once each month, Contractor will submit a payment request to Owner. Owner will pay Contractor for work completed within thirty (30) days after Owner receives:
      (1) Contractor's payment request for work to date;
      (2) a certification by Contractor that Contractor has paid for all labor, materials, and equipment relating to the Work covered by prior payment requests and that Contractor will pay for all labor, materials, and equipment relating to the Work covered by the current payment request; and
      (3) releases of all mechanics' liens and claims of subcontractors, laborers, or material suppliers who supplied labor and/or materials for the Work covered by the payment request.
      Owner may modify or reject the payment request if, in Owner's opinion, the Work for which payment is requested is not acceptable or is less complete than represented on the payment request.

6. **Extras and Change Orders.** Owner may order changes in the Work by altering, adding to, or deducting from the Work. In the event of such a change, Contractor's compensation and/or the time of completion will be adjusted to reflect the change. Contractor will not commence work on any change until either: (a) Contractor and Owner have agreed in writing to the amount of the adjustment resulting from the change; or (b) Owner has issued an order for the change acknowledging that there is a dispute regarding the compensation adjustment relating to the change. If Contractor proceeds with a change in the Work without complying with the preceding sentence, Contractor agrees that it will not be entitled to any additional compensation for such change.

7. **Correction of Work.** Contractor will promptly correct, at its own expense,
   (a) any portion of the Work which
      1) fails to conform to the requirements of the Contract Documents, or
      2) is rejected by the Owner as defective or because it is damaged or rendered unsuitable during installation or resulting from failure to exercise proper protection.
   (b) any defects due to faulty materials, equipment, or workmanship which appear within a period of one year from the date of Substantial Completion or within such longer period of time as may be prescribed by law or the terms of any applicable special warranty required by the Contract Documents.

8. **Time of Completion.** Contractor will complete the Work and have it ready for Owner's inspection within sixty (60) calendar days from Notice to Proceed issued by Owner. Time is of the essence. If Contractor is delayed at any time in the progress of the Work by any act or neglect of Owner, or by changes in the Work, or by strikes, lockouts, unusual delay in transportation, unavoidable casualties, or acts of nature beyond Contractor's control, then the time for completion will be extended by the time that completion of the Work is delayed. However, Contractor expressly waives any damages for any such delays other than those delays willfully caused by Owner.

9. **Permits, Surveys, and Taxes.** Contractor will obtain and pay for all permits and licenses, and also pay any applicable taxes. Contractor will also obtain and pay for any surveys it needs to perform the Work. Contractor will conform to all ordinances and covenants governing the Project Site and/or Work.

10. **Compliance with Laws.** Contractor will comply with all applicable laws, ordinances, rules, regulations, and orders of any public authorities relating to performance of the Work.

11. **Payment of Subcontractors and Materialmen.** Contractor will promptly pay for all labor, materials, and equipment used to perform the Work.

12. **Contractor's Insurance.** Prior to performing any work, Contractor will obtain and maintain during the term of this Agreement: Commercial General Liability Insurance, Workers' Compensation Insurance, Automobile Liability Insurance, and Employers' Liability Insurance. In the event the Contractor's Bid Proposal Amount is over $100,000.00, Contractor's Commercial General Liability Insurance will meet the following additional requirements:
    a. Insurance Services Office (ISO) form *Commercial General (CG) 00 01 (11/93)* or an equivalent, occurrence policy with limits of not less than One Million Dollars ($1,000,000.00) per occurrence and Two Million Dollars ($2,000,000.00) in the aggregate.

b. Contractor's insurer will add the Owner as an additional insured on this policy using ISO endorsement *CG 2010 (10/93)* or its equivalent.

Automobile Liability Insurance will be for "any auto" for which Contractor may be legally responsible, and with not less than One Hundred Thousand Dollars ($100,000.00) combined single limit coverage. In the event the Contractor's Bid Proposal Amount is over $100,000.00, the required Automobile Liability insurance combined single limit coverage will be at least One Million Dollars ($1,000,000.00).

13. **Independent Contractor Relationship.** The parties expressly agree that Contractor is not an agent or employee of Owner but is an independent contractor solely responsible for all expenses relating to Contractor's business.
14. **Indemnity and Hold Harmless.**
    a. Contractor will indemnify and hold harmless Owner and Owner's representatives, employees, agents, architects, and consultants from and against any and all claims, damages, liability, demands, costs, judgments, awards, settlements, causes of action, losses and expenses (collectively "Claims" or "Claim"), including but not limited to attorney fees, consultant fees, expert fees, copy costs, and other expenses, arising out of or resulting from performance of the Work, attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of real or personal property, including loss of use resulting therefrom, except to the extent that such liability arises out of the negligence of Owner, its representatives, agents, and employees. This indemnity includes, without limitation, indemnification of Owner from all losses or injury to Owner's property, except to the extent that such loss or injury arises out of the negligence of Owner, its representatives, agents, and employees. This indemnity applies, without limitation, to include Claims occurring both during performance of the Work and/or subsequent to completion of the Work. In the event that any Claim is caused in part by a party indemnified hereunder, that party will bear the cost of such Claim to the extent it was the cause thereof. In the event that a claimant asserts a Claim for recovery against any party indemnified hereunder, the party indemnified hereunder may tender the defense of such Claim to Contractor. If Contractor rejects such tender of defense and it is later determined that the negligence of the party indemnified hereunder did not cause all of the Claim, Contractor will reimburse the party indemnified hereunder for all costs and expenses incurred by that party in defending against the Claim. Contractor will not be liable hereunder to indemnify any party for damages resulting from the sole negligence of that party.
    b. In addition to the foregoing, Contractor will be liable to defend Owner in any lawsuit filed by any Subcontractor relating to the Project. Where liens have been filed against Owner's property, Contractor (and/or its bonding company which has issued bonds for the Project) will obtain lien releases and record them in the appropriate county and/or local jurisdiction and provide Owner with a title free and clear from any liens of Subcontractors. In the event that Contractor and/or its bonding company are unable to obtain a lien release, Owner in its absolute discretion may require Contractor to provide a bond around the lien or a bond to discharge the lien, at Contractor's sole expense.
    c. In addition to the foregoing, Contractor will indemnify and hold Owner harmless from any claim of any other contractor resulting from the performance, nonperformance or delay in performance of the Work by Contractor.
    d. The indemnification obligation herein will not be limited by a limitation on the amount or type of damages, compensation or benefits payable by or for Contractor or a Subcontractor under worker's compensation acts, disability benefit acts, or other employee benefit acts.
15. **Resolution of Disputes.** In the event there is any dispute arising under the Contract Documents which cannot be resolved by agreement between the parties, either party may submit the dispute with all documentation upon which it relies to Director of Architecture, Engineering, and Construction, Physical Facilities Department, 50 East North Temple, Salt Lake City, Utah 84150, who will convene a dispute resolution conference within thirty (30) days. The dispute resolution conference will constitute settlement negotiations and any settlement proposal made pursuant to the conference will not be admissible as evidence of liability. In the event that the parties do not resolve their dispute pursuant to the dispute resolution conference, either party may commence legal action to resolve the dispute. Any such action must be commenced within six (6) months from the first day of the dispute resolution conference or be time barred. Submission of the dispute to the Director as outlined above is a condition precedent to the right to commence legal action to resolve any dispute. In the event that either party commences legal action to adjudicate any dispute without first submitting the dispute to the Director, the other party will be entitled to obtain an order dismissing the litigation without prejudice and awarding such other party any costs and attorneys fees incurred by that party in obtaining the dismissal, including without limitation copy costs, and expert and consultant fees and expenses.
16. **Termination of Agreement by Contractor.** In the event Owner materially breaches any term of the Contract Documents, Contractor will promptly give Written Notice of the breach to Owner. If Owner fails to cure the breach within ten (10) days of the Written Notice, Contractor may terminate the Agreement by giving Written Notice to Owner and recover from Owner the percentage of the Contract Sum represented by the Work completed on the Project site as of the date of termination together with any out of pocket loss Contractor has sustained with respect to materials and equipment as a result of the termination prior to completion of the Work, less any offsets. Contractor will not be entitled to unearned profits or any other compensation or damages as a result of the termination and hereby waives any claim therefor. Contractor will provide to Owner all warranty, as built, inspection, and other close out documents as well as materials that Contractor has in its possession or control at the time of termination. Without limitation, Contractor's indemnities and obligations as well as all warranties relative to Work provided through the date of termination survive a termination hereunder.
17. **Termination of Agreement by Owner for Cause.** Should Contractor make a general assignment for the benefit of its creditors, fail to apply enough properly skilled workmen or specified materials to properly prosecute the Work in accordance with Contractor's schedule, or otherwise materially breach any provision of the Contract Documents, then Owner may, without any prejudice to any other right or remedy, give Contractor Written Notice thereof. If Contractor fails to cure its default within ten (10) days, Owner may terminate this Agreement by giving Written Notice to Contractor, take possession of the premises and all materials, tools, and appliances thereon, and finish the Work by whatever method Owner deems expedient. In such case, Contractor will not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Sum exceeds the expense of finishing the Work, including compensation for additional administrative, architectural, consultant, and legal services (including without limitation attorneys fees, expert fees, copy costs, and other expenses), such excess will be paid to Contractor. If such expense exceeds the unpaid balance, Contractor will pay the difference to Owner. Contractor will provide to Owner all warranty, as built, inspection, and other close out documents as well as materials that Contractor has in its possession or

control at the time of termination. Without limitation, Contractor's indemnities and obligations as well as all warranties relative to Work provided through the date of termination survive a termination hereunder.

18. **Termination of Agreement by Owner for Convenience.** Notwithstanding any other provision contained in the Contract Documents, Owner may, without cause and in its absolute discretion, terminate the Agreement at any time. In the event of such termination, Contractor will be entitled to recover from Owner the percentage of the Contract Sum equal to the percentage of the Work which Owner and/or its architect determines has been completed on the Project site as of the date of termination together with any out of pocket loss Contractor has sustained with respect to materials and equipment as a result of the termination prior to completion of the Work, less any offsets. Contractor will not be entitled to unearned profits or any other compensation as a result of the termination and hereby waives any claim therefor. Contractor will provide to Owner all warranty, as built, inspection, and other close out documents as well as materials that Contractor has in its possession or control at the time of termination. Owner may, in Owner's sole discretion, take legal assignment of subcontracts and other contractual rights of Contractor. Without limitation, Contractor's indemnities and obligations as well as all warranties relative to Work provided through the date of termination survive a termination hereunder.
19. **Assignment of Contract.** The parties hereto will not assign any rights or obligations under this Agreement without the prior written consent of the other party.
20. **Integration Clause.** The Contract Documents reflect the full agreement of the parties with respect to the Project and the Work and supersede all prior discussions, agreements, and representations regarding the subject matter of the Contract Documents. The Contract Documents may be amended only in a written document signed by both parties hereto.
21. **Applicable Law.** The parties acknowledge that the Contract Documents have substantial connections to the State of Utah. The Contract Documents will be deemed to have been made, executed, and delivered in Salt Lake City, Utah. To the maximum extent permitted by law, (i) the Contract Documents and all matters related to their creation and performance will be governed by and enforced in accordance with the laws of the State of Utah, excluding conflicts of law rules, and (ii) all disputes arising from or related to the Contract Documents will be decided only in a state or federal court located in Salt Lake City, Utah and not in any other court or state. Toward that end, the parties hereby consent to the jurisdiction of the state and federal courts located in Salt Lake City, Utah and waive any other venue to which they might be entitled by virtue of domicile, habitual residence, place of business, or otherwise.
22. **Enforcement.** In the event either party commences legal action to enforce or rescind any term of the Contract Documents, the prevailing party will be entitled to recover its attorneys fees and costs, including without limitation all copy costs and expert and consultant fees and expenses, in that action and on all appeals, from the other party.
23. **Bid Proposal/Agreement.** Contractor's submission to Owner of this agreement signed by Contractor will constitute Contractor's offer and bid proposal to perform the Work described in this agreement according to the terms thereof. Owner's signing of this agreement and delivery to Contractor of the signed copy thereof will constitute acceptance of Contractor's offer and will convert this document to a binding agreement.
24. **Effective Date.** The effective date of this Agreement is the date indicated by the Owner's signature.

OWNER:	**CONTRACTOR:**
Corporation of the Presiding Bishop of The Church of Jesus Christ of Latter-day Saints, a Utah corporation sole,	company name
By:	By:
Designated Representative	Authorized Representative
Print Name: Andy Headley	Print Name
Address: Wichita Kansas FM Group 1201 Grand View Ave. Newton, Kansas 67114	Title: Address:
Telephone No: (318) 283-1620	Telephone No:
Fax No. (318) 283-5712	Fax No.
Effective Date:	Fed. I.D. or SSN: No
Reviewed by:	Date:

DIVISION 01: GENERAL REQUIREMENTS

DIVISION 07: THERMAL AND MOISTURE PROTECTION

END OF TABLE OF CONTENTS

SECTION 01 1100

SUMMARY OF WORK

1.1 WORK COVERED BY CONTRACT DOCUMENTS:

A. Provisions contained in Division 01 apply to Sections of Divisions 02 through 49 of Specifications. Instructions contained in Specifications are directed to Contractor. Unless specifically provided otherwise, obligations set forth in Contract Documents are obligations of Contractor.

B. Contractor will furnish total labor, materials, equipment, and services necessary to perform The Work in accordance with Contract Documents.

1.2 SCOPE OF WORK:

A. Replace existing 80% gas furnace and duct furnace with new, replace existing R22 condensing units and cooling coils with new, and associated work.

B. Products or systems may be provided under a Value Managed Relationship (VMRs) the Owner has negotiated with the supplier. VMR products and systems are indicated as such in the Specifications.

END OF SECTION

SECTION 01 1400

WORK RESTRICTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Work Restrictions.

1.2 PROJECT CONDITIONS

A. During construction period, Contractor will have use of premises for construction operations. Contractor will ensure that Contractor, its employees, subcontractors, and their employees comply with following requirements:
   1. Confine operations to areas within Contract limits shown on Drawings. Do not disturb portions of site beyond Contract limits.
   2. Do not allow alcoholic beverages, illegal drugs, or persons under their influence on Project site.
   3. Do not allow use of tobacco in any form on Project Site.
   4. Do not allow pornographic or other indecent materials on site.
   5. Do not allow work on Project site on Sundays except for emergency work.
   6. Refrain from using profanity or being discourteous or uncivil to others on Project Site or while performing The Work.
   7. Wear shirts with sleeves, wear shoes, and refrain from wearing immodest, offensive, or obnoxious clothing, while on Project Site.
   8. Do not allow playing of obnoxious and loud music on Project Site. Do not allow playing of any music within existing facilities.
   9. Do not build fires on Project Site.
   10. Do not allow weapons on Project Site, except those carried by law enforcement officers or other uniformed security personnel who have been retained by Owner or Contractor to provide security services.

B. Existing Facilities:
   1. Reasonably accommodate use of existing facilities by Owner.

C. Do not load or permit any part of the structure to be loaded with a weight that will endanger its safety. Questions of structural loading as part of construction means and methods shall be addressed by a licensed structural engineer engaged by Contractor, subject to the review by Architect.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 2900

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements to prepare and process Applications for Payments.

1.2 PAYMENT REQUESTS

A. Use Payment Request forms provided by Owner.

B. Each Payment Request will be consistent with previous requests and payments certified by Architect and paid for by Owner.

C. Request Preparation:
   1. Complete every entry on Payment Request form.
   2. Entries will match data on approved schedule of values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
   3. Submit signed Payment Request to Architect with current Construction Schedule.

D. Provide following submittals before or with submittal of Initial Payment Request:
   1. List of Subcontractors.
   2. Initial progress report.
   3. Contractor's Construction Schedule.
   4. Submittal Schedule.

E. Provide Affidavit of Contractor and Consent of Surety with Payment Request following Substantial Completion.

1.3 SCHEDULE OF VALUES

A. Submit schedule of values on Owner's standard form to Architect 20 days minimum before submission of Initial Payment Request as a necessary condition before payment will be processed. Coordinate preparation of schedule of values with preparation of Contractor's Construction Schedule. Correlate line items in Schedule of Values with other required administrative schedules and forms, including:
   1. Contractor's Construction Schedule.
   2. Payment Request form.
   3. Schedule of Allowances.
   4. Schedule of Alternates.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 3100

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Project Management and Coordination on Projects.

1.2 PROJECT COORDINATION

A. Project designation for this Project is LDS 5842271, LDS Arbon Branch HVAC (Pocatello, Idaho Stake).

B. This Project designation will be included on documents generated for Project by Contractor and Subcontractors, or be present on a cover letter accompanying such documents.

1.3 MULTIPLE CONTRACT COORDINATION

A. Contractor shall be responsible for accurately maintaining and reporting schedule of The Work from Notice to Proceed to date of Substantial Completion.

B. Contractor shall be responsible for providing Temporary Facilities and Controls for those who perform work on Project from Notice to Proceed to date of Substantial Completion.

C. Contractor shall be responsible for providing Construction Waste Management And Disposal services for those who perform work on Project from Notice to Proceed to date of Substantial Completion.

D. Contractor shall be responsible for Final Cleaning for entire Project.

1.4 PROJECT MEETINGS AND CONFERENCES

A. Preconstruction Conference:
   1. Attend preconstruction conference and organizational meeting scheduled by Architect at Project site or other convenient location.
   2. Be prepared to discuss items of significance that could affect progress, including such topics as:
      a. Construction schedule.
      b. Critical Work sequencing.
      c. Current problems.
      d. Designation of responsible personnel.
      e. Distribution of Contract Documents.
      f. Equipment deliveries and priorities.
      g. General schedule of inspections by Architect and its consultants.
      h. General inspection of tests.
      i. Office, work, and storage areas.
      j. Preparation of record documents and O & M manuals.
      k. Procedures for processing interpretations and Modifications.
      l. Procedures for processing Payment Requests.
      m. Project cleanup.

n. Security.
o. Status of permits.
p. Submittal of Product Data, Shop Drawings, Samples, Quality Assurance / Control submittals.
q. Use of the premises.
r. Work restrictions.
s. Working hours.

3. Architect will record minutes of meetings and distribute copies to Owner and Contractor within three working days.

B. Progress Meetings:
1. Attend progress meetings at Project site at regularly scheduled intervals determined by Architect, at least once a month.
2. Progress meetings will be open to Owner, Architect, Subcontractors, and anyone invited by Owner, Architect, and Contractor.
3. Be prepared to discuss items of significance that could affect progress, including following:
a. Progress since last meeting.
b. Whether Contractor is on schedule.
c. Activities required to complete Project within Contract Time.
d. Labor and materials provided under separate contracts.
e. Off-site fabrication problems.
f. Access.
g. Site use.
h. Temporary facilities and services.
i. Hours of work.
j. Hazards and risks.
k. Project cleanup.
l. Quality and Work standards.
m. Status of pending modifications.
n. Documentation of information for Payment Requests.
o. Maintenance of Project records.
4. Architect will prepare minutes of progress meetings and distribute copies of minutes to Owner and Contractor within three working days.

C. Pre-Installation Conferences:
1. Attend pre-installation conferences specified in Contract Document.
a. If possible, schedule these conferences on same day as regularly scheduled Progress Meetings. If this is not possible, coordinate scheduling with Architect.
b. Request input from attendees in preparing agenda.
2. Be prepared to discuss following items:
a. Requirements of Contract Documents.
b. Completed work necessary for installation of items or systems.
c. Conditions not in compliance with installation requirements.
d. Installation and inspection schedule.
e. Coordination between trades.
f. Space and access limitations.
g. Testing.
3. Architect will prepare meeting minutes and distribute minutes to Owner and Contractor within three working days.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 3300

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Submittal Procedures.

1.2 SUBMITTAL SCHEDULE

A. Furnish submittal schedule within 20 days after receipt of Notice to Proceed, listing items specified to be furnished for review to Architect including product data, shop drawings, samples, and Informational submittals.
   1. Coordinate submittal schedule with Contractor's construction schedule.
   2. Enclose the following information for each item:
      a. Scheduled date for first submittal.
      b. Related Section number.
      c. Submittal category.
      d. Name of Subcontractor.
      e. Description of part of the Work covered.
      f. Scheduled date for resubmittal.
      g. Scheduled date for Architect's final release or approval.

B. Print and distribute copies to Architect and Owner and post copy in field office. When revisions are made, distribute to same parties and post in same location.

C. Revise schedule monthly. Send copy of revised schedule to Owner and Architect and post copy in field office.

1.3 SUBMITTAL PROCEDURES

A. Coordination:
   1. Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently before performance of related construction activities to avoid delay.
      a. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
      b. Coordinate transmittal of different types of submittals required for related elements of The Work so processing will not be delayed by need to review submittals concurrently for coordination. Architect reserves right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
   2. Processing Time:
      a. Allow sufficient review time so installation will not be delayed by time required to process submittals, including time for resubmittals.
         1) Allow 21 days for initial review. Allow additional time if processing must be delayed to allow coordination with subsequent submittals. Architect will

promptly advise Contractor when submittal being processed must be delayed for coordination.
2) If an intermediate submittal is necessary, process same as initial submittal.
3) Allow 10 days for reprocessing each submittal.
4) No extension of Contract Time will be authorized because of failure to transmit submittals to Architect in sufficient time before work is to be performed to allow processing.

3. Identification:
   a. Place permanent label or title block on each submittal for identification. Include name of entity that prepared each submittal on label or title block.
      1) Provide space approximately 4 by 5 inches on label or beside title block on Shop Drawings to record Contractor's review and approval markings and action taken.
      2) Include following information on label for processing and recording action taken:
         a) Project name.
         b) Date.
         c) Name and address of Architect.
         d) Name and address of Contractor.
         e) Name and address of Subcontractor.
         f) Name and address of supplier.
         g) Name of manufacturer.
         h) Number and title of appropriate Specification Section.
         i) Drawing number and detail references, as appropriate.
4. Transmittal:
   a. Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Architect using transmittal letter. On transmittal, record relevant information and requests for data. Include Contractor's certification that information complies with Contract Document requirements, or, on form or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations.
   b. Submittals received from sources other than Contractor or not marked with Contractor's approval will be returned without action.

1.4 ACTION SUBMITTALS

A. Product Data:
1. Submit Product Data, as required by individual Sections of Specifications.
2. Mark each copy of each set of submittals to show choices and options used on Project. Where printed Product Data includes information on products that are not required for Project, mark copies to indicate information relating to Project.
3. Certify that proposed product complies with requirements of Contract Documents. List any deviations from those requirements on form or separate sheet.
4. Submit five copies of each required submittal unless otherwise required. Architect will return three copies marked with action taken and with corrections or modifications required.
5. Submit electronic files PDF: Architect will return a PDF copy marked with action taken and with corrections or modifications required.

B. Shop Drawings:
1. Submit newly prepared graphic data to accurate scale. 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 36 by 48 inches (915 by 1 200 mm). Highlight, encircle, or otherwise show deviations from Contract Documents. Include following information as a minimum:

a. Dimensions.
b. Identification of products and materials included.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.

2. Do not reproduce Contract Documents or copy standard information as basis of Shop Drawings. Standard printed information prepared without specific reference to Project is not acceptable as Shop Drawings.
3. Review and designate (stamp) approval of shop drawings. Unless otherwise specified, submit to Architect six copies of shop drawings required by Contract Documents. Shop drawings not required by Contract Documents, but requested by Contractor or supplied by Subcontractor, need not be submitted to Architect for review.

C. Samples:
1. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
   a. Mount, display, or package Samples so as to ease review of qualities specified. Prepare Samples to match samples provided by Architect, if applicable. Include following:
      1) Generic description of Sample.
      2) Sample source.
      3) Product name or name of manufacturer.
      4) Compliance with recognized standards.
      5) Availability and delivery time.
2. Submit Samples for review of kind, color, pattern, and texture, for final check of these characteristics with other elements, and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
   a. Where variations in color, pattern, texture or other characteristics are inherent in material or product represented, submit set of three samples minimum that show approximate limits of variations.
   b. Refer to other specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.
   c. Refer to other Sections for Samples to be returned to Contractor for incorporation into The Work. Such Samples shall be undamaged at time of use. On transmittal, indicate special requests regarding disposition of Sample submittals.
3. Where Samples are for selection of color, pattern, texture, or similar characteristics from a range of standard choices, submit full set of choices for material or product. Preliminary submittals will be reviewed and returned with Architect's mark indicating selection and other action.
4. Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit three sets. One will be returned marked with action taken.
5. Samples, as accepted and returned by Architect, will be used for quality comparisons throughout course of construction.
   a. Unless noncompliance with Contract Documents is observed, submittal may serve as final submittal.
   b. Sample sets may be used to obtain final acceptance of construction associated with each set.

1.5 INFORMATIONAL SUBMITTALS

A. Informational submittals are design data, test reports, certificates, manufacturer's instructions, manufacturer's field reports, and other documentary data affirming quality of products and installations. Submit five copies of each required submittal unless otherwise required. Architect will return three copies marked with action taken and with corrections or modifications required. [or] Submit electronic files: PDF. Architect will return a PDF copy marked with action taken and with corrections or modifications required.
   1. **Certificates:** Describe certificates intended to document affirmations by Contractor or others that the work is in accordance with the Contract Documents, but do not repeat provisions of Parts 2 or 3.
   2. **Delegated Design Submittals / Design Data:** Describe submittals intended to demonstrate design work prepared by Contractor's licensed professionals.
   3. **Test And Evaluation Reports**: Describe submittal of test reports or evaluation service reports intended to document required tests.
   4. **Manufacturer Instructions**: Describe submittals intended to document manufacturer instructions.
   5. **Source Quality Control Submittals**: Describe submittal of source quality control documentation.
   6. **Field Quality Control Submittals**: Describe submittal of field quality control documentation.
   7. **Manufacturer Reports**: Describe submittal of Manufacturer reports as documentation of manufacturer activities.
   8. **Special Procedure Submittals**: Describe submittals intended to document special procedures. An example would be construction staging or phasing for remodeling an existing facility while keeping it in operation. While the Contractor would normally be responsible for managing this, submittal of his plan as documentation could be specified.
   9. **Qualification Statements**: Describe submittals intended to document qualifications of entities employed by Contractor.

1.6 CLOSEOUT SUBMITTALS

A. This title groups submittals that occur during project closeout. Coordinate with section 01 7800 Closeout Submittals.
   1. **Maintenance Contracts**: Describe submittal of the maintenance contract.
   2. **Operations & Maintenance Data**: Describe submittal of operation and maintenance data necessary for products of the Section.
   3. **Bonds**: Describe submittals of bonds specific to this Section.
   4. **Warranty Documentation**: Describe submittal of final executed warranty document.
   5. **Record Documentation**: Describe submittal of record documentation specific to this Section.
   6. Sustainable (LEED) Design Closeout Documentation: Describe submittal intended to document sustainable design requirements that cannot be submitted until closing or later.
   7. Software: Describe submittal of extra copy operating system and other utility software necessary to operate and maintain software during life of product.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. This title groups maintenance material submittals required by Section.
   1. **Spare Parts**: Describe spare parts necessary for Owner's use in facility operation and maintenance. 'Parts' are generally understood to be items such as filters, motor drive belts, lamps, and other similar manufactured items that require only simple replacement.

2. **Extra Stock Materials**: Describe extra stock materials to be provided for Owner's use in facility operation and maintenance. Extra stock materials are generally understood to be items such as ceiling tiles, flooring, paint etc.
3. **Tools and Software**:
   a. Describe tools to be provided for Owner's use in facility operation and maintenance. Tools are generally understood to be wrenches, gauges, circuit setters, etc, required for proper operation or maintenance of a system.
   b. If necessary, describe submittal of an extra copy of operating system and other utility software necessary to operate and maintain the software during expected life of product.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 3500

SPECIAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Special Procedures.

1.2 ACCELERATION OF WORK

A. Complete The Work in accordance with Construction Schedule. If Contractor falls behind schedule, take such actions as are necessary, at no additional expense to Owner, to bring progress of The Work back in accordance with schedule.

B. Owner may request proposal for completion of The Work at date earlier than expiration of Contract Time. Promptly provide requested proposal showing cost of such acceleration of The Work. Consult with Owner and Architect regarding possible options to decrease cost of such acceleration. If Owner determines to order acceleration of The Work, change in Contract Sum and Contract Time resulting from acceleration will be included in a Change Order.

1.3 OWNER'S SAFETY REQUIREMENTS

A. Personal Protection:
   1. Contractor shall ensure:
      a. Positive means of fall protection, such as guardrails system, safety net system, personal fall arrest system, etc, is provided to employees whenever exposed to a fall six feet or more above a lower level.
      b. Personnel working on Project shall wear hard hats and safety glasses as required by regulation and hazard.
      c. Personnel working on Project shall wear long or short sleeve shirts, long pants, and hard-toed boots or other sturdy shoes appropriate to type and phase of work being performed.

B. Contractor Tools And Equipment:
   1. Contractor shall ensure:
      a. Tools and equipment are in good working condition, well maintained, and have necessary guards in place.
      b. Ground Fault Circuit Interrupters (GFCI) is utilized on power cords and tools.
      c. Scaffolding and man lifts are in good working condition, erected and maintained as required by governmental regulations.
      d. Ladders are in good condition, well maintained, used as specified by Manufacturer, and secured as required.

C. Miscellaneous:
   1. Contractor shall ensure:
      a. Protection is provided on protruding rebar and other similar objects.
      b. General Contractor Superintendent has completed the OSHA 10-hour construction outreach training course or equivalent.
      c. Implementation and administration of safety program on Project.
      d. Material Safety Data Sheets (MSDS) are provided for substances or materials for which an MSDS is required by governmental regulations before bringing on site.

e. Consistent safety training is provided to employees on Project.

2. Report accidents involving injury to employees on Project that require off-site medical treatment to Owner's designated representative.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 4100

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Regulatory Requirements.

1.2 ASBESTOS

A. Contract Documents for this Project have been prepared in accordance with generally accepted professional architectural and engineering practices. Accordingly, no asbestos or products containing asbestos have been knowingly specified for this Project. Notify Architect immediately for instructions if materials containing asbestos are brought to site for inclusion in the Work.

B. At Architect's direction and with Owner's approval, a certified asbestos inspector will collect samples and an independent testing laboratory will perform testing procedures on suspect materials.

C. Certify that based upon best knowledge, information, inspection, and belief no building materials containing asbestos were used in construction of Project. Submit certification on form provided by Owner.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 4301

QUALITY ASSURANCE - QUALIFICATIONS

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 REFERENCES

A. Definitions:
   1. Accreditation: Process in which certification of competency, authority, or credibility is presented. Verify that laboratories have an appropriate quality management system and can properly perform certain test methods (e.g., ANSI, ASTM, and ISO test methods) and calibration parameters according to their scopes of accreditation.
   2. 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.
   3. Testing Agency: Entity engaged to perform specific tests, inspections, or both.
   4. Testing Agency Laboratory: Agency or firm qualified to perform field and laboratory tests to determine characteristics and quality of materials and workmanship.

B. Reference Standards:
   1. ASTM International:
      a. ASTM E329-09, 'Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.'

1.3 QUALIFICATIONS

A. Qualifications: Qualifications paragraphs in this Article establish minimum qualification levels required; individual Specification Sections specify additional requirements:
   1. Fabricator / Supplier / Installer Qualifications: Firm experienced in producing products similar to those indicated for this Project and with record of successful in-service performance, as well as sufficient production capacity to produce required units.
      a. Where heading '*VMR (Value Managed Relationship) Suppliers / Installers*' is used to identify list of specified suppliers or installers, Owner has established relationships that extend beyond requirements of this Project. No other suppliers / installers will be acceptable. Follow specified procedures to preserve relationships between Owner and specified suppliers / installers and advantages that accrue to Owner from those relationships.
      b. Where heading '*Acceptable or Approved Suppliers / Installers / Fabricators*' is used to identify list of specified suppliers / installers / fabricators, use only one of listed suppliers / installers / fabricators. No others will be acceptable.
      c. Acceptable / Approved Suppliers / Installers:
         1) Following areas of the Work have restrictions on sub-bids which may be accepted by Contractor:
            a) Electrical, Division 26: Installers approved by Architect before bidding.

b) HVAC, Division 23: Installers approved by Architect before bidding.

2) Except where above list indicates 'No other accepted,' other installers may apply for approval to participate in bidding for this Project by complying with submitting following information 10 days minimum before bid date:
   a) Cover letter requesting opportunity to bid Project.
   b) Evidence that licensing requirements required by AHJ have been complied with and other requirements of relevant portions of bidding documents have been met.
   c) List of five recently completed projects of similar size and scope of this Project with following information appended for each project:
      (1) Project name, address, and date of installation.
      (2) Names, addresses, and other contact information of General Contractor, Architect, and Owner.
      (3) Three letter of recommendation from satisfied clients.
3) Architect will review submittals which have been properly submitted and identify approved installers by Addendum.

2. Factory-Authorized Service Representative Qualifications:
   a. 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.
3. 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.
4. 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.
5. Manufacturer's Field Services Qualifications:
   a. Experienced authorized representative of manufacturer to inspect field-assembled components and equipment installation, including service connections.
6. Professional Engineer Qualifications:
   a. Professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.
7. Specialists:
   a. Certain sections of Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations.
   b. Specialists shall satisfy qualification requirements indicated and shall be engaged for activities indicated.
   c. Requirement for specialists shall not supersede building codes and regulations governing the Work.
8. Testing Agency Qualifications:
   a. Independent Testing Agency with experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
      1) Testing Laboratory:
         a) AASHTO Materials Reference Laboratory (AMRL) Accreditation Program.
         b) Cement and Concrete Reference Laboratory (CCRL).
         c) Nationally Recognized Testing Laboratory (NRTL): Nationally recognized testing laboratory according to 29 CFR 1910.7.
         d) National Voluntary Laboratory (NVLAP): Testing Agency accredited according to National Institute of Standards and Technology (NIST)

Technology Administration, U. S. Department of Commerce Accreditation Program.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 6100

COMMON PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Common Product Requirements.

1.2 GENERAL

A. Provide products that comply with Contract Documents, that are undamaged, and, unless otherwise indicated, new and unused at time of installation. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for complete installation and for intended use and effect.

B. Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on surfaces of products that will be exposed to view in occupied spaces or on building exterior.
   1. Locate required product labels and stamps on concealed surface or, where required for observation after installation, on accessible surface that is not conspicuous.
   2. Provide permanent nameplates on items of service-connected or power-operated equipment. Locate on easily accessible surface that is inconspicuous in occupied spaces. Nameplate will contain following information and other essential operating data:
      a. Name of product and manufacturer.
      b. Model and serial number.
      c. Capacity.
      d. Speed.
      e. Ratings.

C. Where specifications describe a product or assembly by specifying exact characteristics required, with or without use of brand or trade name, provide product or assembly that provides specified characteristics and otherwise complies with Contract requirements.

D. Where Specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by manufacturer for application described. General overall performance of product is implied where product is specified for specific application. Manufacturer's recommendations may be contained in published product literature, or by manufacturer's certification of performance.

E. Where specifications only require compliance with an imposed code, standard, or regulation, select product that complies with standards, codes or regulations specified.

F. Where Specifications require matching an established Sample, Architect's decision will be final on whether proposed product matches satisfactorily. Where no product available within specified category matches satisfactorily nor complies with other specified requirements, refer to Architect.

G. Where specified product requirements include phrase ` . . . *as selected from manufacturer's standard colors, patterns, textures* . . . ' or similar phrase, select product and manufacturer

that comply with other specified requirements. Architect will select color, pattern, and texture from product line selected.

H. Refer to individual Specification Sections and Allowance provisions in Division 01 for allowances that control product selection, and for procedures required for processing such selections.

I. Remove and replace products and materials not specified in Contract Documents but installed in the Work with specified products and materials at no additional cost to Owner and for no increase in Contract time.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 6200

PRODUCT OPTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Product Options.

1.2 GENERAL

A. Product Selection:
   1. When option of selecting between two or more products is given, product selected will be compatible with products previously selected, even if previously selected products were also options.

B. Non-Conforming Work:
   1. Non-conforming work as covered in Article 12.3 of General Conditions applies, but is not limited, to use of non-specified products or manufacturers.

C. Product selection is governed by Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include:
   1. Substitutions And Equal Products:
      a. Generally speaking, substitutions for specified products and systems, as defined in the Uniform Commercial Code, are not acceptable. However, equal products may be approved upon compliance with Contract Document requirements.
      b. Approved Products / Manufacturers / Suppliers / Installers:
         1) Category One:
            a) Owner has established 'Value Managed Relationships' that extend beyond requirements of this Project. No substitutions or equal products will be allowed on this Project.
            b) Follow specified procedures to preserve relationships between Owner and specified manufacturers / suppliers and advantages that accrue to Owner from those relationships.
         2) Category Two:
            a) Owner has established National Contracts that contain provisions extending beyond requirements of this Project. No substitutions or equal products will be allowed on this Project.
            b) Follow specified procedures to preserve relationships between Owner and specified manufacturers / suppliers and advantages that accrue to Owner from those relationships.
         3) Category Three:
            a) Specified products are provided to Church Projects under a National Account Program. Use these products to preserve advantages that accrue to Owner from those programs. No substitutions or equal products will be allowed on this Project.
         4) Category Four:
            a) Provide only specified products available from manufacturers listed. No substitutions, private-labeled, or equal products, or mixing of manufacturers' products is allowed on this Project.

b) In Sections where lists recapitulating Manufacturers previously mentioned in Section are included under heading '*Manufacturers*' or '*Approved Manufacturers*', this is intended as a convenience to Contractor as a listing of contact information only. It is not intended that all manufacturers in list may provide products where specific products and manufacturers are listed elsewhere in Section.

c. Acceptable Products / Manufacturers / Suppliers / Installers:
   1) Type One: Use specified products / manufacturers unless approval to use other products / manufacturers has been obtained from Architect by Addendum.
   2) Type Two: Use specified products / manufacturers unless approval to use other products and manufacturers has been obtained from Architect in writing before installing or applying unlisted or private-labeled products.
   3) Use 'Equal Product Approval Request Form' to request approval of equal products, manufacturers, or suppliers before bidding or before installation, as noted in individual Sections.

d. Quality / Performance Standard Products / Manufacturers:
   1) Class One: Use specified product / manufacturer or equal product from specified manufacturers only.
   2) Class Two: Use specified product / manufacturer or equal product from any manufacturer.
   3) Products / manufacturers used shall conform to Contract Document requirements.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 6600

PRODUCT DELIVERY, STORAGE, AND HANDLING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Product Delivery, Storage, and Handling Requirements.

1.2 GENERAL

A. Deliver, store, and handle products according to manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.

1.3 DELIVERY AND ACCEPTANCE REQUIREMENTS

A. Schedule delivery to reduce long-term storage at site and to prevent overcrowding of construction spaces.

B. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

C. Deliver products to site in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

D. Inspect products upon delivery to ensure compliance with Contract Documents, and to ensure that products are undamaged and properly protected.

1.4 STORAGE AND HANDLING REQUIREMENTS

A. Store products at site in manner that will simplify inspection and measurement of quantity or counting of units.

B. Store heavy materials away from Project structure so supporting construction will not be endangered.

C. Store products subject to damage by elements above ground, under cover in weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 7300

EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for governing Execution of the Work.

1.2 COMMON INSTALLATION PROVISIONS

A. Manufacturer's Instructions: Comply with Manufacturer's installation instructions and recommendations to extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents. Notify Architect of conflicts between Manufacturer's installation instructions and Contract Document requirements.

B. Provide attachment and connection devices and methods necessary for securing Work. Secure work true to line and level. Anchor each product securely in place, accurately located, and aligned with other Work. Allow for expansion and building movement.

C. Visual Effects: Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain best visual effect. Refer questionable choices to Architect for final decision.

D. Install each component during weather conditions and Project status that will ensure best possible results. Isolate each part of completed construction from incompatible material as necessary to prevent deterioration.

E. Coordinate temporary enclosures with required inspections and tests, to reduce necessity of uncovering completed construction for that purpose.

F. Mounting Heights: Where mounting heights are not shown, install individual components at standard mounting heights recognized within the industry or local codes for that application. Refer questionable mounting height decisions to Architect for final decision.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 7400

CLEANING AND WASTE MANAGEMENT

PART 1 - SUMMARY

1.1 GENERAL

A. Includes But Not Limited To:
   1. Administrative and procedural requirements for Cleaning and Waste Management as described in Contract Documents.

B. Related Requirements:
   1. In addition to standards described in this section, comply with all requirements for cleaning-up as described in various other Sections of these Specifications.

1.2 REFERENCES

A. Definitions:
   1. Asphalt Pavement, Brick, and Concrete (ABC) Rubble: Rubble that contains only weathered (cured) asphalt pavement, clay bricks and attached mortar normally used in construction, or concrete that may contain rebar. The rubble shall not be mixed with, or contaminated by, another waster or debris.
   2. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
   3. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
   4. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
   5. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
   6. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
   7. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

A. Comply with regulations of authorities having jurisdiction and safety standards for cleaning.

B. Keep premises broom clean during progress of the Work.

C. Keep site and adjoining streets reasonably clean. If necessary, sprinkle rubbish and debris with water to suppress dust.

D. During handling and installation, protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from soiling, damage, or deterioration until Substantial Completion.

E. Clean and maintain completed construction as frequently as necessary throughout construction period. Adjust and lubricate operable components to ensure ability to operate without damaging effects.

F. If Organ Chamber is included, clean debris and leave dust free before organ speakers are installed.

G. Supervise construction activities to ensure that no part of construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.

H. Before and during application of painting materials, clear area where such work is in progress of debris, rubbish, and building materials that may cause dust. Sweep floors and vacuum as required and take all possible steps to keep area dust free.

I. Clean exposed surfaces and protect as necessary to avoid damage and deterioration.

J. Place extra materials of value remaining after completion of associated work have become Owner's property as directed by Owner or Architect.

K. Construction Waste Management And Disposal:
   1. Remove waste materials and rubbish caused by employees, Subcontractors, and contractors under separate contract with Owner and dispose of legally. Remove unsuitable or damaged materials and debris from building and from property.
      a. Provide adequate waste receptacles and dispose of materials when full.
      b. Properly store volatile waste and remove daily.
      c. Do not deposit waste into storm drains, sanitary sewers, streams, or waterways. Do not discharge volatile, harmful, or dangerous materials into drainage systems.
   2. Do not burn waste materials or build fires on site. Do not bury debris or excess materials on Owner's property.

3.2 FINAL CLEANING

A. Immediately before Substantial Completion, thoroughly clean building and area where The Work was performed. Remove all rubbish from under and about building, landscaped areas and parking lot and leave building and Project Site ready for occupancy by Owner.

B. Comply with individual manufacturer's cleaning instructions.

C. Clean each surface or unit to condition expected in normal, commercial building cleaning and maintenance program, including but not limited to:
   1. Interior Cleaning:
      a. Clean inside glazing, exercising care not to scratch glass.
      b. Remove marks, stains, fingerprints and dirt.
      c. Clean and polish woodwork and finish hardware.
      d. Remove labels that are not permanent labels.
      e. Clean plumbing fixtures and tile work. Remove spots, soil or paint.

f. Clean surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean light fixtures and lamps.
g. Clean other fixtures and equipment and remove stains, paint, dirt, and dust.
h. Remove temporary floor protection and clean floors.

2. Exterior Cleaning:
   a. Clean outside glazing, exercising care not to scratch glass.
   b. Remove marks, stains, and dirt from exterior surfaces.
   c. Clean and polish finish hardware.
   d. Remove temporary protection systems.
   e. Clean dirt, mud, and other foreign material from paving, sidewalks, and gutters.
   f. Clean drop inlets, through-curb drains, and other drainage structures.
   g. Remove trash, debris, and foreign material from landscaped areas.

END OF SECTION

SECTION 01 7700

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Closeout Procedures.

1.2 GENERAL

A. Schedule closeout procedures in the four weeks before expiration of Contract Time. Weeks will be marked by three Architect's weekly visits before Final Closeout Review, Final Closeout Review, and expiration of Contract Time.

B. Date of Substantial Completion shall fall within week between Architect's final weekly visit and Final Closeout Review. Date of Substantial Completion shall not occur until Construction Schedule shows completion of construction work, unless agreed to by Architect and included on Certificate of Substantial Completion.

1.3 PRELIMINARY CLOSEOUT REVIEWS

A. Confirm with Architect when Substantial Completion of The Work will be achieved.
   1. Final three Architect's weekly visits will serve as Preliminary Closeout Reviews to determine if Final Closeout Review will occur as scheduled and that Substantial Completion of the Work will be achieved by that date.
   2. By final weekly Architect visit, notify Owner and Architect of date when Substantial Completion of The Work will be achieved.

B. Arrange with Architect date for Final Closeout Review to confirm Substantial Completion.

1.4 CLOSEOUT REQUIREMENTS

A. Before Final Closeout Review:
   1. Deliver Closeout Submittals to Architect.
   2. Deliver tools, spare parts, extra stock, and similar items as required by the Contract Documents.
   3. Complete start-up testing of systems, and instruction of Owner's maintenance personnel as required by the Contract Documents.
   4. Discontinue or change over and remove temporary facilities from site, along with construction tools, mock-ups, and similar elements.
   5. Complete final cleaning requirements.

1.5 FINAL CLOSEOUT REVIEW

A. Participate in Final Closeout Review.

B. When Owner and Architect have confirmed that Contractor has achieved Substantial Completion of The Work, Owner, Architect, and Contractor will execute Certificate of Substantial Completion that contains:
   1. Date of Substantial Completion.
   2. Punch List of Work not yet accepted.
   3. Amount to be withheld for completion of Punch List work.
   4. Time period for completion of Punch List work.
   5. Amount of liquidated damages set forth in Supplementary Conditions to be assessed if Contractor fails to complete Punch List work within time set forth in Certificate.

C. Final Acceptance Conference:
   1. Notify Architect in writing when work on Punch List has been completed.
   2. Arrange with Architect date and time for Final Acceptance Conference.
   3. When Owner and Architect have confirmed that Contractor has completed Punch List work, Architect will issue letter to Owner authorizing final payment.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 7800

CLOSEOUT SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Closeout Submittals.

1.2 GENERAL

A. Workmanship bonds, final certifications, equipment check-out sheets, and similar documents.

B. Releases enabling Owner unrestricted use of The Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

C. Project photographs, damage or settlement survey, and similar record information required by Contract Documents.

1.3 OPERATIONS AND MAINTENANCE DATA

A. Operations And Maintenance Manuals that include:
   1. Copy of Soils Report.
   2. Copy of complete Project Manual including Addenda, Modifications as defined in General Conditions, and other interpretations issued during construction.
      a. Mark these documents to show variations in actual Work performed in comparison with text of specifications and Modifications. Show substitutions, selection of options, and similar information, particularly on elements that are concealed or cannot otherwise be readily discerned later by direct observation.
      b. Note related record drawing information and Product Data.
   3. Operations and maintenance submittals required by Contract Documents.
   4. Certifications required by Contract Documents.
   5. Copies of warranties required by Contract Documents.
   6. Testing and Inspection Reports required by Contract Documents.

1.4 WARRANTIES

A. When written guarantees beyond one year after substantial completion are required by Contract Documents, secure such guarantees and warranties properly addressed and signed in favor of Owner. Include these documents in Operations & Maintenance Manuals specified above.

B. Delivery of guarantees and warranties will not relieve Contractor from obligations assumed under other provisions of Contract Documents.

1.5 PROJECT RECORD DOCUMENTS

A. Do not use record documents for construction purposes. Protect from deterioration and loss in secure, fire-resistive location. Provide access to record documents for Architect's reference during normal working hours.

B. Maintain clean, undamaged set of Drawings. Mark set to show actual installation where installation varies from the Work as originally shown. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
   1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work.
   2. Mark new information that is important to Owner, but was not shown on Drawings.
   3. Note related Change Order numbers where applicable.

1.6 SPARE PARTS

A. Provide items that are indicated in individual Sections.

1.7 EXTRA STOCK MATERIALS

A. Provide items that are indicated in individual Sections.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 07 8400

FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install firestopping not involving penetrations as described in Contract Documents.
   2. Quality of firestopping materials and systems used for penetrations on Project, including submittal requirements.

B. Related Sections:
   1. Furnishing and installing of penetration firestopping specified under Section installing work penetrating structure.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM E 814-00, 'Standard Test Method for Fire Tests of Through-Penetration Fire Stops.'

B. International Conference of Building Officials:
   1. ICBO, 'Uniform Building Code (UBC), Volume 1, Administrative, Fire and Life Safety, and Field Inspection Provisions.'

C. Underwriter's Laboratories / American National Standards Institute:
   1. UL / ANSI 1479-2003, 'Standard for Safety for Fire Tests of Through-Penetration Firestops.'
   2. Fire Resistance Directory, current edition, contains listing of approved Penetration Firestop Systems.

1.3 DEFINITIONS

A. Penetration Firestop System: An assemblage of specific materials or products that are designed, tested, and fire resistive in accordance with UBC Standard 7-5 to resist passage of fire through penetrations for prescribed period of time.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Show each type of Penetration Firestop System to be used on Project with design approval reference number.
   2. Identify locations where each type of Penetration Firestop System is to be installed.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Each Penetration Firestop System shall be UL / ULC listed for that type of penetration occurring on Project.
   2. Ratings shall be in accordance with ASTM E 814, UL 147, or UBC Standard No 43-6, as acceptable to local code authority.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Sealant, packing material, or collar system required by Firestop Manufacturer for Firestop Penetration System to comply with listed design.

B. Type Two Acceptable Manufacturers:
   1. Members of International Firestop Council www.firestop.org.
   2. Equal as approved by Architect before installation. See Section 01 6200.

PART 3 - EXECUTION: Not Used

END OF SECTION

SECTION 07 9213

ELASTOMERIC JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install sealants not specified to be furnished and installed under other Sections.
   2. Quality of sealants to be used on Project not specified elsewhere, including submittal, material, and installation requirements.

B. Related Sections:
   1. Furnishing and installing of sealants is specified in Sections specifying work to receive new sealants.
   2. Section 07 2419: Sealants for EIF Systems.

1.2 SUBMITTALS

A. Product Data:
   1. Manufacturer's literature and installation recommendations for each Product.
   2. Schedule showing joints requiring sealants. Show also backing and primer to be used.

B. Quality Assurance / Control: Certificate from Manufacturer indicating date of manufacture.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Handle to prevent inclusion of foreign matter, damage by water, or breakage.

B. Deliver and keep in original containers until ready for use.

C. Do not use damaged or deteriorated materials.

D. Store in a cool place, but never under 40 deg F 4 deg C.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sealants:
   1. Sealants provided shall meet Manufacturer's shelf-life requirements.
   2. Exterior Building Elements:
      a. Joints and cracks around windows.
      b. Aluminum entrance perimeters and thresholds.
      c. Door frames.
      d. Columns.
      e. Louvers.
      f. Wall penetrations.
      g. Connections.
      h. Parapet caps.

i. Other joints necessary to seal off building from outside air and moisture.
j. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
1) Dow Corning:
a) Primer: 1200.
b) Sealant: 791.
2) GE Sealants & Adhesives:
a) Primer: SS4044.
b) Sealant: Silpruf SCS 2000.
3) Tremco:
a) Primer:
(1) Metal: No. 20.
(2) Other: No. 23.
b) Sealant: Spectrum 1.

3. Exterior Sheet Metal And Miscellaneous:
a. Penetrations in soffits and fascias.
b. Roof vents and flues.
c. Flashings.
d. Gutters.
e. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
1) 791 or 790 by Dow Corning.
2) Sikaflex 15LM by Sika Corp.
3) Tremsil 600 by Tremco.

4. Exterior Concrete:
a. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
1) Joints between building foundations and exterior site concrete:
a) Dow Corning:
(1) Primer: 1200.
(2) Sealant: 790.
b) GE Sealants & Adhesives:
(1) Primer: SS4044.
(2) Sealant: Silpruf SCS 2000.
2) Expansion joints in retaining walls:
a) Dow Corning:
(1) Primer: 1200.
(2) Sealant: 790.
b) GE Sealants & Adhesives:
(1) Primer: SS4044.
(2) Sealant: Silpruf SCS 2000.
3) Expansion joints in Portland cement concrete driveways and parking lots:
a) Dow Corning: 888 (NS). 890 (SL) may be used on non-sloping areas.

5. Interior:
a. Inside jambs and heads of exterior door frames.
b. Inside perimeters of windows.
c. Miscellaneous gaps between substrates.
d. Category Four Approved Product. See Section 01 6200 for definitions of Categories.
1) Tub, Tile, And Ceramic Silicone Sealant by Dow Corning.
2) Acrylseal by GE Sealants & Adhesives.
3) Latisil Sealant by Laticrete.
4) Pro-Select Kitchen And Bath Silicone Sealant by Sherwin Williams.
5) Tremsil 200 by Tremco.

6. Interior Joints Formed By:
a. Countertops and backsplash to wall.

b. Sinks and lavatories to countertops.
c. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
   1) Tub, Tile, And Ceramic Silicone Sealant by Dow Corning.
   2) Acrylseal by GE Sealants & Adhesives.
   3) Latisil Sealant by Laticrete.
   4) Pro-Select Kitchen And Bath Silicone Sealant by Sherwin Williams.
   5) Tremsil 200 by Tremco.

7. Color: As selected by Architect from Manufacturer's standard colors.

B. Backing: Flexible closed cell, non-gassing polyurethane or polyolefin rod or bond breaker tape as recommended by Sealant Manufacturer for joints being sealed.

2.2 MANUFACTURERS

A. Contact Information:
1. Dow Corning Corp, Midland, MI www.dowcorning.com.
2. Laticrete International Inc, Bethany, CT www.laticrete.com.
3. GE Sealants & Adhesives, Huntersville, NC www.gesealants.com.
4. Sika Corporation, Lyndhurst, NJ www.sikaconstruction.com.
5. Sherwin-Williams, Cleveland, OH www.sherwin-williams.com.
6. Tremco, Cleveland, OH www.tremcosealants.com.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surfaces shall be clean, dry, and free of dust, oil, grease, dew, or frost.

B. Apply primer, if required.

C. Joint Backing:
1. Rod for open joints shall be at least 1-1/2 times width of open joint and of thickness to give solid backing. Backing shall fill up joint so depth of sealant bite is no more than 3/8 inch 10 mm deep.
2. Apply bond-breaker tape in shallow joints as recommended by Sealant Manufacturer.

3.2 APPLICATION

A. Apply sealant with hand-calking gun with nozzle of proper size to fit joints. Use sufficient pressure to insure full contact to both sides of joint to full depth of joint. Apply sealants in vertical joints from bottom to top.

B. Tool joints immediately after application of sealant if required to achieve full bedding to substrate or to achieve smooth sealant surface. Tool joints in opposite direction from application direction, i.e., in vertical joints, from the top down. Do not 'wet tool' sealants.

C. Depth of sealant bite shall be 1/4 inch 6 mm minimum and 1/2 inch 13 mm maximum, but never more than one half or less than one fourth joint width.

D. Do not apply calking at temperatures below 40 deg F 4 deg C.

E. Calk gaps between painted or coated substrates and unfinished or pre-finished substrates. Calk gaps larger than 3/16 inch 9 mm between painted or coated substrates.

3.3 CLEANING

A. Clean adjacent materials, which have been soiled, immediately (before setting) as recommended by Manufacturer.

END OF SECTION

DIVISION 23: HEATING, VENTILATING, AND AIR-CONDITIONING

END OF TABLE OF CONTENTS

SECTION 23 0501

COMMON HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Common requirements and procedures for HVAC systems.
2. Responsibility for proper operation of electrically powered equipment furnished under this Division.
3. Interface with Testing And Balancing Agency.
4. Furnish and install sealants relating to installation of systems installed under this Division.
5. Furnish and install Firestop Penetration Systems for HVAC system penetrations as described in Contract Documents.

B. Products Furnished But Not Installed Under This Section:
1. Sleeves, inserts, and equipment for mechanical systems installed under other Sections.

C. Related Requirements:
1. Section 07 8400: 'Firestopping' for quality of Penetration Firestop Systems to be used on Project and submittal requirements.
2. Section 07 9213: 'Elastometric Joint Sealant' for quality of sealants used at building exterior.
3. Section 07 9219: 'Acoustical Joint Sealants' for quality of acoustical sealants.
4. Section 26 2913: 'Enclosed Controllers' for magnetic starters and thermal protective devices (heaters) not factory mounted integral part of mechanical equipment.
5. Division 26: Raceway and conduit, unless specified otherwise, line voltage wiring, outlets, and disconnect switches.
6. Slots and openings through floors, walls, ceilings, and roofs provided under other Divisions in their respective materials.

1.2 SUBMITTALS

A. Action Submittals:
1. Product Data:
   a. Manufacturer's catalog data for each manufactured item.
      1) Provide section in submittal for each type of item of equipment. Include Manufacturer's catalog data of each manufactured item and enough information to show compliance with Contract Document requirements. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
      2) Include name, address, and phone number of each supplier.
2. Shop Drawings:
   a. Schematic control diagrams for each separate fan system, heating system, control panel, etc. Each diagram shall show locations of all control and operational components and devices. Mark correct operating settings for each control device on these diagrams.
   b. Diagram for electrical control system showing wiring of related electrical control items such as firestats, fuses, interlocks, electrical switches, and relays. Include drawings showing electrical power requirements and connection locations.
   c. Drawing of each temperature control panel identifying components in panels and their function.
   d. Other shop drawings required by Division 23 trade Sections.

B. Informational Submittals:

C. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
   a. Operations and Maintenance Data (Modify and add to requirements of Section 01 7800):
      1) At beginning of HVAC section of Operations And Maintenance Manual, provide master index showing items included.
         a) Provide name, address, and phone number of Architect, Architect's Mechanical Engineer, General Contractor, and HVAC, Sheet Metal, Refrigeration, and Temperature Control subcontractors.
         b) Identify maintenance instructions by using same equipment identification used in Contract Drawings. Maintenance instructions shall include:
            (1) List of HVAC equipment used indicating name, model, serial number, and nameplate data of each item together with number and name associated with each system item.
            (2) Manufacturer's maintenance instructions for each piece of HVAC equipment installed in Project. Instructions shall include name of vendor, installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance and lubrication instructions.
            (3) Summary list of mechanical equipment requiring lubrication showing name of equipment, location, and type and frequency of lubrication.
            (4) Manual for Honeywell T7350 thermostat published by Honeywell.
         c) Provide operating instructions to include:
            (1) General description of each HVAC system.
            (2) Step by step procedure to follow in putting each piece of HVAC equipment into operation.
            (3) Provide diagrams for electrical control system showing wiring of items such as smoke detectors, fuses, interlocks, electrical switches, and relays.
   b. Warranty Documentation:
      1) Include copies of warranties required in individual Sections of Division 23.
   c. Record Documentation:
      1) Manufacturers documentation:
         a) Copies of approved shop drawings.

1.3 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. Perform work in accordance with applicable provisions of Gas Ordinances applicable to Project. Provide materials and labor necessary to comply with rules, regulations, and ordinances.
2. In case of differences between building codes, laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Notify Architect in writing of such differences before performing work affected by such differences.
3. Identification:
   a. Motor and equipment name plates as well as applicable UL / ULC and AGA / CGA labels shall be in place when Project is turned over to Owner.

B. Qualifications: Requirements of Section 01 4301 applies, but not limited to following:
1. Company:
   a. Company specializing in performing work of this section.
      1) Minimum five (5) years experience in HVAC installations.
      2) Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
   b. Upon request, submit documentation.
2. Installer:
   a. Licensed for area of Project.
   b. Designate one (1) individual as project foremen who shall be on site at all times during installation and experienced with installation procedures required for this project.
   c. Upon request, submit documentation.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
1. Accept valves on site in shipping containers with labeling in place.

B. Storage And Handling Requirements:
1. In addition to requirements specified in Division 01:
   a. Stored material shall be readily accessible for inspection by Architect until installed.
   b. Store items subject to moisture damage, such as controls, in dry, heated spaces.
   c. Provide temporary protective coating on cast iron and steel valves.
   d. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
2. Protect bearings during installation. Thoroughly grease steel shafts to prevent corrosion.

1.5 WARRANTY

A. Manufacturer Warranty:
1. Provide certificates of warranty for each piece of equipment made out in favor of Owner. Clearly record 'start-up' date of each piece of equipment on certificate.

B. Special Warranty:
1. Guarantee HVAC systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.
2. If HVAC sub-contractor with offices located more than 150 miles (240 km) from Project site is used, provide service / warranty work agreement for warranty period with local HVAC sub-contractor approved by Architect. Include copy of service / warranty agreement in warranty section of Operation And Maintenance Manual.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Components shall bear Manufacturer's name and trade name. Equipment and materials of same general type shall be of same make throughout work to provide uniform appearance, operation, and maintenance.

B. Pipe And Pipe Fittings:
1. Use domestic made pipe and pipe fittings on Project.
2. Weld-O-Let and Screw-O-Let fittings are acceptable.

C. Sleeves:
1. In Framing: Standard weight galvanized iron pipe, Schedule 40 PVC, or 14 ga (2 mm) galvanized sheet metal two sizes larger than bare pipe or insulation on insulated pipe.
2. In Concrete And Masonry: Sleeves through outside walls, interior shear walls, and footings shall be schedule 80 black steel pipe with welded plate.

D. Valves:
1. Valves of same type shall be of same manufacturer.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Acceptable Installers:
   1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

3.2 EXAMINATION

A. Drawings:
   1. HVAC Drawings show general arrangement of piping, ductwork, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
   2. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over HVAC Drawings.
   3. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

B. Verification Of Conditions:
   1. Examine premises to understand conditions that may affect performance of work of this Division before submitting proposals for this work. Examine adjoining work on which mechanical work is dependent for efficiency and report work that requires correction.
   2. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.
   3. Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.
   4. Check that slots and openings provided under other Divisions through floors, walls, ceilings, and roofs are properly located. Perform cutting and patching caused by neglecting to coordinate with Divisions providing slots and openings at no additional cost to Owner.

3.3 PREPARATION

A. Changes Due To Equipment Selection:
   1. Where equipment specified or otherwise approved requires different arrangement or connections from that shown in Contract Documents, submit drawings, if requested by Architect, showing proposed installations.
   2. If proposed changes are approved, install equipment to operate properly and in harmony with intent of Contract Documents. Make incidental changes in piping, ductwork, supports, installation, wiring, heaters, panelboards, and as otherwise necessary.
   3. Provide any additional motors, valves, controllers, fittings, and other additional equipment required for proper operation of system resulting from selection of equipment.
   4. Be responsible for the proper location of roughing-in and connections provided under other Divisions.

3.4 INSTALLATION

A. Interface With Other Work:

1. Furnish sleeves, inserts, supports, and equipment that are to be installed by others in sufficient time to be incorporated into construction as work proceeds. Locate these items and see they are properly installed.
2. Electrical: Furnish exact location of electrical connections and complete information on motor controls to installer of electrical system.
3. Testing And Balancing:
   a. Put HVAC systems into full operation and continue their operation during each working day of testing and balancing.
   b. Make changes in pulleys, belts, fan speeds, and dampers or add dampers as required for correct balance as recommended by Testing And Balancing Agency and at no additional cost to Owner.

B. Cut carefully to minimize necessity for repairs to previously installed or existing work. Do not cut beams, columns, or trusses.

C. Locating Equipment:
1. Arrange pipes, ducts, and equipment to permit ready access to valves, cocks, unions, traps, filters, starters, motors, control components, and to clear openings of doors and access panels.
2. Adjust locations of pipes, ducts, switches, panels, and equipment to accommodate work to interferences anticipated and encountered.
3. Install HVAC work to permit removal of equipment and parts of equipment requiring periodic replacement or maintenance without damage to or interference with other parts of equipment or structure.
4. Determine exact route and location of each pipe and duct before fabrication.
   a. Right-Of-Way:
      1) Lines that pitch shall have right-of-way over those that do not pitch. For example, steam, steam condensate, and drains shall normally have right-of-way.
      2) Lines whose elevations cannot be changed shall have right-of-way over lines whose elevations can be changed.
   b. Offsets, Transitions, and Changes in Direction:
      1) Make offsets, transitions, and changes in direction in pipes and ducts as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.
      2) Furnish and install all traps, air vents, sanitary vents, and devices as required to effect these offsets, transitions, and changes in direction.

D. Piping:
1. Furnish and install complete system of piping, valved as indicated or as necessary to completely control entire apparatus.
   a. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper erection of systems of piping in every respect.
   b. Arrange piping to not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings.
      1) Arrange so as to facilitate removal of tube bundles.
      2) Provide accessible flanges or ground joint unions, as applicable for type of piping specified, at connections to equipment and on bypasses.
         a) Make connections of dissimilar metals with di-electric unions.
         b) Install valves and unions ahead of traps and strainers. Provide unions on both sides of traps.
      3) Do not use reducing bushings, street elbows, bull head tees, close nipples, or running couplings.
      4) Install piping systems so they may be easily drained. Provide drain valves at low points and manual air vents at high points in hot water heating and cooling water piping.
      5) Install piping to insure noiseless circulation.
      6) Place valves and specialties to permit easy operation and access. Valves shall be regulated, packed, and glands adjusted at completion of work before final acceptance.
   c. Do not install piping in shear walls.
2. Properly make adequate provisions for expansion, contraction, slope, and anchorage.

a. Cut piping accurately for fabrication to measurements established at site. Remove burr and cutting slag from pipes.
b. Work piping into place without springing or forcing. Make piping connections to pumps and other equipment without strain at piping connection. Remove bolts in flanged connections or disconnect piping to demonstrate that piping has been so connected, if requested.
c. Make changes in direction with proper fittings.
d. Expansion of Thermoplastic Pipe:
1) Provide for expansion in every 30 feet (9 meters) of straight run.
2) Provide 12 inch (300 mm) offset below roof line in each vent line penetrating roof.

3. Provide sleeves around pipes passing through concrete or masonry floors, walls, partitions, or structural members. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete floors on grade. Seal sleeves with specified sealants.
a. Sleeves through floors shall extend 1/4 inch (6 mm) above floor finish in mechanical equipment rooms above basement floor. In other rooms, sleeves shall be flush with floor.
b. Sleeves through floors and foundation walls shall be watertight.
4. Provide spring clamp plates (escutcheons) where pipes run through walls, floors, or ceilings and are exposed in finished locations of building. Plates shall be chrome plated heavy brass of plain pattern and shall be set tight on pipe and to building surface.
5. Remove dirt, grease, and other foreign matter from each length of piping before installation.
a. After each section of piping used for movement of water or steam is installed, flush with clean water, except where specified otherwise.
b. Arrange temporary flushing connections for each section of piping and arrange for flushing total piping system.
c. Provide temporary cross connections and water supply for flushing and drainage and remove after completion of work.

E. Penetration Firestops: Install Penetration Firestop System appropriate for penetration at HVAC system penetrations through walls, ceilings, roofs, and top plates of walls.

F. Sealants:
1. Seal openings through building exterior caused by penetrations of elements of HVAC systems.
2. Furnish and install acoustical sealant to seal penetrations through acoustically insulated walls and ceilings.

3.5 REPAIR / RESTORATION

A. Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.
1. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown.
2. Surface finishes shall exactly match existing finishes of same materials.

3.6 FIELD QUALITY CONTROL

A. Field Tests:
1. Perform tests on HVAC piping systems. Furnish devices required for testing purposes.

B. Non-Conforming Work:
1. Replace material or workmanship proven defective with sound material at no additional cost to Owner.
2. Repeat tests on new material, if requested.

3.7 SYSTEM START-UP

A. Off-Season Start-up:
1. If Substantial Completion inspection occurs during heating season, schedule spring start-up of cooling systems. If inspection occurs during cooling season, schedule autumn start-up for heating systems.
2. Notify Owner seven days minimum before scheduled start-up.
3. Time will be allowed to completely service, test, check, and off-season start systems. During allowed time, train Owner's representatives in operation and maintenance of system.
4. At end of off-season start-up, furnish Owner with letter confirming that above work has been satisfactorily completed.

B. Preparations that are to be completed before start up and operation include, but are not limited to, following:
1. Dry out electric motors and other equipment to develop and properly maintain constant insulation resistance.
2. Make adjustments to insure that:
   a. Equipment alignments and clearances are adjusted to allowable tolerances.
   b. Nuts and bolts and other types of anchors and fasteners are properly and securely fastened.
   c. Packed, gasketed, and other types of joints are properly made up and are tight and free from leakage.
   d. Miscellaneous alignings, tightenings, and adjustings are completed so systems are tight and free from leakage and equipment performs as intended.
3. Motors and accessories are completely operable.
4. Inspect and test electrical circuitry, connections, and voltages to be properly connected and free from shorts.
5. Adjust drives for proper alignment and tension.
6. Make certain filters in equipment for moving air are new and of specified type.
7. Properly lubricate and run-in bearings in accordance with Manufacturer's directions and recommendations.

3.8 CLEANING

A. Clean exposed piping, ductwork, and equipment.

B. No more than one week before Final Inspection, flush out bearings and clean other lubricated surfaces with flushing oil. Provide best quality and grade of lubricant specified by Equipment Manufacturer.

C. Replace filters in equipment for moving air with new filters of specified type no more than one week before Final Inspection.

3.9 CLOSEOUT ACTIVITIES

A. Instruction Of Owner:
1. Instruct building maintenance personnel and Stake Physical Facilities Representative in operation and maintenance of mechanical systems utilizing Operation And Maintenance Manual when so doing:
   a. Minimum Instruction Periods:
      1) HVAC: Four (4) hours.
      2) Refrigeration: Two (2) hours.

3.10 PROTECTION

A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system. Cap or plug open ends of pipes and equipment to keep dirt and other foreign materials out of system. Do not use plugs of rags, wool, cotton waste, or similar materials.

B. Do not operate pieces of equipment used for moving supply air without proper air filters installed properly in system.

C. After start-up, continue necessary lubrication and be responsible for damage to bearings while equipment is being operated up to Substantial Completion.

END OF SECTION

SECTION 23 0529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Common hanger and support requirements and procedures for HVAC systems.

B. Related Requirements:
1. Section 05 0523: 'Metal Fastening' for quality and requirements for welding.
2. Section 07 8400: 'Firestopping' for quality of Penetration Firestop Systems to be used on Project and submittal requirements.
3. Sections Under 09 9000 Heading: Painting of mechanical items requiring field painting.
4. Slots and openings through floors, walls, ceilings, and roofs provided under other Divisions in their respective materials.

1.2 SUBMITTALS

A. Action Submittals:
1. Product Data:
   a. Manufacturer's catalog data for each manufactured item.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
1. Class Two Quality Standard Approved Manufacturers. See Section 01 6200:
   a. Anvil International, Portsmouth, NH www.anvilintl.com.
   b. Cooper B-Line, Highland, IL www.cooperbline.com.
   c. Erico International, Solon, OH www.erico.com.
   d. Hilti Inc, Tulsa, OK www.hilti.com.
   e. Minerallac, Hampshire, IL www.minerallac.com.
   f. Thomas & Betts, Memphis, TN www.superstrut.com.
   g. Unistrut, Wayne, MI www.unistrut.com.

B. Performance:
1. Design Criteria:
   a. Support rods for single pipe shall be in accordance with following table:

Rod Diameter	Pipe Size	Rod Diameter	Pipe Size
3/8 inch	2 inches and smaller	10 mm	50 mm and smaller
1/2 inch	2-1/2 to 3-1/2 inches	13 mm	63 mm to 88 mm
5/8 inch	4 to 5 inches	16 mm	100 mm to 125 mm
3/4 inch	6 inches	19 mm	150 mm
7/8 inch	8 to 12 inches	22 mm	200 mm to 300 mm

   b. Support rods for multiple pipes supported on steel angle trapeze hangers shall be in accordance with following table:

Rods		Number of Pipes per Hanger for Each Pipe Size						
No.	Diameter	2 Inch	2.5 Inch	3 Inch	4 Inch	5 Inch	6 Inch	8 Inch

2	3/8 Inch	Two	0	0	0	0	0	0
2	1/2 Inch	Three	Three	Two	0	0	0	0
2	5/8 Inch	Six	Four	Three	Two	0	0	0
2	5/8 Inch	Nine	Seven	Five	Three	Two	Two	0
2	5/8 Inch	Twelve	Nine	Seven	Five	Three	Two	Two

Rods		Number of Pipes per Hanger for Each Pipe Size						
No.	Diameter	50mm	63mm	75mm	100mm	125mm	150mm	200mm
2	10 mm	Two	0	0	0	0	0	0
2	13 mm	Three	Three	Two	0	0	0	0
2	16 mm	Six	Four	Three	Two	0	0	0
2	19 mm	Nine	Seven	Five	Three	Two	Two	0
2	22 mm	Twelve	Nine	Seven	Five	Three	Two	Two

1) Size trapeze angles so bending stress is less than 10,000 psi (69 Mpa).

C. Materials:
1. Hangers, Rods, Channels, Attachments, And Inserts:
   a. Galvanized and UL approved for service intended.
   b. Support horizontal piping from clevis hangers or on roller assemblies with channel supports, except where trapeze type hangers are explicitly shown on Drawings. Hangers shall have double nuts.
   c. Class Two Quality Standards:
      1) Support insulated pipes with clevis hanger equal to Anvil Fig 260 or roller assembly equal to Anvil Fig 171 with an insulation protection shield equal to Anvil Fig 167. Gauge and length of shield shall be in accordance with Anvil design data.
      2) Except uninsulated copper pipes, support uninsulated pipes from clevis hanger equal to Anvil Fig 260. Support uninsulated copper pipe from hanger equal to Anvil Fig CT-65 copper plated hangers and otherwise fully suitable for use with copper tubing.
   d. Riser Clamps For Vertical Piping:
      1) Class Two Quality Standard: Anvil Figure 261.
   e. Furnace / Fan Coil Support Channel:
      1) Class One Quality Standard: Unistrut P1000.
      2) Acceptable Manufacturers: Hilti, Thomas & Betts.
      3) Equal as approved by Architect before installation. See Section 01 6200.
   f. Swivel Attachment:
      1) Class One Quality Standard: Unistrut EM3127.
      2) Acceptable Manufacturers: Hilti, Thomas & Betts.
      3) Equal as approved by Architect before installation. See Section 01 6200.

EXECUTION

2.2 INSTALLATION

A. Piping:
1. Properly support piping and make adequate provisions for expansion, contraction, slope, and anchorage.
   a. Except for underground pipe, suspend piping from roof trusses or clamp to vertical walls using support channels and clamps. Do not hang pipe from other pipe, equipment, or ductwork. Laying of piping on any building element is not allowed.
   b. Supports For Horizontal Piping:
      1) Support metal piping at 96 inches (2 400) mm on center maximum for pipe 1-1/4 inches (32 mm) or larger and 72 inches (1 800 mm) on center maximum for pipe 1-1/8 inch (28 mm) or less.
      2) Support thermoplastic pipe at 48 inches (1 200 mm) on center maximum.
      3) Provide support at each elbow. Install additional support as required.
   c. Supports for Vertical Piping:

1) Place riser clamps at each floor or ceiling level.
2) Securely support clamps by structural members, which in turn are supported directly from building structure.
3) Provide clamps as necessary to brace pipe to wall.

d. Insulate hangers for copper pipe from piping by means of at least two layers of Scotch 33 plastic tape.
e. Expansion of Thermoplastic Pipe:
1) Provide for expansion in every 30 feet (9 meters) of straight run.
2) Provide 12 inch (300 mm) offset below roof line in each vent line penetrating roof.

END OF SECTION

SECTION 23 0553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install identification of HVAC equipment and piping as described in Contract Documents.

B. Products Furnished But not Installed Under This Section:
1. Paint identification for gas piping used in HVAC equipment.

C. Related Requirements:
1. Section 22 0529: 'Hangers And Supports For Plumbing' for installation of paint identification for gas piping used with HVAC equipment.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Description:
1. Abbreviations for Pipe Stencils and Equipment Identification and Band Colors for Pipe Identification:
   a. Apply stenciled symbols and continuous painting as follows:

Pipe Type	Pipe Color	Symbol
Gas	Yellow	GAS

B. Materials:
1. Paint:
   a. Paints specified are from Pittsburgh Paint & Glass (PPG), Pittsburgh, PA www.ppgaf.com or PPG Canada Inc, Mississauga, ON (800) 263-4350 or (905) 238-6441.
   b. One Coat Primer:
      1) 6-2 Quick Drying Latex Primer Sealer over fabric covers.
      2) 6-205 Metal Primer under dark color paint.
      3) 6-6 Metal Primer under light color paint.
   c. Finish Coats: Two coats 53 Line Acrylic Enamel.
   d. Class Two Quality Standard. See Section 01 6200.
      1) Paint of equal quality from other Manufacturers may be used.
      2) Maintain specified colors, shades, and contrasts.
2. Labels:
   a. Equipment Identification:
      1) Black formica, with white reveal when engraved.
      2) Lettering to be 3/16 inch (5 mm) high minimum.

PART 3 - EXECUTION

3.1 APPLICATION

A. Labels:
1. Identify following items with specified labels fastened to equipment with screws (unless noted otherwise):
   a. Thermostats and control panels in mechanical spaces (attach label to wall directly above or below thermostats).
   b. Furnaces.
   c. Condensing units.
   d. Duct furnaces.
   e. Air handling units and fan coil units.
2. Engrave following data from Equipment Schedules on Drawings onto labels:
   a. Equipment mark.
   b. Area served.
   c. Thermostat zone number, when different from equipment mark.
   d. Panel and breaker from which unit is powered.

B. Painting:
1. Leave equipment in like-new appearance.
2. Only painted legends, directional arrows, and color bands are acceptable.
3. Locate identifying legends, directional arrows, and color bands at following points on exposed piping of each piping system:
   a. Adjacent to each item of equipment.
   b. At point of entry and exit where piping goes through wall.
   c. On each riser and junction.
   d. Every 25 feet (7.620 m) on long continuous lines.
   e. Stenciled symbols shall be one inch (25 mm) high and black.

END OF SECTION

SECTION 23 0593

DUCT TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Test, balance, and adjust air duct systems as described in Contract Documents.

B. Related Sections:
   1. Other Sections of Division 23:
      a. Completing installation and start-up of mechanical systems, and changing sheaves, belts, and dampers as required for correct balance.
      b. Assisting Balancing Agency in testing and balancing of mechanical system.

1.2 SYSTEM DESCRIPTION

A. Performance Requirements:
   1. Perform testing and balancing in complete accordance with Associated Air Balance Council Standards for Field Measurement & Instructions, Form P1266, Volume I. Record test data on AABC standard forms or facsimile.
   2. Noise level shall not exceed PNC 35 in Chapel or Cultural Center when all mechanical equipment is operating.

1.3 SUBMITTALS

A. Quality Assurance / Control:
   1. Four copies of complete test data for evaluation and approval.
   2. Test And Balance Report:
      a. Complete with logs, data, and records as required herein. Print logs, data, and records on white bond paper bound together in report form.
      b. Certified accurate and complete by Balancing Agency's certified test and balance engineer.
      c. Contain following general data in format selected by Balancing Agency.
         1) Project Number.
         2) Project Title.
         3) Project Location.
         4) Project Architect and Mechanical Engineer.
         5) Test and Balance Agency and Certified Engineer.
         6) Contractor and mechanical sub-contractor.
         7) Dates tests were performed.
         8) Certification Document.
         9) Report Forms similar to AABC Standard format.
      d. Report shall include following:
         1) Preface suggesting abnormalities and problems encountered.
         2) Instrumentation List including type, model, manufacturer, serial number, and calibration dates.

3) System Identification reporting location of zones, supply, return, and exhaust openings.
4) Record following for each piece of air handling equipment:
   a) Manufacturer, model number, and serial number.
   b) Design and manufacturer rated data.
   c) Actual CFM.
   d) Suction and discharge static pressure of each fan.
   e) Outside-air and return-air total CFM.
   f) Actual operating current, voltage, and brake horsepower of each fan motor.
   g) Final RPM of each motor.
   h) Fan and motor sheave manufacturer, model, size, number of grooves and center distance.
   i) Belt size and quantity.
   j) Static-pressure controls final operating set points.

3. Bind approved copy of report in Operations And Maintenance Manual for Division 23.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Work of this Section shall be performed by independent Air Testing And Balance Agency specializing in testing and balancing of heating, ventilating, and cooling systems to balance, adjust, and test air moving equipment, air distribution, and exhaust systems.
   2. Agency shall provide proof of having successfully completed at least five years of specialized experience in air and hydronic system balancing. Work by this Agency shall be done under direct supervision of qualified heating and ventilating engineer employed by Agency.
   3. Agency shall be approved in writing by Architect.
   4. Neither Architect's engineering consultant or anyone performing work on this Project under other Sections of Division 23 shall be permitted to do this work.

1.5 SCHEDULING

A. Award test and balance subcontract to Agency upon receipt of Notice To Proceed to allow Agency to schedule this work in cooperation with other Sections involved and to comply with completion date.

B. Do not begin air testing and balancing until:
   1. After completion of air cooling, heating, and exhaust systems including installation of specialties, devices, and new filters.
   2. Proper function of control system components including electrical interlocks, damper sequences, air and water reset, and fire and freeze stats has been verified.
   3. Automatic temperature controls have been calibrated and set for design operating conditions.
   4. Verification of proper thermostat calibration and setting of control components such as static pressure controllers and other devices that may need set points changed during process of balancing system.

PART 2 - PRODUCTS: Not Used

PART 3 - EXECUTION

3.1 PREPARATION

A. Heating, ventilating, and cooling systems and equipment shall be in full operation and continue in operation during each working day of testing and balancing.

3.2 FIELD QUALITY CONTROL

A. Site Tests:
   1. If requested, conduct tests in presence of Architect.
   2. Instruments used by Agency shall be accurately calibrated and maintained in good working order.
   3. Air Testing And Balancing Procedure:
      a. Perform tests at high and low speeds of multi-speed systems and single speed systems. Perform following testing and balancing functions in accordance with Associated Air Balance Council National Standards:
         1) Fan Speeds: Furnaces And Fan Coil Units (with direct drive motors): Set fan speed to lowest possible setting that will achieve design CFM requirements. Adjust down from Contractor setting, if necessary.
         2) Current And Voltage: Measure and record motor current and voltage.
         3) Pitot-Tube Traverse: Perform pitot-tube traverse of main supply and return ducts to obtain total CFM.
         4) Outside Air: Test and adjust system minimum outside air by pitot-tube traverse.
         5) Static Pressure: Test and record system static pressures, including suction and discharge static pressure of each fan.
         6) Air Temperature: Take wet and dry bulb air temperatures on entering and leaving side of each cooling coil. Dry bulb temperatures shall be taken on entering and leaving side of each heating unit.
         7) Main Ducts: Adjust main ducts to within design CFM requirements and traverse for total CFM quantities.
         8) Branch Ducts: Adjust branch ducts to within design CFM requirements. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open.
         9) Tolerances: Test and balance each diffuser, grille, and register to within 10 percent of design requirements.
         10) Identification: Identify the location and area of each grille, diffuser, and register. Record on air outlet data sheets.
         11) Description: Record size, type, and manufacturer of each diffuser, grille, and register on air outlet data sheets.
         12) Drafts: Adjust diffusers, grilles, and registers to minimize drafts.
      b. Permanently mark all outside air, supply air, and return air damper positions after balancing has been completed.

B. Final Inspection And Adjustments:
   1. System shall be balanced and reports submitted to Architect before final inspection.
   2. Balancing Agency shall be represented at final inspection meeting by qualified testing personnel with balancing equipment and two copies of air balancing test report.
      a. Architect will choose and direct spot balancing of one zone. Differences between the spot balance and test report will be justification for requiring repeat of testing and

balancing for entire building. If recheck testing demonstrates measured flow deviation of 10 percent or more from recorded information on report, report will be rejected and new inspection and report will be made and resubmitted.

b. Perform re-balancing in presence of Architect and subject to its approval.
c. If re-balancing is required, submit revised air test and balance reports to Architect before Substantial Completion.
d. Spot balance and rebalance shall be performed at no additional cost to Owner.

3. Where furnace supplied to job site provides over 5 percent more air than schedule requirements, rooms supplied by that furnace shall have their supply air quantities increased by ratio of actual total air quantity supplied to minimum air quantity required by furnace schedule.

END OF SECTION

SECTION 23 0713

DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install thermal wrap duct insulation as described in Contract Documents.

B. Related Requirements:
1. Section 23 3114: 'Low-Pressure Metal Ducts'.
2. Section 23 3300: 'Acoustic Duct Accessories' for duct liner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer Contact List:
1. Certainteed St Gobain, Valley Forge, PA www.certainteed.com.
2. Johns-Manville, Denver, CO www.jm.com.
3. Knauf Fiber Glass, Shelbyville, IN www.knauffiberglass.com or Toronto, ON (416) 593-4322.
4. Manson Insulation Inc, Brossard, QB www.isolationmanson.com.
5. Owens-Corning, Toledo, OH or Owens-Corning Canada Inc, Willowdale, ON www.owenscorning.com.

2.2 MATERIALS

A. Thermal Wrap Duct Insulation:
1. 1-1/2 inch (38 mm) or 3 inch (76 mm) thick fiberglass with factory-laminated, reinforced aluminum foil scrim kraft facing and density of 0.75 lb / per cu ft (12 kg / per cu m).
2. Thermal Conductivity: 0.27 BTU in/HR SF deg F at 75 deg F (24 deg C) maximum.
3. Type One Acceptable Products:
   a. Type 75 standard duct insulation by Certainteed St Gobain.
   b. Microlite FSK by Johns-Manville.
   c. Duct Wrap FSK by Knauf Fiber Glass.
   d. Alley Wrap FSK by Manson Insulation Inc.
   e. FRK by Owens-Corning.
   f. Equal as approved by Architect before bidding. See Section 01 6200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Thermal Wrap Duct Insulation:
1. Install insulation as follows:
   a. Within Building Insulation Envelope:
      1) 1-1/2 inches (38 mm) thick on rectangular outside air ducts and combustion air ducts.
      2) 1-1/2 inches (38 mm) thick on all round ducts.

b. Outside Building Insulation Envelope:
   1) 3 inch (76 mm) thick on round supply and return air ducts.
   2) 1-1/2 inch (38 mm) thick on rectangular, acoustically lined, supply and return air ducts.

2. Wrap insulation tightly on ductwork with circumferential joints butted and longitudinal joints overlapped minimum 2 inches (50 mm).
   a. Do not compress insulation except in areas of structural interference. Minimum thickness at corners shall be one inch (25 mm) thick.
   b. Remove insulation from lap before stapling.
   c. Staple seams at approximately 16 inches (400 mm) on center with outward clenching staples.
   d. Seal seams with foil vapor barrier tape or vapor barrier mastic. Seal penetrations of facing to provide vapor tight system.

B. Insulate outside of ceiling diffusers, diffuser drops, and duct silencers same as ductwork.

END OF SECTION

SECTION 23 0719

HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install insulation on above ground refrigerant piping and fittings as described in Contract Documents.

B. Related Requirements:
1. Section 23 0501: 'General HVAC Requirements'.

1.2 DELIVERY, STORAGE, AND HANDLING

A. Storage And Handling Requirements:
1. Keep materials and work dry and free from damage.
2. Replace wet or damaged materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
1. Manufacturer Contact List:
   a. Armacell, Mebane, NC www.armaflex.com.
   b. Childers Products Co, Eastlake, OH www.fosterproducts.com.
   c. Foster Products Corp, Oakdale, MN www.fosterproducts.com.
   d. Johns-Manville, Denver, CO www.jm.com.
   e. Knauf, Shelbyville, IN www.knauffiberglass.com.
   f. Manson, Brossard, BC, Canada www.isolationmanson.com.
   g. Nitron Industries, Thousand Oaks, CA www.nitronindustries.com.
   h. Owens-Corning, Toledo, OH www.owenscorning.com or Owens-Corning Canada Inc, Willowdale, ON (416) 733-1600.
   i. Ramco, Lawrenceville, NJ www.ramco.com.
   j. Nomac, Zebulon, NC www.nomaco.com.
   k. Speedline Corp, Solon, OH www.speedlinepvc.com.

B. Materials:
1. Refrigeration Piping System:
   a. Thickness:

Pipe Size, Outside Diameter	Insulation Thickness
One inch and smaller	1/2 Inch
1-1/8 to 2 inch	3/4 Inch

1) One inch sheet for fittings as recommended by Manufacturer.
2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
   a) AP Armaflex 25/50 by Armacell.
   b) Nitrolite by Nitron Industries. White only for exterior.

c) Nomaco K-Flex.

b. Insulation Tape:
1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
a) Armaflex AP Insul Tape by Armacell.
b) FT182 Tape by Nitron Industries.
c) Elastomeric Foamtape by Nomac K-Flex.

c. Exterior Finish:
1) For application to non-white, exterior insulation.
2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
a) WB Armaflex Finish by Armacell.
b) R-374 Protective Coating by Nomaco K-Flex.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before application of insulating materials, brush clean surfaces to be insulated and make free from rust, scale, grease, dirt, moisture, and any other deleterious materials.

B. Use drop cloths over equipment and structure to prevent adhesives and other materials spotting the work.

3.2 INSTALLATION

A. Refrigeration System Piping System:
1. General:
a. Install insulation in snug contact with pipe.
1) Insulate flexible pipe connectors.
2) Insulate thermal expansion valves with insulating tape.
3) Insulate fittings with sheet insulation and as recommended by Manufacturer.
b. Slip insulation on tubing before tubing sections and fittings are assembled keeping slitting of insulation to a minimum.
c. Do not install insulation on lines through clamp assembly of pipe support. Butt insulation up against sides of clamp assembly.
d. Stagger joints on layered insulation. Seal joints in insulation.
e. Install insulation exposed outside building so 'slit' joint seams are placed on bottom of pipe.
f. Paint exterior exposed, non-white insulation with two coats of specified exterior finish.
2. System Requirements:
a. Condensing Units: Install insulation on above ground refrigerant suction piping and fittings, including thermal bulb, from thermal expansion valve.

3.3 FIELD QUALITY CONTROL

A. Non-Conforming Work:
1. Method of installing insulation shall be subject to approval of Architect. Sloppy or unworkmanlike installations are not acceptable.

3.4 CLEANING

A. Leave premises thoroughly clean and free from insulating debris.

3.5 PROTECTION

A. Protect insulation wherever leak from valve stem or other source might drip on insulated surface, with aluminum cover or shield rolled up at edges and sufficiently large in area and of shape that dripping will not splash on surrounding insulation.

END OF SECTION

SECTION 23 0933

ELECTRIC AND ELECTRONIC CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install automatic temperature control system as described in Contract Documents.
   2. Furnish and install conductors and make connections to control devices, motors, and associated equipment.
   3. Assist in air test and balance procedure.

B. Related Requirements:
   1. Section 23 0501: Common HVAC Requirements.
   2. Section 23 0593: Duct testing, adjusting, and balancing of ductwork.
   3. Section 23 3300: Furnishing and installing of temperature control dampers.
   4. Division 26:
      a. Furnishing and installing of raceway, conduit, and junction boxes, including pull wires, for temperature control system except as noted above.
      b. Power wiring to magnetic starters, disconnect switches, and motors.
      c. Motor starters and disconnect switches, unless integral with packaged equipment.

1.2 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Installer to provide product literature or cut sheets for all products specified in Project.
      b. Installer to provide questions of control equipment locations to Mechanical Engineer prior to installation.

B. Informational Submittals:
   1. Certificates:
      a. Installer must provide ‘Certificate of Sponsorship’ signed from Approved Distributor with bid confirming Installer sponsorship.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Leave with O&M Manual specified in Section 23 0501.
      b. Record Documentation:
         1) Installer's 'Certificate of Sponsorship'.

1.3 QUALITY ASSURANCE

A. Qualifications: Requirements of Section 01 4301 applies, but is not limited to the following:
   1. Installer:
      a. Before bidding, obtain sponsorship from a local, Approved Distributor specified under PART 2 PRODUCTS of this specification. Initial requirements for sponsorship are:
         1) Receive product training from Approved Distributor.
         2) Exhibit RedLINK/Commercial system skills to sponsoring Approved Distributor.

3) Installer to provide Distributor sponsorship by submitting 'Certificate of Sponsorship' as Informational Submittal with bid. Certificate available as Attachment in this Specification.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Manufacturers:
1. Manufacturer Contact List:
   a. Air Products & Controls Ltd, Pontiac, MI www.ap-c.com.
   b. Fire-Lite Alarms, Northford, CT www.firelite.com.
   c. Honeywell Inc, Minneapolis, MN www.honeywell.com.
      1) Primary Contact: Chris Brinkerhoff, (801) 550-3344, chris.brinkerhoff@honeywell.com.
   d. ICCA Firex, Carol Stream, IL www.icca.invensys.com.
   e. Insul_Guard, Salt Lake City, UT:
      1) Primary Contact: Dan Craner, (801) 518-3733, insul_guard@comcast.net.
   f. System Sensor, St Charles, IL www.systemsensor.com.
   g. Zimmerman Technologies, Renton, WA:
      1) Primary Contact: Tracy Zimmerman, (425) 255-1906, zimmtech@yahoo.com.

B. Distributors: RP panels, thermostats, and other control equipment from following Sponsoring Approved Distributors. See Section 01 4301:
1. Kansas:
   a. O'Connor Co: (888) 800-3540 pbeach@oconnor-hvac.com Phil Beach.
   b. Superior Controls Concepts: (316) 282-0870 vern@scci.biz Vern Miller.

C. Performance:
1. Design Criteria:
   a. Automatic Temperature Control System design concept utilizes communicating thermostats located near furnace, with electronic sensors and electric / electronic actuation of dampers and with thermostats connected with Echelon approved communication cable. A WebStat Building Manager will interface with the thermostats to provide access via internet browser.
   b. Network communications and control devices will be LonWorks compliant. System shall include HVAC control, WebStat Building Manager to provide maintenance management functions related to normal building operations.

D. Components:
1. Thermostats And Sensors:
   a. Thermostat and Sensor Kit:
      1) Category Four Approved Product. See Section 01 6200 for definitions of Categories:
         a) Part Number Y7335H1009 consisting of following:
            (1) Communicating Thermostat: Low voltage type provided with automatic change-over feature for both heating and cooling stages, seven-day / 365 day program with two starts and stops per day, and provisions for damper operators. Honeywell T7350H1009.
            (2) Push-Button Remote Room Sensor: Honeywell T7771A1005 with three push buttons, OVERRIDE, WARMER, COOLER, and with selectable ohm resistance, 10k or 20k.
            (3) Discharge Air Sensor: Honeywell C7041B2005, 6 inch.
   b. Plain Face Remote Room Sensor:
      1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         a) Honeywell TR21-A, plain face, 10k ohms.
         b) Honeywell TR21, plain face, 20k ohms.
2. Transformer:
   a. 120 / 24 V, 50VA Honeywell AT150F.
   b. 120 / 24 V, 75VA Honeywell AT175F.

3. Damper Actuators:
   a. Electric type equipped for Class I wiring.
   b. Shall not consume power during UNOCCUPIED cycle or use chemicals or expandable media.
   c. Have built in spring return.
   d. Category Four Approved Product. See Section 01 6200 for definitions of Categories:
      1) Honeywell MS8105A1030/U.
      2) Honeywell MS8105A1130 w/ End switch.
4. Conductors:
   a. Color-coded and No. 16 and No. 12 AWG Type TWN, TFN, or THHN, stranded.
   b. Thermostat Cable: 12, 8, or 4 conductor, 18AWG solid copper wire, insulated with high-density polyethylene. Conductors parallel enclosed in brown PVC jacket (22 AWG cable not allowed).
   c. Communicating Cable:
      1) Class Two Quality Standard. See Section 01 6200:
         a) CAT 4, 22 gauge (0.025 in) (0.645 mm), twisted pair, non-plenum and non-shielded cable.
5. Local Relay (RP) Panels For Chapel And Cultural Center Systems:
   a. 16-ga (1.59 mm) screw cover, painted sheet metal. Box with cover and knockouts, pre-wired terminal strips, relay, and transformer.
   b. Provide Labels with Distributor contact information on each panel.
   c. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) Standard: LDS Models RP-1, RP-5, RP-6.

E. Operation Sequences:
1. Programmable thermostat shall control unoccupied and occupied status of fan system based on adjustable seven day program and remote room sensor / push button. Fan shall run continuously in occupied mode and cycle in unoccupied mode.
2. Adjustable heating and cooling set points shall control space temperature by activating either heating or cooling equipment. Programmable thermostat provides automatic change over between heating and cooling.
3. Remote room sensor provides optional override of thermostat program by allowing three hour timed override of thermostat program at any time by pushing ON / OFF button on remote room sensor cover. This shall activate thermostat to occupied mode and system shall control to occupied set point.
4. Minimum outside air damper, spring return type, shall open in occupied mode and remain closed in unoccupied mode in zones using outside air.
5. Two Sensor Averaging, Bishop Zone:
   a. Sensors shall control zone HVAC equipment by averaging temperature in spaces containing sensors.
   b. Third dummy sensor, typically located in unlocked common space, is place-holder for OVERRIDE, WARMER, and COOLER buttons and does not sense temperature.
6. Three Sensor Averaging:
   a. Sensors shall control zone HVAC equipment by averaging temperature in spaces containing sensors.
   b. Fourth dummy sensor, typically located in unlocked common space, is place-holder for OVERRIDE, WARMER, and COOLER buttons and does not sense temperature.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Interface With Other Work:
1. Calibrate room thermostats as required during air test and balance. Insulate sensor J-box with fiberglass insulation; expandable/ foam insulation is NOT acceptable
2. Instruct air test and balance personnel in proper use and setting of control system components.
3. Install low voltage electrical wiring in accordance with Division 26 of these Specifications.

B. Communication Cable:
   1. Network communicating thermostats and WebStat Building Manager together with specified communicating cable.
   2. Do not bundle communication cables with cables of other systems. Maintain 12 inches minimum distance from wires of other systems, except communication cable may cross other low-voltage wiring if done perpendicularly.

C. Safety Controls: Interlock duct smoke detectors to keep heating, cooling, and system fan from operating when detector is energized.

D. Mount damper actuators and actuator linkages external of airflow. Make certain dampers operate freely without binding or with actuator housing moving.

E. Paste copy of record control wiring diagram on back of relay panel door cover for each multiple furnace system.

3.2 FIELD QUALITY CONTROL

A. Field Tests:
   1. Calibrate, adjust, and set controls for proper operation, operate systems, and be prepared to prove operation of any part of control system. This work is to be completed before pre-substantial completion inspection.
   2. Test each individual heating, cooling, and damper control for proper operation using control system.

3.3 SYSTEM STARTUP

A. For systems with WebStat Building Manager.
   1. Contractor is responsible for a fully functioning control system accessible via internet web browser. Contractor is responsible to coordinate Network start up with assistance from local IT technician. Local IT technician shall provide Static, IP address, Network Mask, Default Gateway, Primary DNS Server, Local Host Name, Local Domain Name.
   2. Contractor is responsible configuring all thermostats with proper zone names, zone scheduling, proper Church conference / holiday scheduling, all to be coordinated with local FM manager. Set proper clock setting including day/month/year. Use WebStat as network time master from “System” tab in WebStat.
   3. Set remote sensor to T7771.
   4. Set remote humidity to none unless using remote humidity sensor on DH systems.
   5. Set Occupancy sensor to None.
   6. Set Discharge Air Temp sensor to Remote.
   7. Set Heating / Cooling to proper stages
   8. Set heat cycle rates to 9 cph and cooling to 4 cph. Set discharge high limit to 110 degrees but do not activate (check) the high limit option. This is only to be used later by Owner if equipment experiences issues with system overshoot.
   9. Set Aux relay to “Time of Day”.
   10. Set fan switch operation to “ON”.
   11. Set minimum UnOcc start time for all days. No days shall be scheduled Unconfigured.
   12. Set occupied start times to match meeting start times; provided by local FM manager.
   13. Place all zone over-ride durations to one (1) hour except for Bishop and Stake area which shall be set to two (2) hours.
   14. Set Occupied default heating setpoints to 70 degrees, cooling setpoints to 74 degrees.
   15. Set UnOccupied default heating setpoint to 60 degrees, cooling setpoints to 90 degrees.
   16. Set each zone to applicable Holiday scheduling for General & Stake Conferences.

B. WebStat settings
   1. Obtain from IT a LAN / WAN SMTP email server name for system alarming; where applicable.
   2. Create alarm setpoint of 55 degrees low limit / 92 degrees high limit for all zones.

3. Create separate Administrative User level for Local FM Manager.

3.4 ADJUSTING

A. Program minimum of one (1) day's operation into thermostat memory function.

3.5 CLOSEOUT ACTIVITIES

A. Instruction Of Owner:
   1. Include as part of training required in Section 23 0501, following training:
      a. Training shall be by personnel of installing company and utilize operator's manuals and as-built documentation.
      b. Provide training in (2) two sessions including WebStat for up to six (6) hours total:
         1) First session will occur between system completion and Substantial Completion.
         2) Second session will occur within forty five (45) days of Substantial Completion when agreed upon by Owner.
      c. Training shall include sequence of operation review, selection of displays, modification of schedules and setpoints, troubleshooting of sensors, etc, as follows:
         1) Control System Overview:
            a) Show access to system through both individual thermostats and Internet browser via WebStat and how network works. Demonstrate scheduling for Stake and General Conferences.
         2) Thermostat Programming From Keypad: Instructions on developing setpoints and schedules and adjusting local zone temperatures.
         3) Thermostat Operation:
            a) Identify and explain use of buttons on thermostat face, I.E. 'i' or information button, warmer button, and cooler button.
            b) Identify and explain buttons under thermostat cover.
            c) Provide training for Thermostat Palm Program.
         4) WebStat training with local Facilities Manager during two (2) sessions.
            a) Review all features accessible from the Overview tab including individual zone details, setpoints and fan, show schedule, edit configuration.
            b) Review all features accessible from schedules including multiple schedules, zone assignments, holiday scheduling/ conference scheduling.
            c) Review alarm configurations, alarm assignments, alarm priority.
            d) Review user levels and creating users.
            e) Review thermostat editing and configuration. Explain each thermostat programming option. Explain download pending, download, & commissioning.
            f) Review System backup configuration, restore configuration, reboot WebStat, Network Time Master, time and date setting and Local Weather option. No OAT is associated.
            g) Review system User Log in and User Log Out process.

END OF SECTION

ATTACHMENTS

CERTIFICATE OF SPONSORSHIP

Electric and Electronic Control System for HVAC Installer

PROJECT INFORMATION (To be filled out by Installer - available from project specification):

Project Name: _____

Project Number: _____

Project Address: _____

INSTALLER INFORMATION (To be filled out by Installer):

Installer Name: _____

Installer Firm: _____

Installer Address: _____

I acknowledge and confirm the above listed Installer has received training and exhibit RedLINK/Commercial System skills and is qualified to install the automation control system as specified for Project identified above. Our company will stand behind the Installer meeting the legal specified performance requirements.

Sponsoring Approved Honeywell Distributor Name: _____

Signature: _____ Printed Signature: _____

Date: _____

SECTION 23 1123

FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Perform excavation and backfill required for work of this Section.
2. Furnish and install gas piping and fittings within building and from building to meter including connection to meter as described in Contract Documents.

B. Related Requirements:
1. Section 23 0501: 'Common HVAC Requirements'.

1.2 REFERENCES

A. Reference Standards:
1. ASTM International:
   a. ASTM A53/A53M-12, 'Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless'.
   b. ASTM A234/A234M-11a, 'Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service'.
   c. ASTM D2513-12ae1, 'Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings'.

1.3 QUALITY ASSURANCE

A. Qualifications:
1. Welders:
   a. Welders shall be certified and bear evidence of certification thirty (30) days before commencing work on project.
   b. If there is doubt as to proficiency of welder, Owner's Representative may require welder to take another test. This shall be done at no cost to Owner. Certification shall be by Pittsburgh Testing Laboratories or other approved authority.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Storage And Handling Requirements:
1. Do not store polyethylene pipe so it is exposed to sunlight.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
1. Manufacturer Contact List:
   a. BrassCraft, Novi, MI www.brasscraft.com.
   b. Cimberio Valve Co Inc, Malvern, PA www.cimberio.com.
   c. ConBraCo Industries, Inc, Matthews, NC www.conbraco.com or ConBraCo / Honeywell Ltd, Scarborough, ON (416) 293-8111.
   d. Dormont Manufacturing Company, Export, PA www.dormont.com.
   e. Jenkins-NH-Canada, Brantford, ON www.jenkins-nh-canada.com.
   f. Jomar International, Madison Heights, MI www.jomar.com.
   g. California Valves (formally KOSO) by Pacific Seismic Products Inc, Lancaster, CA, Distributed by Strand Earthquake Consultants www.strandearthquake.net.

h. Watts Regulator Co, North Andover, MA www.wattsreg.com or Watts Industries (Canada) Inc, Burlington, ON (888) 208-8927.

B. Materials:
1. Above-Ground Pipe And Fittings:
   a. Black carbon steel, butt welded, Schedule 40 pipe meeting requirements of A53/A53M.
   b. Welded forged steel fittings meeting requirements of ASTM A234/A234M or standard weight malleable iron screwed.
2. Valves:
   a. 125 psi (862 kPa) bronze body ball valve, UL listed.
   b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) CIM 102.1 by Cimbrio Valve.
      2) Apollo Series 80-100 by ConBraCo.
      3) 'Red Cap' R602 by Jenkins NH Canada.
      4) Model T-204 by Jomar International.
      5) Model B-6000-UL by Watts Regulator.
3. Cocks:
   a. Gauge Cocks: Conbraco Series 50-56 bronze gauge cock.
4. Flexible Connector:
   a. Type 304 stainless steel corrugated tube coated for corrosion protection.
   b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) Dormont Supr-Safe.
      2) BrassCraft Procoat.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Steel pipe installed through air plenums, in walls, and pipes 2-1/2 inches (64 mm) and larger shall have welded fittings and joints. Other steel pipe may have screwed or welded fittings.

B. Lay underground pipe in accordance with Manufacturer's recommendations and local gas utility company regulations and specifications.
1. Provide 24 inch (610 mm) minimum steel pipe between vertical rise of riser and end of polyethylene line if anode-less riser is not used. Use plastic-to-steel transition or compression fitting between end of polyethylene line and steel meter riser. Provide cathodic protection for steel riser or use anode-less riser.
2. Place tracer wire along side of polyethylene pipe from meter to point where pipe rises inside building.
3. Place 4 inches (100 mm) of sand around gas line buried underground.
4. Do not install gas piping under building floor slabs-on-grade.

C. On lines serving gas-fired equipment, install gas cocks adjacent to equipment outside of equipment cabinet and easily accessible.

D. Install 6 inch (150 mm) long minimum dirt leg, with pipe cap, on vertical gas drop serving each gas-fired equipment unit.

E. Use fittings for changes of direction in pipe and for branch runouts.

3.2 FIELD QUALITY CONTROL

A. Field tests:
1. Subject all portions of gas piping system, in sections or in entirety, to air pressure of 75 psig (0.52 MPa) and prove airtight for 4 hours.
2. Disconnect equipment not suitable for 75 psig (0.52 MPa) pressure from piping system during test period.

END OF SECTION

SECTION 23 2300

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install piping and specialties for refrigeration systems as described in Contract Documents.

B. Products Installed But Not Furnished Under This Section:

C. Related Requirements:
1. Section 23 0501: 'Common HVAC Requirements'.
2. Section 23 0719: 'Refrigerant Piping Insulation'.
3. Section 23 6213: 'Packaged Air-Cooled Refrigerant Compressor And Condenser Units'.
4. Section 23 8216: 'Air Coils: DX'.

1.2 REFERENCES

A. Association Publications:
1. Federal Emergency Management Agency (FEMA) / Vibration Isolation and Seismic Control Manufacturers Association (VISCMA) / American Society of Civil Engineers (ASCE):
   a. FEMA 412, 'Installing Seismic Restraints For Mechanical Equipment' (December 2002).
2. Vibration Isolation and Seismic Control Manufacturers Association (VISCMA):
   a. VISCMA 101-12, 'Seismic Restraint Specification Guidelines for Mechanical, Electrical, and Plumbing Systems'.
   b. VISCMA 102-12, 'Vibration Isolation Specification Guidelines for Mechanical, Electrical, and Plumbing Systems'.

B. Definitions:
1. Refrigerant: Absorbs heat by a change of state (evaporation) from liquid to a gas, and releases heat by a change of state (condenses) from gas back to a liquid.
2. Vibration Isolation: Vibration reduction in which an isolation system is placed between the source of unwanted vibration and an item which needs to be shielded from the vibration.

C. Reference Standards:
1. American National Standards Institute (ANSI) / American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
   a. ANSI/ASHRAE Standard 15-2010, 'Safety Standard for Refrigeration Systems'.
   b. ANSI/ASHRAE Standard 34-2010, 'Designation and Classification of Refrigerants'.
2. American National Standards Institute (ANSI) / American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) / Illuminating Engineering Society (IESNA):
   a. ANSI/ASHRAE/IESNA 90.1-2010, 'Energy Standard for Buildings Except Low-Rise Residential Buildings' I-P Edition.
3. American National Standards Institute / American Welding Society:
   a. ANSI/AWS A5.8M/A5.8-2011, 'Specification for Filler Metals for Brazing and Braze Welding'.
4. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
   a. '2011 ASHRAE Handbook - HVAC Applications'.
      1) Chapter 48, 'Noise and Vibration Control'.
5. ASTM International:
   a. ASTM A36/A36M-08, 'Standard Specification for Carbon Structural Steel'.

b. ASTM B280-08, 'Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service'.

6. National Fire Protection Association / American National Standards Institute:
   a. NFPA 90A-2012, 'Installation of Air Conditioning and Ventilating Systems'.
7. Underwriters Laboratories:
   a. UL 2182, 'Refrigerants' (2nd Edition).

1.3 SUBMITTALS

A. Action Submittals:
1. Shop Drawings: Show each individual equipment and piping support.

B. Informational Submittals:
1. Qualification Statements: Technician certificate for use of HFC and HCFC refrigerants.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. Refrigerants:
   a. Underwriters Laboratories / Underwriters Laboratories of Canada:
      1) Comply with requirements of UL 2182.
2. Energy Efficiency: Equal to or greater than prescribed by ANSI/ASHRAE/IESNA 90.1.

B. Qualifications. Section 01 4301 applies, but is not limited to the following:
1. Installer: Refrigerant piping shall be installed by refrigeration contractor licensed by State and by technicians certified in use of HFC and HCFC refrigerants.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Manufacturers:
1. Manufacturer Contact List:
   a. Airtec, Fall River, MA, www.noventcaps.com.
   b. Cush-A-Clamp by ZSI Manufacturing, Canton, MI www.cushaclamp.com.
   c. Elkhart Products Corp, Elkhart, IN www.elkhartproducts.com.
   d. Emerson Climate Technologies, St Louis, MO www.emersonflowcontrols.com.
   e. Handy & Harman Products Division, Fairfield, CT www.handy-1.com.
   f. Harris Products Group, Cincinnati, OH www.harrisproductsgroup.com.
   g. Henry Valve Co, Melrose Park, IL www.henrytech.com.
   h. Hilti Inc, Tulsa, OK www.hilti.com.
   i. Hydra-Zorb Co, Auburn Hills, MI www.hydra-zorb.com.
   j. JB Industries, Aurora, IL www.jbind.com.
   k. Mueller Steam Specialty, St Pauls, NC www.muellersteam.com.
   l. Nibco Inc, Elkhart, IN www.nibco.com.
   m. Packless Industries, Waco, TX www.packless.com.
   n. Parker Corp, Cleveland, OH www.parker.com.
   o. Sporlan Valve Co, Washington, MO www.sporlan.com.
   p. Sherwood Valves, Washington, PA www.sherwoodvalve.com.
   q. Thomas & Betts, Memphis, TN www.superstrut.com.
   r. Unistrut, Div of Atkore International, Inc., Harvey, IL www.unistrut.com.
   s. Universal Metal Hose, Chicago, IL www.universalmetalhose.com.
   t. Vibration Mountings & Controls, Bloomingdale, NJ www.vmc-kdc.com.
   u. Virginia KMP Corp, Dallas, TX www.virginiakmp.com.

B. Materials:
1. Refrigerant Piping:
   a. Meet requirements of ASTM B280, hard drawn straight lengths. Soft copper tubing not permitted.
   b. Do not use pre-charged refrigerant lines.
2. Refrigerant Fittings:
   a. Wrought copper with long radius elbows.
   b. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
      1) Mueller Streamline.
      2) Nibco Inc.
      3) Elkhart.
3. Tee Access:
   a. Brass:
      1) Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
         a) JB Industries: Part #A3 Series with Factory Cap and Valve Core.
4. Connection Material:
   a. Brazing Rods in accordance with ANSI/AWS A5.8M/A5.8:
      1) Copper to Copper Connections:
         a) Classification BCuP-4 Copper Phosphorus (6 percent silver).
         b) Classification BCuP-5 Copper Phosphorus (15 percent silver).
      2) Copper to Brass or Copper to Steel Connections: Classification BAg-5 Silver (45 percent silver).
      3) Do not use rods containing Cadmium.
   b. Flux:
      1) Type Two Acceptable Products:
         a) Stay-Silv White Brazing Flux by Harris Products Group.
         b) High quality silver solder flux by Handy & Harmon.
         c) Equal as approved by Architect before use. See Section 01 6200.
5. Valves:
   a. Expansion Valves:
      1) For pressure type distributors, externally equalized with stainless steel diaphragm, and same refrigerant in thermostatic elements as in system.
      2) Size valves to provide full rated capacity of cooling coil served. Coordinate selection with evaporator coil and condensing unit.
      3) Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
         a) Emerson Climate Technologies.
         b) Henry.
         c) Mueller.
         d) Parker.
         e) Sporlan.
   b. Manual Refrigerant Shut-Off Valves:
      1) Ball valves designed for refrigeration service and full line size.
      2) Valve shall have cap seals.
      3) Valves with hand wheels are not acceptable.
      4) Provide service valve on each liquid and suction line at compressor.
      5) If service valves come as integral part of condensing unit, additional service valves shall not be required.
      6) Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
         a) Henry.
         b) Mueller.
         c) Sherwood.
         d) Virginia.
6. Filter-Drier:
   a. On lines 3/4 inch (19 mm) outside diameter and larger, filter-drier shall be replaceable core type with Schraeder type valve.
   b. On lines smaller than 3/4 inch (19 mm) outside diameter, filter-drier shall be sealed type with brazed end connections.

c. Size shall be full line size.
d. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
1) Emerson Climate Technologies.
2) Mueller.
3) Parker.
4) Sporlan.
5) Virginia.

7. Sight Glass:
a. Combination moisture and liquid indicator with protection cap.
b. Sight glass shall be full line size.
c. Sight glass connections and sight glass body shall be solid copper or brass, no copper-coated steel sight glasses allowed.
d. Category Four Approved Product. See Section 01 6200 for definitions of Categories:
1) HMI by Emerson Climate Technologies.

8. Flexible Connectors:
a. Designed for refrigerant service with bronze seamless corrugated hose and bronze braiding.
b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
1) Vibration Absorber Model VAF by Packless Industries.
2) Vibration Absorbers by Virginia KMP Corp.
3) Anaconda 'Vibration Eliminators' by Universal Metal Hose.
4) Style 'BF' Spring-flex freon connectors by Vibration Mountings.

9. Refrigerant Piping Supports:
a. Base, Angles, And Uprights: Steel meeting requirements of ASTM A36.
b. Securing Channels:
1) At Free-Standing Pipe Support:
a) Class One Quality Standard: P-1000 channels by Unistrut.
b) Acceptable Manufacturers: Hilti, Thomas & Betts.
c) Equal as approved by Architect before installation. See Section 01 6200.
2) At Wall Support:
a) Class One Quality Standard: P-3300 channels by Unistrut.
b) Acceptable Manufacturers: Hilti, Thomas & Betts.
c) Equal as approved by Architect before installation. See Section 01 6200.
3) At Suspended Support:
a) Class One Quality Standard: P-1001 channels by Unistrut.
b) Acceptable Manufacturers: Hilti, Thomas & Betts.
c) Equal as approved by Architect before installation. See Section 01 6200.
4) Angle Fittings:
a) Class One Quality Standard: P-2626 90 degree angle by Unistrut.
b) Acceptable Manufacturers: Hilti, Thomas & Betts.
c) Equal as approved by Architect before installation. See Section 01 6200.
c. Pipe Clamps:
1) Type Two Acceptable Manufacturers:
a) Hydra-Zorb.
b) ZSI Cush-A-Clamp.
c) Hilti Cush-A-Clamp.
d) Equal as approved by Architect before installation. See Section 01 6200.

10. Locking Refrigerant Cap:
a. Provide and install on charging valves:
1) Class One Quality Standard: ‘No Vent’ locking refrigerant cap.
2) Acceptable Manufacturers: Airtec.
3) Equal as approved by Architect before installation. See Section 01 6200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refrigerant Lines:

1. Install as high in upper mechanical areas as possible. Do not install underground or in tunnels.
2. Slope suction lines down toward compressor one inch/10 feet (25 mm in 3 meters). Locate traps at vertical rises against flow in suction lines.

B. Connections:
1. Refrigeration system connections shall be copper-to-copper, copper-to-brass, or copper-to-steel type properly cleaned and brazed with specified rods. Use flux only where necessary. No soft solder (tin, lead, antimony) connections will be allowed in system.
2. Braze manual refrigerant shut-off valve, sight glass, and flexible connections.
3. Circulate dry nitrogen through tubes being brazed to eliminate formation of copper oxide during brazing operation.

C. Specialties:
1. Install valves and specialties in accessible locations. Install refrigeration distributors and suction outlet at same end of coil.
2. Install thermostatic bulb as close to cooling coil as possible. Do not install on vertical lines.
3. Install equalizing line in straight section of suction line, downstream of and reasonably close to thermostatic bulb. Do not install on vertical lines.
4. Provide flexible connectors in each liquid line and suction line at both condensing unit and evaporator on systems larger than five tons. Anchor pipe near each flexible connector.

D. Refrigerant Supports:
1. Support Spacing:
   a. Piping 1-1/4 inch (32 mm) And Larger: 8 feet (2.450 m) on center maximum.
   b. Piping 1-1/8 inch (28.5 mm) And Smaller: 6 feet (1.80 m) on center maximum.
   c. Support each elbow.
2. Isolate pipe from supports and clamps with Hydrozorb or Cush-A-Clamp systems.
3. Run protective cover continuous from condensing units to risers or penetrations at building wall.

3.2 FIELD QUALITY CONTROL

A. Field Tests:
1. Make evacuation and leak tests in presence of Architect's Engineer after completing refrigeration piping systems. Positive pressure test will not suffice for procedure outlined below.
   a. Draw vacuum on each entire system with two stage vacuum pump. Draw vacuum to 300 microns using micron vacuum gauge capable of reading from atmosphere to 10 microns. Do not use cooling compressor to evacuate system nor operate it while system is under high vacuum.
   b. Break vacuum with nitrogen and re-establish vacuum test. Vacuum shall hold for 30 minutes at 300 microns without vacuum pump running.
   c. Conduct tests at 70 deg F (21 deg C) ambient temperature minimum.
   d. Do not run systems until above tests have been made and systems started up as specified. Inform Owner's Representative of status of systems at time of final inspection and schedule start-up and testing if prevented by outdoor conditions before this time.
   e. After testing, fully charge system with refrigerant and conduct test with Halide Leak Detector.
   f. Recover all refrigerant in accordance with applicable codes. Do not allow any refrigerant to escape to atmosphere.

B. Non-Conforming Work:
1. If it is observed that refrigerant lines are being or have been brazed without proper circulation of nitrogen through lines, all refrigerant lines installed up to that point in time shall be removed and replaced at no additional cost to Owner.

END OF SECTION

SECTION 23 2350

REFRIGERANT PIPE COVER

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, and Section 23 0501 apply to this Section.

PART 2 - PRODUCTS

2.1 BASIC COVER

A. Basic refrigerant line cover shall be 18 gauge steel, hot-dipped galvanized steel meeting the requirements of ASTM<A361-85.

B. Pop rivit attachments will not be allowed.

C. All fastening devices shall be plated screws. Arrange covers so they may be taken apart for service.

2.2 MANUFACTURED OUTER COVER

A. Refrigerant line covers at exterior walls shall be 24 ga steel, hot-dipped galvanized meeting requirements of ASTM<A361-85, "Specification for Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process for Roofing and Siding", 1.25 oz/sq ft and complete with accessories recommended by Manufacturer for proper installation.
   1. Approved Manufacturers –
      a. AEP / Span, Dallas, TX or San Diego, CA
      b. Idose Aluminum Products, Allentown, PA
      c. Berridge Manufacturing Co., Houston, TX
      d. Copper Sales Inc., Minneapolis, MN
      e. Engineered Components Inc., Stafford (Houston), TX
      f. Fashion Inc., Lenaxa, KS
      g. Alumax Building Specialties, Mesquite, TX
      h. MM Systems Corp., Tucker, GA
      i. Merchant & Evans Industries Inc., Burlington, NJ
      j. Reynolds Metals Company, Richmond VA

B. Finish:
   1. Fluoropolymer Resin-base finish for coil coating components. Thermo cured two coat system consisting of primer and top coat factory applied over properly pretreated metal.
   2. Color as selected by Engineer from Manufacturer's standard colors.
   3. Approved Manufacturers –
      a. Equal to Duranar 200 by PPG or Fluropon by Desoto containing 70% minimum Kynar 500 by Pennwalt Corp.

PART 3 - INSTALLATION

A. Do not use pop rivets. All fastening devices shall be plated screws and arranged so covers may be taken off for service.

B. Provide access opening for viewing the sight glass on the refrigerant line.

END OF SECTION

SECTION 23 2600

CONDENSATE DRAIN PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Coordinate installation of condensate drain piping with Section 22 0501 as described in Contract Documents.

B. Related Requirements:
   1. Section 22 0501: 'Common Plumbing Requirements'.
   2. Section 23 0501: 'Common HVAC Requirements'.

1.2 REFERENCES

A. Reference Standards:
   1. ASTM International:
      a. ASTM D1785-12, 'Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120'.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Materials:
   1. Condensate Drains:
      a. Schedule 40 PVC for condensate drains from furnace combustion chambers and furnace cooling coils.
   2. Solvent Cement and Adhesive Primer:
      a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
      b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Condensate Drains:
   1. Support piping and protect from damage.
   2. Do not combine PVC condensate drain piping from furnace combustion chamber with copper condensate drain piping from cooling coil.

END OF SECTION

SECTION 23 3001

COMMON DUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. General procedures and requirements for ductwork.
2. Repair leaks in ductwork, as identified by duct testing, at no additional cost to Owner.

B. Related Requirements:
1. Section 07 9219: 'Acoustical Joint Sealants' for quality of acoustic sealant.
2. Section 23 0501: 'Common HVAC Requirements'.
3. Section 23 0593: 'Duct Testing, Adjusting, and Balancing' for ductwork.

1.2 REFERENCES

A. Reference Standards:
1. American National Standards Institute (ANSI) / American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
   a. ANSI/ASHRAE 62.1-2010, 'Ventilation for Acceptable Indoor Air Quality'.
2. American National Standards Institute (ANSI) / American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) / Illuminating Engineering Society (IESNA):
   a. ANSI/ASHRAE/IESNA 90.1-2010, 'Energy Standard for Buildings Except Low-Rise Residential Buildings' I-P Edition.
3. Sheet Metal And Air Conditioning Contractors' National Association / American National Standards Institute:
   a. SMACNA, ‘HVAC Duct Construction Standards - Metal and Flexible' (Third Edition).

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference: Schedule conference immediately before installation of ductwork.

1.4 SUBMITTALS

A. Action Submittals:
1. Product Data: Specification data on sealer and gauze proposed for sealing ductwork.
2. Samples: Sealer and gauze proposed for sealing ductwork.

B. Informational Submittals:
1. Manufacturer Instructions:
   a. Installation manuals providing detailed instructions on assembly, joint sealing, and system pressure testing for leaks.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Performance:

1. Design Criteria:
   a. Standard Ducts: Construction details not specifically called out in Contract Documents shall conform to applicable requirements of SMACNA, 'HVAC Duct Construction Standards - Metal and Flexible'.

B. Materials:
1. Duct Hangers:
   a. One inch (25 mm) by 18 ga (1.27 mm) galvanized steel straps or steel rods as shown on Drawings, and spaced not more than 96 inches (2 400 mm) apart. Do not use wire hangers.
   b. Attaching screws at trusses shall be 2 inch (50 mm) No. 10 round head wood screws. Nails not allowed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. During installation, protect open ends of ducts by covering with plastic sheet tied in place to prevent entrance of debris and dirt.

B. Make necessary allowances and provisions in installation of sheet metal ducts for structural conditions of building. Revisions in layout and configuration may be allowed, with prior written approval of Architect. Maintain required airflows in suggesting revisions.

C. Hangers And Supports:
1. Install pair of hangers as required by spacing indicated in table on Drawings.
2. Install upper ends of hanger securely to floor or roof construction above by method shown on Drawings.
3. Attach strap hangers to ducts with cadmium-plated screws. Use of pop rivets or other means will not be accepted.
4. Secure vertical ducts passing through floors by extending bracing angles to rest firmly on floors without loose blocking or shimming. Support vertical ducts, which do not pass through floors, by using bands bolted to walls, columns, etc. Size, spacing, and method of attachment to vertical ducts shall be same as specified for hanger bands on horizontal ducts.

3.2 CLEANING

A. Clean interior of duct systems before final completion.

END OF SECTION

SECTION 23 3114

LOW-PRESSURE METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install above-grade low-pressure steel ducts and related items as described in Contract Documents.

B. Related Requirements:
1. Section 23 0593: 'Duct Testing, Adjusting, And Balancing' for ductwork.
2. Section 23 0713: 'Duct Insulation' for thermal Insulation for ducts, plenum chambers, and casings.
3. Section 23 0933: 'Electric And Electronic Control System For HVAC':
   a. Temperature control damper actuators and actuator linkages.
   b. Furnishing of duct smoke detectors.
4. Section 23 3001: 'Common Duct Requirements'.

1.2 REFERENCES

A. Reference Standards:
1. ASTM International:
   a. ASTM A653/A653M-11, 'Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process'.
2. Sheet Metal And Air Conditioning Contractors' National Association / American National Standards Institute:
   a. SMACNA, 'HVAC Duct Construction Standards - Metal and Flexible' (Third Edition).

PART 2 - PRODUCTS

2.1 SYSTEM

A. Materials:
1. Sheet Metal:
   a. Fabricate ducts, plenum chambers and casings of zinc-coated, lock-forming quality steel sheets meeting requirements A653/A653M, with G 60 coating.
2. Duct Sealer For Interior Ducts:
   a. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) Duct Butter or Butter Tak by Cain Manufacturing Co Inc, Pelham, AL www.cainmfg.com.
      2) DP 1010 by Design Polymerics, Fountain Valley, CA www.designpoly.com.
      3) SAS by Duro Dyne, Bay Shore, NY or Duro Dyne Canada, Lachine, QB www.durodyne.com.
      4) Iron Grip 601 by Hardcast Inc, Wylie, TX www.hardcast.com.
      5) MTS100 or MTS 200 by Hercules Mighty Tough, Denver CO, www.herculesindustries.com.
      6) 15-325 by Miracle / Kingco, Div ITW TACC, Rockland, MA www.taccint.com.
      7) 44-39 by Mon-Eco Industries Inc, East Brunswick, NJ www.mon-ecoindustries.com.
      8) Airseal Zero by Polymer Adhesive Sealant Systems Inc, Weatherford, TX www.polymeradhesives.com.

9) Airseal #22 Water Base Duct Sealer by Polymer Adhesive Sealant Systems Inc, Weatherford, TX www.polymeradhesives.com.

3. Duct Sealer For Exterior Ducts:
   a. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) Hardcast DT Tape and RTA-50 liquid adhesive by Hardcast Inc, Wylie, TX www.hardcast.com.

B. Fabrication:
1. General:
   a. Straight and smooth on inside with joints neatly finished.
   b. Duct drops to diffusers shall be round, square, or rectangular to accommodate diffuser neck. Drops shall be same gauge as branch duct. Seal joints air tight.
2. Standard Ducts:
   a. General:
      1) Ducts shall be large enough to accommodate inside acoustic duct liner. Dimensions shown on Drawings are net clear inside dimensions after duct liner has been installed.
   b. Rectangular Duct:
      1) Duct panels through 48 inch (1 200 mm) dimension having acoustic duct liner need not be cross-broken or beaded. Cross-break unlined ducts, duct panels larger than 48 inch (1 200 mm) vertical and horizontal sheet metal barriers, duct offsets, and elbows, or bead 12 inches (300 mm) on center.
         a) Apply cross-breaking to sheet metal between standing seams or reinforcing angles.
         b) Center of cross-break shall be of required height to assure surfaces being rigid.
         c) Internally line square and rectangular drops. Externally insulate round drops.
      2) Duct with height or width over 36 inches (900 mm) shall be fabricated using SMACNA T-24 flange joints or of pre-fabricated systems as follows:
         a) Ducts with sides over 36 inches (900 mm) up to 48 inches (1 200 mm): Transverse duct joint system by Ductmate / 25, Elgen, Ward, or WDCI (SMACNA Class 'F' joint).
         b) Ducts 48 inch (1 200 mm) And Larger: Ductmate / 35, Elgen, or WDCI (SMACNA Class 'J' transverse joint).
         c) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
            (1) Ductmate Industries Inc, Charleroi, PA www.ductmate.com or Ductmate Canada Ltd, Burlington, ON (905) 332-7678.
            (2) Ward Industries Inc, Bensonville, IL www.wardind.com.
            (3) Elgen Manufacturing Company, Inc., East Ruterford, NJ www.elgenmfg.com.
   c. Round Duct:
      1) Spiral Seam: 28 ga (0.4 mm) minimum for ducts up to and including 14 inches (355 mm) in diameter.
      2) Longitudinal Seam:
         a) 28 ga (0.4 mm) minimum for ducts up to and including 8 inches (200 mm) in diameter.
         b) 26 ga 0.48 mm minimum for ducts over 8 inches (200 mm) and up to 14 inches (355 mm) in diameter.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Interface With Other Work: Reseal transverse joint duct leaks and seal longitudinal duct joint leaks discovered during air test and balance procedures specified in Section 01 4546, at no additional cost to Owner.

B. Install internal ends of slip joints in direction of flow. Seal transverse and longitudinal joints air tight using specified duct sealer. Cover horizontal and longitudinal joints on exterior ducts with two layers of specified tape installed with specified adhesive.

C. Securely anchor ducts and plenums to building structure with specified duct hangers attached with screws. Do not hang more than one duct from a duct hanger. Brace and install ducts so they shall be free of vibration under all conditions of operation.

D. Ducts shall not bear on top of structural members.

E. Paint ductwork visible through registers, grilles, and diffusers flat black.

F. Properly flash where ducts protrude above roof.

G. Under no conditions will pipes, rods, or wires be allowed to penetrate ducts.

END OF SECTION

SECTION 23 3300

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install duct accessories in specified ductwork as described in Contract Documents.

B. Related Requirements:
1. Section 23 0933: 'Electric And Electronic Control System For HVAC' for temperature control damper actuators and actuator linkages.
2. Section 23 3001: 'Common Duct Requirements'.

1.2 REFERENCES

A. Reference Standards:
1. ASTM International:
   a. ASTM A653/A653M-13, 'Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process'.
   b. ASTM C1071-12, 'Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)'.
   c. ASTM C1338-08, 'Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings'.

PART 2 - PRODUCTS

2.1 ACCESSORIES

A. Manufacturers:
1. Manufacturer Contact List:
   a. AGM Industries, Brockton, MA www.agmind.com.
   b. Air Balance Inc, Holland, OH www.airbalance.com.
   c. Air Filters Inc, Baltimore, MD www.afinc.com.
   d. Air-Rite Manufacturing, Bountiful, UT (801) 295-2529.
   e. American Warming & Ventilating, Holland, OH www.american-warming.com.
   f. Arrow United Industries, Wyalusing, PA www.arrowunited.com.
   g. Cain Manufacturing Company Inc, Pelham, AL www.cainmfg.com.
   h. C & S Air Products, Fort Worth, TX www.csairproducts.com.
   i. CertainTeed Corp, Valley Forge, PA www.certainteed.com.
   j. Cesco Products, Florence, KY www.cescoproducts.com.
   k. Daniel Manufacturing, Ogden, UT (801) 622-5924.
   l. Design Polymerics, Fountain Valley, CA www.designpoly.com.
   m. Ductmate Industries Inc, East Charleroi, PA www.ductmate.com.
   n. Duro Dyne, Bay Shore, NY www.durodyne.com.
   o. Dyn Air Inc. Lachine, QB www.dynair.ca
   p. Elgen Manufacturing Company, Inc. East Rutherford, NJ www.elgenmfg.com
   q. Flexmaster USA Inc, Houston, TX www.flexmasterusa.com.
   r. Greenheck Corp, Schofield, WI www.greenheck.com.
   s. Gripnail Corp, East Providence, RI www.gripnail.com.
   t. Hardcast Inc, Wylie, TX www.hardcast.com.

u. Hercules Industries, Denver, CO, www.herculesindustries.com.
v. Honeywell Inc, Minneapolis, MN www.honeywell.com.
w. Industrial Acoustics Co, Bronx, NY www.industrialacoustics.com.
x. Johns-Manville, Denver, CO www.jm.com.
y. Kees Inc, Elkhart Lake, WI www.kees.com.
z. Knauf Fiber Glass, Shelbyville, IN www.knauffiberglass.com.
aa. Manson Insulation Inc, Brossard, QB www.isolationmanson.com.
bb. Metco Inc, Salt Lake City, UT (801) 467-1572 www.metcospiral.com.
cc. Miracle / Kingco, Rockland, MA www.taccint.com.
dd. Mon-Eco Industries Inc, East Brunswick, NJ www.mon-ecoindustries.com.
ee. Nailor Industries Inc, Houston, TX www.nailor.com.
ff. Owens Corning, Toledo, OH www.owenscorning.com.
gg. Polymer Adhesive Sealant Systems Inc, Irving, TX www.polymeradhesives.com.
hh. Pottorff Company, Fort Worth, TX www.pottorff.com.
ii. Ruskin Manufacturing, Kansas City, MO www.ruskin.com.
jj. Sheet Metal Connectors Inc, Minneapolis, MN www.smconnectors.com.
kk. Tamco, Stittsville, ON www.tamco.ca.
ll. Techno Adhesive, Cincinnati, OH www.technoadhesives.com.
mm. Titus, Richardson, TX (972) 699-1030. www.titus-hvac.com
nn. McGill AirFlow, Groveport, OH www.mcgillairflow.com.
oo. McGill AirSeal, Columbus, OH www.mcgillairseal.com.
pp. Utemp Inc, Salt Lake City, UT (801) 978-9265.
qq. Ventfabrics Inc, Chicago, IL www.ventfabrics.com.
rr. Young Regulator Co, Cleveland, OH www.youngregulator.com.

B. Materials:
1. Acoustical Liner System:
a. Duct Liner:
1) One inch (25 mm) thick, 1-1/2 lb (0.68 kg) density fiberglass conforming to requirements of ASTM C1071. Liner will not support microbial growth when tested in accordance with ASTM C1338.
2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
a) ToughGard by CertainTeed.
b) Duct Liner E-M by Knauf Fiber Glass.
c) Akousti-Liner by Manson Insulation.
d) Quiet R by Owens Corning.
e) Linacoustic RC by Johns-Manville.
b. Adhesive:
1) Category Four Approved Water-Based Products. See Section 01 6200 for definitions of Categories:
a) Cain: Hydrotak.
b) Design Polymerics: DP2501 or DP2502 (CMCL-2501).
c) Duro Dyne: WSA.
d) Elgen Manufacturing: A-410-WB.
e) Hardcast: Coil-Tack.
f) Hercules Mighty Tough: MTA 500 or MTA 600.
g) Miracle / Kingco: PF-101.
h) Mon-Eco: 22-67 or 22-76.
i) Polymer Adhesive: Glasstack #35.
j) Techno Adhesive: 133.
k) McGill Airseal: Uni-tack.
2) Category Four Approved Solvent-Based (non-flammable) Products. See Section 01 6200 for definitions of Categories:
a) Cain: Safetak.
b) Duro Dyne: FPG.
c) Hardcast: Glas-Grip 648-NFSE.
d) Miracle / Kingco: PF-91.
e) Mon-Eco: 22-24.
f) Polymer Adhesive: Q-Tack.
g) Techno Adhesive: 'Non-Flam' 106.

3) Category Four Approved Solvent-Based (flammable) Products. See Section 01 6200 for definitions of Categories:
   a) Cain: HV200.
   b) Duro Dyne: MPG.
   c) Hardcast: Glas-Grip 636-SE.
   d) Miracle / Kingco: PF-96.
   e) Mon-Eco: 22-22.
   f) Polymer Adhesive: R-Tack.
   g) Techno Adhesive: 'Flammable' 106.

c. Fasteners:
   1) Adhesively secured fasteners not allowed.
   2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      a) AGM Industries Inc: 'DynaPoint' Series RP-9 pin.
      b) Cain.
      c) Duro Dyne.
      d) Gripnails may be used if each nail is installed by 'Grip Nail Air Hammer' or by 'Automatic Fastener Equipment' in accordance with Manufacturer's recommendations.

2. Flexible Equipment Connections:
   a. 30 oz closely woven UL approved glass fabric, double coated with neoprene.
   b. Fire retardant, waterproof, air-tight, resistant to acids and grease, and withstand constant temperatures of 200 deg F (93 deg C).
   c. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) Cain: N-100.
      2) Duro Dyne: MFN.
      3) Dyn Air: CPN with G-90 galvanized off-set seam
      4) Elgen: ZLN / SDN.
      5) Ventfabrics: Ventglas.
      6) Ductmate: ProFlex.
3. Duct Access Doors:
   a. General:
      1) Factory built insulated access door with hinges and sash locks, as necessary. Construction shall be galvanized sheet metal, 24 ga (0.635 mm) minimum.
      2) Fire and smoke damper access doors shall have minimum clear opening of 12 inches (300 mm) square or larger as shown on Drawings.
   b. Rectangular Ducts:
      1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         a) Air Balance: Fire/Seal FSA 100.
         b) Air-Rite: Model HAD-2.
         c) Cesco: HDD.
         d) Elgen Manufacturing: TAB Type / Hinge and Cam.
         e) Flexmaster: Spin Door.
         f) Kees Inc: ADH-D.
         g) Nailor: 08SH.
         h) Pottorff: 60-HAD.
         i) Ruskin: ADH-24.
   c. Round Ducts:
      1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         a) Ductmate: ‘Sandwich’ Access Door.
         b) Elgen Manufacturing: Sandwich Access Door.
         c) Kees Inc: ADL-R.
         d) Nailor: 0809.
         e) Pottorff: RAD.
         f) Ruskin: ADR.
4. Dampers And Damper Accessories:
   a. Locking Quadrant Damper Regulators:
      1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         a) Duro Dyne: KS-385.
         b) Dyn Air: QPS-385.
         c) Elgen Manufacturing: EQR-4.

d) Ventfabrics: Ventline 555.
e) Young: No. 1.

b. Concealed Ceiling Damper Regulators:
1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
a) Cain.
b) Duro Dyne.
c) Elgen Manufacturing.
d) Metco Inc.
e) Ventfabrics: 666 Ventlok.
f) Young: 301.

c. Volume Dampers:
1) Rectangular Duct:
a) Factory-manufactured 16 ga (1.6 mm) galvanized steel, single blade and opposed blade type with 3/8 inch (9.5 mm) axles and end bearings. Blade width 8 inches (200 mm) maximum. Blades shall have 1/8 inch (3 mm) clearance all around.
b) Damper shall operate within acoustical duct liner.
c) Provide channel spacer equal to thickness of duct liner.
d) Dampers above removable ceiling and in Mechanical Rooms shall have locking quadrant on bottom or side of duct. Otherwise, furnish with concealed ceiling damper regulator and cover plate.
e) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
(1) Air-Rite: Model CD-2.
(2) American Warming: VC-2-AA.
(3) Arrow: OBDAF-207.
(4) C & S: AC40.
(5) Cesco: AGO.
(6) Daniel: CD-OB.
(7) Greenheck: VCD-20.
(8) Nailor: 1810 or 1820.
(9) Pottorff: CD-42.
(10) Ruskin: MD-35.
(11) Utemp: CD-OB.
2) Round Duct:
a) Factory-manufactured 20 ga (1.0 mm) galvanized steel, single blade with 3/8 inch (9.5 mm) axles and end bearings.
b) For use in outside air ducts.
c) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
(1) Air Balance: Model AC-22.
(2) Air-Rite: Model CD-5.
(3) American Warming: V-22.
(4) Arrow: Type-70.
(5) C & S: AC21R.
(6) Cesco: MGG.
(7) Nailor: 1890.
(8) Pottorff: CD-21R.
(9) Ruskin: MDRS-25.

d. Motorized Outside Air Dampers:
1) General:
a) Low leakage type. AMCA certified.
b) Make provision for damper actuators and actuator linkages to be mounted external of air flow.
2) Rectangular Ducts:
a) Damper Blades:
(1) Steel or aluminum airfoil type with mechanically locked blade seals, 8 inch (200 mm) blade width maximum measured perpendicular to axis of damper.
(2) Jamb seals shall be flexible metal compression type.
(3) Opposed or single blade type.

b) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
(1) Air Balance: AC 526.
(2) American Warming: AC526.
(3) Arrow: AFD-20.
(4) C & S: AC50.
(5) Cesco: AGO3.
(6) Honeywell: D-643.
(7) Nailor: 2020.
(8) Pottorff: CD-52.
(9) Ruskin: CD-60.
(10) Tamco: Series 1000.

3) Round Ducts:
a) Damper Blades:
(1) Steel with mechanically locked blade seals.
(2) Blade seals shall be neoprene or polyethylene.
(3) Single blade type.
b) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
(1) Air Balance: AC 25.
(2) American Warming: VC25.
(3) Arrow: Type 70 or 75.
(4) C & S: AC25R.
(5) Cesco: AGG.
(6) Honeywell: D-690.
(7) Nailor: 1090.
(8) Pottorff: CD-25R.
(9) Ruskin: CD25.
(10) Tamco: Square-to-Round Series 1000.

5. Air Turns:
a. Single thickness vanes. Double thickness vanes not acceptable.
b. 4-1/2 inch (115 mm) wide vane rail. Junior vane rail not acceptable.

C. Fabrication:
1. Duct Liner:
a. Install mat finish surface on airstream side. Secure insulation to cleaned sheet metal duct with continuous 100 percent coat of adhesive and with 3/4 inch (19 mm) long mechanical fasteners 12 inches (300 mm) on center maximum unless detailed otherwise on Drawings. Pin all duct liner.
b. Accurately cut liner and thoroughly coat ends with adhesive. Butt joints tightly. Top and bottom sections of insulation shall overlap sides. If liner is all one piece, folded corners shall be tight against metal. Ends shall butt tightly together.
c. Coat longitudinal and transverse edges of liner with adhesive.
2. Air Turns:
a. Permanently install vanes arranged to permit air to make abrupt turn without appreciable turbulence, in 90 degree elbows of above ground supply and return ductwork.
b. Quiet and free from vibration when system is in operation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Duct Liner:
1. Furnish and install acoustic lining in following types of rectangular ducts unless noted otherwise on Contract Documents:
a. Supply air.
b. Return air.
c. Mixed air.

d. Transfer air.
e. Relief air.
f. Exhaust air.
g. Elbows, fittings, and diffuser drops greater than 12 inches (300 mm) in length.

2. Do not install acoustic lining in round ducts.

B. Flexible Connections: Install flexible inlet and outlet duct connections to each furnace.

C. Access Doors In Ducts:

1. Install at each manual outside air damper and at each motorized damper. Locate doors within 6 inches (150 mm) of installed dampers.
2. Install within 6 inches (150 mm) of fire dampers and in Mechanical Room if possible. Install on side of duct that allows easiest access to damper.

D. Dampers And Damper Accessories:

1. Install concealed ceiling damper regulators.
   a. Paint cover plates to match ceiling tile.
   b. Do not install damper regulators for dampers located directly above removable ceilings or in Mechanical Rooms.
2. Provide each take-off with an adjustable volume damper to balance that branch.
   a. Anchor dampers securely to duct.
   b. Install dampers in main ducts within insulation.
   c. Dampers in branch ducts shall fit against sheet metal walls, bottom and top of duct, and be securely fastened. Cut duct liner to allow damper to fit against sheet metal.
   d. Where concealed ceiling damper regulators are installed, provide cover plate.
3. Install motorized dampers.

END OF SECTION

SECTION 23 4100

AIR FILTERS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install filters used in mechanical equipment.

B. Related Requirements:
1. Section 23 3001: 'Common Duct Requirements'.

1.2 REFERENCES

A. Reference Standard:
1. American National Standards Institute (ANSI) / American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
   a. ANSI/ASHRAE 52.2-2012, 'Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size'.
   b. ANSI/ASHRAE 62.1-2010, Ventilation for Acceptable Indoor Air Quality'.

1.3 SUBMITTALS

A. Informational Submittals:
1. Sustainable Design Submittals:
   a. Product Data for Prerequisite EQ 1:
      1) Documentation indicating that units comply with ANSI/ASHRAE 62.1, Section 5 - 'Systems and Equipment'.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Furnace Filters: Two inches (50 mm) thick throw-away type as recommended by Furnace Manufacturer.

B. Air Handler Filters:
1. One inch (25 mm) thick throw-away type as recommended by Air Handler Manufacturer with ANSI/ASHRAE 52.2 MERV rating of 6 or higher.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide ample access for filter removal.

3.2 FIELD QUALITY CONTROL

A. Inspection: At date of Substantial Completion, air filters shall be new, clean, and approved by Owner's representative.

END OF SECTION

SECTION 23 5134

FLUES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install flues as described in Contract Documents.

B. Related Requirements:
1. Sections Under 09 9000 Heading: Painting.
2. Section 23 0501: 'Common HVAC Requirements'.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
1. Manufacturer Contact List:
   a. Acme Engineering & Manufacturing Corp, Muskogee, OK www.acmefan.com.
   b. AMPCO, Holland, MI www.americanmetalproducts.com.
   c. Breidert Air Products, Jacksonville, FL www.breidert.com.
   d. Metal-Fab Inc, Wichita, KS www.mtlfab.com.
   e. Metlvent by Hart & Cooley, Holland, MI www.hartandcooley.com.
   f. Selkirk Metalbestos, Logan, OH www.selkirkusa.com.
   g. Simpson Dura-Vent Co, Vacaville, CA www.duravent.com.

B. Materials:
1. Flues:
   a. Double wall, factory-fabricated sectional type 'B', of aluminum construction designed to handle combustion products of fuel being used. Provide with inspection cap as required by local code, roof flashing, and clean-out.
   b. Size flues according to local codes except:
      1) No vertical flue shall have an area of less than 12-1/2 sq inches (80.65 sq cm), 4 inches (100 mm) in diameter.
      2) In no case shall vent connector be smaller than outlet collar provided by Manufacturer.
   c. Horizontal flue connectors shall be double wall.
   d. Fittings shall be pre-fabricated double wall.
   e. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) Ameri-Vent by AMPCO.
      2) Metal-Fab Inc.
      3) Metlvent by Hart & Cooley.
      4) Selkirk Metalbestos.
      5) Simpson Dura-Vent.
2. Vent Caps:
   a. Non-backdraft type for installation on top of flue, aluminum construction.
   b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) Mastervent Type MVR by Acme Engineering & Manufacturing.
      2) Ameri-cap by AMPCO.
      3) Type L by Breidert Air Products.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Height of flue above roof shall be as shown on Drawings unless local code requires it be higher.

B. Every portion of flue connector shall have rise of one inch (25 mm) per 1 foot (300 mm) minimum from appliance to vertical flue.

C. Length of horizontal flues or flue connectors shall not be longer than 75 percent of height of vertical flue between point at which horizontal flue enters vertical flue to top of vertical flue. In no case shall horizontal run exceed 15 feet (4.57 m).

D. When two or more flue connections enter common vertical flue, smaller flue connector shall enter at higher level. Do not enter flue connectors in same horizontal plane.

E. Every gas appliance flue shall have a 'backdraft preventer' installed at top of flue.

END OF SECTION

SECTION 23 5135

AIR PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install heating equipment exhaust piping and combustion air intake piping as described in Contract Documents.

B. Related Requirements:
1. Section 23 0501: 'Common HVAC Requirements'.

1.2 REFERENCES

A. Reference Standards:
1. ASTM International:
   a. ASTM D1785-12, 'Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120'.
   b. ASTM D2564-12, 'Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems'.
   c. ASTM D2661-11, 'Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings'.
   d. ASTM D2665-12, 'Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings'.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
1. Manufacturer Contact List:
   a. Armaflex by Armacell, Mebane, NC www.armaflex.com.
   b. Nomaco, Youngsville, NC www.nomacokflex.com.

B. Materials:
1. Air Piping: Schedule 40 pipe and fittings meeting requirements of ASTM D1785, ASTM D2661, or ASTM D2665.
2. Piping Primer And Cement:
   a. Meet requirements of ASTM D2564.
3. Flexible Foamed Pipe Insulation:
   a. Thickness:
      1) 1/2 inch (13 mm) for 2 through 3 inch (50 through 75 mm) outside diameter pipe.
      2) 1/2 inch (13 mm) sheet for fittings as recommended by Manufacturer.
   b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) Tubolit by Armaflex.
      2) ImcoLock or Therma-Cel by Nomaco K-Flex.
4. Insulation Joint Sealer:
   a. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) 520 by Armaflex.
      2) R-320 by Nomaco K-Flex.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation For Condensing Furnaces:
1. Run individual vent and individual combustion intake piping from each furnace to concentric roof termination kit provided by Furnace Manufacturer. Slope lines downward toward furnace.
2. Slope combustion chamber drain downward to funnel drain. Anchor to wall with wall clamps, allowing free movement through clamp for expansion.
3. Use concentric roof termination kit provided by Furnace Manufacturer. Install vent and combustion air intake piping at clearance and distances required by Furnace Manufacturer.
4. Attach factory-supplied neoprene coupling to combustion-air inlet connection and secure with clamp.
5. Ensure that factory-supplied perforated metal disc is installed in flexible coupling, unless its removal is required.

B. Support:
1. Support concentric roof termination kit at ceiling or roof line with 20 ga (0.912 mm) sheet metal straps as detailed on Drawings.
2. Support horizontal and sloping sections of pipe with 1 inch (25 mm) wide 20 ga (1.0058 mm) galvanized steel straps. Anchor securely to structure, not allowing pipe to sway.

C. Insulation:
1. General:
   a. Install insulation in snug contact with pipe and in accordance with Manufacturer's recommendations.
   b. Slip insulation on piping before piping sections and fittings are assembled keeping slitting of insulation to a minimum.
   c. Joints:
      1) Place 'slit' joint seams of insulation exposed outside building on bottom of pipe.
      2) Stagger joints on layered insulation.
      3) Seal joints in insulation.
   d. Paint exterior exposed insulation with two coats of finish recommended by Insulation Manufacturer, color selected by Architect.
2. Install specified insulation on PVC air piping serving mechanical equipment as follows
   a. Combustion air PVC piping in truss space and in attic.
   b. Combustion vent PVC piping in attic and in truss space.
   c. Insulate fittings with sheet insulation and as recommended by Manufacturer.
3. Paint exposed flues through the roof with two coats of paint to match roof color.

END OF SECTION

SECTION 23 5417

GAS-FIRED FURNACES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install horizontal/vertical gas-fired condensing furnaces as described in Contract Documents.

B. Related Sections:
1. Section 23 0501: 'Common HVAC Requirements'.
2. Section 23 1123: 'Facility Natural Gas Piping'.
3. Section 23 2300: 'Refrigerant Piping'.
4. Section 23 4100: 'Air Filters'.

1.2 REFERENCES

A. Reference Standard:
1. American National Standards Institute (ANSI) / American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
   a. ANSI/ASHRAE 62.1-2010, 'Ventilation for Acceptable Indoor Air Quality'.

1.3 SUBMITTALS

A. Informational Submittals:
1. Manufacturer Reports: Equipment check-out sheets.

B. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
   a. Warranty Documentation:
      1) Final, executed copy of Warranty.
   b. Record Documentation:
      1) Manufacturers Documentation:
         a) Equipment checkout sheet: Complete and sign all items for each unit.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. ASHRAE Compliance:
   a. Applicable requirements in with ANSI/ASHRAE 62.1, Section 5 - 'Systems and Equipment'
2. ASHRAE/ESNA Compliance:
   a. Applicable requirements in ANSI/ASHRAE/IESNA 90.1, Section 6 - 'Heating, Ventilating, and Air-Conditioning'.

1.5 WARRANTY

A. Manufacturer’s Warranty:
1. Provide fifteen (15) year minimum limited warranty of heat exchanger and five (5) year limited warranty on parts.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturer:
1. Manufacturer Contact List:
   a. Carrier Corporation:
      1) Carrier National: Steven L. Ament (979) 324-2304 steven.l.ament@carrier.utc.com.
      2) Carrier Utah: Rich Carpenter (Contractors HVAC Supply) (801) 410-6077 e-mail rcarpent@mtncom.net.
   b. Lennox Industries:
      1) For pricing and information contact Lennox National Account @ 1-800-367-6285.
   c. York International:
      1) Brian Michael (405) 419-6230 brian.k.michael@jci.com.

B. Performance:
1. Design Criteria:
   a. Rated at 92 percent minimum AFUE (Annual Fuel Utilization Efficiency) calculated in accordance with DOE test procedures.

C. Manufactured Units:
1. Furnaces:
   a. Factory assembled units certified by CSA complete with blower section, furnace section, steel casing, piped, and wired.
   b. Blower section shall consist of cabinet, blower, and motor.
      1) Cabinet shall be of 22 ga (0.8 mm) minimum cold rolled steel and have finish coat of baked-on enamel.
      2) Blower shall be Class 1, full DIDW, statically and dynamically balanced.
   c. Automatic controls shall consist of:
      1) Manual gas shut-off valve.
      2) Operating automatic gas valve.
      3) Solid-state type fan and thermal limit controls.
      4) 24-volt transformer.
      5) Hot surface ignition system.
   d. Blower shall be driven by multi-speed direct driven motor.
   e. Furnace section shall be enclosed in 22 ga (0.8 mm) minimum enameled steel casing lined with foil covered insulation.
   f. Heat Exchanger: Aluminized steel.
   g. Gas Burners: Aluminized steel.
   h. PVC intake of outside air and PVC combustion product exhaust, with sealed combustion, direct vent system.
   i. Concentric roof termination kit for roof mounting.
   j. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) Standard Furnaces:
         a) Carrier: 59SC5A.
         b) Lennox: ML195.
         c) York: TG9S.
2. Cooling Coil:
   a. Cooling coil shall consist of heavy gauge steel cabinet with baked-on enamel finish to match furnace:
      1) Coil shall have aluminum fins bonded to seamless copper or aluminum tubing.
      2) Coil shall be ARI rated. Provide drain pans with connections at one end.
      3) Use thermal expansion valve.
   b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) Vertical:
         a) Carrier: CNPVP.
         b) Lennox: CX34.
         c) York: FC.

2.2 ACCESSORIES

A. Filter Frame:
1. Build filter frame external to furnace as detailed on Drawings.

B. Vibration Isolators:
1. Vertical Installation: 4 inches (100 mm) square by 1/2 inch (13 mm) thick minimum neoprene type vibration isolation pads.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Vibration Isolators:
1. Install vibration isolator on each corner of vertical furnace.

3.2 FIELD QUALITY CONTROL

A. Field Tests And Inspections:
1. Manufacturer Services:
   a. Furnace installer shall:
      1) Verify proper gas orifice size.
      2) Clock gas meter for rated input.
      3) Verify and set gas pressure at furnace.
      4) Check and measure temperature rise.
      5) Check safety controls for proper operation.
      6) Check combustion vent sizes and combustion air sizes.
   b. In addition, furnace installer shall start up, check out, and adjust furnaces using equipment check-out sheet provided by Manufacturer. Complete and sign all items on sheet.

END OF SECTION

SECTION 23 5418

GAS-FIRED DUCT FURNACES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install horizontal gas-fired duct furnaces as described in Contract Documents.

B. Related Sections:
1. Section 23 0501: Common HVAC Requirements.
2. Section 23 1123: Natural Gas Piping System.
3. Section 23 2300: Refrigerant Piping System.
4. Section 23 4100: Air Filters.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Duct Furnace
1. AGA approved, equipped for natural gas, and complete with following components -
   a. Type E3, 409, 430, or 321 stainless steel heat exchanger.
   b. Drain pan.
   c. Steel casing with baked-on enamel finish.
   d. Power venter with sealed combustion air intake.
2. Controls -
   a. For two-stage (high-low flame) operation.
   b. Factory installed and including -
      1) Manual gas shut-off valve.
      2) Limit control.
      3) Operating automatic gas valve.
      4) 100 percent shut-off safety pilot.
      5) Gas pressure regulator.
      6) Transformer.
      7) Electronic ignition.
   c. Limit control shall be located ahead of valve on hot side of power source.
   d. Electric Controls - Factory wired in flexible conduit.
   e. Easily accessible and mounted at bottom-front, bottom-front rear, or on accessible side of furnace.
   f. Combination flue - Intake for sidewall or roof.
3. Burners - Of die-formed aluminized steel with stainless steel ribbon inserts.
4. Approved Manufacturers -
   a. Hastings Industries, Hastings, NE (402) 463-9821 www.hasting-ind.com
   b. Janitrol Air Conditioning & Heating, Houston, TX (713) 868-1356 www.janitrol.com
   c. Modine Manufacturing Co, Racine, WI (800) 828-4328 or (262) 636-1200 www.modine.com
   d. Reznor, Div of Thomas & Betts, Memphis, TN (800) 695-1901 or (901) 682-7766 www.tnb.com/mpd/
   e. Trane Co, La Crosse, WI (608) 787-2000 www.trane.com

PART 3 - EXECUTION - Not Used

END OF SECTION

SECTION 23 6213

PACKAGED AIR-COOLED REFRIGERANT COMPRESSOR AND CONDENSER UNITS: Air Conditioning

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install condensing units as described in contract documents.

B. Related Sections:
1. Section 23 0501: 'Common HVAC Requirements'.
2. Section 23 2300: 'Refrigerant Piping'.

1.2 REFERENCES

A. Definitions:
1. Compressor: Pump that increases vapor (refrigerant or air) pressure from one level to a higher level of pressure.
2. Condenser: Device used to condense refrigerant in a cooling system.
3. Condenser Coils: In an air conditioner, the coil dissipates heat from the refrigerant, changing the refrigerant from vapor to liquid.
4. Condensing Unit: Outside section of an air conditioning system which pumps vaporized refrigerant from the evaporator, compresses it, liquefies it in the condenser and returns it to the evaporator coil. The outdoor portion of a split system air conditioner contains the compressor and outdoor coil.
5. Refrigerant: Absorbs heat by a change of state (evaporation) from liquid to a gas, and releases heat by a change of state (condenses) from gas back to a liquid.
6. SEER (Seasonal Energy Efficiency Ratio): Measure of cooling efficiency for air conditioners and heat pumps. A ratio of total cooling in comparison to electrical energy input in watts per hour. Higher the seer, the more energy efficient the unit. Since 2006, the minimum SEER required by the Department of Energy is 13.00 and 15.00+ SEER is considered high efficiency.
7. Split System: Combination of an outdoor unit (air conditioner or heat pump) with an indoor unit (furnace or air handler). Split systems must be matched for optimum efficiency.

B. Reference Standards:
1. American National Standards Institute / Air-Conditioning, Heating, and Refrigeration Institute:
   a. ANSI/AHRI Standard 210/240-2008, 'Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment' (formerly ARI Standard 210/240).

1.3 SUBMITTALS

A. Informational Submittals:
1. Tests and Evaluation Reports:
   a. Manufacturer Reports: Equipment check-out sheets.
2. Qualification Statements:
   a. Technician certificate for use in HFC and HCFC refrigerants.

B. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
   a. Warranty Documentation:
      1) Final, executed copy of Warranty.

b. Record Documentation:
1) Manufacturers Documentation:
a) Equipment checkout sheet: Complete and sign all items for each unit.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. Each unit shall be UL / ULC or ETL labeled.
2. Comply with ANSI/AHRI Standard 210/240.
3. Refrigeration compressor, coils, and specialties shall be designed to operate with CFC·free refrigerants.

B. Qualifications. Section 01 4301 applies, but is not limited to the following:
1. Installer: Refrigerant piping shall be installed by refrigeration contractor licensed by State and by technicians certified in use of HFC and HCFC refrigerants.

1.5 WARRANTY

A. Manufacturer's Warranty:
1. Provide ten (10) year limited warranty on compressor and five (5) year limited warranty on parts from date of 'start-up'.
2. Record 'start-up' date on warranty certificate for each unit.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
1. Manufacturer Contact List:
a. Carrier Corporation:
1) Carrier National: Steven L. Ament (979) 324-2304 steven.l.ament@carrier.utc.com.
2) Carrier Utah: Rich Carpenter (Contractors HVAC Supply) (801) 410-6077 e-mail rcarpent@mtncom.net.
b. Lennox Industries:
1) For pricing and information call Lennox National Account at 1-800-367-6285.
c. York International:
1) Brian Michael (405) 419-6230 brian.k.michael@jci.com.

B. Performance:
1. Capacities: SEER rating as defined by AHRI shall be 13.0 or greater.

C. Manufactured Units:
1. Condensing Units (5 Tons or Less):
a. General:
1) Units shall be operable down to 0 deg F (minus 18 deg C) outdoor temperature.
2) Use R-410a refrigerant.
3) Only one liquid line, one suction line, and one power connection shall be made to each compressor. Provide charging valves.
b. Condenser Coils:
1) Aluminum plate fins mechanically bonded to seamless copper tubes or 'Spine Fin' trade mark system which has aluminum fins epoxy bonded to aluminum tubes or micro-channel.
2) Provide stamped louver coil guard for unit.
c. Fans:
1) Direct driven propeller type.

2) Fan motor shall be single or two speed, thermostatically controlled, permanently lubricated, and designed with permanent protection.
3) Motors shall be resiliently mounted.
4) Each fan shall have a safety guard.

d. Compressor:
1) Each condenser unit shall have only one compressor.
2) Design with following features:
a) Externally mounted brass service valves with charging connections.
b) Crankcase heater.
c) Resilient rubber mounts.
d) Compressor motor-overload protection.
e) Single speed.

e. Controls:
1) Factory wired and located in separate enclosure.
2) Following three paragraphs may not be factory installed and will therefore have to be field installed.
3) Safety devices:
a) High and low pressure cutout.
b) Condenser fan motor-overload devices.
4) Anti-cycle timers to prevent units from starting up again for five minutes after any power interruption.
5) Head pressure type low ambient kit.

f. Casing:
1) Fully weatherproof for outdoor installation. Finish shall be weather resistant.

g. Openings shall be provided for power and refrigerant connections.
h. Panels shall be removable for servicing.
i. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
1) Standard:
a) Carrier: 24ACB3.
b) Lennox: 13ACX.
c) York: YCHD or YCJD.

D. Condensing Units, 6 Tons and Larger:
1. General:
a. Use R-410a refrigerant.
b. Make one liquid line, one suction line, and one power connection to each unit for each compressor in condensing unit. Provide charging valves.
c. Units shall be operable down to 0 deg F (minus 18 deg C) outdoor temperature.

2. Condenser Coils:
a. Aluminum plate fins mechanically bonded to seamless copper tubes.
b. Units having side inlets shall have coil guards.
c. Coil shall be circuited for sub-cooling.

3. Fans:
a. Direct driven propeller upflow type.
b. Fan motors shall have inherent overload protection, be permanently lubricated, and resiliently mounted.
c. Each fan shall have a safety guard.
d. Cycle fans or use solid-state fan speed control for low ambient operation.

4. Compressors:
a. Hermetic or semi-hermetic design with following features:
1) Spring isolators.
2) Crankcase heater.
3) Compressor motor-overload protection.
4) Ring, reed or disc type valves.
5) Service valves, back-seating type with Schraeder charging valves.

b. Semi-hermetic type shall have following additional features:
1) Automatically reversible oil pump.
2) Oil sight glass.
3) Oil pressure switch.

c. Condensing units ten tons or smaller shall have only one compressor. Condensing units larger than ten tons shall have two compressors minimum, each serving separate cooling circuit and coils.

5. Controls:
   a. Factory wired and located in separate enclosure.
   b. Factory installed safety devices:
      1) High and low pressure cutouts
      2) Internal or plug type relief valves
   c. Integral magnetic starters.
   d. Anti-cycle timers to prevent units from starting up again for five minutes after any power interruption.
   e. Low ambient kit.
6. Casing:
   a. Fully weatherproof for outdoor installation. Finish shall be weather resistant.
   b. Panels shall be removable for servicing.
   c. Provide openings for power and refrigerant connections.
7. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
   a. Air Handler Systems:
      1) Airtherm.
      2) Bohn Refrigeration Products.
      3) 39L by Carrier Corp.
      4) McQuay International.
      5) Climate Changer by Trane.
      6) York International Corp.

2.2 ACCESSORIES

A. Vibration Isolators:
   1. 4 inches (100 mm) square by 3/4 inch (19 mm) thick minimum neoprene type vibration isolation pads.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set condensing units level on concrete slab on vibration isolation pads located at each corner of unit. This does not apply to condensing units that have a composite non-metal bottom.

B. Do not use capillary tube and piston type refrigerant metering devices.

3.2 FIELD QUALITY CONTROL

A. Manufacturer Services:
   1. Condensing units shall be started up, checked out, and adjusted by condensing unit installer.
   2. Use equipment checkout sheet provided by Manufacturer:
      a. Complete and sign all items on sheet.

END OF SECTION

SECTION 23 8216

AIR COILS

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:
   1. Section 23 0501: Common HVAC Requirements.
   2. Section 23 3114: Low-Pressure Metal Ducts and installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Category Four Approved Manufacturers And Suppliers. See Section 01 6200 for definitions of Categories:
   1. Carrier: U S Air Conditioning Distributors, attention Saad Khoury (801) 463-5306.
   2. Trane: Salt Lake Trane, attention: Jason Bradford (801) 486-0500 www.Jason.Bradford@trane.com.
   3. USA Coil & Air Inc, Malvern, PA www.usacoil.com or USA Coil & Air/Airex Inc, Brampton, ON (905) 790-8667.

2.2 MANUFACTURED UNITS

A. Cooling Coil:
   1. DX type and factory equipped with following features:
      a. Refrigerant line fittings which permit mechanical or sweat connections.
      b. Thermal expansion valve refrigerant control.
      c. Row split or intertwined. 4 row.
      d. Single or dual circuit as called for on drawings.

PART 3 - EXECUTION: Not Used

END OF SECTION
END OF DIVISION 23

DIVISION 26: ELECTRICAL

SECTION 26 0501

COMMON ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. General electrical system requirements and procedures.
2. Perform excavating and backfilling work required by work of this Division as described in Contract Documents.
3. Make electrical connections to equipment provided under other Sections.
4. Furnish and install Penetration Firestop Systems at electrical system penetrations as described in Contract Documents.

B. Products Furnished But Not Installed Under This Section:
1. Anchor bolts and templates for exterior lighting equipment bases.

C. Related Requirements:
1. Section 07 8400: 'Firestopping' for quality of Penetration Firestop Systems to be used on Project and submittal requirements.
2. Section 31 2316: 'Excavation' for criteria for performance of excavating.
3. Section 31 2323: 'Fill' for criteria for performance of backfilling.

1.2 REFERENCES

A. Reference Standards:
1. National Fire Protection Association / American National Standards Institute:
   a. NFPA 70-2011, National Electric Code (NEC).
2. National Electrical Manufacturing Association Standards (NEMA):
   a. NEMA 250-2008, 'Enclosure for Electrical Equipment (1000 Volts Maximum)'.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate with Owner for equipment and materials to be removed by Owner.

B. Sequencing:
1. Include detailed sequence of individual electrical demolition operations on Construction Schedule specified in Section 01 3200.

1.4 SUBMITTALS

A. Action Submittals:
1. Product Data:
   a. Provide following information for each item of equipment:
      1) Catalog Sheets.
      2) Assembly details or dimension drawings.
      3) Installation instructions.
      4) Manufacturer's name and catalog number.
      5) Name of local supplier.

b. Furnish such information for following equipment:
1) Section 26 0520: 'Heating Cables' for heating cable equipment.
2) Section 26 2417: 'Circuit-Breaker Panelboards'.
3) Section 26 2418: 'Fusible Panelboards'.
4) Section 26 2726: 'Wiring Devices' for lighting control and dimmer equipment.
5) Section 26 2773: 'Chime systems'.
6) Section 26 2774: 'Bell systems'.
7) Section 26 2816: 'Enclosed Switches And Circuit Breakers'.
8) Section 26 2913: 'Enclosed Controllers'.
9) Section 26 5100: 'Interior Lighting Fixtures'.
10) Section 26 5200: 'Emergency Lighting' for battery units.
11) Section 26 5600: 'Exterior Lighting' for fixtures, poles, and associated control equipment.
c. Do not purchase equipment before approval of product data.

2. Shop Drawings:
a. Submit on following equipment:
1) Panelboards.
2) Switchboards.
3) Motor Control Centers.
4) Dimming Equipment.
5) Low voltage relay switching system for lighting.
b. Indicate precise equipment to be used, including all options specified. Indicate wording and format of nameplates where applicable. Submit in three-ring binder with hard cover.

B. Informational Submittals:
1. Test And Evaluation Reports:
a. Report of site tests, before Substantial Completion.
2. Qualification Statement:
a. Electrical Subcontractor:
1) Provide Qualification documentation if requested by Architect or Owner.
b. Installer:
1) Provide Qualification documentation if requested by Architect or Owner.

C. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
a. Operations and Maintenance Data:
1) Provide operating and maintenance instructions for each item of equipment submitted under Product Data.
b. Record Documentation:
1) Manufacturers documentation:
a) Manufacturer's literature.
b) Include copy of approved shop drawings.
c) Provide tritium exit sign tabulations for each exit sign installed on Project including following:
(1) Serial number.
(2) Expiration number.
(3) Installed building location (example – chapel north rear exit, north corridor east end, main west foyer, etc.).

1.5 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. NEC and local ordinances and regulations shall govern unless more stringent requirements are specified.
2. Material and equipment provided shall meet standards of NEMA or UL and bear their label wherever standards have been established and label service is available.

B. Qualifications: Requirements of Section 01 4301 applies, but not limited to following:
1. Electrical Subcontractor:
   a. Company specializing in performing work of this section.
      1) Minimum five (5) years experience in electrical installations.
      2) Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
   b. Upon request, submit documentation.
2. Installer:
   a. Licensed for area of Project.
   b. Designate one (1) individual as project foremen who shall be on site at all times during installation and experienced with installation procedures required for this project.
   c. Upon request, submit documentation.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Performance:
1. Design Criteria:
   a. Materials and equipment provided under following Sections shall be by same Manufacturer:
      1) Section 26 2417: Panelboards.
      2) Section 26 2418: Fusible Panelboards.
      3) Section 26 2816: Enclosed Switches And Circuit Breakers.
      4) Section 26 2913: Enclosed Controllers.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Acceptable Installers:
1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

3.2 EXAMINATION

A. Verification Of Conditions:
1. Confirm dimensions, ratings, and specifications of equipment to be installed and coordinate these with site dimensions and with other Sections.

B. Evaluation And Assessment:
1. All relocations, reconnections, and removals are not necessarily indicated on Drawings. Include such work without additional cost to Owner.

3.3 PREPARATION

A. Disconnect equipment that is to be removed or relocated. Carefully remove, disassemble, or dismantle as required, and store in approved location on site, existing items to be reused in completed work.

B. Where affected by demolition or new construction, relocate, extend, or repair raceways, conductors, outlets, and apparatus to allow continued use of electrical system. Use methods and materials as specified for new construction.

C. Perform drilling, cutting, block-offs, and demolition work required for removal of necessary portions of electrical system. Do not cut joists, beams, girders, trusses, or columns without prior written permission from Architect.

D. Remove concealed wiring abandoned due to demolition or new construction. Remove circuits, conduits, and conductors that are not to be re-used back to next active fixture, device, or junction box.

E. Patch, repair, and finish surfaces affected by electrical demolition work, unless work is specifically specified to be performed under other Sections of the specifications.

3.4 INSTALLATION

A. General:
1. Locations of electrical equipment shown on Drawings are approximate only. Field verify actual locations for proper installation.
2. Coordinate electrical equipment locations and conduit runs with those providing equipment to be served before installation or rough in.
   a. Notify Architect of conflicts before beginning work.
   b. Coordinate locations of power and lighting outlets in mechanical rooms and other areas with mechanical equipment, piping, ductwork, cabinets, etc, so they will be readily accessible and functional.
3. Work related to other trades which is required under this Division, such as cutting and patching, trenching, and backfilling, shall be performed according to standards specified in applicable Sections.

B. Install Penetration Firestop System appropriate for penetration at electrical system penetrations through walls, ceilings, and top plates of walls.

3.5 FIELD QUALITY CONTROL

A. Field Tests:
1. Test systems and demonstrate equipment as working and operating properly. Notify Architect before test. Rectify defects at no additional cost to Owner.
2. Measure current for each phase of each motor under actual final load operation, i.e. after air balance is completed for fan units, etc. Record this information along with full-load nameplate current rating and size of thermal overload unit installed for each motor.

3.6 CLEANING

A. Remove obsolete raceways, conductors, apparatus, and lighting fixtures promptly from site and dispose of legally.

3.7 CLOSEOUT ACTIVITIES

A. Training:
1. Provide competent instructor for three (3) days to train Owner’s maintenance personnel in operation and maintenance of electrical equipment and systems. Factory representatives shall assist this instruction as necessary. Schedule instruction period at time of final inspection.

END OF SECTION

SECTION 26 0519

LINE-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Quality of conductors used on Project except as excluded below.

B. Related Requirements:
1. Section 23 0933: Conductors and cables for temperature control system.
2. Section 26 0501: Common Electrical Requirements.

1.2 REFERENCES

A. Definitions:
1. Line Voltage: Over 70 Volts.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Line Voltage Conductors:
1. Copper with AWG sizes as shown:
   a. Minimum size shall be No. 12 except where specified otherwise.
   b. Conductor size No. 8 and larger shall be stranded.
2. Insulation:
   a. Standard Conductor Size No. 10 And Smaller: 600V type THWN or XHHW (75 deg C).
   b. Standard Conductor Size No. 8 And Larger: 600V Type THW, THWN, or XHHW (75 deg C).
   c. Higher temperature insulation as required by NEC or local codes.
3. Colors:
   a. 208Y / 120 V System:
      1) Black: Phase A.
      2) Red: Phase B.
      3) Blue: Phase C.
      4) Green: Ground.
      5) White: Neutral.
   b. Conductors size No. 10 and smaller shall be colored full length. Tagging or other methods for coding of conductors size No. 10 and smaller not allowed.
   c. For feeder conductors larger than No. 10 at pull boxes, gutters, and panels, use painted or taped band or color tag color-coded as specified above.

B. Line Voltage Cables:
1. Non-Metallic Sheathed Cable (NM) and Metal Clad Cable (MC) may be used as restricted below:
   a. Copper conductors.
   b. Sizes #12 through #8.
   c. Use only in indoor dry locations where:
      1) Not subject to damage.
      2) Not in contact with earth.
   d. Not in concrete.

e. Not where exposed or not concealed.
f. Not over suspended ceilings.

2. Metal Clad Cable (MC) may be used as restricted below:
   a. Copper conductors.
   b. Sizes #12 through #8.
   c. Use only in indoor dry locations where:
      1) Not subject to damage.
      2) Not in contact with earth.
      3) Not in concrete.

C. Standard Connectors:
1. Conductors No. 8 And Smaller: Steel spring wire connectors.
2. Conductors Larger Than No. 8: Pressure type terminal lugs.
3. Connections Outside Building: Watertight steel spring wire connections with waterproof, non-hardening sealant.

D. Terminal blocks for tapping conductors:
1. Terminals shall be suitable for use with 75 deg C copper conductors.
2. Acceptable Products:
   a. 16323 by Cooper Bussmann, Ellisville, MO www.bussmann.com
   b. LBA363106 by Square D Co, Palatine, IL www.us.squared.com.
   c. Equal as approved by Architect before bidding. See Section 01 6200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Conductors and cables shall be continuous from outlet to outlet.
2. Do not use direct burial cable.

B. Line Voltage Conductors:
1. Install conductors in raceway where indicated on Drawings. Run conductors of different voltage systems in separate conduits.
2. Route circuits at own discretion, however, circuiting shall be as shown in Panel Schedules. Group circuit homeruns to panels as shown on Drawings.
3. Neutrals:
   a. On three-phase, 4-wire systems, do not use common neutral for more than three circuits.
   b. On single-phase, 3-wire systems, do not use common neutral for more than two circuits.
   c. Run separate neutrals for each circuit where specifically noted on Drawings.
   d. Where common neutral is run for two or three home run circuits, connect phase conductors to breakers in panel which are attached to separate phase legs so neutral conductors will carry only unbalanced current. Neutral conductors shall be of same size as phase conductors unless specifically noted otherwise.
4. Pulling Conductors:
   a. Do not pull conductors into conduit until raceway system is complete and cabinets and outlet boxes are free of foreign matter and moisture.
   b. Do not use heavy mechanical means for pulling conductors.
   c. Use only listed wire pulling lubricants.

C. Line Voltage Cables:
1. Route circuits at own discretion, however, circuiting and numbering shall be as shown in Panel Schedules.
2. Support cables using approved staples, cable ties, straps, hangers, or similar fittings, spaced as required.

3. Where installing in framing, do not bore holes in joists or beams outside center 1/3 of member depth or within 24 inches (600 mm) of bearing points. Do not bore holes in vertical framing members outside center 1/3 of member width. Holes shall be one inch diameter maximum.
4. Conceal cables within ceilings and walls of finished areas. Cables may be exposed in unfinished areas but not run on floors of mechanical equipment spaces or in such a way that they obstruct access to, operation of, or servicing of equipment.
5. Install exposed cables parallel to or at right angles to building structure lines.
6. Keep cables 6 inches (150 mm) minimum from hot water pipes.
7. Do not support cables from mechanical ducts or duct supports without Architect's written approval.
8. Prohibited procedures:
   a. Boring holes for installation of cables in vertical truss members.
   b. Notching of structural members for installation of cables.

END OF SECTION

SECTION 26 0533

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Quality of material and installation procedures for raceway, boxes, and fittings used on Project but furnished under other Divisions.
2. Furnish and install raceway, conduit, and boxes used on Project not specified to be installed under other Divisions.

B. Related Requirements:
1. Section 23 0933: 'Electric and Electronic Control System for HVAC' for concealed raceway and extensions for temperature control system.
2. Section 26 0501: 'General Electrical Requirements'.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
1. Manufacturer Contact List:
   a. Cooper B-Line, Highland, IL www.b-line.com.
   b. Hubbell Incorporated, Milford, CT www.hubbell-wiring.com or Hubbell Canada Inc, Pickering, ON (905) 839-4332.
   c. Square D, Palatine, IL www.squared.com.
   d. Thomas & Betts, Memphis, TN www.tnb.com or Thomas & Betts Ltd, Iberville, PQ (450) 347-5318.
   e. Walker Systems Inc, Williamstown, WV (800) 240-2601 or Walker Systems Inc / Wiremold Canada Inc, Fergus, ON (519) 843-4332.
   f. Wiremold Co, West Hartford, CT www.wiremold.com.

B. Materials:
1. Raceway And Conduit:
   a. Sizes:
      1) 3/4 inch (19 mm) for exterior use, unless indicated otherwise.
      2) 1/2 inch (13 mm) for interior use, unless indicated otherwise.
   b. Types: Usage of each type is restricted as specified below by product.
      1) Galvanized rigid steel or galvanized intermediate metal conduit (IMC) is allowed for use in all areas. Where in contact with earth or concrete, wrap buried galvanized rigid steel and galvanized IMC conduit and fittings completely with vinyl tape.
      2) Galvanized Electrical Metallic Tubing (EMT), Flexible Steel Conduit, and Electrical Non-Metallic Tubing (ENT):
         a) Allowed for use only in indoor dry locations where it is:
            (1) Not subject to damage.
            (2) Not in contact with earth.
            (3) Not in concrete.
         b) For metal conduit systems, flexible steel conduit is required for final connections to indoor mechanical equipment.
      3) Galvanized Electrical Metallic Tubing (EMT) and Flexible Steel Conduit:

a) Allowed for use only in indoor dry locations where it is:
(1) Not subject to damage.
(2) Not in contact with earth.
(3) Not in concrete.
b) For metal conduit systems, flexible steel conduit is required for final connections to indoor mechanical equipment.

4) Schedule 40 Polyvinyl Chloride (PVC) Conduit:
a) Allowed for use only underground or below concrete with galvanized rigid steel or IMC elbows and risers.

5) Listed, Liquid-Tight Flexible Metal Conduit:
a) Use in outdoor final connections to mechanical equipment, length not to exceed 36 inches (900 mm).

6) Pre-wired 3/8 Inch (9.5 mm) Flexible Fixture Whips: Allowed only for connection to recessed lighting fixtures, lengths not to exceed 72 inches (1 800 mm).

c. Prohibited Raceway Materials:
1) Aluminum conduit.
2) Armored cable type AC (BX) cable.

2. Outlet Boxes:
a. Galvanized steel of proper size and shape are acceptable for all systems. Where metal boxes are used, provide following:
1) Provide metal supports and other accessories for installation of each box.
2) Equip ceiling and bracket fixture boxes with fixture studs where required.
3) Equip outlets in plastered, paneled, and furred finishes with plaster rings and extensions to bring box flush with finish surface.
b. Non-metallic boxes may be used only for control voltage wiring systems.
c. HVAC Instrumentation And Control:
1) Junction boxes in mechanical equipment areas shall be 4 inches (100 mm) square.
2) Boxes for remote temperature sensor devices shall be recessed single device.
3) Boxes for thermostats shall be 4 inches (100 mm) square with raised single device cover.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
1. Confirm dimensions, ratings, and specifications of materials to be installed and coordinate these with site dimensions and with other Sections.

3.2 INSTALLATION

A. Interface With Other Work:
1. Coordinate with Divisions 22 and 23 for installation of raceway for control of plumbing and HVAC equipment.
2. Before rough-in, verify locations of boxes with work of other trades to insure that they are properly located for purpose intended.
a. Coordinate location of outlet for water cooler with Division 22.
b. Coordinate location of outlets adjacent to or in millwork with Division 06 before rough-in. Refer conflicts to Architect and locate outlet under his direction.
3. Coordinate installation of floor boxes in carpeted areas with carpet installer to obtain carpet for box covers.
4. Install pull wires in raceways installed under this Section where conductors or cables are to be installed under other Divisions.

B. Conduit And Raceway:

1. Conceal raceways within ceilings, walls, and floors, except at Contractor's option, conduit may be exposed on walls or ceilings of mechanical equipment areas and above acoustical panel suspension ceiling systems. Install exposed raceway runs parallel to or at right angles to building structure lines.
2. Keep raceway runs 6 inches (150 mm) minimum from hot water pipes.
3. Make no more than four quarter bends, 360 degrees total, in any conduit run between outlet and outlet, fitting and fitting, or outlet and fitting.
   a. Make bends and offsets so conduit is not injured and internal diameter of conduit is not effectively reduced.
   b. Radius of curve shall be at least minimum indicated by NEC.
4. Cut conduit smooth and square with run and ream to remove rough edges. Cap raceway ends during construction. Clean or replace raceway in which water or foreign matter have accumulated.
5. Install insulated bushings on each end of raceway 1-1/4 inches (32 mm) in diameter and larger, and on all raceways where cables emerge. Install expansion fittings where raceways cross building expansion joints.
6. Run two spare conduits from each new panelboard to ceiling access area or other acceptable accessible area and cap for future use.
7. Bend PVC conduit by hot box bender and, for PVC 2 inches (50 mm) in diameter and larger, expanding plugs. Apply PVC adhesive only by brush.

C. Boxes:
1. Boxes shall be accessible and installed with approved cover.
2. Do not locate device boxes that are on opposite sides of framed walls in the same stud space. In other wall construction, do not install boxes back to back.
3. Locate boxes so pipes, ducts, or other items do not obstruct outlets.
4. Install outlets flush with finished surface and level and plumb.
5. Support switch boxes larger than two-gang with side brackets and steel bar hangers in framed walls.
6. At time of substantial completion, install blank plates on uncovered outlet boxes that are for future use.
7. Location:
   a. Install boxes at door locations on latch side of door, unless explicitly shown otherwise on Drawings. Verify door swings shown on electrical drawings with architectural drawings, and report discrepancies to Architect before rough-in. Distance of box from jamb shall be within 6 inches (150 mm) of door jamb.
   b. Properly center boxes located in walls with respect to doors, panels, furring, trim and consistent with architectural details. Where two or more outlets occur, space them uniformly and in straight lines with each other, if possible.
   c. Center ceramic tile boxes in tile.

D. Support factory-fabricated speaker enclosures from structure or ceiling suspension system.

END OF SECTION

SECTION 26 2816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install disconnects as described in Contract Documents, except those provided integral with equipment.

B. Related Requirements:
1. Section 26 0501: Common Electrical Requirements.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
1. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories.
   a. Disconnects: Same as Manufacturer of Project's main panelboard.
   b. Fuses.
      1) Cooper Bussmann, Ellisville, IL www.cooperbussmann.com.
      2) Edison Fuse, Ellisville, IL (314) 391-3443.
      3) Ferraz Shawmut, Newburyport, MA www.ferrazshawmut.com.
      4) Littelfuse Inc, Des Plaines, IL www.littelfuse.com.

B. Disconnects:
1. Heavy-duty quick-make, quick-break type, non-fused unless indicated otherwise.
2. Provide interlock to prevent opening of door when switch is in ON position.
3. Provide means to lock switch in OFF position with padlock.
4. Disconnects for motor circuits shall be horsepower rated.
5. Disconnects For Furnace Units And Unit Heaters: Provide manual starter with thermal overload relay. Provide overload relay to match motor full load amps.
6. Enclosures:
   a. Interior: NEMA / CEMA Type 1.
   b. Exterior: NEMA / CEMA Type 3R.
7. Fuses:
   a. Fuse fused disconnects with dual-element time delay fuses and equip with rejection type fuse holders.
   b. Fuses on Project shall be from single manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Label disconnects to indicate equipment served, such as Condensing Unit CU-1. Use 1/16 inch (1.6 mm) thick laminated plastic composition material with contrasting color core. Engraved letters shall be 1/4 inch (6 mm) high. Attach labels with screws.

END OF SECTION

SECTION 26 2923

VARIABLE FREQUENCY MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 Description

A. This specification describes an AC Adjustable Speed Sensorless Vector Drive used to control the speed/torque of a NEMA design B induction motor. The drive must provide a v/hz, sensorless vector and flux vector mode of operation.

B. The Drive shall be manufactured by a firm with at least ten (10) years experience in the production of this type of equipment.

1.2 Quality Assurance

A. The Drive manufacturing facility shall be ISO 9001 and 14001 certified.

B. The AFD shall be UL listed, or Canadian UL listed, and complies with EMC Directive 89/336 EEC, Low Voltage Directive 73/23 EEC and Machinery Directive 98/37 EC in accordance with the European Union's CE directive.

C. All printed circuit boards shall be completely tested and burned-in before being assembled into the completed Drive. The Drive shall then be subjected to a preliminary functional test, minimum one (1) hour burn-in and computerized final test. The burn-in shall be at 104°F (40°C), at full rated load, or cycled load. Drive input power shall be continuously cycled for maximum stress and thermal variation.

D. The Drive shall utilize efficient IGBT technology throughout the entire Drive manufacturer's Power and Voltage range.

E. The Drive shall utilize the same communications architecture for high-speed connectivity throughout the entire Drive manufacturer's Power range.

F. The Drive manufacturer shall have an analysis laboratory to evaluate the failure of any component. The failure analysis lab shall allow the manufacturer to perform complete electrical testing, x-ray components, and decap or delaminate components and analyze failures within the component.

G. The Drive shall utilize surface mount technology in the manufacturing of internal printed circuit boards and electronics, for maximum performance and reliability.

1.3 Submittals

A. The Submittals shall include the following information:
1. Outline Dimensions.
2. Weight.
3. Compliance to IEEE 519 - Harmonic analysis for particular jobsite including total voltage harmonic distortion and total current distortion.
    a. The Drive manufacturer shall provide calculations, specific to this installation, showing total harmonic current distortion (TDD), at the Point of Common Coupling (PCC), is less than required. Input line filters shall be sized and provided as required by the Drive manufacturer to ensure compliance with IEEE standard 519-1992, IEEE Recommended Practices and

Requirements for Harmonic Control in Electrical Power Systems. The acceptance of this calculation must be completed prior to Drive installation.

b. Prior to installation, the Drive manufacturer shall provide the estimated total harmonic distortion (THD) caused by the Drive. The results shall be based on a computer aided circuit simulation of the total actual system, with information obtained from the power provider and the user.

c. If the total harmonic current distortion (TDD), at the Point of Common Coupling (PCC), exceeds required levels, the Drive manufacturer is to recommend the additional equipment required to reduce the current TDD to an acceptable level.

PART 2 - PRODUCTS

2.1 Adjustable Frequency Drives

A. The Drive shall be solid state, with a Pulse Width Modulated (PWM) output. The drive shall be a Sensorless Vector AC to AC converter utilizing the latest isolated gate bipolar transistor (IGBT) technology. The Drive shall employ a Sensorless Vector inner loop torque control strategy that mathematically determines motor torque and flux. The drive must also provide an optional operational mode for V/Hz or closed loop Flux Vector Operation.

B. Ratings:

1. The Drive shall be rated to operate from 3-phase power at 230VAC to 480VAC +10/-10, 48Hz to 63Hz. The Drive shall employ a full wave rectifier to prevent input line notching and operate at a fundamental (displacement) input power factor of 0.97 at all speeds and loads. The Drive efficiency shall be 98% or better at full speed and load. An internally mounted AC line reactor or DC choke shall be provided to reduce input current harmonic content, provide protection from power line transients such as utility power factor correction capacitor switching transients and reduce RFI emissions. When a DC choke is utilized it shall be of swinging choke design to mitigate harmonics substantially more than conventional choke designs and shall provide a minimum of 5% impedance.
2. The overvoltage trip level shall be a minimum of 30% over nominal, and the undervoltage trip level shall be a minimum 35% under the nominal voltage.
3. Output voltage and current ratings shall match the adjustable frequency operating requirements of standard 460VAC, 3ph, 60Hz, NEMA design A or NEMA design B motors. The overload current capacity shall be 110% of rated current for one (1) minute out of ten (10) minutes and 180% for two (2) seconds out of each minute with an instantaneous overcurrent trip at 350% or higher. Output frequency shall be adjustable between 0Hz and 500Hz. Operation above motor nameplate shall require programming changes to prevent inadvertent high-speed operation. The drive shall be furnished in a UL Type 1 listed enclosure rated for operation at ambient temperatures between 0° and 40°C at an altitude not exceeding 3300 feet, with relative humidity less than 95% and no condensation allowed. The drive shall be protected from atmospheric contamination by chemical gasses and solid particles pre IEC 721-3-3, classes 3C2 and 3S2. The drive shall be protected from vibration per IEC 68-2-6 (max. sinusoidal displacement 1.5 mm, 2Hz to 9Hz and max. acceleration 5m/s^2, 9Hz to 200Hz).

C. Control Functions and Adjustments:

1. Start-up data entries shall include motor nameplate power, speed, voltage, frequency and current.
2. A motor parameter ID function shall automatically define the motor equivalent circuit used by the sensorless vector torque controller.
3. Two independent PID speed/torque loop regulators shall be provided with an autotune function as well as manual adjustments.
4. A dynamic braking chopper shall be provided on all models rated 15 horsepower and smaller.
5. A selection of nine (9) preprogrammed application macro parameter sets shall be provided to minimize the number of different parameters to be set during start-up. Macros included as standard are as follows: ABB Standard, 3-Wire, Alternate, Motor Potentiometer, Hand/Auto, PID Control, Pump & Fan Control, and Torque Control. A selection of two (2) user defined macros shall are also be available.

6. Carrier frequency shall be adjustable between 1 and 12 kHz. The AFD shall automatically adjust to the highest carrier frequency dependent upon drive temperature and load.
7. Start/Stop control functions shall include two (2) or three-(3) wire start/stop, coast/ramp stop selections, optional dynamic braking and flux braking.
8. The AFD shall be capable of starting into a rotating load (forward or reverse) and accelerate or decelerate to reference without safety tripping or component damage (flying start). The AFD shall also be capable of flux braking at start to stop a reverse spinning motor prior to ramp.
9. The AFD shall have the ability to automatically restart after an overcurrent, overvoltage, undervoltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between reset attempts shall be programmable.
10. Accel/Decel control functions shall include two (2) sets of ramp time adjustments with linear and two (2) s-curve ramp selections.
11. Speed/Torque control functions shall include:
    a. Adjustable min./max. speed and/or torque limits
    b. Selection of up to 7 preset speed settings or external speed control
    c. Two (2) sets of critical speed lockout adjustments.
    d. Two, independent built-in PID controllers to control a process variable such as pressure, flow or fluid level.
    e. Two (2) analog inputs shall be programmable to form a reference by addition, subtraction, multiplication, minimum selection or maximum selection.
12. Output control functions shall include:
    a. Current and torque limit adjustments to limit the maximum Drive output current and the maximum torque produced by the motor. These limits shall govern the inner loop torque regulator to provide tight conformance with the limits with minimum overshoot.
    b. torque regulated operating mode with adjustable torque ramp up/down and speed/torque limits.
13. The AFD shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay output shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.
14. The Drive shall have programmable “Sleep” and “Wake up” functions to allow the drive to be started and stopped from the level of a process feedback signal.
15. Three (3) programmable critical frequency lockout ranges to prevent the AFD from operating the load continuously at an unstable speed.

D. Static and Dynamic Performance:
1. Open loop static speed regulation shall be 0.5 % to 1% of rated motor speed. When motor speed feedback is provided from a suitable encoder, closed loop speed regulation shall be 0.01% or better. Dynamic speed accuracy shall be 3 %-sec or better open loop and 0.3 %-sec or better closed loop.
2. Torque response time shall be 10 ms or less. In the torque regulating mode, torque regulating accuracy shall be 5% or better.

E. Operator Control Panel (Keypad)
1. Each AFD shall be equipped with a front mounted operator control panel (keypad) consisting of a backlit, alphanumeric, graphic display and a keypad with keys for Start/Stop, Local/Remote, Increase/Decrease and Help. Softkeys will be provided which change functionality depending upon the position within the parameter hierarchy.
2. All parameter names, fault messages, warnings and other information shall be displayed in complete English words or standard English abbreviations to allow the user to understand what is being displayed without the use of a manual or cross-reference table.
3. Other languages selectable in addition to American English (Am) shall be as follows: English (European), French, Spanish, Portuguese, German, Italian, Dutch, Danish, Swedish, Finnish, Czech, Polish and Russian.
4. The Display shall have contrast adjustment provisions to optimize viewing at any angle.
5. The control panel shall provide a real time clock for time stamping events and fault conditions.
6. The control panel shall include a feature for uploading parameter settings to control panel memory and downloading from the control panel to the same drive or to another drive.

7. All Drives throughout the entire power range shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating.
8. The keypad is to be used for local control, for setting all parameters, and for stepping through the displays and menus.
9. The keypad shall be removable and insertable under drive power, capable of remote mounting, and shall have it's own non-volatile memory.
10. The standard operator panel shall provide a start-up, maintenance and diagnostic assistants that guides a new user through initial start-up and commissioning of the drive as well as provide indications for maintenance and help to diagnose a fault.
11. During normal operation, one (1) line of the control panel shall display the speed reference, and run/stop forward/reverse and local/remote status. The remaining three (3) lines of the display shall be programmable to display the values of any three (3) operating parameters. At least 26 selections shall be available including the following:
    a. Speed/torque in percent (%), RPM or user-scaled units
    b. Output frequency, voltage, current and torque
    c. Output voltage, power and kilowatt hours
    d. Heatsink temperature and DC bus voltage
    e. Status of discrete inputs and outputs
    f. Values of analog input and output signals
    g. Values of PID controller reference, feedback and error signals.
    h. Control interface inputs and outputs shall include:

F. I/O Capabilities
1. Six (6) discrete inputs, all independently programmable with at least 25 input function selections. Inputs shall be designed for "dry contact" inputs used with either an internal or external 24 VDC source.
2. Three (3) form C relay contact outputs, all independently programmable with at least 30 output function selections. Relay contacts shall be rated to switch 2 Amps at 24VDC or 115/230VAC. Function selections shall include indications that the drive is ready, running, reversed and at set speed/torque. General and specific warning and fault indications shall be available. Adjustable supervision limit indications shall be available to indicate programmed values of operating speed, speed reference, current, torque and PID feedback. An optional relay expansion card shall be available to provide 3 additional relay outputs. This option card shall be integrally mounted.
3. Two (2) analog inputs, each selectable for 0VAC - 10VAC or 4mA - 20mA, and independently programmable with at least ten (10) input function selections. Analog input signal processing functions shall include scaling adjustments, adjustable filtering and signal inversion. If the input reference (4-20mA or 0-10V) is lost, the AFD shall give the user the option of the following: (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the AFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus.
4. Two-(2) analog outputs providing 4mA to 20mA signals. Outputs shall be independently programmable to provide signals proportional to at least 12 output function selections including output speed, frequency, voltage, current and power.

G. Serial communications
1. Serial communication interface modules are available for a wide selection of communication protocols. Available adapters are as follows: DeviceNet, Profibus, CAN Open and ControlNet. Communications modules shall be internally mountable. I/O shall be accessible through the serial communications adapter.
2. The AFD shall have an RS-485 port as standard. The standard protocol shall be Modbus.
3. Serial communication capabilities shall include, but not be limited to, run-stop control; speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, and accel/decel time adjustments. The drive shall have the capability of monitoring feedback such as process variable feedback, output speed/frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), relay outputs, and diagnostic warning and fault information. Additionally, remote Local Area Network (LAN) VFD fault reset shall be possible. A minimum of 15 field parameters shall be capable of being monitored. The DDC system shall be able to monitor if the motor is running in the AFD mode or bypass mode (if bypass is specified) over serial communications.

4. The AFD shall allow the DDC to control the drive's digital and analog outputs via the serial interface. The serial communications interface shall allow for Digital Ouput DO (relay) control and Analog Output (AO) control. This control shall be independent of any AFD function. Examples of possible DO usage are as follows: Opening check valves, opening discharge valves, starting auxiliary equipment, etc. In addition, status of DO's are available over the communications link. Examples of possible AO usage are as follows: Controlling a bypass valve position, throttling valve position, etc. In addition, status of AO's are available over the communications link.

H. The operator panel port shall be connectable to a personal computer interface. Microsoft© Windows based software shall be available for drive setup, diagnostic analysis, monitoring and control. The software shall provide real time graphical displays of drive performance.

I. Protective Functions:

1. For each programmed warning and fault protection function, the drive shall display a message in complete English words or Standard English abbreviations. The three (3) most recent fault messages along with time, current, speed, voltage, frequency and DI Status shall stored in the drive's fault history. The last ten (10) fault names shall be stored in drive memory.
2. The drive shall include internal MOV's for phase to phase and phase to ground line voltage transient protection.
3. Output short circuit and ground fault protection rated for 65,000 amps shall be provided per UL508C without relying on line fuses. Motor phase loss protection shall be provided.
4. The drive shall provide electronic motor overload protection qualified per UL508C.
5. Protection shall be provided for AC line or DC bus overvoltage at 130% of max. rated or undervoltage at 65% of min. rated and input phase loss.
6. A power loss ride through feature will allow the drive to remain fully operational after losing power as long as kinetic energy can be recovered from the rotating mass of the motor and load.
7. Stall protection shall be programmable to provide a warning or stop the drive after the motor has operated above a programmed torque level for a programmed time limit.
8. Underload protection shall be programmable to provide a warning or stop the drive after the motor has operated below a selected underload curve for a programmed time limit.
9. Over-temperature protection shall provide a warning if the power module temperature is less than 5°C below the over-temperature trip level.
10. Input terminals shall be provided for connecting a motor thermister (PTC type) to the drive's protective monitoring circuitry. An input shall also be programmable to monitor an external relay or switch contact (klixon).

PART 3 - EXECUTION

3.1 Installation

A. The Drive manufacturer shall provide adequate drawings and instruction material to facilitate installation of the Drive by electrical and mechanical trades people employed by others.

3.2 Start-Up:

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

B. The factory will extend the normal warranty for the Drive with a certified factory start-up.

3.3 Product Support

A. Factory trained application engineering and service personnel that are thoroughly familiar with the Drive products offered shall be locally available at both the specifying and installation locations.

3.4 Warranty

A. Standard Warranty shall be 12 months from the date of start-up, not to exceed 18 months from the date of shipment. The warranty shall include all parts.

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

END OF SECTION

END OF DIVISION 26