Issuance Date: September 9, 2020
Pre-Bid Meeting Date: September 16, 2020
Questions Deadline: September 21, 2020
Bid Opening Date: September 30, 2020
BMA Approval Date: October 26, 2020

INVITATION TO BID
PACKAGED UNIT REPLACEMENT
COG2021-01

CITY OF GERMANTOWN
PROCUREMENT DEPARTMENT
1930 SOUTH GERMANTOWN ROAD
GERMANTOWN, TENNESSEE 38138

ENGINEER

HNA Engineering
11880 Cranston Dr.
Arlington, TN 38002

BID PACKAGE CONSISTS OF:

BID PROJECT DIRECTORY

BID SITE PLANS

CITY OF GERMANTOWN BID ENVELOPE

FINAL FORM
All Other Previous Forms Superseded
As of August 2016

CITY OF
GERMANTOWN
TENNESSEE
1930 South Germantown Road • Germantown, Tennessee 38138-2815
Phone (901) 757-7200 Fax (901) 757-7292 www.germantown-tn.gov

Date: September 9 , 2020

The City of Germantown, Tennessee, will accept Bids on: COG2021-01 Packaged Unit Replacement

Bid shall be mailed in a **sealed envelope** marked **"COG2021-01 Packaged Unit Replacement "** in the lower left-hand corner of the envelope and addressed to Procurement Director, City of Germantown, P. O. Box 38809, Germantown, TN 38183-0809 or, **if using express mail** (Fed Ex, Priority Mail, etc), address to 1930 S. Germantown Rd., Germantown, TN 38138. Please place in a sealed envelope inside the express mail packaging. *(Bid must be received by the City prior to the time indicated below.)* **Please mark envelope with the name of the Bid.**

BID DATE: Bid opening shall be recorded live at 1930 S. Germantown Rd at 2:00 p.m. on September 30, 2020, recording will be posted on the City's website.

Mandatory Pre-bid Meeting will be held September 16, 2020 at 2:00 pm CST, at the Economic Community Development Building located at 1920 S. Germantown Road in Germantown, Tennessee.

All purchases are F.O.B. Germantown, Tennessee.

The City reserves the right to accept or reject any Bid, to accept a Bid containing variations from these specifications if the Bid so merits, and to accept partial Bids. *Bids must be submitted on the Bid document that the City issues* ***and it must be signed.***

The Successful Bidder shall be prohibited from discriminating against any individual due to his race, creed, color, national origin, age or sex.

The City may waive any informalities or minor irregularities. The Board of Mayor and Aldermen is the final authority and shall have the right to reject any single Bid or all Bids submitted.

See attached Specifications, Bid Sheet, Bid Bond and Drug and Alcohol Testing Acknowledgment Statement and Affidavit, along with Company's Testing Policy, and Iran Divestment Act that must be returned as part of the Bid. Returning the form for disclosure of the Title VI and Title IX information is voluntary.

The Standard Germantown Construction Contract, Payment Bond, Performance Bond and the required Insurance Certifications are included and will be required from the selected Bidder.

Sincerely,

Lisa A. Piefer
Lisa A. Piefer
Procurement Director

ACKNOWLEDGEMENT OF RECEIPT OF BID PACKAGE
INVITATION TO BID NUMBER COG2021-01

Packaged Unit Replacement

Upon receipt of documents, please email this page to:

City of Germantown – Procurement Department
1930 South Germantown Road
Germantown, TN 38138
Phone: 901-757-7260
Fax: 901-757-7258
Email:procurement@germantown-tn.gov

I hereby acknowledge receipt of documents pertaining to the above referenced ITB.

COMPANY NAME:_____

CONTACT PERSON: _____

ADDRESS:_____

CITY:_____STATE:_____ZIP_____

PHONE: (____)_____FAX: (_____)_____

E-MAIL:_____

_____ _____
(Signature) (Date)

PRIME CONTRACTOR NAME & ADDRESS

_____

_____

_____

License Number _____

Date of Expiration _____

Classification _____

SUBCONTRACTORS

ELECTRICAL:

Name _____

Address _____

City & State _____

License Number_____

Expiration Date _____

Classification _____

PLUMBING:

Name _____

Address _____

City & State _____

License Number_ _____

Expiration Date _____

Classification _____

HVAC:

Name _____

Address _____

City & State _____

License Number_____

Expiration Date _____

Classification _____

MASONRY:

Name _____

Address _____

City & State _____

License Number_____

Expiration Date _____

Classification _____

ROOFING:

Name _____

Address _____

City & State _____

License Number_____

Expiration Date _____

ATTENTION: ALL CONTRACTORS

State law (Tennessee Code Annotated, Section 62-6-119) requires that the name, license number, expiration date thereof, and license classification of the contractors applying to bid for the prime contract and for the electrical plumbing, heating, ventilation and air conditioning contracts appear on the outside of the envelope containing the bid except when the bid is in an amount less than $25,000. Effective July 1, 2010, the amendment to Public Chapter 78 now requires the Masonry contractor to also be listed on the bid envelope, unless the portion is less than $100,000 (including materials and labor). Failure to include the aforesaid information on this envelope will result in your bid not being opened and disqualifying your bid from consideration. Effective September 6, 2017, the amendment to Tennessee Board for Licensing Contractors Rule Chapter # 0608-01-24 requires subcontractors to report their license information accurately to general contractors when roofing project exceeds $25,000.

CITY OF GERMANTOWN
Procurement Department
1930 South Germantown Road
Germantown, Tennessee 38138

BID DUE

Date_____

Time_____

Project Name _____

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Division 23 Mechanical

Section

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ADVERTISEMENT FOR BIDS

Separate sealed BIDS will be received by the City of Germantown at the office of the Procurement Director at 1930 South Germantown Road, Germantown, Tennessee until 2:00 p.m., Local Time, on the 30th day of September 2020, and then at said office publicly opened and read aloud for the construction of:

Project: COG2021-01 Packaged Unit Replacement

The Project is briefly described as follows: Work includes all necessary mechanical and electrical work required to remove the existing packaged unit and installing new packaged unit at the Economic Community Development Building.

Mandatory Pre-Bid Meeting will be held at 2:00 p.m. CST on September 16, 2020 at the Economic Community Development Building located at 1920 S. Germantown Road in Germantown, Tennessee.

Copies of the CONTRACT DOCUMENTS and plans and specifications may be examined and obtained at the following location(s):

City of Germantown - Owner
Procurement Director
1930 South Germantown Road
Germantown, TN 38138

Examined Only at:

Builder's Exchange
642 S. Cooper Street
Memphis, Tennessee 38104

McGraw Hill Construction
Dodge Plan Room
1604 Elm Hill Pike, Suite 200
Nashville, TN 37224
www.dodgeconstruction.com

Each BID must be submitted on forms provided in the BID PACKET DOCUMENTS provided and either accompanied by a BID BOND, properly executed on the form provided, or a Certified check or Cashier's check drawn on a National or Tennessee Bank in the amount of five percent (5%) of the TOTAL BID PRICE and payable to the City of Germantown.

For construction projects, the BIDDER'S license number, its expiration date, and that part of the classification applying to the BID, together with certain information regarding subcontractors, must appear on the envelope containing the BID, otherwise the BID shall not be opened or considered. For additional details on this requirement, see Document C of the attached document headed "Information for Bidders". The successful BIDDER shall be prohibited from discriminating against any individual due to the individual's race, creed, color, national origin, age, or sex.

The City may waive any informalities or irregularities. The Board of Mayor and Aldermen of the City is the final authority and shall have the right to reject any single BID or all BIDS submitted.

Procurement Director
City of Germantown, Tennessee

SPECIAL NOTICE

DOCUMENTS:

All contractors bidding on construction projects for the City of Germantown are required to use the Documents contained herein.

Insurance:

It is recommended that contractors consult with their insurance agent(s) to assure themselves that they can obtain the required insurance coverage set out in the Insurance Documents **(Insurance Requirement Section L)** and that their insurance agent(s) is authorized to execute the required Certificate of Insurance Coverage.

Documents to be Executed:

A BIDDER should only execute the BID and BID BOND, DRUG AND ALCOHOL ACKNOWLEDGMENT STATEMENT AND AFFIDAVIT (**Form D-2**) along with Company's Testing Policy, IRAN DIVESTMENT ACT (**Form D (A-2)**) and ADDENDA, and ACKNOWLEDGMENT FORM (**Form F (A-1)**), if any, when making a BID. The remaining forms contained in the CONTRACT DOCUMENTS will be required to be executed and complied with only by the successful BIDDER after notice of the award has been issued.

Additional Information

General and/or technical questions relating to this solicitation shall be submitted in writing to the City of Germantown, City Procurement Director, at fax number (901) 757-7258.

INFORMATION FOR BIDDERS

NOTICE - It is necessary for prospective BIDDERS to read the INFORMATION contained below to understand exactly how to submit a BID, what Documents must accompany the BID, what information should be on the outside of the envelope containing the BID, what the BIDDER legally obligates itself for by submitting a BID, and the reason why the City of Germantown (CITY) included the other Documents in this BID PACKET. Failure to carefully read and understand the INFORMATION contained below may either cause the BIDDER'S BID not to be considered or accepted by the CITY or cause the BIDDER to legally obligate itself to more than it realizes. The BID Document and the other Documents contained in this BID PACKET are legal Documents; and if the BIDDER does not understand any of them, the BIDDER should consult with its attorney. Only the Document forms included in this BID PACKET may be used.

1. Each BID must be submitted on the form provided in this BID PACKET and be accompanied by either a BID BOND, properly executed, on the form provided (**Document G**) or a Certified or Cashier's check drawn on a National or Tennessee Bank in the amount of five percent (5%) of the TOTAL BID PRICE and payable to the CITY OF GERMANTOWN. The BID, with the BID BOND or Certified or Cashier's check, must be placed in a sealed envelope and delivered to the office of the City Procurement Director, 1930 South Germantown Road, Germantown, Tennessee 38l38 on or before the time set out in the ADVERTISEMENT FOR BIDS; and then, at said office, the BID and all other BIDS shall be publicly opened and read aloud.

2. A BID shall be invalid if the BIDDER fails to deposit it at the designated location prior to the time and date for receipt of BIDS as indicated in the ADVERTISEMENT FOR BIDS. The CITY will not consider any bid received at the CITY'S designated location for the bid opening after the exact time specified for receipt. The CITY reserves the right to consider BIDS determined by the CITY, in the CITY'S sole discretion, to have been received late due to mishandling by the CITY after receipt of the BID and prior to any award.

3. If necessary, and within no later than three (3) days prior to the date established for receipt of BIDS (except as provided in 4 below), the CITY'S Procurement Department shall e-mail ADDENDA to each person or firm recorded by the Procurement Department as having acquired a BID package.

4. The CITY will not orally interpret the meaning of the plans, specifications or other PRE-BID documents. BIDDERS must submit all questions about the meaning or intent of PRE-BID documents in writing to the CITY'S Procurement Director and his/her designated buyer. The CITY must receive said written questions at least five (5) days prior to the date fixed for the opening of BIDS. The CITY will reply to such questions with written ADDENDA e-mailed to all parties recorded by the CITY'S Procurement Department as having acquired a BID PACKET. The CITY'S Procurement Department shall furnish such written ADDENDA not later than three (3) days prior to the date fixed for the opening of BIDS. Only questions answered by the CITY in written ADDENDA will be binding; all other interpretations shall be of no effect. Failure of any BIDDER to receive any such ADDENDA shall not relieve such BIDDER from any obligation under its BID, as submitted. All ADDENDA so issued shall become part of the CONTRACT DOCUMENTS.

BIDDERS shall submit all general and/or technical questions relating to the BID PACKET in writing to the CITY of Germantown Procurement Director, via e-mail. If any questions or responses require revisions to the solicitation as originally published, such revisions will be made by the CITY by written ADDENDA only, as described above. If the BID solicitation includes a separate contact person for technical information, BIDDERS are cautioned that any written or oral representations made by any engineer, CITY representative or other person(s) that appear to change materially, conflict with, or modify any portion of the solicitation shall not be relied upon and shall be of no effect. Only written ADDENDA issued by the CITY shall be effective as an amendment or as clarification of the BID solicitation. BIDDERS should contact the CITY'S Procurement Director at procurement@ germantown-tn.gov for a determination of whether an oral or written representation of any CITY representative or other person requires the CITY to issue an ADDENDUM.

5. A BIDDER may modify or withdraw a BID by an appropriate document executed and delivered to the Procurement Department at any time prior to the opening of BIDS.

6. As applicable, the product(s) specified in the BID PACKET DOCUMENTS shall be the basis for the BID. The BIDDER shall not be allowed to substitute another product without the CITY'S prior written approval. A BIDDER shall submit any request for substitution to the CITY no later than ten (10) days prior to the date fixed for the opening of the BIDS. The requesting BIDDER shall submit three (3) copies of each such request for substitution, which request shall include:

(a) Complete data substantiating the compliance of the proposed substitution with the contract documents;

(b) For products – product identification (including manufacturer's name and address) and manufacturer's literature (including product description, performance and test data and reference standards);

(c) Sample(s);

(d) Name and address of similar projects on which the product was used and date of product's installation;

(e) For manufacturing methods – detailed description of the proposed methods and drawings illustrating the methods;

(f) Itemized comparison of proposed substitution with product or method specified;

(g) Data relating to changes in construction schedule; and

(h) Identification of changes or coordination required.

7. In making a request for substitution, a BIDDER represents that such BIDDER has personally investigated the proposed substituted product or method and that the BIDDER has determined that the proposed substitute product or method is equal or superior in all respects to that specified, that the BIDDER will provide the same guarantee for the substitution as for the product or method specified in the BID PACKET DOCUMENTS, and that the BIDDER will coordinate the installation of accepted substitutions into the WORK, making all changes for the WORK to be complete in all respects.

8. Substitutions will not be considered when: they are indicated or implied on shop drawings or product data submittals without a formal request submitted in accordance with Paragraph 6; or acceptance will require substantial revision of the CONTRACT DOCUMENTS.

9. Any request for substitution received within six (6) days or less from the date fixed for the opening of BIDS will not be considered.

10. If product substitution is acceptable to the CITY, BIDDERS shall receive notification by Addendum a minimum of three (3) days prior to the BID date. If no approval notification through ADDENDUM is received by the BIDDER, the BIDDER shall submit the original specified product.

11. If this BID is for a construction project, the provisions of Tennessee Code Annotated Sections 62-6-101 et seq., Relating to General Contractors, will be applicable and same are incorporated herein by reference. All invited BIDDERS on a construction project are advised that a BIDDER must provide evidence of a license in the appropriate classification before its BID may be considered. The Official Bid Envelope containing the BID must be plainly marked with the following information:

(A) The BIDDER'S and any electrical, plumbing, heating, masonry, roofing, ventilation, and air conditioning subcontractor's name and address;
(B) The respective Tennessee Contractor's License Numbers of the BIDDER and the aforesaid subcontractors and the expiration dates of each; and
(C) That part of the license classification applying to the BID for all of the foregoing.

Otherwise the BID shall not be opened or considered except that if that BID is in an amount less than $25,000, only the name of the BIDDER for the contract and not the names of any subcontractors need to appear on the outside of the envelope.

12. The CITY has an employee drug and alcohol testing program, and a copy of the relevant portions thereof is enclosed. You must have a testing program for your employees that is at least as stringent as that of the City of Germantown. You must submit a copy or a summary of your drug and alcohol testing policy with your bid or proposal by attaching it to the enclosed Drug and Alcohol Testing Acknowledgement Statement and Affidavit (**Form D-2**). You must also submit a copy of the Iran Divestment Act (**Form D (A-2)**). IF BIDDERS DO NOT HAVE A TESTING PROGRAM THAT MEETS THIS REQUIREMENT, AND DO NOT SUBMIT A SIGNED COPY OF THE IRAN DIVESTMENT ACT THEIR BID CANNOT BE ACCEPTED BY THE CITY. THIS IS A REQUIREMENT OF TENNESSEE LAW AND CANNOT BE WAIVED BY THE CITY.

13. If Bidders choose to do so, attach a completed voluntary Title VI and Title IX form with the BID (Form E-2).

14. All blank spaces for BID prices must be filled in, in ink or typewritten, and the BID form must be fully completed and executed when submitted. Only the original of the BID is required. The CITY may waive any informalities or defects and may reject any and all BIDS. Any BID may be withdrawn prior to the scheduled BID opening time or authorized postponements thereof. No BIDDER may withdraw his BID within sixty (60) days after the actual time of the BID opening. Should there be any reason why the contract cannot be awarded within the specified time, the time may be extended by mutual agreement between the CITY and the successful BIDDER.

15. All CONTRACT DOCUMENTS are part of the CONTRACT AND AGREEMENT (sometimes referred to as the "C & A"). A BIDDER should only execute the BID, BID BOND, Drug and Alcohol Acknowledgement Statement and Affidavit (**Form D-2**) along with Company's Testing Policy and (as applicable) Iran Divestment Act (**Form D (A-2)**) and ADDENDA ACKNOWLEDGEMENT FORM (**Form F(A-1**)) when making a BID. The remaining Document forms in the BID PACKET should not be executed at the time of making a BID, as they are the Document forms which either contain information for the successful BIDDER or are Document forms the successful BIDDER will be required to execute and with which the successful BIDDER must comply. The BIDDER'S attention is directed to these Document forms.

16. The CONTRACT DOCUMENTS contain all the provisions required for the construction of the PROJECT. Information obtained from any officer, agent or employee of the CITY or any other person shall not affect the risks or obligations assumed by the BIDDER or relieve the BIDDER from fulfilling any of the conditions of the C & A or the other CONTRACT DOCUMENTS.

17. BIDDERS must satisfy themselves of the accuracy of the estimated quantities in the BID SCHEDULE and other matters that shall be applicable by examination of the site and a review of the CONTRACT DOCUMENTS, including any addenda. After BIDS have been submitted, a BIDDER shall not be legally entitled to assert that there was a misunderstanding concerning the quantities or conditions of the work to be performed, the quantities, qualities or conditions of the equipment and/or supplies to be furnished or any other terms or conditions of the C & A or the other CONTRACT DOCUMENTS.

18. The CITY will consider only those BIDS that are offered by BIDDERS who can show evidence of satisfactory completion of the work that is comparable in size and type of the WORK that is contemplated in the CONTRACT DOCUMENTS or, in the case of a new business, the ability to perform the work contemplated.

19. The CITY shall determine which is the lowest responsible and best BIDDER for the PROJECT and shall deliver to the successful BIDDER a NOTICE OF AWARD accompanied by the C & A and the Document forms to be executed and returned with the executed C & A. These Document forms include the PAYMENT AND PERFORMANCE BONDS and the CERTIFICATE OF INSURANCE COVERAGE. The successful BIDDER shall be required to return the C & A and the required attachments, properly executed, to the CITY within fifteen (15) days after receipt of same. Upon approval of same, the CITY shall forward the successful BIDDER a NOTICE TO PROCEED (**Form Q**).

20. Once the CITY determines which party is the successful BIDDER, that BIDDER must, as indicated above, fully comply with the BID and execute and deliver to the CITY the C & A and other

required documents. Upon its failure to timely do so, the CITY shall be authorized to advise the BIDDER that it is in default and that the CITY shall proceed to contract with another to fulfill the contract with which the defaulting BIDDER has failed to comply; and the defaulting BIDDER and the surety on its BID BOND shall be liable for all damages suffered by the CITY due to such default. The obligation of the defaulting BIDDER shall not be limited to the amount of its BID BOND, although the liability of the surety on such BID BOND will be limited to the amount thereof.

21. Any protest concerning the award of this bid shall be addressed to the Procurement Department Director. Protest shall be made in writing to the Procurement Department Director and shall be filed within seven days after the intended award is announced. A protest is considered filed when received by the Procurement Department Director. The written protest shall include the name and address of the protestor, identification of the procurement, a statement of the specific reasons for the protest and supporting exhibits. The submitted information will be reviewed with the City Attorney and City Administrator to render a final decision and a formal response provided within seven days. This decision relative to the protest shall be considered final.

22. The BIDDER shall be responsible for obtaining any and all permits required by the CITY to successfully complete this project.

23. If required, the successful low apparent BIDDER shall furnish the CITY, within forty-eight (48) hours after BIDS are received, the following detailed information for the CITY'S use:

(a) A cost breakdown analysis of all areas of WORK contained in the BID PROPOSAL, including a separation of all labor and material items; and

(b) A list of names of subcontractors, other persons or organizations (including those who are to furnish materials or equipment fabricated to a special design) proposed for such portions of the WORK. The BIDDER will be required to establish, to the satisfaction of the CITY Engineer and the CITY, the reliability of the proposed subcontractors to furnish and perform the WORK described in the sections of the specifications pertaining to such proposed subcontractor's respective trades. Subcontractors and other persons and organizations proposed by the BIDDER and accepted by the CITY and CITY Engineer must be on the WORK for which they were proposed and accepted, and shall not be changed without the written approval of the CITY and the CITY Engineer.

This list shall be submitted at the time the Cost Breakdown Form is presented to CITY, as set forth in this paragraph 23.

24. The CITY may, in its discretion, conduct a PRE-BID conference in the CITY on the date and at the time and place to be selected by the CITY. Any party interested in bidding should so advise the CITY in writing by e-mailing notice of such interest to the CITY'S Procurement Director at procurement@germantown-tn.gov . That party will receive notice of the date, time and place of the PRE-BID conference. BIDDERS are required to attend this conference and to submit written questions in advance of the conference to the Procurement Director. Additional written questions may be submitted at the conference. If the CITY has set a PRE-BID conference, the conference shall be held on the date at the time and place set forth herein below.

MANDATORY PRE-BID CONFERENCE TO BE HELD:

***** ALL Vendors will be required to wear a mask, and practice social distancing. The City intends to hold the meeting outside, should the meeting need to be moved inside due to weather, a temperature check will also be required before entering the building.**

DATE: **September 16, 2020**

TIME: **2:00 pm**

LOCATION: **Economic Community Development Building**

1920 S. Germantown Road

Germantown, TN 38138

CITY OF GERMANTOWN
DRUG AND ALCOHOL TESTING POLICY

All City of Germantown employees are subject to reasonable suspicion drug and alcohol testing. Employees in safety-sensitive positions, including, without limitation, police, fire and those who hold a commercial driver's license, are subject to pre-employment, reasonable suspicion, post-accident and random drug and alcohol testing. All BIDDERS are required to submit an affidavit, in the form attached hereto, that attests that such bidder operates a drug-free workplace program or other drug or alcohol testing program with requirements at least as stringent as that of the program operated by the City of Germantown. BIDDERS are hereby notified pursuant to Public Chapter 693 of the Public Acts of 2002 (codified as T.C.A. Section 50-9-114) that employers shall have seven (7) calendar days from the date that the successful BIDDER and the City of Germantown enter into the Contract & Agreement to file suit in the Shelby County Chancery Court to contest the Contract & Agreement issued to the successful BIDDER on the grounds that it violates said Public Chapter due to the fact that the successful BIDDER did not comply with said Public Chapter. Employers that do not contest the Contract & Agreement within said seven (7) calendar days by filing suit in Shelby County Chancery Court shall waive their rights to challenge the Contract & Agreement for violation of the provisions of Public Chapter 693.

DRUG AND ALCOHOL TESTING ACKNOWLEDGMENT STATEMENT AND AFFIDAVIT

Comes _____, for and on behalf of
(*Printed name of Principal Officer of Company)*
_____, (the "Company") and makes oath that: (i) the Company has received a copy of the relevant portions of the City of Germantown Drug and Alcohol Testing Policy; (ii) the Company understands that it must have a drug and alcohol testing policy at least as stringent as that of the City of Germantown; and (iii) the Company has in effect a drug and alcohol testing policy at least as stringent as that of the City of Germantown.

Attached hereto is a summary of the relevant portions of the Company's drug and alcohol testing program or a complete copy thereof.

_____
Signature

Title: _____

Sworn to and subscribed before me, a Notary Public, this _____ day of _____, 2020.

_____
Notary Public

My Commission Expires:

_____

DRUG AND ALCOHOL ABUSE

GENERAL POLICY

This is to establish the City's policy regarding drug and alcohol use and the unlawful possession of controlled substances on City of Germantown premises. The City of Germantown Medical Benefits Program provides clinical treatment for employees and dependents who are experiencing the following disorders or conditions: Mental and Nervous Disorders Treatment, Alcohol and Drug Dependency. The City also provides an Employee Assistance Program.

SCOPE

All employees of the City of Germantown.

PROVISIONS

A. City employees shall not take or be under the influence of any alcohol or illegal drugs while on duty. Employees may not be under the influence of legally prescribed or over-the-counter medications while on duty if such medications would impair their ability to safely and effectively perform their job.

B. City employees are prohibited from the use, possession, manufacture, distribution and sale of drugs at any time, or of alcohol while on duty or while in or on City property or in City vehicles.

C. All property belonging to the City is subject to inspection at any time without notice. Property includes, but is not limited to, vehicles, desks, containers, files, and storage lockers.

D. City employees who have reason to believe another employee is illegally using drugs or narcotics, shall report the facts and circumstances immediately to the supervisor.

E. All City employees are subject to reasonable suspicion drug and alcohol testing. Employees in safety-sensitive positions, including without limitation, police, fire and those who hold a commercial driver's license, are subject to pre-employment, reasonable suspicion, post-accident and random drug and alcohol testing. Testing procedures and other rules relating to drug and alcohol abuse are described in the City Drug and Alcohol Testing Policy or the respective department drug and alcohol policies.

F. Failure to comply with the intent or provisions of this policy or the applicable drug and alcohol testing policy may be used as grounds for disciplinary action, up to and including termination. (See Policy on Disciplinary Action.)

CITY OF GERMANTOWN
IRAN DIVESTMENT ACT COMPLIANCE

The Iran Divestment Act of 2016, effective as of July 1, 2016, is codified at Tenn. Code Ann. § 12-12-101 *et seq*. The Iran Divestment Act, with certain exceptions, prohibits municipalities, including the CITY, from entering into contracts with persons or entities engaged in investment activities in the energy sector of Iran. Pursuant to the terms set forth in Tenn. Code Ann. § 12-12-105, a person engages in investment activities in the energy sector of Iran if:

> (1) The person provides goods or services of twenty million dollars ($20,000,000) or more in the energy sector of Iran, including a person that provides oil or liquefied natural gas tankers, or products used to construct or maintain pipelines used to transport oil or liquefied natural gas, for the energy sector of Iran; or
>
> (2) The person is a financial institution that extends twenty million dollars ($20,000,000) or more in credit to another person, for forty-five (45) days or more, if that person will use the credit to provide goods or services in the energy sector in Iran and is identified on a list, created pursuant to § 12-12-106, as a person engaging in investment activities in Iran as described in this section.

This Act requires the State of Tennessee's chief procurement officer to publish on the State's web site a list of persons it determines engage in investment activities in Iran (the "Prohibited Entities List").1

Any BIDDER that is on the Prohibited Entities List will be ineligible to contract with the CITY.

Pursuant to the Act, any BIDDER that attempts to contract with the CITY must certify, at the time the bid is submitted, that the BIDDER is not identified on the Prohibited Entities List. A bid shall not be considered for award, nor shall any award be made where the BIDDER fails to submit a signed and verified Bidder's Certification.

1 The State published its listed dated July 15, 2016, which can be found on the Department of General Services' web page here: https://www.tn.gov/assets/entities/generalservices/cpo/attachments/List_of_persons_pursuant_to_Tenn._Code_Ann._12-12-106,_Iran_Divestment_Act-July.pdf

BIDDER'S CERTIFICATION OF COMPLIANCE WITH IRAN DIVESTMENT ACT

Tenn. Code Ann. § 12-12-101 *et seq*.

Comes _____, for and on behalf of
(*Printed name of Principal Officer of Company)*
_____, (the "Company") and, after being duly authorized by the Company so to do, makes oath that:

By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of its knowledge and belief that each bidder is not on the list created pursuant to the Iran Divestment Act, Tenn. Code Ann. § 12-12-106.

_____
Signature

Title: _____

Sworn to and subscribed before me, a Notary Public, this ____ day of _____, 20___.

_____
Notary Public

My Commission Expires:

_____

TITLE VI INFORMATION

1. The City of Germantown agrees to comply with the Title VI of the Civil Rights Act of 1964 (42 U.S.C. 2000d, et seq.), and the Department of Transportation Implementing Regulations (49 CFR Part 21) relative to the Contract which is the subject hereof.

2. The Contractor is requested, but is not obligated, to include the attached disclosure sheet, Voluntary Title VI and Title IX Form, with the Contractor's sealed bid.

VOLUNTARY TITLE VI AND TITLE IX FORM

Attach form to sealed bid

For Title VI and Title IX compliance, the Contractor's voluntary disclosure of the following information is requested.

1. Number of Contractor's Employees Who Are:

_____Male _____Female

2. Number of Contractor's Employees Who Are:

_____Caucasian _____African-American

_____Other (please specify) _____

_____

_____

_____

BID

Bid of:

(Name of Bidder)

(Address of Bidder)

organized and existing under the laws of the State of _____ and doing business as _____(indicate: "a corporation", "a partnership", "an individual", a "limited liability company" or otherwise, as applicable).

To: City of Germantown - Owner
City Procurement Director
1930 South Germantown Road
Germantown, Tennessee 38l38

In compliance with your ADVERTISEMENT FOR BIDS, BIDDER hereby proposes to furnish all necessary labor, machinery, tools, apparatus, materials, equipment, services, and other necessary supplies in strict accordance with the terms and conditions of the plans, specifications and CONTRACT DOCUMENTS within the number of consecutive calendar days and at the prices set forth below for the construction of:

Project: COG2021-01 Packaged Unit Replacement

By submitting this BID, BIDDER certifies that this BID has been arrived at independently without consultation, communication or agreement as to any matter relating to this BID with any other BIDDER or with any other competitor.

BIDDER agrees, upon receipt of the NOTICE OF AWARD accompanied by the CONTRACT AND AGREEMENT (C & A) and all required attachments, to cause same to be properly executed and returned to the CITY OF GERMANTOWN within fifteen (15) days thereafter. BIDDER further agrees, upon receipt of the NOTICE TO PROCEED, (i) to commence work on the PROJECT not later than the last date stated in the Notice to Proceed as to which the BIDDER may commence to proceed, and (ii) to complete the PROJECT within ninety days (90) consecutive calendar days after such date; otherwise, to pay the CITY OF GERMANTOWN as liquidated damages the sum of two hundred fifty dollars ($250.00) for each consecutive calendar day thereafter as provided in the GENERAL PROVISIONS; and (iii) to complete all Punch List items within ten (10) consecutive calendar days after the date of Substantial Completion, as such date is determined by the CITY, otherwise, the BIDDER agrees that the CITY may use any remaining retainage to complete all Punch List items. BIDDER acknowledges receipt of addenda(s) No._____.

BIDDER agrees to perform all work described in the CONTRACT DOCUMENTS for the following unit price or lump sum:

BID FORM

Item	Description	Unit	Quantity	Unit Price	Total Price
1	Work includes all necessary mechanical and electrical work required to remove the existing packaged unit and install new packaged unit per bid specifications in COG2021-01.	LS	1		
2	Tree trimming and/or tree removal as necessary.			Allowance	$3,000.00
				Total Bid	

TOTAL BID PRICE, IN WORDS:

_____DOLLARS AND_____CENTS ($_____.___)

The City reserves the right to purchase any and/or all items in this bid off the current State of Tennessee Statewide or Cooperative Contract, if it is considered by the Procurement Director to be in the best interest of the City. For any company that participates in a cooperative/state contract please provide cooperative/state pricing, or best pricing.

Name Cooperative Contract: _____
Cooperative Contract # _____

State Wide Contract #_____

Notes: The Contractor shall have 10 years experience working with Packaged Unit removal and installation that must maintain operations during installation, references for similar projects shall be provided upon request by the City. The City may also request Contractor and/or subcontractor personnel resumes. Contractor shall have the logistical expertise to secure the area of work so that patrons are not in harm's way. Contractor shall be responsible for all measures to secure the construction perimeter and control dust and debris.

Submitted By:

_____
(Name of Bidder) (Printed)

Signature: _____

Title:_____

Address: _____

_____

_____

Telephone No.: _____

Fax No.: _____

_____
(Date Bid Submitted)

_____ _____
License Number License Type

_____ _____
Date of Expiration of License Monetary Limit

ADDENDA ACKNOWLEDGEMENT FORM

BIDDER acknowledges receipt of the following addenda (as applicable):

Addendum No. 1 _____ Dated _____

Addendum No. 2_____ Dated _____

Addendum No. 3 _____ Dated _____

Addendum No. 4 _____ Dated _____

Addendum No. 5 _____ Dated _____

Addendum No. 6 _____ Dated _____

_____
(Name of Bidder)

By: _____

Title: _____

Use this form for bid bond.

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, _____(BIDDER) and _____(SURETY) are held and firmly bound unto the City of Germantown, Tennessee in the penal sum of five percent (5%) of the total amount of the BID, for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns, firmly by these presents.

The conditions of the above obligation are such that whereas BIDDER has submitted to the CITY OF GERMANTOWN a certain BID, attached hereto and hereby made a part hereof, to execute and enter into a certain CONTRACT AND AGREEMENT (C & A) for_____ (PROJECT) in compliance with the CONTRACT DOCUMENTS.

NOW, THEREFORE,

(a) If the BID shall be rejected, or

(b) If the BID is accepted and the BIDDER enters into a C & A for said project with the CITY OF GERMANTOWN within fifteen (15) days after receipt of the NOTICE OF AWARD accompanied by the C & A and all required attachments, then, this obligation shall be null and void; otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the SURETY for any and all claims hereunder shall, in no event, exceed the penal sum of this obligation as herein stated but the liability of the BIDDER is not so limited.

The SURETY, for value received, hereby stipulates and agrees that the obligation of said SURETY on this, its BID BOND, shall in no way be impaired or released by any extension of the time within which the CITY OF GERMANTOWN may accept such BID and the SURETY does hereby waive notice of any such extension.

WITNESS THE DUE EXECUTION HEREOF, on the _____ day of _____, 2020.

NAME OF BIDDER

_____

BY:_____
Signature of BIDDER or Authorized Officer
Title: _____

NAME OF SURETY

_____

BY:_____
Authorized Representative
(Attach Power of Attorney)

INFORMATION FOR SUCCESSFUL BIDDER

Those proposing to bid on the construction and completion of this City Project (PROJECT) should note the following:

(1) The City of Germantown (the "City") may award the contract to the lowest responsible and best bidder in accordance with the CONTRACT DOCUMENTS and in accordance with the following provisions:

a. The City may conduct such investigations as it deems necessary to evaluate any bid and to conclude, if warranted, that the BIDDER or, if an entity, its owners and officers, and the BIDDER'S proposed subcontractors, are responsible, qualified, and competent and have the financial ability to do the work in accordance with the contract documents to the City's satisfaction within the prescribed time.

b. The City reserves the right to reject the bid of any BIDDER who does not satisfy such evaluation.

c. The City reserves the right to reject any BID if any of the unit prices contained therein are obviously unbalanced, either above or below the reasonable cost thereof, as analyzed by the City. The purpose of insisting on balanced unit prices is to prevent the City from paying excessive unit prices, even though the bid, as a whole, is the lowest bid.

d. The City reserves the right to: reject any and all bids; waive any and all informalities; and discard all nonconforming and non-responsive or conditional bids.

e. In evaluating bids, the City shall consider the qualifications of the bidders, the degree of compliance with the prescribed requirements, and the alternatives and unit prices (if requested in the bid forms).

f. As a part of the evaluation process, the CONTRACTOR will be required to provide a detailed description of their Safety Program including the name of the CONTRACTOR'S Safety Officer, contract information and location at which they maintain their office. The CONTRACTOR will also be required to provide a list of any citations received for willful violations for failure to abate or for repeated violations by the United States Occupational Safety and Health Administration (OSHA); by the Tennessee Occupational Safety and Health Administration (TOSHA); or by any other governmental body for the last three years. Violations should be noted along with the nature of the violation, date of the violation, and name, address, telephone number and contact person for the agency issuing the citation.

g. If awarded, the contract will be awarded to the lowest bidder whose evaluation by the City indicates to the City that the award will be in the best interest of the Project.

h. The City may reject all bids submitted and call for new bids.

(2) The City will notify the successful BIDDER that it is the successful BIDDER by telephone following approval. City will then e-mail additional information and NOTICE OF AWARD. CONTRACTOR shall then be responsible for picking up contract documents from CITY and returning same to the CITY, properly executed, within fifteen (15) days of receipt. Accompanying the NOTICE OF AWARD will be the CONTRACT AND AGREEMENT (C & A), the PAYMENT AND PERFORMANCE BONDS and information regarding the City's insurance requirement.

(3) The CONTRACTOR is required to sign the C & A as set out therein. The CONTRACTOR is required to sign the PAYMENT AND PERFORMANCE BONDS exactly as set out therein, have an authorized agent of an insurance company authorized to do business in the State of Tennessee sign same and attach his Power of Attorney. Said PAYMENT AND PERFORMANCE BONDS must be attached to the C & A. The CONTRACTOR is required to have an authorized agent of an insurance company or companies authorized to do business in the State of Tennessee sign the CERTIFICATE OF INSURANCE COVERAGE and attach his or their Power(s) of Attorney to it. The CERTIFICATE OF INSURANCE COVERAGE must be attached to the C & A.

(4) The CONTRACTOR shall be notified by the City when said C & A, with the required attachments, has been approved and executed on behalf of the City , and the City shall furnish a copy of same to the CONTRACTOR. The City will thereafter issue a writing to the Contractor notifying the CONTRACTOR to commence work under the C & A (the "Notice to Proceed"). When such occurs, the CONTRACTOR is required to commence work on the PROJECT as specified therein and complete construction of the PROJECT within the number of consecutive calendar days set out in the CONTRACT DOCUMENTS.

(5) If the CONTRACTOR fails to comply with the foregoing, he shall become liable to the City for any damages suffered by the City because of such failure and/or may lose any benefits obtained by receiving the NOTICE OF AWARD.

(6) Further, the CONTRACTOR, by submitting his BID, agrees that he has read and is familiar with all the terms and conditions of the documents making up the CONTRACT DOCUMENTS and will abide by the terms and conditions thereof.

(7) The C & A and the other CONTRACT DOCUMENTS will be interpreted in accordance with and controlled by the laws of the State of Tennessee.

(8) The original of the C & A shall remain on file at the Office of the City Clerk, 1930 South Germantown Road, Germantown, Tennessee 38l38. Drawings and Specifications shall remain on file at the office set out in the CONTRACT DOCUMENTS.

CONTRACT AND AGREEMENT BY AND BETWEEN
THE CITY OF GERMANTOWN, TENNESSEE
AND
_____

This CONTRACT AND AGREEMENT (sometimes "C & A") is entered into this _____ day of _____,2020, by and between the CITY OF GERMANTOWN, TENNESSEE, a municipality organized and existing under the laws of the State of Tennessee ("CITY" OR "OWNER"), and , a_____ [***State Where Contractor Established]*** _____ ***[type of entity, e.g., corporation, LLC, partnership]*** ("CONTRACTOR"). For and in consideration of the agreements, covenants, payments and promises herein, the CITY and CONTRACTOR contract, covenant and agree as follows:

ARTICLE I

One (I) set of complete Contract Documents is on file in the Procurement Department. The parties expressly agree that the following documents are a part of this C & A:

Advertisement for Bids	A
Special Notice	B
Information for Bidders	C-1 thru C-6
Drug & Alcohol Policy	D-1 thru D-3
Iran Divestment Act	D (A-1 thru A-2)
Title VI Form	E-1 thru E-2
Bid Form	F-1 thru F-3
Addenda Acknowledgment Form	F (A-1)
Bid Bond	G
Information for Successful Bidder	H-1 & H-2
Contract and Agreement	I-1 thru I-8
Payment Bond	J-1 thru J-3
Performance Bond	K-1 thru K-3
Germantown Insurance Requirement	L
Affidavit of Contractor	M-1 thru M-2
Waiver and Release of Lien	N
Certificate of Payment to Contractor	O-1 thru O-2
Notice of Award	P
Notice to Proceed	Q
Notice of Project Acceptance	R
Change Order Form	S
General Provisions	GP-1 thru GP-21
Special Conditions	SC-1 thru SC-10

TECHNICAL SPECIFICATIONS

Section 1010 Summary of Work

Section 230000 Basic Mechanical Requirements

230100	General Provisions – Mechanical
230500	Basic Mechanical Materials and Methods
230529	Hangers and Supports for HVAC Piping and Equipment
230548	Vibration and Seismic Controls for HVAC
230553	Mechanical Identification
230593	Testing, Adjusting, and Balancing for HVAC
230713	Duct Insulation
230719	HVAC Piping Insulation
233113	Metal Ducts
233300	Ductwork Accessories

Section 260000 Basic Electrical Requirements

260100	General Provisions, Electrical
260500	Basic Materials and Methods, Electrical
260548	Electrical Supports and Seismic Restraints

CONSTRUCTION DRAWINGS

Cover Sheet

M001	Legends Notes - Mechanical
M101	Floor plans - Mechanical
M201	Details and Schedules – Mechanical
E001	Schedules and Legends – Electrical
E101	Floor Plan - Electrical

ARTICLE II

CONTRACTOR agrees to furnish and pay for all material, supplies, tools, equipment, labor and other services required to do and perform all the work required to complete the Project as described in the Contract Documents within ninety (90) consecutive calendar days after the day specified in the Notice to Proceed (**FORM Q**) as the last day upon which the Contractor is to proceed, all in strict and complete compliance with the terms and conditions of this C & A and with the other Contract Documents for this Project, all of which shall be deemed a part hereof as fully and completely as if set out and copied verbatim herein. The CITY agrees to pay the CONTRACTOR for said work described in Article II as shown on the attached BID FORM and pursuant to the terms and conditions of this C & A and the other Contract Documents.

No payments under this C & A will be made except upon presentation of the monthly estimate form prepared by CONTRACTOR and approved by the CITY, which shall show that the work covered by the periodic Certificate of Payment Form has been done and the payments therefor are due in accordance with this C & A.

The first estimate shall be of the value of the work completed within the first thirty days from the commencement of performance by the CONTRACTOR pursuant to this C & A. Every subsequent monthly estimate shall be for the work done since the CONTRACTOR's commencement of performance of this C & A, less the amount previously paid. If the CONTRACTOR fails to adhere to the program of completion provided for in the Contract Documents, the CITY shall deduct from the next and all subsequent estimates the full calculated accruing amount of the liquidated damages (if any) to the date of said estimate until such time as compliance with the program has been restored.

The monthly estimates shall be submitted on a form acceptable to the CITY signed by the City Engineer, architect or other professional retained by the CITY relative to the Project, if any. Such estimates shall be subject to the approval of the CITY. If the CITY approves such estimates, the CITY, subject to the foregoing provisions, will pay or cause to be paid to the CONTRACTOR, in the manner provided by law, the amount equal to NINETY-FIVE PERCENT (95%) of the estimated value of the work performed.

The CONTRACTOR shall, as soon as practical after final acceptance of the work under the C & A, make a final estimate of the amount of work done hereunder and the value thereof. Such final estimate shall be checked, approved and signed by the engineer/architect retained by the CITY relative to the Project, if any, and the official representative of the CITY. After such approval, the CITY shall pay, or cause to be paid, the CONTRACTOR, in the manner provided by law, the entire sum so found to be due hereunder after deducting there from all previous payments and such other lawful amounts as the terms of this C & A prescribe. Neither the final payment nor any part of the retained percentage shall become due until the CONTRACTOR shall deliver to the CITY a complete release of all claims or liens arising out of this C & A with an affidavit that all material suppliers and laborers to or on the Project have been paid. The CONTRACTOR may furnish a bond satisfactory to the CITY to indemnify the CITY against any claim or lien if a subcontractor refuses to furnish a release or receipt in full. If any claim or lien remains unsatisfied after all payments are made, the CONTRACTOR shall refund to the OWNER all monies that the latter may be compelled to pay in discharging such a lien, including all costs and reasonable attorneys fees incurred by the OWNER in defending against such claim or lien. In no case will final payment be made in less than thirty (30) days after completion of the work and the acceptance of same by the OWNER. Nothing contained herein shall be construed as signifying that a materialman or laborer has a right to a lien on the Project, as such liens are not permitted by Tennessee law. Any party giving notice to the OWNER that such party has not been paid by the CONTRACTOR shall be

referred by the OWNER to the CONTRACTOR and the surety on the bonds required to be posted by the CONTRACTOR relative to the Project.

ARTICLE III

CONTRACTOR declares that neither the Mayor, nor any Aldermen, nor any other CITY official holds a direct or indirect interest in this C & A. CONTRACTOR pledges that he will notify the Finance Director of the CITY in writing should any CITY official become either directly or indirectly interested in this C & A. CONTRACTOR declares that as of the date of this declaration he has not given or donated or promised to give or donate, either directly or indirectly, to any official or employee of the CITY, or to pay anyone else for the benefit of any official or employee of the CITY, any sum of money or other thing of value for aid or assistance in obtaining this C & A. CONTRACTOR further pledges that neither he nor any other officer or employee of CONTRACTOR will give or donate or promise to give or donate, directly or indirectly, to any official or employee of the CITY or anyone else for the benefit thereof any sum of money or other thing of value for aid or assistance in obtaining any change order to this C & A.

ARTICLE IV

CONTRACTOR agrees to indemnify and save the CITY, CITY officers, CITY agents, and CITY employees harmless from and against all loss and expense, including court costs and attorneys' fees, by reason of liability imposed on the CITY, CITY officers, CITY agents, or CITY employees, for damage because of bodily injury, death or property damage arising out of or in consequence of the performance of the work under or in any manner related to this C & A, whenever such injury, death or damage is due or claimed to be due to the negligence of the CONTRACTOR, his subcontractors, officers, agents, and/or employees.

In the event the CITY shall have occasion to either defend or assert its rights under this C & A in a court of law or equity, before a board of arbitration or otherwise, and if the CITY shall prevail in any such action, either as defendant or plaintiff (as the case may be), CONTRACTOR shall pay any and all costs of such action, including court costs and reasonable attorneys' fees, incurred by the CITY in asserting or defending its rights under this C & A.

All personal pronouns used in the Contract Documents, whether used in the masculine, feminine or neuter gender, shall include all other genders, the singular shall include the plural, and vice versa, as the context may require.

WITNESS the due execution hereof, effective _____, 2020 which date is the date of the signature of the Mayor as attested to by the City Clerk/Recorder under seal of office.

_____

[CONTRACTOR NAME]

By: _____

Title: _____

Address: _____

_____

_____

Telephone No.: (_____) _____

Fax No.: (_____) _____

CITY OF GERMANTOWN, TENNESSEE

By: _____
Mike Palazzolo, Mayor

I certify that on the ____day of _____, 2020, the signature of the Mayor was attested to by the City Clerk under seal of office on the original of this CONTRACT AND AGREEMENT.

_____
City Clerk/Recorder

Date: _____

Approved as to form:

_____
City Attorney

Date: _____

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS, that

_____(*Name of Contractor*)

_____(*Address of Contractor*) a

_____ (*State of formation of CONTRACTOR*)

_____ (*Corporation, Partnership, Limited Liability Company, Individual or Joint Venture—indicate which*), hereinafter called CONTRACTOR,

and _____(*Name of Surety*)

_____(*Address of Surety*)

hereinafter called SURETY, are held and firmly bound unto the City of Germantown, Tennessee, 1930 South Germantown Road, Germantown, Tennessee, hereinafter called OWNER, in the penal sum of

_____ Dollars

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

THE CONDITION OF THIS OBLIGATION is such that whereas, the CONTRACTOR has entered into a certain Contract and Agreement ("Contract") with the OWNER which is made a part hereof by reference for the construction of: COG2021-01 Packaged Unit Replacement

_____

NOW, THEREFORE, if the CONTRACTOR shall promptly make payment to all persons, firms, and SUBCONTRACTORS furnishing materials for or performing labor in the prosecution of the work provided for in such Contract, and any extension or modification thereof, including all amounts for materials, lubricants, oil, gasoline, parts and repairs on machinery, equipment, and tools consumed or used in

connection with such work, and all insurance premiums on said work, and for all labor performed in such work, whether by SUBCONTRACTORS or otherwise, then this obligation shall be void; otherwise, same is to remain in full force and effect.

PROVIDED, FURTHER, that said SURETY, for value received, hereby stipulates and agrees that no change, extension of time, modification, alteration, or addition to the terms of the Contract, to the work to be performed thereunder or to the SPECIFICATIONS accompanying the same shall in any way release its obligation under this BOND. Said SURETY hereby waives notice of any such change, extension of time, modification, alteration, or addition to the terms of the work or to the SPECIFICATIONS.

PROVIDED, FURTHER, that no final settlement between the OWNER and the CONTRACTOR shall abridge the right of any beneficiary hereunder, whose claim is entitled to be satisfied by the CONTRACTOR and its SURETY.

PROVIDED, FURTHER, that the CONTRACTOR and SURETY agree that any claim under this BOND may only be litigated in a court of competent jurisdiction in Shelby County, Tennessee.

IN WITNESS WHEREOF, this instrument is duly executed, this the _____ day of _____, 2020.

_____
(*CONTRACTOR*)

By: _____

Title: _____

Address: _____
_____
_____

_____
(*SURETY*)

By: _____
(*Attorney-in-Fact*)

Title: _____

Address: _____
_____
_____

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that

_____(*Name of Contractor*)

_____(*Address of Contractor*) a

_____ (*State of formation of CONTRACTOR*)

_____ (*Corporation, Partnership, Limited Liability Company, Individual or Joint Venture—indicate which*), hereinafter called CONTRACTOR,

and _____(*Name of Surety*)

_____(*Address of Surety*)

hereinafter called SURETY, are held and firmly bound unto

the City of Germantown, Tennessee, 1930 South Germantown Road, Germantown, Tennessee, hereinafter called OWNER, in the penal sum of_____Dollars ($_____), in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, and our successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that, whereas, the CONTRACTOR has entered into a certain Contract and Agreement ("Contract") with the OWNER, which is made a part hereof by reference, for the construction of: COG2021-01 Packed Unit Replacement

_____,

,and if the CONTRACTOR shall satisfy all claims and demands incurred under such Contract, and shall fully indemnify and save harmless the OWNER from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the OWNER all outlay and expense which the OWNER may incur in making good any default, then this obligation shall be void; otherwise, same is to remain in full

force and effect.

PROVIDED, FURTHER, that the said SURETY, for value received hereby, stipulates and agrees that no change, extension of time, modification, alteration, or addition to the terms of the Contract or to the work to be performed thereunder or the SPECIFICATIONS accompanying the same shall in any way release its obligation on this BOND, and it does hereby waive notice of any such change, extension of time, modification, alteration, or addition to the terms of the Contract, to the work, or to the SPECIFICATIONS.

PROVIDED, FURTHER, that no final settlement between the OWNER and the CONTRACTOR shall abridge the right of any beneficiary hereunder whose claim may be unsatisfied and which is entitled to be satisfied by the CONTRACTOR and SURETY.

PROVIDED, FURTHER, that the CONTRACTOR and SURETY agree that any claim under this BOND may only be litigated in a court of competent jurisdiction in Shelby County, Tennessee.

IN WITNESS WHEREOF, this instrument is duly executed this the _____ day of _____, 2020.

_____
(*CONTRACTOR*)

By: _____

Title: _____

Address: _____
_____
_____

_____
(*SURETY*)

By: _____
(*Attorney-in-Fact*)

Title: _____

Address: _____
_____
_____

GERMANTOWN INSURANCE REQUIREMENT
CITY PROJECT CONTRACT

The **CONTRACTOR** shall purchase and maintain the insurance outlined below to provide protection from the **CONTRACTOR'S** negligent acts. The **CONTRACTOR** shall provide this insurance as required by the Contract Documents. The negligence by any subcontractor, by anyone directly or indirectly employed by any of them, shall be considered a negligent act of the **CONTRACTOR.**

- Comprehensive General Liability in the amount of $1,000,000 per occurrence and must include Products/Completed Operations, Explosion/Collapse/Underground Coverage and Contractual Liability. The City of Germantown must be named Additional Insured using a CG 2010 (11/85) endorsement (or equivalent) and this must be noted on the Certificate of Insurance. The Insurance Company agrees to Waive their Right of Subrogation against The City of Germantown and this must be noted on the Certificate of Insurance.

- Auto Liability Insurance in the amount of $1,000,000 Combined Single Limit. The City of Germantown must be named Additional Insured and the Insurance Company agrees to Waive their Right of Subrogation against The City of Germantown and this must be noted on the Certificate of Insurance.

- Statutory Workers Compensation with Employers Liability Limits of 100/500/100 - The Insurance Company agrees to Waive their Right of Subrogation against The City of Germantown and this must be noted on the Certificate of Insurance.

- Umbrella Liability in the amount of $2,000,000 per occurrence – the terms and conditions of the Umbrella must be following form to the primary insurance.

- The Cancellation Clause on the Certificate of Insurance is amended to read: Should any of the described policies on the attached Certificate of Insurance be cancelled, non-renewed or reduced in coverage – the issuing Insurance Company will mail 30 days written notice to: The City of Germantown, Procurement Department, P.O. Box 38809 Germantown, TN 38138-0809, by registered mail, return receipt requested.

- The **CONTRACTOR** shall maintain a Builder's Risk/Installation Floater equal to the contract amount naming The City of Germantown as Loss Payee until final acceptance of the work. The policy must provide "all risk" including the peril of earthquake/earth movement.

- All Certificates should be issued with an Insurance Company (or Companies) maintaining an AM Best Rating of A- or better and a Financial Size of IX or greater. All Insurance Companies shall be authorized to conduct business in The State of Tennessee.

The **CONTRACTOR** shall maintain the above insurance – with the exception of Builders Risk/Installation – through both final acceptance and any Warranty Period defined by the contract documents.

AFFIDAVIT OF CONTRACTOR

STATE OF)
) SS:
COUNTY OF)

_____, being duly sworn according
(*Name of Affiant*)
to law, deposes and says that he is the_____
(*Title*)
of _____, the CONTRACTOR,
(*Name of Contractor*)
in a Contract and Agreement entered into between the Contractor and

the City of Germantown, the Owner,

for the construction of _____

_____(the "Project"),

and that he is authorized to and does make this affidavit on behalf of said CONTRACTOR in order to induce the OWNER to make payment to the CONTRACTOR, in accordance with the provisions of the said Contract and Agreement.

Affiant further says that all persons who have furnished materials and/or labor in connection with the construction of the Project have been paid in full; that the names of all materialmen and subcontractors that furnished any material and/or services in connection with such construction and the kind or kinds of material and/or services so furnished are as listed hereinafter; and that the CONTRACTOR has delivered to the OWNER waivers and releases of liens executed by all such materialmen and subcontractors.

_____
(*Signature of Affiant*)

Sworn to and subscribed
before me this _____ day
of _____, 2020.

_____
Notary Public

My Commission Expires:

_____

NAME	KIND OF MATERIAL AND/OR SERVICE

WAIVER AND RELEASE OF LIEN

WHEREAS, the undersigned, _____,
(*Name of manufacturer, material man, or subcontractor*)

has furnished to _____ labor and/or material for
(*Name of Contractor*)

use in the construction of _____(the "Project")

belonging to the City of Germantown _____,

NOW THEREFORE, the undersigned, _____, for and in consideration of One Dollar ($1.00) and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, does hereby waive and release any and all liens, or right to claim a lien, on the above described Project and premises or right to claim under any bond furnished by the CONTRACTOR relative to the Project and/or under any law, common or statutory, on account of labor or materials, or both, heretofore or hereafter furnished by the undersigned to or for the account of

said _____ for said Project.
(*Name of Contractor*)

Given under my (our) hand(s) and seal this ____ day of _____, 2020.

Manufacturer, Material man or Subcontractor Name:

By: _____

STATE _____
COUNTY _____

I, _____, a Notary Public, in and for said State and County, hereby certify that _____ who is _____
(*Name of Individual*) (Title
_____ of _____
(*Title or Office*) (*Name of material man or subcontractor or furnisher*)
and whose name is signed to the foregoing, and who is known to me, acknowledged before me on this day that he, with full authority, executed the foregoing instrument voluntarily for and as the act of said
_____.
(*Name of material man or subcontractor or furnisher*)

Given under my hand and seal this _____ day of _____, 2020.

_____
Notary Public

My Commission Expires:

_____

CITY OF GERMANTOWN
PROFESSIONAL SERVICE/CONSTRUCTION APPLICATION CERTIFICATION PAYMENT FORM

DATE:	TYPE OF CONTRACT	CERTIFIED BY:*	PAYMENT TO:
PROJECT #:	☐ ARCHITECT		
APPLICATION #:	☐ ENGINEER		
PROJECT NAME:	☐ CONSTRUCTION		
	☐ OTHER		
CONTRACT DATE:			
PERIOD TO:			INVOICE:
ACCOUNT NO.			INVOICE DATE:

APPLICATION FOR PAYMENT

1	ORIGINAL CONTRACT AMOUNT	
2	NET CHANGE BY CHANGE ORDERS	
3	CONTRACT SUM TO DATE (LINE 1+ LINE 2)	
4	TOTAL COMPLETED TO DATE	
5	RETAINAGE: (If Applicable)	
A.	_____ % of Completed Work (Line 4 X Line 5)	
6	TOTAL EARNED LESS RETAINAGE (Line 4 less Line 5 total)	
7	LESS SUM OF PREVIOUS PAYMENTS	
8	ADDITIONAL FEES DUE	
9	OUT-OF-POCKET EXPENSES	
10	CURRENT PAYMENT DUE	
11	BALANCE TO FINISH, including retainage	

CERTIFICATION OF PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising the application, the undersigned certifies that to the best of their knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents,and the Company is entitled to payment of the Amount Certified.

AMOUNT CERTIFIED _____

Signature: _____ Date: _____

Dept. Project Coordinator Approval:	Dept. Director Approval:

(Attach explanation if "Amount Certified" differs from the "Current Payment Due")

SIGNATURE & NOTARIZATION OF FIRM REQUESTING PAYMENT

(Required for Construction Projects only)

The undersigned certifies that to the best of their knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents for this project, that all amounts have been paid by the Contractor to any subcontractors and / or suppliers for which previous Application for Payments were issued and payments received from the City of Germantown, and that current payment shown herein is now due.

COMPANY NAME: _____

Signature: _____ Date: _____

State of: _____ County of: _____

Subscribed and sworn to before me this _____ day of _____

_____

Notary Public:

My Commission expires: _____

* If CONSTRUCTION Project: "Certification of Payment" section must be completed by architect/engineering firm.

* If ARCHITECT/ENGINEERING/OTHER Contract: "Certification of Payment" section must be completed by Dept. Project Coordinator.

**** Dept. Coordinator & Dept. Director must approve ALL payment applications.***

MONTHLY CONSTRUCTION ESTIMATE

PROJECT_____JOB NO._____ESTIMATE NO._____

ITEM NO.	DESCRIPTION	VALUE OF ITEM AS REFLECTED IN BID	NO. OF UNITS	UNIT PRICE	AMENDED CONTRACT PRICE	QUANTITY THIS ESTIMATE	INSTALLED TO DATE	AMOUNT EARNED TO DATE	MATERIALS: STORED	MATERIALS: COMPLETED	BALANCE OR OVERRUN (-)	RETAINAGE

CITY OF
GERMANTOWN
TENNESSEE
1930 South Germantown Road • Germantown, Tennessee 38138-2815
Phone (901) 757-7200 Fax (901) 757-7292 www.germantown-tn.gov

NOTICE OF AWARD

Date:

TO:
CONTRACT:

Dear :

This is to inform you that by action of the Board of Mayor and Aldermen during their meeting on _____, 2020, your firm was awarded the contract for _____ _____in the amount of_____.

Enclosed you will find one (1) copy of the Contract and Agreement, and the Performance and Payment Bonds for you to execute as set forth on Pages "H-1 and H-2" of INFORMATION FOR SUCCESSFUL BIDDER, of the SPECIFICATION BOOKLET. Further, you should have your insurance agent execute the insurance certificate exactly as it is found in the Germantown Insurance Requirements.

Also, enclosed are the Code of Ethical Conduct and Germantown Forward 2030 Strategic Plan for the City for your review. The Organizational Profile for Corporate Sustainability Form is also included and should be returned with above documents.

Additionally, as set forth on Page "SC-2" of SPECIAL CONDITIONS, of the SPECIFICATION BOOKLET, you are required to present at the Pre-Construction Conference:

1. A general sequence of operations (schedule of work), including major work items along with anticipated completion dates and present
2. A list of all sub-contractors to be used in the execution of the work under this project at the Pre-Construction Conference.
3. ADDITIONAL INFORMATION AS REQUESTED BY PROJECT MANAGER

Failure to present these documents as required at the Pre-Construction Meeting will result in the Notice to Proceed being withheld until all required information has been received.

You have fifteen (15) days to return the above required documents, properly executed, to the City of Germantown.

Congratulations on being the successful bidder for this project.

Sincerely,

Lisa A. Piefer
Procurement Director

Enclosure

P

CITY OF
GERMANTOWN
TENNESSEE
1930 South Germantown Road • Germantown, Tennessee 38138-2815
Phone (901) 757-7200 Fax (901) 757-7292 www.germantown-tn.gov

NOTICE TO PROCEED

To: _____ Date: _____
(*Contractor*)
_____
_____
_____ Project: _____
_____
_____

Relative to the above referenced project, this is your official Notice to Proceed within _____ ( ) consecutive calendar days of the date hereof and to complete the work within the time specified in the Contract and Agreement entered into by you and the City.

CITY OF GERMANTOWN

By: _____

Title: _____

ACCEPTANCE OF NOTICE TO PROCEED

Receipt of the above NOTICE TO PROCEED

is hereby acknowledged by _____
(*Typed or Printed Name of Contractor*)

this the ____ day of _____2020.

By: _____

Title: _____

Substantial Completion Date: _____

NOTE: The Contractor must promptly sign and return to the City of Germantown a copy of this Notice to Proceed.

NOTICE OF PROJECT ACCEPTANCE

City of Germantown
Procurement Department
1930 South Germantown Road
Germantown, Tennessee 38138

Date: _____
Contract Number: _____
Project Name: _____
Contractor: _____

This is to advise you that all items set forth on the Punch List for the project referenced above have been completed to our satisfaction, and the project is accepted by the City of Germantown on _____.

CITY OF GERMANTOWN

By: _____
Name: _____
Title: _____

R

CITY OF GERMANTOWN
CONTRACT CHANGE ORDER FORM

PROJECT NAME		**DATE**	
PROJECT ADDRESS		**PROJECT #**	
CITY, ST ZIP		**CONTRACT DATES**	
CONTRACTOR NAME		**CHANGE ORDER #**	
ADDRESS		**PROJECT COORDINATOR**	
CITY, STATE ZIP		**CONTRACT AMOUNT**	

THE CONTRACT IS CHANGED AS FOLLOWS:

ITEM #	DESCRIPTION OF CHANGES/JUSTIFICATIONS	DECREASE IN CONTRACT AMOUNT	INCREASE IN CONTRACT AMOUNT
	TOTALS		

ORIGINAL CONTRACT AMOUNT	$	
NET CHANGES BY PREVIOUSLY AUTHORIZED CHANGE ORDERS	$	
CONTRACT SUM PRIOR TO THIS CHANGE ORDER	$	
CONTRACT SUM WILL BE INCREASED/DECREASED BY THIS CHANGE ORDER IN THE AMOUNT OF	$	
NEW CONTRACT SUM INCLUDING THIS CHANGE ORDER	**$**	

ORIGINAL CONTRACT COMPLETION DATE _____

CONTRACT COMPLETION CHANGE +/- (# OF DAYS) _____

CONTRACT COMPLETION DATE ADJUSTMENT TO

Project Manager	**Dept Director**	**City Administrator**
ARCHITECT	**CONTRACTOR**	**OWNER**
ADDRESS	**ADDRESS**	**ADDRESS**
BY *(SIGNATURE)*	**BY** *(SIGNATURE)*	**BY** *(SIGNATURE)*
(TYPED NAME)	*(TYPED NAME)*	*(TYPED NAME)*
DATE	**DATE**	**DATE**

S

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GENERAL PROVISIONS

1. DEFINITIONS:

A. The word "OWNER" means the City of Germantown.

B. The word "ENGINEER" means the City Engineer, Consultant Engineer or Architect of Germantown.

C. The word "INSPECTOR" means a City of Germantown inspector.

D. The word "CONTRACTOR" means the successful BIDDER and/or assigned representative to whom the contract is awarded.

E. The words "install", "furnish", "provide", or words of like import mean the CONTRACTOR shall install, furnish, or provide, and similarly, the words "approved", "authorized", "required", "satisfactory", "acceptable", or words of like import mean approved by, authorized by, required by, satisfactory to, or acceptable to the ENGINEER, unless otherwise expressly stated.

F. The words "indicated", "shown", "detailed", or "scheduled" mean indicated, shown, detailed, or scheduled on the contract drawings, unless otherwise expressly stated.

G. The word "work" means the labor, materials, equipment, supplies, and services to be furnished under the contract, and the performing of all duties and obligations required by the contract documents.

H. The word "submit" means the CONTRACTOR shall submit to the ENGINEER for approval, unless otherwise expressly stated.

I. The word "Provide" means the CONTRACTOR shall furnish and install, complete and ready for use, unless otherwise expressly stated.

J. The word "selected" means selected by the ENGINEER, unless otherwise expressly stated.

K. The term "substantial completion" means the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the OWNER can occupy or utilize the Work for its intended use.

2. ENGINEER'S DECISION:

The ENGINEER shall in all cases determine the amount, quality, acceptability, and fitness of the several kinds of finished work and materials which are to be paid for hereunder, and shall decide all questions which may arise as to fulfillment of this contract on the part of the CONTRACTOR, and the ENGINEER'S interpretation of the contract and the ENGINEER'S determination and

decision thereto shall be final and conclusive. Such determinations and decisions, in case any question arises, shall be a condition precedent to the CONTRACTOR'S right to receive any money hereunder. The ENGINEER shall have the right to correct all clerical, mathematical, or minor errors or omissions in the specifications when such corrections are necessary for the proper coordination of the contract documents.

3. INSPECTOR'S RESPONSIBILITY:

The INSPECTOR will visit the job periodically to see that the terms of the plans and specifications are being performed in general accordance with the Contract Documents. Should the INSPECTOR be needed by the CONTRACTOR or his representative, these individuals may call the CITY OF GERMANTOWN DEPARTMENT OF COMMUNITY DEVELOPMENT to arrange a time that the INSPECTOR will confer with the CONTRACTOR about any aspect of the job, but the INSPECTOR will not give instructions to the CONTRACTOR. The CONTRACTOR will be responsible for compliance with the plans and specifications and all requirements of the Contract. The INSPECTOR may advise the CONTRACTOR or his representative that changes in the work should be accomplished. The INSPECTOR, acting through the authority of the Engineer, can reject work which clearly does not meet the requirements of the City.

4. CONTRACTOR'S RESPONSIBILITY:

A. From commencement until completion and final acceptance by the OWNER, the work under this Contract shall be under the charge and control of the CONTRACTOR. During such period of control by the CONTRACTOR, all risks in connection with the construction of the work and the materials to be used therein shall be borne by the CONTRACTOR.

B. The CONTRACTOR shall be fully responsible for the safety and protection of all persons and of all work and material connected with his contract until the project is finally accepted by the OWNER. The CONTRACTOR shall use proper precautions to fully protect all persons, his own work and that of others, and the property of the OWNER and others from injury and damage, and at his own expense he shall be liable for injury to all persons and shall make good all damage and injury to property belonging to the OWNER and others caused by himself and his employees through negligence, carelessness, or any other cause.

C. The OWNER and ENGINEER shall not be responsible for the methods and means employed by the CONTRACTOR in the performance of the CONTRACTOR'S work. The ENGINEER shall have no responsibility for the safety of the workmen and others who may be injured during the course of the CONTRACTOR'S work.

D. The CONTRACTOR must have a designated representative available on short notice who is capable of making decisions and giving directions at any time there is work ongoing.

5. SITE OF THE WORK:

A. Each CONTRACTOR submitting a bid or a proposal on this project and each Subcontractor estimating and furnishing a bid under any division and/or section of this Contract to the

CONTRACTOR shall visit the site of the work and examine its present condition to inform himself as to the nature and scope of all work to be done and all difficulties that may be involved therein.

B. The submission of a bid or a proposal by the CONTRACTOR to the OWNER or a bid furnished by a Subcontractor to the CONTRACTOR shall be accepted as evidence that the examination referred to in 5A above has been made and that all difficulties encountered have been provided for in his proposal or bid. Later foreseeable claims for extra compensation for labor, materials, and equipment will therefore not be recognized by the OWNER.

6. CONTRACTOR'S SUPERVISION:

A. The CONTRACTOR, or his duly authorized agent with authority to control the work, shall be present at the site whenever the work is in progress. The CONTRACTOR'S authorized agent shall meet with the approval of the ENGINEER.

B. The OWNER reserves the right to require the removal from the Project of the Superintendent or any other employee of the CONTRACTOR if, in the ENGINEER'S judgment, such removal is necessary to protect the OWNER'S interest.

7. CARE OF THE WORK:

A. The CONTRACTOR shall indemnify and save harmless the OWNER, the ENGINEER, their agents, and their employees from all claims, suits, or proceedings of any nature whatsoever which may be brought against the OWNER, the ENGINEER, their agents, or their employees on account of any injuries to persons or property received from the CONTRACTOR or his agents or servants. See also Paragraph 24 B hereinafter.

B. The CONTRACTOR shall be responsible for the proper care and protection of all materials delivered and work performed until completion and final acceptance of the project. The CONTRACTOR shall provide adequate barricades and warning signs to properly protect his work and to safeguard the life and property of others. Barricades, open trenches, etc. shall be properly illuminated with flares and/or blinking lights at night. All Traffic Control/warning devices used shall conform with Section VI of the Manual of Uniform Traffic Control Devices.

8. SCHEDULE OF WORK:

A. Before beginning work, the CONTRACTOR shall submit a construction schedule to the ENGINEER for approval. In general, the CONTRACTOR'S work shall be so scheduled as to interfere as little as possible with the operations of the OWNER and other contractors. All work shall be performed after 7:00 a.m. and before 6:00 p.m., local time, Monday through Saturday unless a specific requirement for overtime work is included elsewhere in the Contract Document, or is specifically granted by the ENGINEER. No work shall be performed on a Sunday without the express permission of the ENGINEER.

C. The OWNER will use the CONTRACTOR'S work schedule to prepare notification to individual property owners of the general date(s) that they may expect work to be performed in areas

adjoining their property. It will be the CONTRACTOR'S responsibility to keep the City advised of any significant changes in the work schedule in a timely manner so that the affected private property owners may be kept informed.

9. WORKMANSHIP, TOOLS AND CONSTRUCTION EQUIPMENT:

A. All work shall be performed in a finished and workmanlike manner, and in accordance with the best recognized trade practices.

B. The CONTRACTOR shall provide and maintain in good operating condition all tools and construction equipment necessary for the satisfactory performance of the work. Inadequate, unsuitable, defective, worn out, or otherwise unsatisfactory tools and construction equipment shall be removed from the site and replaced with satisfactory tools and construction equipment or the proper repairs shall be made or the unsatisfactory conditions shall be remedied.

10. CODES, ORDINANCES, REGULATIONS, LAWS, PERMITS, LICENSES AND FEES:

A. The CONTRACTOR shall comply with all City, County, State and Federal codes, ordinances, regulations and laws applicable to the work to be done and applicable to the use of public streets, alleys and highways. Such codes, ordinances, regulations and laws shall be considered as minimum requirements, and everything shown or specified in the Contract Documents in excess of these minimum requirements shall be installed in excess thereof, as shown or specified. No instructions given in the Contract Documents shall be construed as an authorization to violate any code, ordinance, regulation or law.

B. Before beginning work, the CONTRACTOR shall obtain and pay for all licenses and permits required to perform work covered by this contract, shall obtain and pay for all necessary inspections by all applicable authorities, and shall include their cost in the bid price. Whereas certain parts of the work may require the approval of public or other authorities, all work shall be subject to the ENGINEER'S decision before proceeding with the portion of the work involved.

11. DRAWINGS AND SPECIFICATIONS:

A. The drawings accompanying these specifications, and forming a part thereof, are listed elsewhere and, together with the specifications, they cover the work to be performed under the Contract. The CONTRACTOR and each Subcontractor employed on this work shall carefully examine all contract drawings and read all specifications. They will be bound by all things therein affecting their special work no matter under what heading they may appear.

B. The drawings and specifications are intended to cover a complete project ready for use, and all items necessary for a complete and workable job shall be furnished and installed. All minor items not specifically covered by the drawings and specifications but required in the construction of the project shall be furnished and installed as though shown or specified. This is not intended to cover major items of equipment or labor not shown or specified, but it is intended and will be interpreted

to cover all miscellaneous labor, parts, devices, accessories, controls, and appurtenances which are: required by all applicable codes, ordinances, laws, and regulations; required to complete and place the project in satisfactory operation; and required for a first class job that is complete in every respect.

C. The drawings and specifications are mutually explanatory and supplementary, and all features covered in one and not in the other shall have the same force and effect as though covered in both. In the event of any conflicts between the drawings and specifications, the ENGINEER'S decision shall govern. Should any error, discrepancy, or variance be discovered in the drawings or specifications by the Contractor or his Subcontractor, the CONTRACTOR shall immediately notify the ENGINEER before beginning the work and submit the question to the ENGINEER for his interpretation and decision. The ENGINEER will be governed by the overall meaning of the documents.

D. The CONTRACTOR shall keep at least one copy of all drawings and specifications on the project site in good condition and available to the ENGINEER and to his representatives at all times.

E. No deviations from the drawings and specifications shall be made without the ENGINEER'S prior written approval.

F. The GENERAL PROVISIONS and the SPECIAL CONDITIONS shall apply to every division and/or section of the STANDARD SPECIFICATIONS, as fully as if quoted verbatim therein.

12. STANDARD PUBLICATIONS:

Wherever in these documents reference is made to standard specifications, standards, codes, or other standard publications, such as "ASTM" (American Society for Testing and Materials), "AASHTO" (American Association of State Highway and Transportation Officials), "ANSI" (American National Standards Institute), "AWWA" (American Waterworks Association), "ACI" (American Concrete Institute), "AISC" (American Institute of Steel Construction), "AWS" (American Welding Society), Federal Specifications, "NEC" (National Electrical Code), or others, in all cases the latest published editions of such referenced standard publications in effect at the time of receipt of bids shall apply.

13. STANDARD EQUIPMENT AND EQUIPMENT INSTALLATION:

Except where special equipment is required, it is the general intent of the STANDARD SPECIFICATIONS that manufacturers' standard equipment shall be furnished. Minor variations from the Technical Specifications to accommodate manufacturers' standard equipment will be permissible, provided that the proposed equipment complies substantially with the STANDARD Specifications and that it will accomplish the required results, all to the ENGINEER'S satisfaction.

14. STANDARDS FOR MATERIALS:

A. All materials shall be new, unless used or salvaged materials are authorized by the ENGINEER.

B. The use of manufacturers' names and catalog numbers in these specifications or on the drawings indicates the type, size, rating, capacity, design, quality, or kind of materials required, and a closed specification is not intended, and similar and equal products of any reputable manufacturer which will satisfactorily perform the required functions will be acceptable, unless otherwise indicated by the words NO SUBSTITUTES, or unless otherwise specifically stated. The ENGINEER reserves the right to reject all materials which he deems not equal to those specified, or which he decides will not satisfactorily perform the required functions.

C. As promptly as possible after award of contract, and prior to the purchase of materials, the CONTRACTOR shall submit to the ENGINEER for approval a complete list of all proposed materials. The CONTRACTOR shall include with such list complete catalog data and descriptive literature of all materials.

15. SAMPLES:

The CONTRACTOR shall furnish to the ENGINEER for approval all samples as specified or requested. Unless otherwise specified, the CONTRACTOR shall submit duplicate samples of adequate size showing quality, type color range, finish, texture, or other specified features. The work shall be in accordance with approved samples.

16. MATERIALS, SERVICES AND FACILITIES:

Except as otherwise specifically stated in the Contract Documents, the CONTRACTOR shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, superintendence, temporary construction of every nature, and all other services and facilities of every nature whatsoever necessary to execute, complete and deliver the work within the specified time.

17. INSPECTION AND TESTING OF MATERIALS:

Where specifically provided for in the specifications, the inspection and testing of materials and finished articles to be incorporated in the work at the site shall be made by bureaus, laboratories, or agencies approved by the ENGINEER. The cost of such inspection and testing shall be paid by the CONTRACTOR. The CONTRACTOR shall furnish evidence satisfactory to the ENGINEER that the materials and finished articles have passed the required tests prior to the incorporation of such materials and finished articles in the work. The CONTRACTOR shall promptly segregate and remove rejected materials and rejected finished articles from the site of the work.

18. PATENTS:

The CONTRACTOR shall hold and save harmless the OWNER and its officers, agents, servants, and employees from liability of any nature or kind, including cost and expenses for or on account of any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the contract, including its use by the OWNER, unless otherwise specifically stipulated in the Contract Documents.

19. ACCURACY OF DATA AND INTERFERENCES:

A. Before beginning any work, the CONTRACTOR shall examine carefully the site of the work and all contract drawings, and shall verify all dimensions, elevations, and all existing conditions.

B. All work shall be installed to conform as nearly as possible with the dimensions, elevations, locations, and arrangements indicated, with only such minor adjustments as necessary to coordinate the work of the various trades and specification divisions and/or sections: coordinate the work of this contract with that of other contracts; accommodate the actual equipment furnished; avoid all interferences between the various parts of the work; and accommodate existing conditions which may differ from those indicated. Any and all parts of the work installed under this contract which interfere with other parts of the work or other contracts or which deviate from the drawings and specifications without the ENGINEER'S prior approval shall be altered by the CONTRACTOR, at his own expense, to clear such interferences or to comply with the drawings and specifications. All interferences or discrepancies which may be discovered or anticipated shall be reported promptly to the ENGINEER for decision before proceeding with the work. The ENGINEER shall have the privilege of authorizing minor changes without additional cost, provided that such changes are made prior to the commencement of work on the item involved.

20. LINES, GRADES, STAKES, AND TEMPLATES:

A. At his own expense, the CONTRACTOR shall furnish all stakes, templates, patterns, platforms, and labor which may be required in setting and cutting or laying out each part of the work.

B. Upon CONTRACTOR'S request, the ENGINEER will furnish locations and bench marks reasonably necessary for the execution of the work. The CONTRACTOR shall furnish all lines and grades and will be held responsible for the proper execution of the work to such lines and grades. Lines and grade stakes which are destroyed shall be replaced by the CONTRACTOR at his own expense.

21. LAND ACQUISITIONS AND RIGHTS OF WAY:

The properties on which the items included in the contract are to be located will be provided by the OWNER without cost to the CONTRACTOR, and all rights-of-way and easements across private or public property required for the installation of the work will be obtained by the OWNER. The OWNER will make every effort to obtain easements and rights-of-way in sufficient time to allow work to progress in an orderly and expeditious manner. Failure on the OWNER'S part to obtain rights-of-way and easements in sufficient time to cause no interference with the progress of the work will be considered as just cause for allowing extensions of time to the CONTRACTOR in accordance with the time lost because of the lack of rights-of-way and easements.

22. CONTRACT SECURITY:

A. The CONTRACTOR shall furnish Performance and Payment Bonds as security for the faithful performance and payment of all his obligations under the contract documents. These bonds shall

be in amounts as shown in the Instructions to Bidders and in the form and with sureties acceptable to the OWNER.

B. The OWNER shall have the right to waive the surety bond requirements, in which case the CONTRACTOR shall reduce his bid price in the amount of the CONTRACTOR'S cost for such security.

23. WAGE RATES:

The CONTRACTOR shall pay at least the minimum wage rates established by law. Such wage rates are minimum rates only, and the OWNER will not consider any claims for additional compensation made by their CONTRACTOR because of payment by the CONTRACTOR of any wage rates in excess of minimum rates, nor will the OWNER consider any claim for additional compensation made by the CONTRACTOR because of wage increases established by law during the life of the contract.

24. SUBCONTRACTING:

A. The CONTRACTOR shall not award any subcontract to any Subcontractor without the ENGINEER'S prior approval. Only those Subcontractors of proven ability whose reputation is known to the ENGINEER for executing first-class work will be approved. The ENGINEER'S approval will not be given until the CONTRACTOR submits to the ENGINEER an itemized written statement designating the name of each Subcontractor and the amount of each subcontract. This statement shall also designate the items of the contract which the CONTRACTOR proposes to execute directly with his own organization. The amount of these items, combined with the amounts of the various subcontract proposals, shall correspond to the contract price for the entire project. The contract will not be signed until all subcontractors have been approved.

B. The CONTRACTOR shall be as fully responsible to the OWNER for the acts and omissions of his Subcontractors, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

C. The CONTRACTOR shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind Subcontractors to the CONTRACTOR by the terms of the General Provisions and other Contract Documents insofar as applicable to the work of Subcontractors, and give the CONTRACTOR the same power to terminate any subcontract that the OWNER may exercise over the CONTRACTOR under any provisions of the Contract Documents.

D. Nothing contained in this contract shall create any contractual relation between any Subcontractor and the OWNER. The contractual relationship shall exist between the OWNER and the CONTRACTOR only. It is the CONTRACTOR'S duty, in his own interest, to enter into subcontractual agreements in strict accordance with all provisions of the Contract Documents. The failure of the CONTRACTOR to make the proper agreements with his Subcontractors and suppliers shall in no way relieve the CONTRACTOR of his responsibilities and obligations to the OWNER.

E. The Standard Specifications are grouped under the various divisions and/or sections for convenience of reference only. Each trade involved is not necessarily represented by a separate specification division and/or section, but rather, such divisions and/or sections are arbitrary and the CONTRACTOR will be permitted to allot portions of the work to Subcontractors at his own discretion, subject to the requirements of this Article 24 of the General Provisions, regardless of grouping of the specifications. It shall be the sole responsibility of the CONTRACTOR to settle definitely with each Subcontractor the portion of the work which each Subcontractor will be required to do. Neither the OWNER nor the ENGINEER will assume any responsibility whatsoever for any claims or disclaims by any of the Subcontractors or trades concerning the responsibility for performing any particular portion of the work, or jurisdiction over any particular type of work.

F. The CONTRACTOR and all Subcontractors for the various branches of work employed on the project shall cooperate fully with each other to facilitate the progress of the work, and to avoid all interferences between the various parts of the work.

G. Whenever his work is in progress, each Subcontractor shall have present at the job site a Job Superintendent, foreman, or other duly authorized agent with authority to control the Subcontractor's work. This duly authorized agent shall meet with the approval of the ENGINEER. The ENGINEER reserves the right to remove from the project the Subcontractor's agent or any other employee of the Subcontractor, if, in the ENGINEER'S judgment, such removal is necessary to protect the OWNER'S interest.

25. PAYMENTS BY CONTRACTORS:

The CONTRACTOR shall pay:

(l) for all transportation and utility services not later than the twentieth (20th) day of the calendar month following that in which such services are rendered;

(2) for all materials, tools, and other expendable equipment to the extent of ninety-five percent (95%) of cost thereof not later than the twentieth (20th) day of the calendar month following that in which such materials, tools, and equipment are delivered to the project site; and

(3) to each of his Subcontractors, not later than the fifth (5th) day following each payment to the CONTRACTOR, the respective amounts allowed the CONTRACTOR on account of the work performed by his Subcontractor, to the extent of each Subcontractor's interest therein.

26. TIME FOR COMPLETION FOR WEATHER DELAYS:

A. WET CONDITIONS: The required time of completion is given in calendar days in the BID. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for completion of the work described in the Contract Documents is a reasonable time for completion of the same, taking into consideration the average climatic range and usual lost time due to normal seasonal weather in this locality.

Time for completion in the Contract Documents includes the average number of days that are lost due to wet conditions. The table below shows the average number of days lost in each month due to wet conditions on outdoors civil projects, as heretofore determined by the Memphis and Shelby County Airport Authority and the Associated General Contractors Association, and it will be used to calculate additional time that will be allowed for time lost due to wet conditions.

For the purpose of consistency, the parties hereby agree that they will use the information contained in the table below as a guide, regardless of any differences in the weather at the site of the Project and the Memphis International Airport. The information in the table below was developed by the Associated General Contractors Association and the Memphis and Shelby County Airport Authority to determine a standard for wet conditions that stop outside work. The table below is not simply a summary of days that it rained, rather, the table shows the average number of days lost in each month due to wet conditions on outdoor civil projects as heretofore determined by the aforesaid parties in relation to one or more outdoor civil projects. This table will be used to calculate additional time that will be allowed for time lost due to wet conditions. The OWNER and the CONTRACTOR agree that it is an acceptable standard and agree to abide by it.

MONTH	AVERAGE DAYS LOST TO NORMAL WET CONDITIONS*
January	11.55
February	14.40
March	7.45
April	8.40
May	7.50
June	7.25
July	5.95
August	4.85
September	5.90
October	6.50
November	14.85
December	14.50

*Determined by the Memphis and Shelby County Airport Authority in conjunction with the Associated General Contractors Association based on ten (10) consecutive years of Shelby County weather data. The total contract time includes these days that are expected to be lost each month.

Because the Contract Documents prohibit work on Sunday, and because the average number of days of wet weather in the above chart are based on all days of the month and Sundays might or might not be one of such days, to maintain a fair standard for purposes of calculating wet weather days, it will be assumed that an additional two (2.0) wet weather days occurred during each month.

B. ICE, STANDING SNOW AND FROZEN GROUND: In addition to the work being delayed due to wet conditions (see A. above), it is recognized that the work may also be delayed due to certain conditions relating to ice, snow and frozen ground. Loss of working time may also be claimed and allowed for such conditions in accordance with the provisions of this paragraph. The average

number of days lost per month in this locality due to ice, standing snow and frozen ground conditions shall be considered to be zero. Lost days due to ice, standing snow and frozen ground conditions may be claimed, however, if it is caused by one or more of the following conditions which prevent outside construction activity or access to the site within a 24-hour period:

1. Ice which does not melt on a substantial portion of the project by 10 a.m.;
2. Temperatures which do not rise above 32 degrees Fahrenheit by 10 a.m.; or
3. Standing snow in excess of one inch (1.00").

C. FURTHER PROVISIONS REGARDING TIME FOR COMPLETION:

(a) A weather delay day may be counted only if worse than average weather prevents work on the project for fifty percent (50%) or more of the CONTRACTOR'S scheduled work day.

(b) The CONTRACTOR must submit a Daily Job Site Work Log showing which and to what extent construction activities have been affected by weather on a monthly basis.

(c) The CONTRACTOR must submit actual weather data to support a claim for the time extension obtained from the nearest NOAA weather station or other independently verified source approved by the Owner at the beginning of the project.

(d) The CONTRACTOR must maintain a rain gauge, thermometer and clock at the job site and keep daily records of precipitation, temperature and the time of each occurrence throughout the project.

(e) The CONTRACTOR must organize the claim documentation to facilitate its evaluation on the basis of calendar month periods and submit it monthly to the Owner.

(f) If an extension of the contract time is appropriate, it shall be effected in accordance with the provisions of Paragraph 27.

(g) No extra cost will be incurred by the OWNER for any extra time increase to the contract.

EXAMPLE: The following example is given for further clarification of how extra time for wet conditions and/or ice, standing snow or frozen ground is to be calculated. If wet conditions were to occur for a total of sixteen (16) days during the month of January, then the extra contract time allowed would be 16 days minus 11.55 days (from table in 26.A.), or 4.45 days, which may be rounded up to the nearest whole day, or 5.0 days, plus 2.0 additional wet weather days for a total of 7.0 days. Also, if during that same month there was standing snow or any combination of conditions as in B. above for three (3) days, then the Contractor would be allowed an extra 3.0 days in addition to the 7.0 days for wet conditions. The Contractor would get a total of 10.0 extra days. No extra cost will be incurred by the Owner for any extra time increase to the Contract.

27. CHANGE OF CONTRACT TIME

The contract time may only be changed by a change order or by a written amendment. Any claim for an adjustment in the contract time shall be based on written notice submitted by the CONTRACTOR within thirty (30) days after the event which caused the delay. The OWNER will render a decision on such a claim within thirty (30) days, and if the OWNER does not render a decision, a decision denying the claim shall be deemed to have been issued thirty-one (31) days after the claim was received. No extra cost will be incurred by the OWNER for any extra time increase to the Contract.

28. LIQUIDATED DAMAGES:

A. It is hereby understood and mutually agreed, by and between the CONTRACTOR and the OWNER, that the date of beginning and the time for completion as specified in the Contract for the work to be done hereunder are ESSENTIAL CONDITIONS of this contract and that TIME IS OF THE ESSENCE with respect to this contract; it is further mutually understood and agreed that the work embraced in this Contract shall be commenced not later than a date to be specified in the "Notice to Proceed".

B. The CONTRACTOR agrees that said work shall be processed regularly, diligently and uninterruptedly at such rate of progress as will ensure full completion thereof within the time specified. It is expressly understood and agreed, by and between the CONTRACTOR and the OWNER, that the time for the completion of the work described herein is a reasonable time for the completion of the same, taking into consideration the average climatic range and usual conditions prevailing in this locality. If the CONTRACTOR shall neglect, fail or refuse to complete the work within the time herein specified, or any proper extension thereof granted by the OWNER, then the CONTRACTOR does hereby agree, as a part consideration for the awarding of this contract, to pay the OWNER the amount stated in the BID per day, not as a penalty, but as liquidated damages, for such breach of contract, for each and every calendar day that the CONTRACTOR shall be in default after the time stipulated in the contract for completing the work.

C. The aforesaid amount is fixed and agreed upon by and between the CONTRACTOR and the OWNER because both parties recognize that the OWNER and its citizens will suffer actual damages if the CONTRACTOR fails to complete the work within the time specified herein but such damages are indeterminable and difficult to measure at the time of contracting. In making their agreement regarding liquidated damages, the parties have considered, among other things: (a) that this is a public project, i.e. a project being built by the OWNER for the benefit of and use by its citizens and the public generally, and that any delay in its scheduled completion will cause damages to those persons anticipated to use the project, which will be difficult to measure; and (b) that the OWNER'S staff will be required to monitor the CONTRACTOR throughout the pendency of construction, and the longer that construction takes, the longer the owner will be required to devote the services of its personnel and, in some instances employ the services of its consultants, all at additional expense to the OWNER. The CONTRACTOR recognizes the foregoing, and agrees that the amount of liquidated damages fixed and agreed upon herein is a reasonable estimate made at the inception of the Contract and agrees that such is not a penalty.

D. It is further agreed that time is of the essence of each and every portion of this contract and of the SPECIFICATIONS wherein a definite and certain length of time is fixed for the performance of any act whatsoever. Where under the Contract an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall be of the essence for this Contract. The CONTRACTOR shall not be charged with liquidated damages or any excess cost when the OWNER determines that the CONTRACTOR is without fault and the CONTRACTOR's reason(s) for the time extension are acceptable to the OWNER. The CONTRACTOR shall not be charged with liquidated damages or any excess cost when the delay of completion of the work is due:

(a) to unforeseeable cause beyond the control and without the fault or negligence of the CONTRACTOR; or

(b) to any delays of SUBCONTRACTORS or suppliers occasioned by any of the causes specified in subsection (a) immediately above.

Provided, however, that the CONTRACTOR shall, within ten (10) days from the beginning of such delay, notify the OWNER in writing of the causes of the delay. The OWNER shall then ascertain the facts and extent of the delay and notify the CONTRACTOR within a reasonable time of its decision in the matter.

29. NOTICES AND SERVICE THEREOF:

A. All notices, demands, requests, instructions, approvals and claims shall be in writing.

B. Each notice to or demand upon the CONTRACTOR shall be sufficiently given if delivered at the office of the CONTRACTOR shown by him in the BID (or at such other office as the CONTRACTOR may from time to time designate to the OWNER in writing), or sent via facsimile transmission to CONTRACTOR'S fax number, in each case addressed to such office.

C. Unless otherwise specified in writing to the CONTRACTOR, all papers required to be delivered to the OWNER shall be delivered to the ENGINEER, and each notice to or demand upon the OWNER shall be sufficiently given if delivered to the ENGINEER'S office or sent via facsimile transmission to the OWNER'S fax number In each case such shall be addressed to the ENGINEER or to such other representative of the OWNER or to such other address as the OWNER may subsequently specify in writing to the CONTRACTOR for such purposes.

D. Each such notice or demand shall be deemed to have been given or made as of the time of actual delivery if delivered, or, in the case of facsimile transmissions, at the time when same are properly transmitted by telecommunication device.

30. RIGHTS OF THE OWNER TO TERMINATE CONTRACT:

If the CONTRACTOR should be adjudged bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed for the CONTRACTOR or any of his property, or if he should persistently or repeatedly refuse or fail to supply enough properly skilled workmen or proper material, or if he should refuse or fail to make prompt payment to persons

supplying labor or material for the work under the Contract, or persistently disregard instructions or fail to observe or perform any provisions of the OWNER'S instructions, or fail to observe or perform any provisions of the Contract Documents, or otherwise be guilty of a violation of any provision of the Contract Documents, then the OWNER may, by at least five (5) days prior written notice to the CONTRACTOR, without prejudice to any other rights or remedies of the OWNER under the circumstances, terminate the CONTRACTOR'S right to proceed with the work. In such event, the Surety shall take over the work and prosecute it to completion, by contract or otherwise, and the Surety shall be liable for all costs in excess of the contract price. In such case, the Surety may take possession of, and utilize in completing the work, such materials, appliances, and plant as may be on the site of the work and necessary therefor. The foregoing provisions are in addition to, and not a limitation of, the rights of the OWNER under all other provisions of the Contract Documents.

31. ASSIGNMENT OF CONTRACT:

The CONTRACTOR shall not assign the whole or any part of this Contract or any monies due or to become due hereunder without the OWNER'S written consent. In case the CONTRACTOR assigns all or any part of any monies due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any monies due or to become due to the CONTRACTOR shall be subject to prior liens or claims of all persons, firms, and corporations for services rendered or materials supplied for the performance of the work called for in this Contract.

32. CLAIMS FOR EXTRA COST:

If the CONTRACTOR claims that any instructions by drawings or otherwise involve extra cost or an extension of time, he shall so notify the OWNER in writing within ten (10) days after the receipt of such instructions, and in all cases before proceeding to execute the work. Thereafter, the procedure shall be the same as that described in Article 33, CHANGES IN WORK. No such claim shall be valid unless it is made in accordance with the terms of Article 33.

33. CHANGES IN WORK:

A. At any time, by a written order and without notice to the sureties, the OWNER may make changes in the drawings and specifications of this Contract and within the general scope thereof. In making any change, the charge or credit for the change will be determined by the OWNER by one of the following methods prior to the issuance of the order for the changed work:

(I) Method I: The order shall fix the total lump sum value of the change, and shall establish the amount which shall be added to or deducted from the contract price. On all changes involving extras which will be added to the contract price, the price of the extras shall include the CONTRACTOR'S overhead and profit, which shall be as described in Method (4) below. On all changes which involve a new credit to the OWNER, no allowance for overhead and profit shall be figured, except as otherwise noted in Method (2) below;

(2) Method 2: If the change involves construction items for which unit bid prices are shown in the BID, the amount to be added to or deducted from the contract price shall be determined by multiplying the unit quantities of the items to be added or omitted by the corresponding unit bid prices for the items involved, without further allowance for CONTRACTOR'S overhead and profit;

(3) Method 3: If the work is performed on a unit price basis and the change involves adding construction items for which no unit prices are shown in the BID, the unit prices for the items involved shall be estimated by Method (l) above or Method (4) below, based upon cost data of similar bid items. The amount to be added to the contract price shall be determined by multiplying the unit quantities of the item to be added by this estimated unit price;

(4) Method 4: Upon the OWNER'S order, the CONTRACTOR shall proceed with the work and keep and present to the OWNER, in such form as the OWNER may authorize, a correct account of the total cost of the change, together with all vouchers therefor. The total cost shall be determined as follows:

a. Compute the net cost of the change, which shall include: direct labor and items incidental to labor, such as public liability insurance, workmen's compensation insurance, and social security; materials and sales taxes on materials; the actual use of power tools and equipment; power; and pro-rata charges for foremen.

b. Except as otherwise specified in Paragraph B below, compute an allowance for overhead and profit. This allowance shall not exceed the following percentages of the net cost of the change as determined in Paragraph (4)a above: for all work performed, an allowance of 10% overhead and 10% profit shall be allowed; and an additional allowance of a 5% handling charge may be allowed for work performed by a sub-contractor. In no case shall the 10% overhead and 10% profit be applied to any work which has previously had these allowances added, nor shall the 5% handling charge be applied to any work which is not Subcontracted. The 5% handling charge may be applied to the net cost of the change plus its allowable overhead and profit. Among the items which may be considered as overhead are: bond or bonds; supervision; superintendents; timekeepers; clerks; watchmen; small tools; incidental job burdens; general office expenses; and insurance other than that noted in Paragraph (4)a above.

c. The sum of the amounts computed in accordance with Paragraphs (4)a and (4)b above shall constitute the total cost of the Change Order, except as otherwise specified in Paragraph B below.

B. Where a cash allowance is included in the BID for authorized Contract Amendments or other purposes, the CONTRACTOR shall include in his total bid price all overhead, profit, and handling charges on the stated amount of the allowance. On all changes in the work which are to be paid for by this allowance, the CONTRACTOR shall not add to the net cost of the change any additional overhead and profit or any handling charges. However, if any part of such work is subcontracted,

each Subcontractor and Sub-subcontractor may allow himself not more than 10% overhead and 10% profit, as described in Paragraph (4)b above, but shall not include any handling charges.

C. Where required by the OWNER, the CONTRACTOR shall furnish to the OWNER an itemized breakdown of the quantities and prices used in computing the value of each change that may be authorized.

D. In figuring changes, instructions for measurement of quantities as set forth in the specifications shall be followed.

E. During the progress of the work, should the CONTRACTOR encounter, or the ENGINEER or OWNER discover, subsurface or latent conditions at the site differing materially from those shown on the drawings or indicated in the specifications, or unknown conditions of an unusual nature differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the drawings and specifications, the ENGINEER'S attention shall be called immediately to such conditions before they are disturbed. The ENGINEER will thereupon promptly investigate the conditions. If he finds that they do materially differ, with the written approval of the OWNER, the Contract will be modified to provide for the increase or decrease of cost and difference in time resulting from such conditions.

34. SANITARY FACILITIES:

Where satisfactory sanitary facilities are not available to the job, the CONTRACTOR shall construct and maintain, at his expense, temporary toilet facilities complying with all local health department requirements and satisfactory to the ENGINEER, and shall remove them after completion of the project.

35. CUTTING AND PATCHING:

A. Generally, cutting of new construction shall be avoided wherever possible by the proper coordination between the various trades, and by the placing of proper sleeves, inserts, bolts, and other items in the construction as the work progresses.

B. However, where subsequent cutting of new construction or cutting of existing construction is required, it shall be done in a neat, careful, and approved manner, without unnecessary or extensive damage to the construction involved, and only to such an extent that is reasonably necessary for the installation of the work.

C. All patching, repairing, and altering shall be done only by mechanics skilled in the various trades involved, using materials and workmanship to match those of the original construction in type and quality.

D. All existing construction which is disturbed or damaged in any way by the CONTRACTOR'S operations shall be restored at least to the conditions which existed before work was begun, unless otherwise indicated.

36. REMOVAL OF DEBRIS:

During the progress of the work, the CONTRACTOR shall remove and properly dispose of the resultant dirt and debris and keep the premises reasonably clear thereof. Upon completion of the work he shall: remove all construction equipment and unused materials provided for the work; put all the buildings, structures, and premises in a neat and clean condition; and do all cleaning and washing required by the specifications.

37. USE OF COMPLETED WORK:

A. The ENGINEER may accept a section or sections of a project before the entire project is completed. Such section(s) shall be of reasonable size, as determined by the ENGINEER, and shall be completed in full accordance with the Plans, Specifications and all other applicable provisions of the Contract. The acceptance of a section or sections of a project shall in no way void or alter any of the terms of the Contract.

B. Upon written request to the CONTRACTOR, the OWNER may elect to place any one or more of the approved completed portions of the work in operation, in which event the OWNER shall assume complete and sole responsibility for those portions of the work covered in the written request; provided, however, that nothing contained herein shall relieve the CONTRACTOR of any liability with respect to defective workmanship and materials as provided for under Article 40, GUARANTEE, below.

38. STARTING, TESTING, AND ADJUSTING:

Upon substantial completion of all work under this contract and after the ENGINEER'S preliminary inspection thereof, the CONTRACTOR shall maintain one or more qualified competent workers on the job as required: to put the project in operation; to conduct all specified tests; to make all necessary corrections and adjustments to obtain specified, indicated, and satisfactory operation; and if a trial run is specified in SPECIAL CONDITIONS or the TECHNICAL SPECIFICATIONS, to cooperate with, assist, and instruct the OWNER'S representatives during the required trial run. Failure of the CONTRACTOR to comply with this requirement of the contract shall be considered just cause for delaying final approval and acceptance of the work, delaying the commencement of the guarantee period, and withholding any and all funds which may then be due the CONTRACTOR.

39. TAXES:

The CONTRACTOR shall pay all applicable Federal, State and Local taxes and shall include the total amount of the taxes in the bid price.

40. GUARANTEE

A. All labor and material furnished by the CONTRACTOR covered by the drawings and specifications and official modifications thereof shall be guaranteed by the CONTRACTOR for a period of one (1) year from the date of final acceptance of the completed project by the OWNER. All necessary repairs required during this period due to defective workmanship or material shall be made promptly by the CONTRACTOR without cost to the OWNER at times convenient to the OWNER. An additional one (1) year guarantee period from the date of acceptance of the repaired item by the OWNER shall apply to any such repaired item.

B. The ENGINEER shall have the sole right to establish the beginning of the guarantee period for all portions of the project, and if so stated in the SPECIAL CONDITIONS or the STANDARD SPECIFICATIONS, the guarantee period shall not begin until a trial run has been completed with satisfactory operation, to be determined in the sole discretion of the OWNER, for the period of time stated in the SPECIAL CONDITIONS or the STANDARD SPECIFICATIONS. It shall be the CONTRACTOR'S duty to make all final adjustments, perform all miscellaneous clean-up work, and conduct all specified performance tests. Final acceptance will not be given until the completion of all final adjustments, clean-up work, and tests.

C. Where certain portions of the project are placed in use before the entire project is completed, the guarantee period for the equipment or items placed in use shall begin prior to the acceptance date of the entire project.

41. SAFETY AND HEALTH REGULATIONS

A. The CONTRACTOR shall comply with the Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL 91-54).

B. Authorized representatives of the Department of Labor shall be permitted free access to the project for inspections.

42. ARCHITECTURAL PROVISIONS:

The following provisions shall be applicable in the event that a licensed architect is involved with the Project:

A. The drawings, specifications and other documents prepared by the ARCHITECT are instruments of the ARCHITECT'S service through which the Work to be executed by the CONTRACTOR is described. The CONTRACTOR may retain one contract record set. Neither the CONTRACTOR nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the drawings, specifications and other documents prepared by the ARCHITECT, and unless otherwise indicated the ARCHITECT shall be deemed the author of them and will retain all common law, statutory and other reserved rights, in addition to the copyrights. All copies of the drawings, except the Contractor's record set, shall be returned or suitably accounted for to the ARCHITECT, on request, upon completion of the work. The drawings, specifications and other

documents prepared by the ARCHITECT, and copies thereof furnished to the CONTRACTOR are for use solely with respect to this Project. They are not to be used by the CONTRACTOR or any Subcontractor, Sub-subcontractor or for additions to this Project outside the scope of the Work without the specific written consent of the OWNER and ARCHITECT. The CONTRACTOR, Subcontractors, Sub-subcontractors and material or equipment suppliers are granted a limited license to use and reproduce applicable portions of the drawings, specifications and other documents prepared by the ARCHITECT appropriate to and for use in the execution of Work under the Contract Documents. All copies made under this license shall bear the statutory copyright notice, if any, shown on the drawings, specifications and other documents prepared by the ARCHITECT. Submittal or distribution to meet official requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the ARCHITECT'S copyright or other reserved rights. PROVIDED, HOWEVER, notwithstanding any provision in this Section 42.A to the contrary, it is understood and agreed that the OWNER shall be the owner of all drawings, specifications and other documents prepared by the ARCHITECT for this Project and that the OWNER may make any use of same as is lawful.

B. The ARCHITECT will not have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the CONTRACTOR'S responsibility. The ARCHITECT will not be responsible for the CONTRACTOR'S failure to carry out the Work in accordance with the Contract Documents. The ARCHITECT will not have control over or charge of and will not be responsible for acts or omissions of the CONTRACTOR, Subcontractors, or their agents or employees, or of any other persons performing portions of the Work.

C. The ARCHITECT will have authority to reject Work, which does not conform to the Contract Documents. Whenever the ARCHITECT considers it necessary or advisable for implementation of the intent of the Contract Documents, the ARCHITECT will have authority to require additional inspection or testing of the Work whether or not such Work is fabricated, installed or completed. However, neither this authority of the ARCHITECT nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the ARCHITECT to the CONTRACTOR, Subcontractors, material and equipment suppliers, their agents or employees, or other persons performing portions of the Work.

D. The ARCHITECT will review and approve or take other appropriate action under the CONTRACTOR'S submittals such as shop drawings, product data and samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The ARCHITECT'S action will be taken with such reasonable promptness as to cause no delay in the Work or in the activities of the OWNER, CONTRACTOR or separate contractors, while allowing sufficient time in the ARCHITECT'S professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the CONTRACTOR as required by the Contract Documents. The ARCHITECT'S review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the ARCHITECT, of any construction means, methods,

techniques, sequences or procedures. The ARCHITECT'S approval of a specific item shall not indicate approval of an assembly of which the item is a component.

E. The ARCHITECT will interpret and decide matters concerning performance under the requirements of the Contract Documents on written request of either the OWNER or CONTRACTOR. The ARCHITECT'S response to such requests will be made with reasonable promptness and within any time limits agreed upon.

F. Interpretations and decisions of the ARCHITECT will be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the ARCHITECT will endeavor to secure faithful performance by both OWNER and CONTRACTOR, will not show partiality to either and will not be liable for results of interpretations or decisions so rendered in good faith.

43. MODIFICATIONS TO GENERAL PROVISIONS

Modifications to these GENERAL PROVISIONS, if any, shall be as specified in SPECIAL CONDITIONS.

[END OF GENERAL PROVISIONS]

SPECIAL CONDITIONS

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I. SCOPE OF THE CONTRACT:

A. The work required under this Contract includes furnishing and paying for all necessary materials, labor, tools, equipment, and other items and construction improvements of the packaged unit replacement, complete in every detail, ready for the City's beneficial use as specified herein and/or indicated on the contract drawings. The packaged unit replacement will begin at the Economic Community Development Building located at 1920 S. Germantown Road. The project shall consist of, but is not limited to, the following items:

1. Packaged Unit Replacement
2. Mechanical work
3. Electrical work
4. Other Related Work

B. See paragraphs 1 and 10 of the General Provisions.

2. WORK ITEMS AND MATERIAL NOT LISTED IN THE BID:

Cost for work and/or material and/or services not specifically listed in the BID but needed for a complete product as set forth in the Plans and Specifications shall be incidental to the work items listed in the BID, unless otherwise shown on the drawings or specified herein.

3. AWARD OF CONTRACT:

A. See Information for Bidders and Information for Successful Bidder.

B. Instances of conflict between unit price and amount shown in the BID shall be by the unit price. The amount to be considered in the bid will be the product of the quantity shown multiplied by the unit price shown by the bidder.

4. PRE-CONSTRUCTION CONFERENCE:

A. After the Contract is awarded, and incident to the issuance of the Notice to Proceed, the ENGINEER will conduct a pre-construction conference.

B. The CONTRACTOR shall be prepared during the conference to:

1. Present a general sequence of operations, including major work items along with anticipated completion dates.

2. Present a list of all sub-contractors to be used in the execution of the work under this project.

3. Discuss any of the submittals and/or respond to any questions the OWNER may have regarding the submittals.

4. Advise the OWNER of all anticipated construction problems and difficulties with the OWNER'S operations, and present plans to avoid unnecessary interference therewith.

5. Discuss conflicts between the proposed work and any existing utilities with the representatives of the affected utilities. Determine the relocation plans, if required, of the utilities and develop a schedule that will coordinate the relocation plans of the utility with the work.

6. Obtain the interpretation, clarification, and/or the OWNER'S decision concerning requirements of the drawings, specifications, or other contract documents which the CONTRACTOR finds unclear. Discuss any other items pertaining to the work, as desired.

C. The ENGINEER will furnish to the CONTRACTOR written minutes of the Pre-Construction Conference, verifying the interpretations, clarification, instructions, agreements, and other information pertinent to the Project resulting from the conference.

5. LINES, GRADES, STAKES, AND TEMPLATES:

A. The construction horizontal and vertical control staking shall be performed by a licensed engineer or land surveyor acceptable to the OWNER.

B. The following shall be the minimum requirements of the Project for construction control staking:

1. Establish Centerline or Baseline Control

a. Establish in field all control points, P.I.'s, P.C.'s, P.T.'s, P.O.T.'s, etc.
b. Establish in field points on line of Centerline or Baseline.
   1. Maximum 100' intervals for straight tangents
   2. Maximum 50' intervals for horizontal curves
c. The stationing used shall correspond to the Centerline or Baseline stationing used in the plans. All points shall be labeled with the appropriate station.
d. All control points shall be referenced so they may be easily and accurately re-established.
e. The establishment of the Centerline or Baseline Control for the entire Project shall be established before any construction staking will be undertaken.

2. Field notes shall be kept in a Surveyor's Field Book of all construction and staking performed. The Field Book shall be available for review or reference by the OWNER or CONTRACTOR at all times.

C. Prior to final acceptance, the CONTRACTOR shall have a licensed engineer or land surveyor certify that the work has been constructed and completed essentially to the lines and grades shown on the contract drawings. Receipt of said certification under the signed seal of the engineer or land surveyor shall be a condition of release of the final payment for the Contract.

6. **WATER AND ELECTRICITY & GAS FOR CONSTRUCTION:**

A. Water: At no cost to the CONTRACTOR, the OWNER will furnish all necessary water for testing, sterilizing, flushing, dust control and other construction purposes, subject to following conditions:

1. Water will be available from existing facilities at locations designated by the OWNER. The CONTRACTOR shall obtain a fire hydrant use permit. The fee for the permit will be waived; however, the CONTRACTOR should be prepared to provide the estimated quantity of water to be used. The CONTRACTOR shall provide all necessary hoses, temporary pipework, portable tanks, and other equipment to convey and use water.

2. The CONTRACTOR and subcontractors shall carefully conserve all water, and not waste it unnecessarily. If, in the opinion of the OWNER, the CONTRACTOR is using excessive amounts of water, the OWNER may require the CONTRACTOR to begin paying for all water used after such determination.

B. Electricity: At its own expense, the CONTRACTOR shall provide all electric power & gas for the Project construction.

7. LABORATORY TESTING:

A. The cost of laboratory testing services specified for earth work, concrete work, paving materials, and base course, and the cost of laboratory inspection, and stamping of pipe, fittings, equipment and other materials shall be included in the various unit prices; no separate payment shall be made thereof.

B. The OWNER may, at its own expense, make arrangements for any additional testing services that it may deem appropriate. These tests shall in no way release the CONTRACTOR of his responsibility to provide a quality product meeting the specification requirements for materials and workmanship of the project.

8. EXISTING UTILITIES, STRUCTURES, AND OTHER PROPERTY:

A. The position of pole lines, conduits, water mains, sewers, storm drains, natural gas lines, and other above and below ground utilities and structures is not necessarily shown on the contract drawings. Where shown, the accuracy of the position of such utilities and structures is not guaranteed. Before construction begins, the CONTRACTOR shall inform himself of the exact location of all such utilities and structures, and shall assume all liability for damaging them. Unless otherwise specified, the CONTRACTOR shall support all such utilities and structures, or temporarily remove them, and restore them to the satisfaction of the owners of the utilities and /or structures.

B. After commencing work, the CONTRACTOR shall use every precaution to avoid interfaces with existing underground and surface utilities and structures, and to protect them from damage.

C. The CONTRACTOR shall contact owners of underground utilities to determine the exact location of those utilities before performing any construction in the immediate vicinity of those respective utilities. Contact for relocation shall be made through the Tennessee One Call service, telephone number 1-800-351-1111. The location of the services must be requested three (3) days prior to digging.

Utility	Owner	Telephone
Gas and Electricity	Memphis Light, Gas, and Water	901-367-3300 (Hickory Hill Work Center)
Sewer and Water	City of Germantown	901-757-7350
Cable Television	Comcast	800-351-1111
Telephone	AT&T	800-351-1111
Traffic Signal	City of Germantown	901-757-7281

D. The CONTRACTOR shall repair or pay for any damage caused by his operations to all utility property, and private property whether it is above or below ground, and he shall settle in total cost all damage suits which may arise as a result of his operations.

9. EXISTING UTILITY RELOCATIONS AND/OR ADJUSTMENTS:

A. All relocations and/or adjustments required for electrical facilities, natural gas mains and service lines, and related appurtenances shall be performed by Memphis Light, Gas, and Water.

B. Telephone lines and cables, above and below ground, shall be relocated and/or adjusted as needed by AT&T Telephone Company.

C. Television cable lines shall be relocated and/or adjusted as necessary by Comcast.

D. If the plans for the Project provide for relocation and/or adjustment of sanitary and/or related service lines and/or storm drainage facilities, the CONTRACTOR shall be responsible for performing such work at his expense.

E. The CONTRACTOR shall cooperate fully with each of the companies named in A, B, and C above. The CONTRACTOR shall cooperate and schedule his work with these utilities to avoid all interference with each utility's and CONTRACTOR'S work.

F. Existing utilities and telecom lines located within the City's right of Way and on City projects will be relocated or adjusted by the appropriate utility/telecom provider at no cost to the Contractor

10. ACCESS TO PROPERTIES DURING CONSTRUCTION:

A. Each property owner affected by the Project will be provided with continuous access to his respective property. The CONTRACTOR shall plan his work so as to ensure this. When the situation requires, the CONTRACTOR shall provide signage and barricades to redirect local traffic to the appropriate detour.

B. Failure to provide appropriate signage and barricades shall be cause for the OWNER to stop work on all activities associated with the Project.

11. VEHICULAR TRAFFIC AND PEDESTRIAN WARNINGS:

The Contractor shall:

A. Schedule and perform all work to interfere as little as possible with vehicular and pedestrian traffic flow. Poor planning and gross inconsideration of traffic flow will be just cause to stop the CONTRACTOR'S work until the unsatisfactory conditions have been remedied.

B. Mark clearly all open ditches, open excavations, soft backfill, parked equipment, etc. with signs, fences, and/or barricades during daytime hours, and, in addition, with lights at night and maintain all flares, signs, fences, and/or barricades during weekend, holiday and all other times when work is not in progress.

C. Provide adequate signage, barricades, fences, and watchmen to comply with the requirements of all authorities having jurisdiction, and, as necessary, for the safety and convenience of the general public.

D. All traffic control shall conform to Section VI of the Manual on Uniform Traffic Control Devices as adopted by the Federal Highway Administration and the Tennessee Department of Transportation.

E. All existing structures, trees, fences, etc. that are not required to be removed in the execution of the work shall be preserved as specified in the appropriate sections of the Technical Specifications portion of this document.

12. EROSION AND SILTATION:

The Contractor shall:

A. During Project construction, use every precaution and make all provisions as required to minimize erosion and siltation, and to prevent damage to adjacent properties by erosion and siltation resulting from performance under this Contract.

B. All adjacent properties damaged by erosion and/or siltation resulting from this Project are shall be restored to at least pre-construction conditions by the CONTRACTOR.

13. AIR QUALITY PROTECTION:

A. General: The CONTRACTOR shall use suitable precautions to minimize air pollution during the progress of the work. The CONTRACTOR shall maintain all excavations, stockpiles, and all other work areas within and without the Project boundaries free from dust that would cause the standards for air pollution to be exceeded, thus causing a hazard or nuisance to others. All equipment utilized for dust control shall be of safe design

and/or of sufficient capacity for the intended work. The CONTRACTOR shall perform dust control as the work proceeds and when a dust hazard or nuisance occurs.

B. Burning: No burning will be permitted.

14. CHANGES IN WORK:

A. See Paragraph 33 of the General Provisions.

B. If conditions described in Paragraph 33E of the General Provisions are encountered and the CONTRACTOR fails to notify the ENGINEER and/or proceeds to work in area(s) without written permission from the ENGINEER, the CONTRACTOR shall assume full responsibility for all work performed. All unacceptable work performed under these conditions shall be promptly repaired or replaced at the CONTRACTOR'S expense with no cost to the City. No extra cost shall be allowed for any work performed in the area(s) described in Paragraph 33E without written approval from the ENGINEER.

15. CLEAN UP:

In addition to the requirements of Paragraph 36 of the General Provisions, the site and structures to be constructed thereon shall be maintained and kept clean and free of rubbish, unused materials, and equipment during the construction period. The CONTRACTOR shall remove all dirt, rubbish, and surplus materials of all descriptions, including equipment not in use, and maintain the site in a neat and orderly condition, all as approved by the OWNER in its sole discretion. Materials and equipment known to belong to others shall not be removed from the site without duly notifying the owner thereof.

16. WEATHER CONDITIONS:

In the event of temporary suspension of work, or during a period of inclement weather, or whenever the ENGINEER shall direct, the CONTRACTOR will protect, and will cause his subcontractor(s) to protect, the CONTRACTOR'S and the respective subcontractor's work and materials against damage or injury from the weather. If, in the opinion of the ENGINEER, any work or materials are damaged by reason of the failure of the CONTRACTOR or any of his subcontractors to protect said work or materials, such work or materials shall be removed and replaced at the expense of the CONTRACTOR.

17. SUBSTANTIAL COMPLETION:

A. Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the OWNER can occupy or utilize the Work for its intended use.

B. When the CONTRACTOR considers that the Work, or a portion thereof which the OWNER agrees to accept separately, is substantially complete, representatives of the OWNER and

the CONTRACTOR will make a thorough inspection of the entire Project and prepare a "Punch List" of all items requiring correction or additional work prior to final payment. Failure to include an item on such list does not alter the responsibility of the CONTRACTOR to complete all Work in accordance with the Contract Documents.

C. Upon receipt of the CONTRACTOR'S Punch List, the ENGINEER or the OWNER'S designee (as applicable) will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the inspection by the ENGINEER or the OWNER'S designee (as applicable) discloses any item, whether or not included on the CONTRACTOR'S Punch List, which is not sufficiently complete in accordance with the Contract Documents so that the OWNER can occupy or utilize the Work or designated portion thereof for its intended use, the CONTRACTOR shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the ENGINEER, or the OWNER'S designee, (as applicable). In such case, the CONTRACTOR shall then submit a request for another inspection by the ENGINEER or OWNER'S designee to determine Substantial Completion.

D. When the Work or designated portion thereof is substantially complete, the ENGINEER or OWNER'S designee will prepare a Certificate of Substantial Completion, which shall establish the date of Substantial Completion, shall establish responsibilities of the OWNER and CONTRACTOR for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the CONTRACTOR shall finish all items on the Punch List accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

E. The Certificate of Substantial Completion shall be submitted to the OWNER and CONTRACTOR for their written acceptance of responsibilities assigned to them in such Certificate.

18. PARTIAL OCCUPANCY OR USE:

A. The OWNER may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated in accordance with the Special Conditions herein contained, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the OWNER and CONTRACTOR have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the CONTRACTOR considers a portion substantially complete, the CONTRACTOR shall prepare and submit a Punch List to the ENGINEER or OWNER'S designee (as applicable) as provided under Section 17.

B. Immediately prior to such partial occupancy or use, the OWNER, the CONTRACTOR and ENGINEER or OWNER'S designee (as applicable) shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

19. <u>FINAL INSPECTION AND FINAL PAYMENT</u>:

A. After the CONTRACTOR has corrected all of the items listed on the Punch List to the satisfaction of the ENGINEER or the OWNER'S designee (as applicable), the ENGINEER or the OWNER'S designee (as applicable) will notify the CONTRACTOR, in writing, that the project is accepted (i.e., the "Notice of Acceptance") and final payment will be made to the CONTRACTOR not less than thirty (30) days thereafter.

B. The CONTRACTOR'S one (1) year guarantee period will commence with the date of the Notice of Acceptance. All necessary repairs required during this period due to defective workmanship or material shall be made promptly by the CONTRACTOR without cost to the OWNER at times convenient to the OWNER. An additional one (1) year guarantee period from the date of acceptance of the repaired items by the OWNER shall apply to any such repaired item.

C. Neither final payment nor any retained percentage shall become due until the CONTRACTOR submits to the OWNER: (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the OWNER or the OWNER'S property might be responsible or encumbered (less amounts withheld by OWNER) have been paid or otherwise satisfied; (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be cancelled or allowed to expire until at least thirty (30) days' prior written notice has been given to the OWNER; (3) a written statement that the CONTRACTOR knows of no reason that the insurance will not be renewed to cover the period required by the Contract Documents; (4) consent of surety, if any, to final payment; and (5) other data requested by the OWNER establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the OWNER. If a Subcontractor refuses to furnish a release or waiver required by the OWNER, the CONTRACTOR may furnish a bond satisfactory to the OWNER to indemnify the OWNER against such lien. If such lien remains unsatisfied after payments are made, the CONTRACTOR shall refund to the OWNER all money that the OWNER may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

D. If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the CONTRACTOR or by issuance of Change Orders affecting final completion, the OWNER may in the OWNER'S sole and absolute discretion, upon application by the CONTRACTOR without terminating the Contract, make payment of the

balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the CONTRACTOR to the ENGINEER or OWNER'S representative (as applicable) prior to certification of such payment. Such payment, if any, shall be made under terms and conditions governing final payment.

E. The making of final payment shall not constitute a waiver of claims by the OWNER.

F. Acceptance of final payment by the CONTRACTOR, a Subcontractor or material supplier shall constitute a waiver of claims by that payee.

[END OF SPECIAL CONDITIONS]

TECHNICAL SPECIFICATIONS

SECTION 01 10 00 - SUMMARY OF THE WORK

1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. The scope of work includes removing and replacing the existing packaged units and related components as indicated in the contract documents.

1.3 LOCATION OF PROJECT

A. 1920 SOUTH GERMANTOWN ROAD, GERMANTOWN, TN 38138

1.4 RELATED REQUIREMENTS - COORDINATION

Contractor's duties during construction shall include but not limited to the following:

A. Except as specifically approved in writing by the Owner, Contractor shall provide and/or pay for all labor, materials, equipment, tools, construction equipment and machinery, heat, and utilities required for construction and other facilities and services necessary for proper execution and completion of work.

B. Pay legally required sales, consumer and use taxes.

C. Secure and pay for, as necessary for proper execution and completion of work, and as applicable at time of receipt of bids, all permits, government fees, and licenses.

D. Give required notices.

E. Comply with codes, ordinances, rules, regulations, orders, and other legal requirements of public authorities which bear on performance of work.

F. Promptly submit written notice to Designer of observed variance of Contract Documents from legal requirements. It shall not be Contractor=s responsibility to make certain that drawings and specifications comply with codes and regulations. Appropriate modifications to Contract Documents will be issued to Contractor as necessary. Contractor shall assume responsibility for all work known to be contrary to legal requirements.

G. Enforce strict discipline and good order among employees. Unfit persons not skilled in assigned tasks shall not be employed.

1.5 SPECIAL ORDER MATERIALS

A. Contractor is herewith advised that certain products, materials and equipment may be available on special order basis only, and that orders for such materials shall be placed with manufacturers as early as possible to avoid delays in work.

1.6 CONTRACTOR'S USE OF PREMISES

A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractors use of the premises as directed by the Owner.

B. Site shall not be unreasonably encumbered with materials or equipment.

C. Structure shall not be loaded with weight that will endanger structure.

D. Contractor shall assume full responsibility for protection and safe keeping of products stored on premises.

E. Stored products which interfere with operations of Owner shall be relocated as necessary by Contractor.

F. Contractor shall obtain and pay for use of additional storage or work areas needed for construction operations.

1.7 EXAMINATIONS OF SURFACES

A. Contractor shall examine all surfaces on which, or against which, finished or unfinished work is to be applied and shall notify Designer and Owner of any defects discovered which would be detrimental to proper installation of products. Installation of materials by Contractor will be considered as acceptance of surfaces by Contractor.

1.8 COMPLETION

A. It is the intent of the Contract Documents that each and every fixture, piece of equipment, appliance and all other related articles shown on drawings or specified and required for proper completion of work will be completely installed, connected, wired, and made satisfactorily operable for use and service for which it is intended.

END OF SECTION

SECTION 23 01 00 - GENERAL PROVISIONS, MECHANICAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials, equipment, fabrication, installation, and tests in conformity with applicable codes and authorities having jurisdiction for the following:
   1. Mechanical work covered by all sections within DIVISION 23 - MECHANICAL of these Specifications, including but not limited to:
      a. Heating, ventilating, and air conditioning systems and equipment.
      b. Plumbing systems and equipment.

1.2 REFERENCE STANDARDS, CODES, FEES AND UTILITY CONNECTION CHARGES

A. Local codes.
B. Standard Building Codes.
C. State Codes.
D. FM - Factory Mutual.
E. Federal Codes.
F. ASME Boiler Code.
G. AGA - American Gas Association.
H. ASH RAE - American Society of Heating, Refrigerating and Air Conditioning Engineers.
I. AABC - Associated Air Balance Council.
J. ADC - Air Diffusion Council.
K. IEEE - Institute of Electrical Electronic Engineers.
L. ANSI - American National Standards Institute.
M. ASME - American Society of Mechanical Engineers.
N. NEMA - National Electrical Manufacturer's Association.
0. NFPA - National Fire Protection Association.
P. ARI - Air-Conditioning and Refrigeration Institute.
Q. UL - Underwriters Laboratories, Inc.
R. NBC - National Building Code.
S. NMC - National Mechanical Code.
T. NPC - National Plumbing Code.
U. OSHA - Occupational Safety and Health Act.
V. SMACNA - Sheet Metal and Air Conditioning Contractors National Association, Inc.
W. Standards Compliance: When materials or equipment must conform to the standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), and Underwriters Laboratories (UL), proof of such conformance shall be submitted for approval. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified.
X. Contractor shall make arrangements with utility company(ies) for their services and metering work. Pay all charges therefor and include the cost thereof in the contract price.

1.3 QUALITY ASSURANCE

A. Supply all equipment and accessories new and free from defects.

B. Products Criteria:
   1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least two years prior to bid opening. Provide list of users upon request.
   2. Equipment having less than a two-year use record, which in the opinion of the Engineer, provides significant benefits to the Owner such as improved energy efficiency, will be acceptable if it is a product of a manufacturer who has been regularly engaged in the manufacture of that specific type of product which has been used in similar applications for a period of two years. The Architect/Engineer reserves the right to require the Contractor to submit evidence to this effect for his approval.
   3. Equipment Service: Products shall be supported by a service organization which maintains an adequate inventory of repair parts and is located, in the opinion of the Architect/Engineer, reasonably close to the site.
   4. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
   5. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
   6. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

C. Equipment Vibration Tolerance:
   1. After air and/or water balance work is completed and permanent drive mechanisms are in place, perform field mechanical balancing and adjustments required to meet the specified vibration tolerance.

D. Welding: Before any welding is performed submit a copy of the Welding Procedure Specification (WPS) together with the Procedure Qualification Record as required by Section IX of the ASME Boiler and Pressure Vessel Code.
   1. Before any welder performs any welding, submit a copy of the Manufacturer's Record of Welder or Welding Operator Qualification Tests as required by Section IX of the ASME Boiler and Pressure Vessel Code. The letter or symbol (as shown on the qualification test form) shall be used to identify the work of that welder and shall be affixed in accordance with appropriate construction code, to each completed weld.
   2. The types and extent of non-destructive examinations required for pipe welds are shown in Table 136.4 of the Code for Pressure Piping, ANSI/ASME B31.1.

E. Supply all equipment and accessories in compliance with the applicable standards listed in Article 1.3 of this section and with all applicable national, state, and local codes.

F. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the

material being installed, printed copies of these recommendations shall be furnished for record to the Architect/Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations may be cause for rejection of the material.

G. When included, reflected ceiling plan drawings shall govern over mechanical and electrical drawings for location of ceiling-installed elements.

H. In addition to all requirements specified hereinafter, each material and equipment item shall have all features as standard with its manufacturer and/or required for the complete operational system.

I. Capacities, ratings, sizes, and other requirements not specified hereinafter shall be as scheduled or otherwise indicated on the drawings.

J. Should the Contractor at any time discover a discrepancy in the drawings or with respect to a variance of code requirements, he shall notify the Architect/Engineer for clarification and shall not proceed with the work affected until clarification has been made.

1.4 SUBMITTALS

A. Submittals and shop drawings shall be submitted in accordance with these CONTRACT DOCUMENTS and in accordance with the following:
   1. Submit shop drawings, manufacturers data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, and have them approved before procurement, fabrication, or delivery of the items to the job site. Partial submittals will not be acceptable and will be returned without review. All equipment, material, and manufacturer's literature shall be submitted for approval at one time and in a tabulated binder. Control drawings and the controls equipment submittal may be submitted at a later time, but as soon as practical after the contract has been awarded and after the general equipment submittal has been made. However, every attempt shall be made to include the complete controls submittal with the general equipment submittal at one time.
   2. The submittal shall include summary cover sheet(s) and manufacturer’s literature under each tab of the submittal binder which together clearly indicate compliance or deviation from the specifications and drawings.
   3. Submission material and all shop drawings shall be marked with the appropriate identification relating the equipment to the drawings. Mark and reference each item on the submittal summary sheet and the manufacturer's literature to the appropriate paragraph number in the specifications. Manufacturer's standard catalogs will not be accepted.
   4. Failure to comply with the above for a complete and clear submittal may result in resubmittal.

B. Operating instructions and parts lists.
   1. Before requesting acceptance of work, furnish the number of printed and hardback bound sets required.

2. Equipment and systems.
   a. Complete description of equipment and systems and basic operating features.
   b. Manufacturer's name, model number, service manual, spare parts list, and descriptive literature for all components
3. Maintenance instructions.
4. Listing of possible breakdown and repairs.
5. Instruction for starting and operation.
6. Detailed and simplified one line, color coded flow and wiring diagrams.
7. Schedule of valve identification.

1.5 JOB CONDITIONS

A. Examine related work and surfaces before starting work of any section.
   1. Report in writing, conditions which will prevent proper provision of this work.
   2. Installed work which interferes with architectural or any other work, or which deviates from drawings and specifications without prior approval, shall be altered by contractor, without cost to Owner, to clear such interferences, or to comply with the drawings and specifications. Interferences or discrepancies which may be discovered or anticipated shall be reported promptly. Architect/Engineer shall have privilege of making minor changes without additional cost, provided that such changes are made before commencing work on items involved.

B. Continuity of Services and Connections to Existing Work:
   1. At no additional cost to Owner, provide all necessary temporary connections and temporary facilities to accomplish the required continuity of services and existing operations.
   2. Arrange all work to interfere as little as possible with the normal existing operations. Do not interrupt any existing utility or other service or existing operation at any time without Owner's prior approval. After each interruption has been made, make all necessary connections and alterations, and restore services and avoid interferences with normal existing operations as quickly as possible.
   3. Install new work and connect to existing work with minimum interference to existing facilities and maintain water and air tightness when applicable.
   4. Temporary shutdowns of existing services:
      a. At no additional charges.
      b. At times not to interfere with normal operation of existing facilities.
      c. Only with written consent of Owner.
   5. Maintain continuous operation of existing facilities as required with necessary temporary connections between new and existing work.
   6. Connect new work to existing work in neat and satisfactory high quality workmanship manner.
   7. Restore existing disturbed work to original or better conditions.

1.6 ACCURACY OF DATA AND DRAWINGS

A. Drawings are generally diagrammatic, and where not dimensioned or detailed, indicated approximate locations of work. Examine carefully existing buildings and structures, existing systems, and all other contract drawings, and install work to conform as nearly as possible to locations and arrangements indicated, with only such minor adjustments as necessary to coordinate mechanical work with other work, and to avoid interferences

therewith. All piping and ductwork, offsets, rises, and fittings are not necessarily shown; however, provide these as required by the conditions involved.

B. Building and structure dimensions: TAKE THESE FROM ARCHITECTURAL AND FROM ACTUAL MEASUREMENTS OF EACH EXISTING BUILDING AND EACH EXISTING STRUCTURE INVOLVED.

1.7 COORDINATION

A. Carefully examine the architectural, electrical, heating and air-conditioning, plumbing, fire protection, structural, and site plan drawings and specifications, and coordinate this work among trades to avoid delay.

B. In general, permanent openings or knockout panels are provided to permit only future service or replacement of system components, not the entire assembly. The Contractor shall coordinate his equipment delivery with construction progress so that installation may be made in an orderly manner.

C. The structural design is based on installed locations of the equipment only. Any necessary shoring or other protection necessary for moving heavy equipment to installed location is the responsibility of the Contractor. Take extra precautions in using any existing structure for hoisting or temporary support.

D. Wherever piping, conduits, ducts, or other items are to run in the same general direction, elevation, or location, coordinate for the proper allocation of the space position. If necessary, consult the Architect/Engineer, whose decision shall be final.

E. Wherever work is to be concealed or installed above ceilings, maintain adequate clearance to allow for access, repairs, and removal of all devices.

F. Coordinate setting of sleeves, anchor bolts, and inserts as required to accommodate equipment before concrete is set and masonry is placed.

1.8 ELECTRICAL CHARACTERISTICS, MOTORS, MOTOR STARTERS, CONTROLS, AND WIRING

A. Electrical Characteristics: Refer to electrical section for electrical characteristics of motors specified or scheduled under the Mechanical Section.

B. Motor Sizes: Motor horsepowers specified in Mechanical Section and/or indicated on mechanical drawings are approximate and are not intended to limit motor sizes. Each motor shall be of proper size to operate continuously the actual equipment driven thereby, without overload on motor under all operating conditions, except as otherwise specified.

C. Motor starters and other electrical control devices: Generally, motor starters for equipment motors shall be furnished by contractor. Also, provide electrical control devices required for the Mechanical system, unless otherwise specified.

D. All motor starters shall comply with specifications for motor starters as specified in DIVISION 23.

E. In addition to the items specified in DIVISION 23, starters that operate in parallel with other starters shall be equipped with auxiliary contacts on the main disconnect for breaking one leg of the control power. In these cases, the secondaries of the starter transformers shall be properly phased.

F. Installation of electrical devices, EXCEPT those factories mounted on equipment: electrical control devices which require electrical connections ONLY, shall be installed by contractor; electrical control devices which required piping, linkage, remote bulb, or other mechanical connections IN ADDITION TO electrical connections, shall be installed by contractor, ready for electrical connections. Electric wiring: All electric wiring required to operate the mechanical systems, EXCEPT wiring which is factory installed on equipment, shall be done by contractor, in accordance with approved wiring diagrams which shall be furnished by this Section.

G. Install name plates with full data on all motors, starters, and disconnect switches.

1.9 TRANSPORTATION AND HANDLING

A. Pay all transportation and handling charges. Immediately report any damage to equipment received to the carrier so that job progress will not be delayed.

B. All items received by the Contractor shall be left in their original containers, or as shipped, where possible, until installed in final locations.

C. All items shall be protected from the elements. If stored outside, provide blocking to raise the base of each item well above ground and/or water levels.

D. Provide additional protection for items subject to damage, where necessary, so that when installed, the items will be in new condition.

E. Supply electrical items that might be damaged by condensation with heated air in an enclosed area until placed into service.

1.10 CUTTING AND PATCHING

A. Execute cutting (including excavating), fitting, and patching of work required to:
1. Make several parts fit properly.
2. Uncover work to provide for installation of ill-timed work.
3. Remove defective work.
4. Remove work not complying with the requirements of the contract documents.
5. Remove samples of installed work as specified for testing.
6. Where work is cut for any reason, restore cut and damaged areas with new materials meeting requirements of the contract documents.

B. In addition to the requirements above and upon written instructions of the Architect/ Engineer, provide cutting, fitting, and patching to:
1. Uncover work to provide observation of covered work.
2. Remove samples of installed materials for testing.

C. Do not endanger work by cutting or altering work or any part of it.

D. Prior to cutting that affects structural safety of project, submit written notice to

Architect/Engineer requesting consent to proceed with cutting, including:
1. Identification of project.
2. Description of affected work.
3. Necessity for cutting.
4. Effect on other work and on structural integrity of project.
5. Description of proposed work. Designate scope of cutting and patching, trades to execute work, products proposed to be used, and extent of refinishing.
6. Alternatives to cutting and patching.
7. Designation of party responsible for cost of cutting and patching.

E. Prior to cutting and patching done on the instruction of the Architect/Engineer, submit cost estimate.

F. Should conditions of work or schedule indicate the need for change of materials or methods, submit written recommendations Architect/Engineer, including conditions indicating the need for change, recommendations for alternative materials or methods, submittals as required for substitution of materials, and cost estimate for changing materials or methods.

G. Submit written notice designating time work will be uncovered to provide for observation.

H. Costs caused by ill-timed or defective work and work not complying with requirements of the contract documents, including costs of additional services of Architect/Engineer, shall be borne by the party responsible for the ill-timed, defective, or non-complying work.

1.11 INSTRUCTION TO OWNER/OPERATING PERSONNEL

A. The Contractor shall furnish the services of factory trained instructors who will give full instruction to the designated personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the equipment or system specified. The instruction will be for a minimum of 8 hours unless otherwise noted. Each instructor shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given after the equipment or system has been accepted for regular operation. When significant changes or modifications in the equipment or system are made under the terms of the contract, additional instruction shall be provided to acquaint the operating personnel with the changes or modifications.

PART 2 PRODUCTS

2.1 MATERIALS, SUBSTITUTIONS, AND PRODUCT OPTIONS

A. Manufacturers or Trade Names:
1. The use of manufacturer's names and catalog numbers in these specifications or on the drawings indicates the type, size, rating, capacity, design, quality, or kind of materials required, and a closed specification is not intended, and similar and equal products of any reputable manufacturer which will satisfactorily perform the required functions will be acceptable, unless otherwise indicated by the words NO SUBSTITUTES, or unless otherwise specifically stated. The Architect/Engineer reserves the right to reject all materials which he deems not equal to those specified, or which he decides will not satisfactorily perform the

required functions.

2. Any manufacturer providing equipment for this project shall provide a written guarantee to the Contractor stipulating that any parts used in the equipment so provided will be readily available for a minimum of ten years from date of shipment from the factory. The Contractor shall, in turn, provide the Owner with these guarantees in the brochures submitted covering all the equipment used.

PART 3 EXECUTION

3.1 FIELD TESTS

A. All piping shall be free of leaks, and test gauges shall show no loss of pressure for at least 30 minutes after source of test pressure has been cut off, or as noted. Pipes may be tested in sections as the work progresses. Repair and retest all sections failing to pass tests, as required to obtain approval of tests. No caulking, welding, or brazing will be permitted on threaded pipe or fittings to stop leaks. Replace with new material all cracked or otherwise defective pipe and fittings of all types, as approved. Furnish suitable testing equipment, give all applicable authorities ample advance notice of all proposed tests and readiness of work for inspections, and advance notice of all proposed tests and readiness of work for inspections, and conduct each test in their presence, as approved. Do not conceal or insulate piping and do not conceal ductwork until all inspections have been made and all required tests have been approved by all applicable authorities. Submit results for review.

B. Provide required labor, material, equipment, and connections.

C. Test all piping, EXCEPT as otherwise specified below, as follows: hydrostatic test, at 150 percent of normal operating pressure of piping involved, or 100 psi, whichever is higher, AFTER removing all air from piping involved in test.
   1. Natural gas and fuel oil piping: 50 psi test using air or inert gas.
   2. Test all equipment in accordance with sections specified hereinafter.

D. Test all ductwork in accordance with leakage test method recommended in latest edition of SMACNA "HVAC Duct Construction Standards - Metal and Flexible". After remedying audible leaks, total leakage on system shall not exceed one percent of system total design air flow rate.

3.2 ADJUSTING AND CLEANING

A. Flush or blow all welding slag, pipe joint compound, loose scale, and other debris from pipework before connecting equipment thereto.

B. After systems have been tested and before any field painting is commenced, clean up all work thoroughly. Remove all foreign matter which has accumulated in ducts, casings, enclosures, fixtures, and equipment. Clean and polish all valves, plates, and other surfaces that are not to be painted, so that they present a new and acceptable appearance.

C. Put systems in operation, test all fixtures and other equipment, remedy all leaks and defects, make all necessary adjustments, and remove all air from water circulating

systems. Adjust all air and water flows to indicated and/or required quantities, and adjust all controls and other items as required to balance system and provide uniform air flows and uniform temperatures in air conditioned areas. Demonstrate that all controls and mechanical equipment function satisfactorily, as specified, as indicated, and as approved.

D. Strainers and Dirt Pockets: Clean out each of these; REMOVE EACH STRAINER SCREEN FOR CLEANING.

E. Circulating Water Systems: Completely drain each of these, and refill with clean water.

F. Gas piping shall be cleaned in accordance with the requirements.

G. After systems have been tested and before putting any part of or the entire system in operation for Owner's beneficial use, ensure that all necessary adjustments have been made.
   1. Bearings and other items requiring lubrication, except factory permanently lubricated type: lubricate each of these as recommended by its manufacturer; this includes lubricated type plug valves.
   2. Belts: adjust each of these to proper tension.
   3. Filters: replace each disposable ("throw-away") filter with a new clean filter (except blanket roll and high efficiency type). Clean each cleanable filter. NOTE: ALL FILTERS SHALL BE IN PLACE DURING TESTING AND ADJUSTING.
   4. Motor load tests: make an ammeter check of actual running current of each motor in mechanical system under operating conditions. Correct all motors which are found to be overloaded, as approved.

3.3 INSTALLATION

A. Equipment rooms and other areas in which equipment is to be installed have limiting dimensions - Install all mechanical work within these areas substantially as indicated, with ample unobstructed access space around each piece of equipment to facilitate proper installation, operation, and maintenance of equipment, and to allow ample space for plumbing, electrical, and other equipment indicated to be installed therein. Minor revisions in layout may be made subject to approval, but major changes in layout to accommodate proposed equipment which differs substantially from specified equipment in size and arrangement may not be considered or will be subjected to the provisions hereinbefore. Each bidder shall determine before bidding that equipment upon which he proposes to base his bid will conform to these requirements. Install each equipment item in accordance with its manufacturer's recommendations, and as indicated on the drawings, and/or specified. If the drawings and/or specifications conflict with the manufacturer's recommendations, report this to the Architect/Engineer for his decision before proceeding with the work involved.

A. Generally, install pipework and ductwork as follows unless otherwise indicated.
   1. Finished areas: conceal pipework and ductwork within pipe chases, above suspended ceiling, and within other building construction, and other finished areas, unless otherwise indicated.
   2. Unfinished areas: install aboveground pipework and ductwork exposed in areas

where pipe chases or suspended ceilings are not indicated or concealing is otherwise impracticable, in mechanical and electrical equipment rooms, manufacturing areas, warehouse, or storage areas, and other unfinished areas.

3. ALL areas: install pipework and ductwork parallel or at right angles with beams, walls, ceilings, and other building lines, in straight lines between required direction changes, with vertical runs plumb. Install exposed pipework and ductwork as close as practicable to walls, columns, ceilings, and overhead construction, and to provide maximum headroom and minimum interference with usable building space.

3.4 REMOVAL AND RELOCATION OF EXISTING WORK

A. Disconnect, remove or relocate material, equipment, piping, and other work noted and required by removal or changes in existing construction.

B. Provide new material and equipment related for relocated equipment.

C. Plug or cap active piping or ductwork behind or below finish.

D. Do not leave long dead end branches:
   1. Cap or plug as close to active line as possible.

E. Salvaged Existing Mechanical Materials and Equipment: Promptly haul away from Owner's premises all materials and equipment which are removed from existing system and are neither indicated nor required to be reused in the completed project, EXCEPT as otherwise specified. Owner may select certain removed existing materials and equipment and retain them for his future use. Before removing any existing materials and equipment, determine from Owner which of these materials and equipment he desires to retain. Remove all Owner selected materials and equipment without unnecessary damage thereto, and safely store them at locations designated by Owner.

3.5 CUTTING AND PATCHING

A. Inspect existing conditions of work, including elements subject to movement or damage during cutting and patching and excavating and backfilling.

B. After uncovering work, inspect conditions affecting installation of new products.

C. Provide shoring, bracing, and support required to maintain structural integrity of the project.

D. Provide protection for other portions of the project.

E. Provide protection from the elements.

F. Execute fitting and adjustment of products to provide finished installation to comply with specified tolerances and finishes.

G. Execute cutting and demolition by methods that prevent damage to other work and

provide proper surfaces to receive installation of repairs and new work.

H. Refinish the entire surfaces where cutting and patching work occurs to provide an even, continuous surface to the nearest intersections. Where assemblies are damaged by cutting and patching, refinish entire assemblies.

3.6 PAINTING

A. All equipment shall be factory prime coated and painted, however, the following may be shop prime coated and made ready for painting:
   1. Tanks.
   2. Structural supports and frames.

B. Uncoated Hangers, Supports, Rods, and inserts shall be prime coated.

C. Exposed, uninsulated black steel piping, pipe supports, and pipe braces shall be prime coated.

D. Marred surfaces of prime coated or factory painted surfaces shall be painted and/or primed to match adjacent coat.

END OF SECTION

SECTION 23 05 00 – BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section includes the following basic mechanical materials and methods to complement other Division 23 Sections.
   1. Piping materials and installation instructions common to most piping systems.
   2. Concrete base construction requirements.
   3. Dielectric fittings.
   4. Flexible connectors.
   5. Mechanical sleeve seals.
   6. Equipment nameplate data requirements.
   7. Labeling and identifying mechanical systems and equipment is specified in Division 23 Section "Mechanical Identification."
   8. Nonshrink grout for equipment installations.
   9. Field-fabricated metal and wood equipment supports.
   10. Installation requirements common to equipment specification sections.
   11. Cutting and patching.
   12. Painting and finishing.

1.2 RELATED SECTIONS

A. Drawings and general provisions of the Construction Agreement and Division 1 Specification Sections, apply to this Section.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

D. The following are industry abbreviations for plastic materials:
   1. ABS: Acrylonitrile-butadiene-styrene plastic.

2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PVC: Polyvinyl chloride plastic.

E. The following are industry abbreviations for rubber materials:
1. CR: Chlorosulfonated polyethylene synthetic rubber.
2. EPDM: Ethylene propylene diene terpolymer rubber.

1.4 SUBMITTALS

A. Submittals and shop drawings shall be submitted in accordance with Division 1 - SUBMITTALS.

B. Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.

C. Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

D. Coordination Drawings: For access panel and door locations.

1.5 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and

bending.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Dielectric Unions:
      a. Hart Industries International, Inc.
      b. Watts Industries, Inc.; Water Products Div.
      c. Zurn Industries, Inc.; Wilkins Div.
   2. Dielectric Flanges:
      a. Capitol Manufacturing Co.
      b. Central Plastics Co.
      c. Watts Industries, Inc.; Water Products Div.
   3. Dielectric Nipples:
      a. Grinnell Corp.; Grinnell Supply Sales Co.
      b. Perfection Corp.
      c. Victaulic Co. of America.

   4. Metal, Flexible Connectors:
      a. Metraflex Co.
      b. Proco Products, Inc.

c. Uniflex, Inc.
5. Mechanical Sleeve Seals:
   a. Calpico, Inc.
   b. Metraflex Co.
   c. Thunderline/Link-Seal.

2.2 PIPE AND PIPE FITTINGS

A. Refer to individual Division 23 piping Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness, unless thickness or specific material is indicated.
   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

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

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32.
1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
2. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.
3. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10 percent maximum lead content.
4. Alloy HB: Tin-antimony-silver-copper nickel, with 0.10 percent maximum lead content.
5. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.20 percent maximum lead content.

F. Brazing Filler Metals: AWS A5.8.
1. BCuP Series: Copper-phosphorus alloys.

2. BAg1: Silver alloy.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements: Manufacturer's standard solvent cements for the following:
1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

I. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.

J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

K. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.
1. Sleeve: ASTM A 126, Class B, gray iron.
2. Followers: ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 536 ductile iron.
3. Gaskets: Rubber.
4. Bolts and Nuts: AWWA C111.
5. Finish: Enamel paint.

2.4 DIELECTRIC FITTINGS

A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

C. Insulating Material: Suitable for system fluid, pressure, and temperature.

D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

F. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
1. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

H. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.5 FLEXIBLE CONNECTORS

A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig (860-kPa) minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:
   1. 2-Inch NPS (DN50) and Smaller: Threaded.
   2. 2-1/2-Inch NPS (DN65) and Larger: Flanged.
   3. Option for 2-1/2-Inch NPS (DN65) and Larger: Grooved for use with keyed couplings.

B. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

2.7 PIPING SPECIALTIES

A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
   1. Steel Sheet Metal: 0.0239-inch (0.6-mm) minimum thickness, galvanized, round tube closed with welded longitudinal joint.
   2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
   3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.8 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
   1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 3000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise.

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

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

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

L. Install couplings according to manufacturer's written instructions.

M. Sleeves are not required for core drilled holes.

N. Permanent sleeves are not required for holes formed by PE removable sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
   2. Install sleeves large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
      a. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS (DN150).
      b. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS (DN150) and larger, penetrating gypsum-board partitions.
   3. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants.
   4. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

Q. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
   2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) in diameter and larger.
   3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

R. Verify final equipment locations for roughing-in.

S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

T. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
   1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
   2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
   3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
   4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
   5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.
      Cut threads full and clean using sharp dies. Ream threaded pipe ends to

remove burrs and restore full ID. Join pipe fittings and valves as follows:

a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
c. Align threads at point of assembly.
d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

6. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
8. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:
   a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   b. ABS Piping: ASTM D 2235 and ASTM D 2661.
   c. CPVC Piping: ASTM D 2846 and ASTM F 493
   d. PVC Pressure Piping: ASTM D 2672.
   e. PVC Nonpressure Piping: ASTM D 2855.
   f. PVC to ABS Nonpressure Transition Fittings: Procedure and solvent cement according to ASTM D 3138.
9. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657 procedures and manufacturer's written instructions.
   a. Plain-End Pipe and Fittings: Use butt fusion.
   b. Plain-End Pipe and Socket Fittings: Use socket fusion.

U. Piping Connections: Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.
   2. Install flanges, in piping 2-1/2-inch NPS (DN65) and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
   3. Dry Piping Systems: Install dielectric unions and flanges to connect piping

materials of dissimilar metals.

4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Designer.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment giving right of way to piping installed at required slope.

F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.3 PAINTING AND FINISHING

A. Apply paint to exposed piping according to the following, unless otherwise indicated:

1. Interior insulated piping: Use two coats of semi-gloss, acrylic-enamel finish. Paint to match the existing.
2. Interior or Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer. Paint to match existing.
3. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
4. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

B. Paint piping specialties to match piping.

C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.4 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.5 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.6 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's written instructions.

END OF SECTION

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Equipment supports.

1.3 DEFINITIONS

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

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

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

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 ACTION SUBMITTALS

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

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

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

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

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

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

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
   a. Cooper B-Line, Inc.
   b. Unistrut Corporation; Tyco International, Ltd.
   c. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
1. Piping Technology & Products, Inc.
2. Rilco Manufacturing Co., Inc.
3. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

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

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

2.6 EQUIPMENT SUPPORTS

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

2.7 MISCELLANEOUS MATERIALS

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

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

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

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

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

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

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

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

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

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

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

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

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

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

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

M. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

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

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

5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

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

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

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

3.3 METAL FABRICATIONS

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

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

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

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

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

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm)

C. PAINTING

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

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

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

3.5 HANGER AND SUPPORT SCHEDULE

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

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

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

D. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
   2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
   3. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
   4. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
   5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
   6. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
   7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
   8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
   9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

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

   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
   2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

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

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

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

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

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

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

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

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
7. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

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

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

END OF SECTION 230529

SECTION 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Open-spring isolators.
5. Housed-spring isolators.
6. Restrained-spring isolators.
7. Housed-restrained-spring isolators.
8. Pipe-riser resilient supports.
9. Resilient pipe guides.
10. Air-spring isolators.
11. Restrained-air-spring isolators.
12. Elastomeric hangers.
13. Spring hangers.
14. Snubbers.
15. Restraint channel bracings.
16. Restraint cables.
17. Seismic-restraint accessories.
18. Mechanical anchor bolts.
19. Adhesive anchor bolts.
20. Vibration isolation equipment bases.
21. Restrained isolation roof-curb rails.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For professional engineer

C. Welding certificates.

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For restrained-air-spring mounts to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

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

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are

preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: See structural.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: See structural.

2.2 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Kinetics Noise Control, Inc.
   b. Mason Industries, Inc.
   c. VMC group

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Waffle pattern.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.

2.3 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Kinetics Noise Control, Inc.
   b. Mason Industries, Inc.
   c. VMC Group

2. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded

element and attachment hardware from contacting the housing during normal operation.

a. Housing: Cast-ductile iron or welded steel.
b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.4 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. VMC Group
   b. Kinetics Noise Control, Inc.
   c. Mason Industries, Inc.

2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.5 SNUBBERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Kinetics Noise Control, Inc.
2. Mason Industries, Inc.
3. VMC Group

B. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.

3. Maximum 1/4-inch (6-mm) air gap, and minimum 1/4-inch- (6-mm-) thick resilient cushion.

2.6 RESTRAINT CABLES

A. Provide no aircraft cable restraints. All seismic bracing to be rigid supports.

2.7 SEISMIC-RESTRAINT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by the following

1. VMC Group.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.

B. Hanger-Rod Stiffener: steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.

E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.

F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.8 MECHANICAL ANCHOR BOLTS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. VMC Group.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.

B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

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

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Division 3.

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES that provides required submittals for component.

D. Piping Restraints:

1. Comply with requirements in MSS SP-127.

2. Space lateral supports a maximum of 40 feet on center, and longitudinal supports a maximum of 80 feet on center
3. Brace a change of direction longer than 12 feet (3.7 m).

E. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES that provides required submittals for component.

F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

G. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

I. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION

SECTION 23 05 53 – MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section includes mechanical identification materials and devices.

1.2 RELATED SECTIONS

A. Drawings and general provisions of the Construction Agreement and Division 1 Specification Sections apply to this Section.

1.3 SUBMITTALS

A. Submittals and shop drawings shall be submitted in accordance with Division 01.

B. Product Data: For identification materials and devices.

1.4 QUALITY ASSURANCE

A. Comply with ASME A13.1, "Scheme for the Identification of Piping Systems" for lettering size, length of color field, colors, and viewing angles of identification devices.

1.5 SEQUENCING AND SCHEDULING

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

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

PART 2 - PRODUCTS

2.1 IDENTIFYING DEVICES AND LABELS

A. General: Products specified are for applications referenced in other Division 23 Sections. If more than single type is specified for listed applications, selection is

Installer's option.

B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.
   1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
   2. Location: Accessible and visible.

C. Snap-On Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

D. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive, vinyl type with permanent adhesive.

E. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers, extending 360 degrees around pipe at each location.

F. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers, at least 3 times letter height and of length required for label.

G. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
   1. Arrows: Either integrally with piping system service lettering, to accommodate both directions, or as separate unit, on each pipe marker to indicate direction of flow.

H. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive, vinyl tape, at least 3 mils (0.08 mm) thick.
   1. Width: 1-1/2 inches (40 mm) on pipes with OD, including insulation, less than 6 inches (150 mm); 2-1/2 inches (65 mm) for larger pipes.
   2. Color: Comply with ASME A13.1, unless otherwise indicated.

I. Valve Tags: Stamped or engraved with 1/4-inch (6-mm) letters for piping system abbreviation and 1/2-inch (13-mm) sequenced numbers. Include 5/32-inch (4-mm) hole for fastener.
   1. Material: 3/32-inch- (2.4-mm-) thick plastic laminate with 2 black surfaces and a white inner layer.
   2. Material: Valve manufacturer's standard solid plastic.
   3. Size: 1-1/2-inches (40-mm) diameter, unless otherwise indicated.
   4. Shape: As indicated for each piping system.

J. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

K. Valve Tag Fasteners: Brass, wire-link chain; beaded chain; or S-hooks.

L. Access Panel Markers: 1/16-inch- (2-mm-) thick, engraved plastic-laminate markers, with abbreviated terms and numbers corresponding to concealed valve. Provide 1/8-inch (3-mm) center hole for attachment.

M. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
2. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

N. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:
1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Brown: Energy reclamation equipment and components.
4. Blue: Equipment and components that do not meet criteria above.
5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
6. Terminology: Match schedules as closely as possible. Include the following:
   a. Name and plan number.
   b. Equipment service.
   c. Design capacity.
   d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
7. Size: 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.

O. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.
1. Size: 3-1/4 by 5-5/8 inches (85 by 145 mm).
3 Fasteners: Brass grommets and wire.
4 Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

P. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of mechanical systems and equipment.
1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

PART 3 - EXECUTION

3.1 LABELING AND IDENTIFYING PIPING AND DUCT SYSTEMS

A. Install pipe markers on each system. Include arrows showing normal direction of flow.

B. Marker Type: Stenciled markers complying with ASME A13.1.

C. Marker Type: Plastic markers, with application systems. Install on pipe insulation segment where required for hot, non-insulated pipes.

D. Fasten markers on pipes and insulated pipes smaller than 6 inches (150 mm) OD by one of following methods:
   1. Snap-on application of pretensioned, semirigid plastic pipe marker.
   2. Adhesive lap joint in pipe marker overlap.
   3. Laminated or bonded application of pipe marker to pipe or insulation.
   4. Taped to pipe or insulation with color-coded plastic adhesive tape, not less than 3/4 inch (20 mm) wide, lapped a minimum of 1-1/2 inches (40 mm) at both ends of pipe marker, and covering full circumference of pipe.

E. Fasten markers on pipes and ducts 6 inches and larger by one of following methods:
   1. Laminated or bonded application of pipe marker to pipe or insulation.
   2. Taped to pipe or insulation with color-coded plastic adhesive tape, not less than 1-1/2 inches (40 mm) wide, lapped a minimum of 3 inches (75 mm) at both ends of pipe marker, and covering full circumference of pipe.
   3. Strapped to pipe or insulation with manufacturer's standard stainless-steel bands.

F. Locate markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior non-concealed locations according to the following:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units.
      Mark each pipe at branch, where flow pattern is not obvious.
   3. Near penetrations through walls, floors, ceilings, or non-accessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at a maximum of 50-foot (15-m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in areas of congested piping and equipment.
   7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

3.2 VALVE TAGS

A. Install on control valves and control devices in piping systems.

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

C. Tag Material: Brass.

D. Tag Size and Shape: According to the following:
   1. Cold and Hot Water: 2 inches (50 mm), round.

E. Tag Color: According to the following:
   1. Cold Water: Blue.
   2. Hot Water: Red

F. Letter Color: According to the following:
   1. Cold and Hot Water: White.

G. Install mounted valve schedule in each major equipment room.

3.3 EQUIPMENT SIGNS AND MARKERS

A. Install engraved plastic-laminate signs or equipment markers on or near each major item of mechanical equipment. Include signs for the following general categories of equipment:
   1. Pumps, chillers, condensers, and similar motor-driven units.
   2. Heat exchangers, cooling towers, and similar equipment.
   3. Fans, blowers, primary balancing dampers, and mixing boxes.
   4. Water-treatment systems, and similar equipment.

B. Plasticized Tags: Install within concealed space, to reduce amount of text in exposed sign outside concealment, if equipment to be identified is concealed above acoustical ceiling or similar concealment.
   1. Identify operational valves and similar minor equipment items located in unoccupied spaces, including machine rooms, by installing plasticized tags.

3.4 ADJUSTING AND CLEANING

A. Relocate mechanical identification materials and devices that have become visually blocked by work of this or other Divisions.

B. Clean faces of identification devices and glass frames of valve charts.

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

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

E. TAB Specialist: An entity engaged to perform TAB Work.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Certified TAB reports.

C. Sample report forms.

D. Instrument calibration reports, to include the following:

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

1.4 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

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

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

1.5 PROJECT CONDITIONS

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

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

1.6 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

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

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

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

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

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

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

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

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

J. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

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

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

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Isolating and balancing valves are open and control valves are operational.

6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

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

1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

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

C. Take and report testing and balancing measurements in inch-pound units.

3.4 PROCEDURES FOR MOTORS

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

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.5 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.
2. Airflow.
3. Air pressure drop.
4. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.6 TOLERANCES

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

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

3.7 REPORTING

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

3.8 FINAL REPORT

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

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

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

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

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

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Designer’s name and address.
6. Contractor's name and address.
7. Report date.
8. Signature of TAB supervisor who certifies the report.
9. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
10. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

11. Nomenclature sheets for each item of equipment.
12. Data for terminal units, including manufacturer's name, type, size, and fittings.
13. Notes to explain why certain final data in the body of reports vary from indicated values.
14. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

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

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.

5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

8. Test Data (Indicated and Actual Values):

    a. Total air flow rate in cfm (L/s).
    b. Total system static pressure in inches wg (Pa).
    c. Fan rpm.
    d. Discharge static pressure in inches wg (Pa).
    e. Filter static-pressure differential in inches wg (Pa).
    f. Preheat-coil static-pressure differential in inches wg (Pa).
    g. Cooling-coil static-pressure differential in inches wg (Pa).
    h. Heating-coil static-pressure differential in inches wg (Pa).
    i. Outdoor airflow in cfm (L/s).
    j. Return airflow in cfm (L/s).
    k. Outdoor-air damper position.
    l. Return-air damper position.
    m. Vortex damper position.

E. Apparatus-Coil Test Reports:

1. Coil Data:

    a. System identification.
    b. Location.
    c. Coil type.
    d. Number of rows.
    e. Fin spacing in fins per inch (mm) o.c.
    f. Make and model number.
    g. Face area in sq. ft. (sq. m).
    h. Tube size in NPS (DN).
    i. Tube and fin materials.
    j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

    a. Air flow rate in cfm (L/s).
    b. Average face velocity in fpm (m/s).
    c. Air pressure drop in inches wg (Pa).
    d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
    e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
    f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
    g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
    h. Water flow rate in gpm (L/s).
    i. Water pressure differential in feet of head or psig (kPa).
    j. Entering-water temperature in deg F (deg C).
    k. Leaving-water temperature in deg F (deg C).
    l. Refrigerant expansion valve and refrigerant types.
    m. Refrigerant suction pressure in psig (kPa).
    n. Refrigerant suction temperature in deg F (deg C).

o. Inlet steam pressure in psig (kPa).

F. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h (kW).
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches (mm), and bore.
n. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).

2. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm (L/s).
b. Entering-air temperature in deg F (deg C).
c. Leaving-air temperature in deg F (deg C).
d. Air temperature differential in deg F (deg C).
e. Entering-air static pressure in inches wg (Pa).
f. Leaving-air static pressure in inches wg (Pa).
g. Air static-pressure differential in inches wg (Pa).
h. Low-fire fuel input in Btu/h (kW).
i. High-fire fuel input in Btu/h (kW).
j. Manifold pressure in psig (kPa).
k. High-temperature-limit setting in deg F (deg C).
l. Operating set point in Btu/h (kW).
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h (kW).

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

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.

g. Sheave make, size in inches (mm), and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Suction static pressure in inches wg (Pa).

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

1. Unit Data:

a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm (L/s).
b. Entering-air temperature in deg F (deg C).
c. Leaving-air temperature in deg F (deg C).

I. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

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

J. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

K. Prepare test and inspection reports.

END OF SECTION

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor/Outdoor supply, return, exhaust and outdoor air duct insulation.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.5 QUALITY ASSURANCE

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

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

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

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

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 COORDINATION

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

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

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

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

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

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

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

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

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

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

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534, Type II for sheet materials.

1. Products: Subject to compliance with requirements provide the following provide one of the following:
   a. Aeroflex USA
   b. Armacell LLC
   c. K-Flex USA

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin and factory applied FSK jacket. Comply with ASTM C553, Type II and ASTM C1290. Factory-applied jacket requirements are specified in “Factory-Applied Jackets” article.

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

   a. CertainTeed Corp.; SoftTouch Duct Wrap.
   b. Johns Manville; Microlite.
   c. Owens Corning; SOFTR All-Service Duct Wrap.

2.2 ADHESIVES

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

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

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

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.Eagle Bridges - Marathon Industries; 225.
   b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-03/11-70.Mon-Eco Industries, Inc.; 22-25.

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

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

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

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
   b. Eagle Bridges - Marathon Industries; 225.

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

2.3 MASTICS

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

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

2.4 JACKETS

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

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms (0.86 metric perm) when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.5 FIELD-APPLIED JACKETS

A. Metal Jacket:

1. Provide jacket equal to RPR Products Insul-Mate.
2. Aluminum Jacket: Comply with ASTM B209 Alloy 3003 with an H-14 temper, 0.016” thickness

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

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

3.2 PREPARATION

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

3.3 GENERAL INSTALLATION REQUIREMENTS

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

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

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

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

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

F. Keep insulation materials dry during application and finishing.

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

H. Install insulation with least number of joints practical.

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

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

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

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

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

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

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

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

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

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

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

3.4 PENETRATIONS

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

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

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

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

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

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

1. Comply with requirements in Section 078413 "Penetration Firestopping" Firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches (50 mm).
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

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

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) on center
    b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) on center each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not over compress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

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

vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

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

5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) on center
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) on center

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

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

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

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

C. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) on center and at end joints.

3.8 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

3.9 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.10 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. All Supply return, and Outside air ducts.
2. Exhaust ductwork connected to energy recovery unit.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.

7. Factory-insulated access panels and doors.

3.11 DUCT AND PLENUM INSULATION SCHEDULE

A. Round and rectangular concealed and exposed single wall supply, outside air, return, make-up air, and exhaust air ducts connected to ERV shall be insulated with 2” thick mineral fiber blanket with “K” value of 0.27 at 75 degrees F, minimum 0.75 PCF density, and minimum “R” value of 6.0 per inch thickness at 75 degrees F.

B. Plenums shall be insulated with 1” thick flexible elastomeric insulation with “R” value of 4.2 per inch thickness at 75 degrees F, maximum service temperature of 250 degrees F, maximum density of 3.0 PCF, maximum velocity on coated air side of 6,000 FPM.

C. Internal lining in rectangular supply, outside air, return, make-up air, and exhaust ducts connected to ERV shall be 1” thick flexible elastomeric with “R” value of 4.2 per inch thickness at 75 degrees F, maximum service temperature of 250 degrees F, maximum density of 3.0 PCF, maximum velocity on coated air side of 6,000 FPM.

D. Return transfer ducts shall be lined with ½” thick flexible elastomeric with “R” value of 4.2 per inch thickness at 75 degrees F, maximum service temperature of 250 degrees F, maximum density of 3.0 PCF, maximum velocity on coated air side of 6,000 FPM.

E. Round and rectangular concealed and exposed single wall supply, outside air, return, make-up air, and exhaust air ducts connected to ERV located outside of building shall be insulated with 3” thick mineral fiber blanket with minimum “R” value of 8.0 per inch thickness at 75 degrees F.

END OF SECTION

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating HVAC piping systems

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

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

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

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 COORDINATION

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

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

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

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

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

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

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

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

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

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

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

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

a. Aeroflex USA, Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:
a. Johns Manville; Micro-Lok.
b. Knauf Insulation; 1000-Degree Pipe Insulation.
c. Owens Corning; Fiberglas Pipe Insulation.

2. Preformed Pipe Insulation: Type I, Grade A with factory applied ASJ
3. 850 deg F (454 deg C).
4. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
5. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

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

2.3 MASTICS

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

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

2.4 FACTORY-APPLIED JACKETS

A. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

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

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

3.3 GENERAL INSTALLATION REQUIREMENTS

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

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

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

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

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

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

G. Keep insulation materials dry during application and finishing.

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

I. Install insulation with least number of joints practical.

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

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

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

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

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) on center
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) on center.

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

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

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

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

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

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

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

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

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

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

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

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

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07.

3.5 GENERAL PIPE INSULATION INSTALLATION

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

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

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers,

valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

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

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

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

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

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

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

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

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches (150 mm) on center
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 PIPING INSULATION SCHEDULE, GENERAL

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

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

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 PIPING INSULATION SCHEDULE

A. Condensate piping:

1. All Pipe Sizes: Insulation shall be:
   a. Interior Piping - Mineral-Fiber: 1 inch thick.
   b. Exterior Piping - Flexible Elastomeric: 1/2 inch
      1) Exterior exposed insulation shall be UV resistant or provided with paint/shield to protect against UV radiation

B. Refrigerant Piping:

1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 1/2 inch
2. Exterior exposed insulation shall be UV resistant or provided with paint/shield to protect against UV radiation.

3.10 INDOOR, FIELD-APPLIED JACKET SCHEDULE

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

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

C. Provide as indicated on drawings

END OF SECTION

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. SUMMARY
1. Section Includes:
2. Single-wall rectangular ducts and fittings.
3. Double-wall rectangular ducts and fittings.
4. Single-wall round and flat-oval ducts and fittings.
5. Double-wall round and flat-oval ducts and fittings.
6. Sheet metal materials.
7. Sealants and gaskets.
8. Hangers and supports.
9. Seismic-restraint devices.

1.2 PERFORMANCE REQUIREMENTS

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

B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7. Retain one of three subparagraphs below if retaining "SMACNA's 'Seismic Restraint Manual: Guidelines for Mechanical Systems'" option in paragraph above. If using other seismic design criteria, delete three subparagraphs below.

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

1.3 INFORMATIONAL SUBMITTALS

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

B. Welding certificates.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.

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

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

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

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

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

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

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

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

2.2 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

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

a. Lindab Inc.
b. SEMCO Incorporated.
c. Sheet Metal Connectors, Inc.
d. Spiral Manufacturing Co., Inc.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

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

1. Lindab Inc.
2. McGill AirFlow LLC.
3. SEMCO Incorporated.
4. Sheet Metal Connectors, Inc.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.

1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Inner Duct: as noted on plans

E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F (24 deg C) mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

2.4 SHEET METAL MATERIALS

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

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

1. Galvanized Coating Designation: G90
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

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

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

D. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.5 SEALANT AND GASKETS

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

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Sealant: Modified styrene acrylic.
3. Water resistant.
4. Mold and mildew resistant.
5. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
6. Service: Indoor and outdoor.
7. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
8. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
9. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
10. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

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

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

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

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for 10-inch wg (2500-Pa) static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

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

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

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

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

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

H. Trapeze and Riser Supports:

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

3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

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

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

C. Install round and flat-oval ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

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

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

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

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

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

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

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

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease and sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 20 feet (6) m in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches (38 mm) from bottom of duct.

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 DUCT SEALING

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

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

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class C.

10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.5 HANGER AND SUPPORT INSTALLATION

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

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

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

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

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at maximum intervals of 16 feet (5 m).

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

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Ductwork Accessories."

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

3.7 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

    a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

C. Duct system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.9 DUCT CLEANING

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

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Ductwork Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

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

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

2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.10 START UP

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

END OF SECTION

SECTION 233300 - DUCTWORK ACCESSORIES

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Barometric relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Fire dampers.
6. Ceiling radiation dampers.
7. Smoke dampers.
8. Combination fire and smoke dampers.
9. Turning vanes.
10. Duct-mounted access doors.
11. Flexible connectors.
12. Duct accessory hardware.

1.3 ACTION SUBMITTALS

A. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances, and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control-damper installations.
d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors.
e. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to [10] <Insert number> percent of amount installed.

PART 2 - PRODUCTS

2.1 ACCESS DOORS

A. Fabricate rigid and close-fitting hinged doors of galvanized steel with sealing gaskets and quick fastening cam locking devices. For insulated ductwork, install minimum 1 inch thick insulation with sheet metal cover.

B. Provide two hinges and two sash locks for sizes up to 18 inch square, two hinges and two compression latches with outside and inside handles for sizes up to 24 inch x 48 inch.

C. Sizes:
1. For 6" to 8" ducts: 6" x 6" (1 latch and 2 hinges)
2. For 10" to 12" ducts: 10" x 10" (1 latch and 2 hinges)
3. For 12" to 16" ducts: 12" x 12"(2 latches and 2 hinges).

D. Install at all fire dampers, smoke dampers, back draft, dampers, control dampers and all temperature controls otherwise not accessible.

E. Ceiling, wall, and floor access panels must line up with duct access doors.

2.2 FIRE DAMPERS

A. Fire Rating

1. Rated at 1-1/2 hours and so labeled.
2. Rated at 1-1/2 hours and so labeled for up to 2 hour walls.
3. Rated at 3 hours and so labeled for over 2 hour walls to 4 hour walls.

B. Frame: Curtain type with blades outside airstream fabricated with roll-formed galvanized steel; with mitered and interlocking corners; gauge in accordance with UL listing.

C. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel; gauge in accordance with UL listing.

D. Mounting Orientation: Vertical or horizontal as indicated.

E. Blades: Roll-formed, interlocking, galvanized sheet steel; gauge in accordance with UL listing.

F. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

G. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

H. Fire dampers size shall be the same size as connecting ductwork. Duct liner shall be interrupted at each fire damper.

I. Provide separate or integral collars as required with wall retaining angles, on both sides of walls, floors, ceilings, etc.

J. Contractor to verify location to make sure that dampers are in correct location in fire walls or ceilings before installation. Discuss location with General Contractor before installation.

K. Provide access panels at all fire dampers. Label these access panels "F.D." Access panels must be located to provide access to the fusible links and resetting devices. Grilles are acceptable as access.

L. All fire dampers to be dynamic type, rated and labeled according to UL 555.

M. Closing rating in ducts up to 4-inch wg (static pressure class and minimum 2000-fpm velocity)

2.3 COMBINATION FIRE AND SMOKE DAMPERS

A. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

B. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm

C. Fire Rating
1. Rated at 1-1/2 hours and so labeled.
2. Rated at 1-1/2 hours and so labeled for up to 2 hour walls.
3. Rated at 3 hours and so labeled for over 2 hour walls to 4 hour walls.

D. Frame: Hat-shaped, galvanized sheet steel, with [welded] [interlocking, gusseted] [or] [mechanically attached] corners[and mounting flange]; gauge in accordance with UL listing.

E. Heat-Responsive Device: Replaceable 165 deg F rated, fusible links

F. Smoke Detector: Integral, factory wired for single-point connection.

G. Blades: Roll-formed, horizontal, interlocking overlapping, galvanized sheet steel; gauge in accordance with UL listing.

H. Leakage: Class II

I. Rated pressure and velocity to exceed design airflow conditions.

J. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application, gauge in accordance with UL listing.

K. Master control panel for use in dynamic smoke-management systems.

L. Damper Motors: two-position action.

M. Damper shall be automatic remote resettable after test, detection, or power failure.

2.4 MANUAL DAMPERS

A. Standard, Steel, Manual Volume Dampers:
   1. Standard leakage rating, with linkage outside airstream.
   2. Suitable for horizontal or vertical applications.
   3. Frames:
      a. Mitered and welded corners.
      b. Flanges for attaching to walls and flangeless frames for installing in ducts.
   4. Blades:
      a. Multiple or single blade.
      b. Parallel- or opposed-blade design.
      c. Stiffen damper blades for stability.
      d. Galvanized steel, 0.064 inch (1.62 mm) thick.
   5. Bearings:
      a. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
   6. Tie Bars and Brackets: Galvanized steel.

7. Provide extended quadrant where damper is installed in insulated duct so adjustments can be made without disturbing insulation.

2.5 FLEXIBLE CONNECTORS

A. Materials: Flame-retardant or noncombustible fabrics.

B. Coatings and Adhesives: Comply with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

2.6 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

B. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

D. Vane Construction: Double wall.

E. FLEXIBLE DUCTS

1. Insulated, 1”, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
2. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
3. Maximum Air Velocity: 4000 fpm.
4. Temperature Range: Minus 20 to plus 175 deg F (Minus 29 to plus 79 deg C).
5. Insulation R-Value: Comply with ASHRAE/IESNA 90.1.

2.7 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install test holes at fan inlets and outlets and elsewhere as indicated.

F. Install fire dampers according to UL listing.

G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. At outdoor-air intakes and mixed-air plenums.
2. At drain pans and seals.
3. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
4. At each change in direction and at maximum 50-foot spacing.
5. Elsewhere as indicated.

H. Install access doors with swing against duct static pressure.

I. Install flexible connectors to connect ducts to equipment.

J. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

K. Connect terminal units to supply ducts with maximum 3’ lengths of flexible duct. Do not use flexible ducts to change directions.

L. Install duct test holes where required for testing and balancing purposes.

M. Install turning vanes in mitered elbows that have a velocity greater than 1000 feet per minute.

N. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

SECTION 260100 - GENERAL PROVISIONS, ELECTRICAL

PART 1 - GENERAL

1.1 CONTRACTOR'S RESPONSIBILITY

A. Contractor agrees to assume responsibility for liability, workmanship, and quality of materials concerning work sublet to others. Before contract is sublet, submit in writing the names of proposed subcontractor and obtain written approval.

1.2 CODES AND FEES

A. All work shall be installed in accordance with the applicable provisions of the local codes, the National Electrical Code, and the National Electrical Safety Code.

B. All electrical materials shall have Underwriters' approval where applicable, and shall be so labeled where UL labeling is customary.

C. All electrical equipment shall conform to applicable NEMA Standards whether specified hereinafter or not, and to other applicable Standards which may be specified hereinafter.

D. The Contractor shall be responsible for obtaining local permits, payment of fees and notification for inspection by code authorities consistent with the schedule of work. The contractor shall be responsible for obtaining state permits, payment of fees and notification for inspection by code authorities as required by the project.

1.3 EQUIPMENT LISTS, SHOP DRAWINGS, SAMPLES AND SUBMITTALS

A. Submit under provisions of DIVISION 01 and General Conditions.

B. Submit to the Designer for approval, within 30 days after receipt of Notice to Proceed with the work, a complete list of materials, equipment and accessories proposed for use, including complete descriptions and specifications of any proposed substitutions, manufacturer's shop drawings, and roughing-in work. Submit five (5) copies of all items for approval and furnish additional copies if required for installation purposes. Electronic submittals are acceptable in PDF format.

C. Submission material and all shop drawings for the various items of equipment shall indicate section number and shall be marked with the respective mark number or identification of the equipment shown on the drawings or specified. The shop drawings shall list all ratings, capacities, accessories, and other pertinent data to show that the proposed item is as called for and as specified.

D. Shop drawings shall show sizes and details of required steel machine foundation, locations of anchor bolts, physical dimensions of equipment, capacity characteristics of equipment, and all other work pertinent to details.

1.4 QUALITY CONTROL

A. Comply with Section GENERAL CONDITIONS.

B. Qualifications: Where specific qualifications are specified in individual specification section, provide required data with Subcontractor list.

1.5 GUARANTEE

A. Comply with Section GENERAL CONDITIONS

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Install all equipment in accordance with applicable manufacturer's drawings and recommendations.

B. Identification of circuits and equipment: Identification designations shall correspond to those indicated on electrical drawings and as specified in corresponding articles describing the equipment.

3.2 ALTERATIONS AND ADDITIONS TO EXISTING ELECTRICAL WORK

A. Make alterations and additions to existing electrical work as indicated, and as required to accommodate new construction and to clear all interferences therewith. This includes disconnecting, removing, relocating, rerouting, extending, reworking, reconnecting, or otherwise altering existing electrical work as required, whether indicated on the drawings or not.

3.3 TEMPORARY LIGHTS AND POWER

A. Provide temporary lights and power. Lights shall be one pigtail socket and lumens equivalent to a 150W incandescent lamp for each 500 sf building space, minimum one per room. Power outlets shall be provided as coordinated with construction. Temporary service connections and electrical charges shall be provided by the owner. The contractor shall coordinate the exact location of this power with the owner.

3.4 TEST, INSPECTIONS, ADJUSTMENTS, AND CLEANUP

A. Wiring, 600 volts and less: Make insulation tests with a "Megger", demonstrate that neither short circuits nor ground faults exist, and that wiring complies with NEC. Provide a copy of the insulation tests in the Close-Out documents.

B. Furnish suitable testing equipment, give the Designer and all applicable authorities ample advance notice of all proposed tests and readiness of work for inspections, and conduct each test in their presence, as approved. Do not conceal electrical work until all necessary inspections have been made and all required tests have been approved by the Owner's Representative and all applicable authorities.

C. Put entire electrical system in operation, test all equipment, remedy all defects, and make all necessary adjustments. Demonstrate that the entire system functions satisfactorily, as specified, as indicated, and as approved.

D. After electrical system has been tested and before any field painting is commenced, clean up all electrical work thoroughly. Remove all foreign matter which has accumulated in all fixtures, equipment, and enclosures. Clean all fixture glassware and reflectors, and clean and polish all other surfaces that are not to be painted so that they present a new and acceptable appearance.

3.5 PROTECTION AND CLEANING

A. Work shall be protected at all times. Conduit openings shall be closed with caps or plugs until permanent connections are made. Fixtures and equipment shall be covered, if necessary, to protect against dirt, water, chemical or mechanical damage or defacement. The installation of fixtures liable to damage shall be coordinated with installing UL fire protective barriers and ceiling systems.

B. Electrical equipment rooms shall be cleaned up prior to energizing equipment and shall not be used for storage or other purposes after power is applied to the electrical equipments.

3.6 OPERATING INSTRUCTIONS

A. Furnish the services of personnel with experiences in the operation of an electrical system to instruct the Owner's personnel in the proper operation and maintenance of all equipment, for a period of not less than five working days.

B. Furnish and deliver to the Owner three sets of operating instructions for all equipment installed under this contract, including shop drawings, piping diagrams, wiring diagrams, maintenance recommendations and information concerning replacement parts.

C. All floor mounted electrical equipment shall be provided with 4” thick housekeeping pads which are 4 inches larger than the equipment.

END OF SECTION

SECTION 260500 - BASIC MATERIALS AND METHODS, ELECTRICAL

PART 1 - GENERAL

1.1 SUBMITTALS

A. Submit under provisions of Division 01.

1.2 O&M MANUAL

A. The preliminary O&M Manuals shall be submitted thirty (30) days after final submittal approval.

B. Provide an electronic copy in searchable Adobe PDF format.

1.3 ELECTRICAL WIRING FOR EQUIPMENT OF OTHER SECTIONS

A. General:

1. All electrical wiring of every description required to operate all equipment furnished by other Sections shall be done by the Electrical Section, except as otherwise specified hereinafter. Read carefully all other Sections in which electrically operated equipment is specified, and include in the electrical work all electric wiring required for the proper operation of the equipment, whether indicated on the electrical drawings or not. Coordinate the Electrical section work with that of all other Sections that furnish equipment requiring electrical connections.
2. All control devices required to operate the equipment shall be furnished by the Section that furnishes the equipment, unless otherwise specified. All control devices which are not factory mounted on the equipment and require electrical connections ONLY shall be installed by the Electrical Section. All control devices which are not factory mounted on the equipment and require piping, linkage, remote bulb, or other mechanical connections as well as electrical connections shall be installed by the Section that furnishes the equipment involved, ready for electrical connections.
3. Outlet locations indicated on the electrical drawings for motors, controls, and other electrically operated items of other Sections are APPROXIMATE ONLY, as the actual wiring requirements are not necessarily identical for the various makes of each item of equipment involved. However, the Electrical Section shall locate all outlets and arrange all wiring to properly serve the equipment ACTUALLY INSTALLED, generally as indicated on the electrical drawings, but EXACTLY in accordance with rough-in sheets and/or wiring diagrams furnished by the other Sections involved.
4. The necessary wiring diagrams shall be furnished by the Section that furnishes the equipment involved, and after these are approved, do all wiring accordingly.

B. Wiring NOT Included: Wiring which is factory installed on equipment.

C. Wiring Included: Generally equipment of other Sections requiring wiring, includes but shall not be limited to the following items:
   1. Plumbing: water heater.
   2. Door installation: automatic door equipment.
   3. Food service: equipment connections.
   4. Special construction: equipment connections.
   5. Special type wire (other than type MTW): If any of this is required for other Divisions, that wire shall be furnished by the other Divisions and installed under this Division.

PART 2 – PRODUCTS

2.1 HANGERS, SUPPORTS, AND SLEEVES

A. Securely attach all hangers, supports, and devices to the building structure with anchors suitable for the types of building construction involved. Provide all necessary pipe, angle iron, "Unistrut", "Kindorf", or other suitable steel auxiliary supports for the electrical work.

B. Hangers or supports for conduits and raceways shall be standard conduit or raceway straps, or other suitable clamping devices. Trapeze hangers may be used for groups of suspended horizontal conduits, with each conduit clamped to each trapeze bar. Perforated strap iron hangers will not be permitted.

C. Maximum hanger or support spacing for all conduits shall be as required by the Codes. Support non-concrete encased underground conduits by laying with full length bearing on firm trench bottoms. Support each riser conduit at each building floor level within one foot of floor, one foot of boxes, and every ten feet for vertical and horizontal runs; each run shall have at least one support.

D. Adequately support all boxes, gutters, panelboards, switches, starters, fixtures, and other devices, and equipment. Where supporting method is indicated or detailed, provide supports accordingly; OTHERWISE, supports shall be as required by the Codes, and as approved.

E. Provide all necessary sleeves for conduits and other electrical items passing through concrete and masonry construction, where electrical items are not installed prior to concrete placing and masonry laying. Sleeves through concrete walls, concrete columns, and concrete beams shall be IPS steel pipe or rigid steel conduit, flush with finished concrete surfaces. Sleeves for all exposed conduits passing through floors (except slabs on ground) where water on floor can pass through the opening shall be galvanized IPS pipe or galvanized rigid steel conduit extending two inches above finished floor, and flush with slab below. Other sleeves may be sheet metal or plastic.

2.2 CONDUIT AND FITTINGS, EXCEPT UNDERGROUND DUCTS

A. Conduits: These shall be zinc coated rigid steel, zinc coated steel electrical metallic tubing (hereinafter referred to as "thin wall conduit"), ANSI Specification C80.5 rigid aluminum, Carlon Schedule 40 Certainteed PVC Schedule 40 or Cantex PVC Schedule 40 as approved UL listed heavy wall rigid PVC, as applicable. In each case where the conduit type is indicated, specified, or required by the Codes, install only the indicated, specified, or Code required type; OTHERWISE, conduit usage shall be as follows:
   1. Embedded in concrete: rigid steel coated with bituminous compound or PVC coated.
   2. Conduit below grade shall be PVC encased in concrete as indicated.
   3. For supporting fixture, outlet boxes, and other devices and equipment which are not directly anchored to the building structure: rigid steel or rigid aluminum conduit, with all joints and connections threaded.
   4. Flexible connections: flexible steel conduit ("Greenfield"), in short lengths only, at each motor connection and other location requiring flexibility; of liquid tight type where exposed to weather or excessive moisture.
   5. PVC conduit shall not be used in return air ceilings or plenums.
   6. Rigid metal conduit shall be used for service conductors entering and inside building.
   7. Rigid metal conduit shall be used for fire pump service wiring and all runs between controller and pump and other equipment. All conduit within a fire pump room shall be rigid metal conduit except flexible connections to motors may be liquid tight type flexible steel conduit.
   8. All other locations: thin wall or rigid steel, as applicable.
   9. DO NOT INSTALL ALUMINUM CONDUIT UNDERGROUND, IN CONTACT WITH GROUND, OR EMBEDDED IN CONCRETE.
   10. MC Cable is unacceptable, unless otherwise indicated on the drawings. MC Cable allowed on the documents shall be supported at twice the NEC recommendations and shall be used for runouts only. All homeruns shall be EMT.
   11. Minimum 0.75” conduit except switch legs may be 0.5” conduit.

B. Conduit Fittings: For metallic conduit, fittings shall be zinc coated steel, cast aluminum, or cast zinc. For PVC conduit, fittings shall be of the same materials and make as those of the conduit. All fittings exposed to weather shall be weatherproof type.

C. Installation:

   1. General: ream ends of all conduits after cutting. Prior to wire pulling, keep all open conduit ends plugged, and swab out all trapped conduits in which water or moisture has collected. Where conduits are concealed in walls, install these conduits so that the exposed wall faces will not be marred.
   2. PVC conduits: solvent weld all joints between PVC materials, with cement furnished by the conduit manufacturer. Provide suitable adapters where PVC conduits are coupled to metallic conduits. Provide a rigid steel elbow at the

base of each exposed riser from below ground and below floor to above ground and above floor.

3. Conduit routing, general: see TYPE OF SYSTEM, METHOD OF WIRING hereinbefore for locations where concealed and exposed conduits are required and/or permitted. Where conduit routings are detailed or dimensioned install conduits accordingly; OTHERWISE, install concealed conduits with the shortest practicable path, and install all exposed conduits in straight, level, and plumb lines, parallel with or at right angles with beams, walls, ceilings, and other building lines.
4. Branch circuit conduit routings: except where detailed or dimensioned, the indicated branch circuit conduit routings are generally diagrammatic, and are intended to show the required circuitry from panelboards to outlets. However, if necessitated by job conditions, deviations from the indicated routings may be made, provided that regardless of the actual installed arrangement of the conduits: each outlet marked with the same circuit number is connected to the same corresponding numbered circuit; outlets are switched and controlled as indicated; and no home run is brought into any switch box unless otherwise indicated.
5. Thin wall conduit: Use compression type fittings with proper tools for all joints and terminations. Point screw type fittings are allowed with proper installation methods.

2.3 UNDERGROUND DUCTS

A. General: Where indicated on the electrical drawings as "duct" or "ducts", underground conduits shall be PVC type, with concrete encasement.

B. Duct Materials and Joints:
   1. PVC conduit: This shall be Carlon Type EB or equivalent from Allied or Cantex, or as approved, UL listed.
   2. Fittings: These shall include couplings, elbows (except the riser elbows specified below), adapters, and other necessary types, all of the same material and make as those of the PVC conduit.
   3. Joints between PVC materials shall be solvent welded type, made with cement furnished by the PVC conduit manufacturer.
   4. Riser elbows: Provide a galvanized rigid steel conduit elbow at the base of each duct riser from below-ground and below-floor to above-ground and above-floor, coupled to the horizontal end of the PVC conduit with a suitable adapter.
   5. Supports and spacers: Provide these as required to securely hold conduits in proper position prior to and during concrete placing, with required spacing between adjacent conduits.

C. Concrete Encasement: This shall be as detailed; if not detailed, concrete shall be at least 3" thick below, above, and on each side of the duct assembly. (Concrete by Concrete Section, with 5/8" maximum size aggregate).

D. Grounding Conductor: For each run of one or more PVC conduits in an underground duct assembly, provide a single stranded copper grounding conductor, buried directly in the ground above the concrete encasement, and connected to the above-ground metallic conduit system at each end of the duct run.

2.4 PULL BOXES, JUNCTION BOXES, AND WIRING GUTTERS

A. General: Pull boxes, junction boxes, and wiring gutters shall be of the types and minimum sizes indicated, or as required for the conditions involved where types and sizes are not indicated. Before installation, check proposed locations of boxes and gutters with the architectural, structural, and mechanical drawings, and locate each box and gutter so that it will be accessible in the finished project.

B. Underground Boxes: These shall be galvanized cast iron strictly watertight submersible type, with wide flanges on box top, neoprene cover gasket, cover bolted on with stainless steel bolts, and threaded hubs for all conduit connections.

C. Above Ground Boxes and Gutters: These shall be galvanized steel of at least Code gauge for each size involved, and of weatherproof construction where exposed to weather.
   1. Where indicated, boxes for under ground conduits shall be above ground and encased in concrete pedestals, as detailed.

2.5 OUTLET BOXES

A. General: Outlet boxes and covers therefor shall be steel or cast ferrous metal with zinc or other suitable metallic rustproof coating, or cast aluminum, all of the proper sizes and types to accommodate the conduits, conductors, connections, devices, fixtures, architectural conditions, and structural conditions involved.

B. Installation:
   1. Before installation, check proposed location of each outlet box with the architectural, structural, and mechanical drawings, and locate each outlet box so that it will be accessible and interference free in the finished project.
   2. Set each concealed box flush with finished surfaces, and so that exposed finished surfaces will not be marred.
   3. Install each wall switch on the knob side of the door involved. Before placing each wall switch box, verify the applicable door swing with the architectural drawings, and locate the wall switch box accordingly.
   4. Where equipment is served by exposed flexible cords, locate the outlet box as near as practicable to the equipment connection point, to minimize flexible cord length.

2.6 WIRE, JOINTS, AND SPLICES, 600 VOLTS AND LESS

A. Lighting and power wire shall be copper only: Types shall be as follows:

   1. Feeders shall be copper as indicated on single line diagram.
   2. High temperature and other special conditions: types NEC approved for the conditions involved.
   3. Exposed flexible cords: Type S, with grounding conductor.
   4. Direct earth burial: Type USE, with neoprene jacket.

5. All other lighting and power wire: No. 8 and larger, Type THWN stranded; No. 10 and smaller, Type THWN/THHN solid.

B. Control wire shall be Type MTW copper, stranded.

C. Signaling, sound, communications, alarm, indicating, and other special system wire shall be copper, of the types specified hereinafter with the equipment, or as indicated, or as recommended by the equipment manufacturers if neither indicated nor specified.

D. Wire Sizes: Where sizes are neither indicated nor otherwise specified wire sizes shall be:
1. Branch circuit wire: No. 12.
2. Control wire: No. 14, or as recommended by the control manufacturer.
3. Special system wire: as recommended by the manufacturer of the equipment involved.
4. Home runs shall be 12 gauge if the distance from the panelboard to first outlet is less than 100 feet; 10 gauge if distance is over 100 feet.

E. Identification:
1. General: All wires shall be identified as required by NEC.
2. Control and special systems wire: these shall be color coded throughout, or identified at each terminal and junction point with a suitable permanently attached tag or label.

F. Joints and Splices: Make these with suitable solderless connectors, in the various boxes, gutters, and similar locations, but not in any conduit. Leave enough wire slack to permit at least one splice or joint to be remade in case of fault.
1. Branch circuit, control, and special system wire joints: use Ideal, Buchanan, 3M, or similar tool-applied to twist-on type connectors.
2. All other wire joints: use Ilsco tin plated aluminum type pressure connectors, or suitable brass, bronze, or copper pressure type connectors.
3. Insulate all joints and splices with suitable insulating sleeves or caps integral with the connectors or separate therefrom, or with vinyl plastic insulating tape.

2.7 ELECTRICAL IDENTIFICATION AND NAMEPLATES

A. Conductors identified by wire markers shall be branch circuits in the panel or panelboard and at the point of termination. The text shall be of black, non-smear ink. Text shall be pre-printed letters and numbers. Combinations of text and numbers shall be used to indicate the branch circuit or other use of the conductor or cable.

B. Disconnects, panelboards shall be identified with name plates with 1.5” black lettering with white background. Provide 1.5” white lettering with red background on all equipment served by generator.

C. Each panelboard shall be included with a label listing the following:
1. Source info
2. Voltage/Phase
3. Current/Phase

D. Junction boxes and pull boxes shall be identified with the circuit numbers and panel designation in permanent marker or label.

E. All conduits shall be labeled with circuit numbers labeled with permanent marker at conduit entry into panelboard.

2.8 FUSES

A. General: Provide fuses of the indicated types and sizes, in place, for each device requiring fuses. Unless otherwise indicated, fuses shall be dual element non-renewable delay type. Fuses shall be Bussman, and Littlefuse.
   1. Spare Fuses: Furnish three spare fuses of each size and type required for the electrical system, deliver these to the Owner's representative in a suitable clearly labeled box, and obtain signed receipt for delivery. Include this receipt in the Close-Out documents.

2.9 DISCONNECT SWITCHES, MOTOR STARTERS, AND SEPARATE CIRCUIT BREAKERS

A. General: Except as otherwise specified below, Electrical Section shall provide disconnect switches, circuit breakers, and motor starters for all motors and other electrically operated equipment, regardless of who furnishes and/or installs that equipment. Types and locations of these devices shall be as indicated, or as required where types and/or locations are not indicated.
   1. These devices which are located on other equipment shall be as specified under the corresponding headings; these devices NOT located on other equipment shall be as specified below, and shall be separately mounted.
   2. Separately mounted disconnect switches, circuit breakers, and motor starters shall be Square D, Allen-Bradley, Eaton Cutler Hammer, or as approved. Enclosure types shall be: NEMA 3R for devices exposed to weather; NEC required type for devices in other special locations; and NEMA 1 type for devices in other locations. Each circuit breaker and each disconnect switch, including those integral with motor starters, shall have padlocking means.
   3. All terminals for disconnect switches, circuit breakers and motor starters shall be rated and marked for 75 degrees C terminations.

B. Disconnect Switches: These shall be: non-fused heavy duty type safety switches where overcurrent protection is not required; and fused heavy duty type safety switches or circuit breakers (as indicated) where overcurrent protection is required; except that other suitable properly rated switches may be used for fractional hp motors and other small loads.

C. Circuit Breakers: These shall be molded case type. Breakers shall be quick make, quick break type with trip indications shown and with common trip handle on all multi-pole breaker.

D. Manual Motor Starters: These shall have neon motor running pilot lights and proper sized overload protective devices for the motors involved; and shall be surface mounted in equipment rooms and unfinished areas, and flush mounted in finished

area. Where manual motor starters are not indicated, small manually controlled motors shall be controlled directly by the panelboard circuit breakers.

E. Magnetic Motor Starter: Each motor of 1/8 hp or larger shall be provided with thermal overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, unless otherwise specified, the protective device shall be of the manually reset type. Magnetic starters shall be NEMA size and type including the NEMA withstand ratings, with the automatic-control device actuating the pilot-control circuit. Each magnetic starter shall have a built in control circuit transformer to supply 120 volts to the control circuit. Each magnetic starter shall be provided with a three-position selector switch marked MANUAL-OFF-AUTOMATIC. Connections to the selector switch shall be such that only the normal automatic regulatory control devices will be bypassed when the switch is in the Manual position; all safety control devices, such as low or high-pressure cutouts, high-temperature cutouts, and motor-overload protective devices, shall be connected in the motor-control circuit in both the Manual and the Automatic positions of the selector switch. Two auxiliary contacts shall be a part of the starters. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with approved wiring diagram. All controls shall be 120 volts or less unless otherwise indicated. All motors with a rating of 50 hp and above shall have autotransformer reduced voltage starters; motors less than 50 hp shall be line voltage starters.

F. Identification of Separately Enclosed Devices: Identify each separately enclosed circuit breaker, disconnect switch, magnetic motor starter, and manual motor starter, by attaching to the device cover a metal or plastic nameplate clearly and permanently lettered with the description and location of the equipment controlled by the device.

G. Devices Furnished by Other Sections or Others:
1. 3/4 hp and small single phase roof mounted fans: If the disconnect switches for these are furnished with and factory mounted on the equipment; Electrical Section shall connect to fan motors and/or switches, as required. Verify that disconnects are furnished by others.

2.10 DEVICES

A. General:
1. Wiring devices shall be Hubbell, Leviton, Pass & Seymour Legrand or other makes as approved or as specified below or on drawings. Type of wiring devices required for this project shall be as indicated on the drawings, or suitable for the application involved if type is not indicated; qualities, ratings, and other requirements of wiring devices shall be as specified below. All wiring device types specified below may not necessarily be required for this project.
2. Receptacle configurations shall conform to NEMA standards unless otherwise noted.
3. Exposed finish shall be: for each device with a plastic plate, same color as that of plate; for devices with stainless steel plates, brown; and for all other devices, brown or black. Hospital grade, isolated ground receptacles and emergency

devices shall be marked by symbol on the face. Coordinate device and plate color requirements with designer.

B. Devices: Qualities, ratings, and other requirements shall be: (All models are based on Hubbell – other manufacturers are Leviton, Pass & Seymour Legrand or as approved)
   1. Wall switches: 20A 120-277VAC, single or double pole, 3 or 4 way, as applicable; Hubbell 1221 series. Where indicated as WEATHERPROOF, the above specified switch, Hubbell 7420. Wall switches with occupancy sensors as shown on drawings.
   2. Momentary contact switches: 20A 120-277 volt, SPDT, three position with center off; Hubbell 1557 series.
   3. Door switches: Hubbell RDS50.
   4. Duplex receptacles: (Commercial) 20A 125 volt, 2 pole, 3 wire grounding: Hubbell 5362. Where indicated as WEATHERPROOF the above specified duplex receptacle Hubbell 5206WO, double lift spring door cover.
   5. Ground fault circuit interrupter receptacles: (Commercial) 20A 125 volt feed through duplex 5ma sensitivity type with test and reset buttons; Hubbell GF5362. Where indicated as WEATHERPROOF, the above specified receptacle with Hubbell CWP26H spring door cover.
   6. Single Receptacle: (Commercial) 20A 125 volt, 2 pole, 3 wire grounding Hubbell 5361. Single receptacles: 30A, 125 volt, 2 pole, 3 wire grounding; Hubbell No. 9308.
   7. Single receptacles: 20A, 250 volt, 2 pole 3 wire grounding; Hubbell 5461.
   8. Flush floor receptacles: 20A 125 volt, 2 pole, 3 wire grounding; above specified single receptacle with Steel City 889 and P-90-2 receptacle and floor plates.
   9. Standing floor receptacles: 20A 125 volt, 2 pole, 3 wire grounding; above specified duplex receptacle in Steel City SFH-40 or equal outlet fitting.
   10. Other devices not specified above; as indicated on the drawings.

C. Device Plates: Unless otherwise specified or inapplicable to the devices involved, plates shall be: emergency circuit devices as selected by Designer, plastic; isolated ground receptacles, as selected by Designer. In finished areas device plate colors shall be as selected by Designer, and unfinished areas, brown plastic for flush devices, and zinc coated steel for surface devices.
   1. Identification of Emergency System Receptacles: Emergency system receptacles shall be red in color.
   2. Identification of Data Processing Equipment Receptacles: These shall be engraved or hot stamped "Data Processing Equipment Only".

3.1 INSTALLATION

A. Run exposed conduit, trays, and other wireways parallel to the principal parts of the building. Wireways shall be run concealed when provisions are made in floors, walls, ceilings, and chases through all finished areas. Fire stop all openings around conduit which penetrates floors and walls with approved non-combustible materials, slabs on grade are accepted.

B. Conduits and other raceways shall be kept as close as possible to ceilings, walls, columns, etc., and shall be installed in such an orderly manner as to take up a minimum of space and allow a maximum of headroom, per applicable codes.

C. Circuiting: Circuit numbers shown on drawings indicate specific panelboard to which each branch circuit shall be connected, and specific outlets which shall be connected to each branch circuit, and unless otherwise indicated these circuit numbers do not necessarily indicate actual number of circuit breaker in each panel to which each branch circuit shall be connected. Connect each outlet marked with same circuit number to same numbered branch circuit, and connect each branch circuit to indicated panelboard. In each individual panelboard:
   1. Balance active circuits on panelboard busses, and leave spare circuit breakers equally divided among panelboard busses, as nearly as practicable.
   2. Connect each ungrounded wire of each 3 and 4 wire common neutral circuit to a different panelboard bus.
   3. Group conveniently at top of panelboard all breakers used for switching lights not having wall or other switches, and neatly paint handles of all such breakers with white durable quick drying automobile touch up or other similar type lacquer for each identification as light switches. This does not apply to any panelboard in which ALL circuit breakers serve as lighting switches.

D. Provide templates, layouts drawings, and supervision to ensure correct placement of anchors and conduit projecting in concrete.

E. Painting shall be done to repair scratches to surfaces, electrical equipment nameplates shall be protected from paint.

F. Qualifications: Where specific qualifications are specified in individual specification section, provide required data with Subcontractor list.

3.2 TYPE OF SYSTEM, WIRING METHOD

A. Electrical system characteristics: These shall be as indicated. In addition, whether indicated or not, provide low voltage (less than 120 volts) wiring for controls and other purposes, as required for the complete electrical system.

B. Enclosures: Regardless of voltage or use, install wiring in conduits and metal or other enclosures, unless otherwise indicated or otherwise specified.

C. Finished Areas: Conceal conduits below floors, within slabs, within walls, within pipe chases, above suspended ceilings, and within other building construction, in offices, rest rooms, and other finished areas, unless otherwise indicated.

D. Unfinished Areas: Install above-floor conduits exposed in areas where pipe chases or suspended ceilings are not indicated or concealing is otherwise impractical, in mechanical and electrical equipment rooms, manufacturing areas, warehouse or storage areas, and other unfinished areas.

E. Flexible Cords: Exposed flexible cords approved for the purpose involved shall be used to connect equipment where indicated or specified, and where equipment is factory furnished with or factory arranged for flexible cord connections only. However, in each such case, install the supply outlet as near as practical to the equipment served thereby, and use the shortest practical length of exposed flexible cord between the equipment and the outlet. If a receptacle is used as an outlet, the

receptacle and the cord plug shall be 3 or 4 wire (as applicable) grounding twist-lock type.

F. Ground electrical equipment and conductors as required by NEC and other applicable electrical codes.
   1. Panelboards served by individual transformers: ground panelboard neutral busses to building grounding system.
   2. All metallic cable sheaths, cable shields, metal conduit, transformer cases, cabinets and pedestals shall be made electrically secure to form a continuous system and shall be grounded.
   3. The neutral shall only be grounded at the panelboard or service grounding device. Grounding conductors shall be continuous between the service and the driven grounding electrode or other grounding electrode as permitted in Part H of NEC Article 250.
   4. All conduits shall have code sized green equipment grounding conductors with diameter based on the largest circuit in each conduit.

3.3 EXCAVATION AND BACKFILL

A. Excavate and backfill as required for the electrical work. Cut bottoms of trenches to the proper lines and grades to provide firm and continuous support for the underground electrical work, and to provide 24 inch MINIMUM depth from finished grade to tops of all exterior underground electrical work. Sheet and brace excavations as required to protect personnel and adjacent structures.

B. After the underground electrical work has been installed and approved, place all backfill in 8 inch maximum thickness loose layers, and compact each layer to at least the density of the adjacent undisturbed site soil, using pneumatic or other suitable power tampers. Mass backfilling (backfilling without tamping) is prohibited.

C. Warning tape for buried electrical work: install detectable warning tape directly over every device by burying tape as close to the surface as possible but no less than six inches beneath finished grade. Tape shall be Reef Industries, Inc., "Terra Tape D", or equal as approved, composition metallized foil-plastic film laminate bearing imprint describing the type of buried electrical work. All materials shall be specifically formulated for prolonged use underground.

3.4 FIRE WALL PENETRATIONS

A. Four hour fire walls shall not be penetrated with conduit runs. Conduit runs shall be routed under the floor in these areas. UL listed approved fire stops shall be provided for all two hour wall penetrations.

B. FEEDER, STARTER, SWITCH, PROTECTIVE DEVICE, AND OTHER ELECTRICAL DEVICE SIZES

A. Capacities of feeders, motor starters, circuit breakers, switches, protective devices, and other electrical devices indicated to be furnished and installed by Electrical Section for electrically operated equipment, regardless of who furnishes and/or installs that equipment, are based upon the average horsepower and/or electrical

ratings. HORSEPOWER AND/OR ELECTRICAL RATINGS OF ELECTRICALLY OPERATED EQUIPMENT INDICATED ON ELECTRICAL DRAWINGS SHALL NOT LIMIT SIZES OF THE ELECTRICALLY OPERATED EQUIPMENT AND CAPACITY OF THE ELECTRICAL WORK.

1. Equipment electrical requirements are based on the specified manufacturer and model. Alternate equipment and model revisions result in electrical load variations and is the responsibility of the contractor. Before commencing electrical work for electrically operated equipment, Electrical section shall: check horsepower and/or electrical rating of each individual electrically operated equipment items, regardless of who furnishes and/or installs that equipment; and adjust sizes of all applicable feeders, motor starters, circuit breakers, switches, protective devices, and other electrical devices furnished by Electrical Section, as required to provide proper protection and satisfactory operation of the electrically operated equipment actually installed. This includes increasing to next larger size, or decreasing to next smaller size, all feeders, circuit breakers, starters, switches, protective devices, and other electrical devices involved, as required to match capacities of corresponding electrically operated equipment actually installed, except that no sizes shall be decreased without approval.

B. Switches, circuit breakers, motor starters, protective devices, and other electrical devices furnished by other Sections and by others for installation and/or wiring by Electrical Section, are specified elsewhere to have adequate capacities to serve the electrically operated equipment for which they are furnished. However, BEFORE installing and/or wiring each of these devices, Electrical Section shall check each individual device's electrical rating with the horsepower and/or electrical rating of the corresponding electrically operated equipment actually installed, regardless of who furnishes and/or installs the devices and equipment. Electrical Section shall not install and/or wire any device that is found to be the incorrect size, and shall see to it that correctly sized devices are furnished by the applicable Section and other applicable persons in all cases.

C. The intent and requirement of the above is to obtain a coordinated electrical system and all of the above shall be done by Electrical Section as part of the contract, at no extra cost to the Owner.

END OF SECTION

SECTION 260548 - ELECTRICAL SUPPORTS AND SEISMIC RESTRAINTS

PART 1 – GENERAL

1.1 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

D. SBC: The current version of the Standard Building Code.

E. IBC: The correct resin of the International Building Code.

F. Seismic Restraint: A structural support element such as a metal framing member, a cable, an anchor bolt or stud, a fastening device, or an assembly of these items used to transmit seismic forces from an item of equipment or system to building structure and to limit movement of item during a seismic event.

1.2 SUBMITTALS

A. Product Data: Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of electrical support and seismic-restraint component used.

1. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear.
2. Annotate to indicate application of each product submitted and compliance with requirements.

B. Calculations:

1. For applicable electrical items listed in IBC Section 1621 and based upon the Project Conditions, provide calculations signed and sealed by a qualified Professional Engineer. The calculations shall first analyze each equipment item mounted utilizing the maximum number and size of the factory supplied mounting bolts including attachment and anchorage devices.

2. Where it is determined that the factory mounting bolts are not sufficient to meet the seismic forces, additional supports and restraints and associated calculations are required. These shall be submitted in the Shop Drawings section below.

C. Shop Drawings: Indicate materials and dimensions and identify hardware, including attachment and anchorage devices, signed and sealed by a qualified Professional Engineer. Include the following:

1. Fabricated Supports: Representations of field-fabricated supports not detailed on Drawings.
2. Seismic Restraints: Detail anchorage and bracing not defined by details or charts on Drawings. Include the following:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.

b. Details: Detail fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacing. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events.

D. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

E. Welding certificates.

F. Qualification Data: For Professional Engineer.

G. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Testing of Seismic Anchorage Devices: Comply with testing requirements in Part 3 and in Division 26 Section "Basic Electrical Materials and Methods."

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of vibration isolation bases and seismic restraints that are similar to those indicated for this Project in material, design, and extent.

1.4 PROJECT CONDITIONS

A. Project seismic zone information is Seismic Hazard Exposure Group II, Seismic Performance Category C, Effective Peak Velocity - Related Acceleration Coefficient of 0.10.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project, with a minimum structural safety factor of five times the applied force.

B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly.

1. Available Manufacturers:

a. Cooper B-Line; a division of Cooper Industries.
b. Unistrut; Tyco International, Ltd.
c. Or approved equal

2. Finishes:

a. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3.
b. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-3.
c. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-3.

3. Channel Dimensions: Selected for structural loading and applicable seismic forces.

C. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.

1. Available Manufacturers:
   a. Allied Support Systems; Aickinstrut Unit.
   b. Cooper B-Line; a division of Cooper Industries.
   c. Or Approved Equal
2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
3. Fitting and Accessory Materials: Same as channels and angles.
4. Rated Strength: Selected to suit structural loading and applicable seismic forces.

D. Raceway and Cable Supports: As described in NECA 1.

E. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

F. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

G. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

H. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
   1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
      a. Available Manufacturers:
         1) Hilti, Inc.
         2) 3M
         3) Or Approved Equal
   2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
      a. Available Manufacturers:
         1) Cooper B-Line; a division of Cooper Industries.
         2) Hilti, Inc.
         3) 3M
   3. Concrete Inserts: Steel or malleable-iron slotted-support-system units similar to MSS Type 18; complying with MFMA-3 or MSS SP-58.
   4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
   5. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
   6. Toggle Bolts: All-steel springhead type.
   7. Hanger Rods: Threaded steel.

2.3 SEISMIC-RESTRAINT COMPONENTS

A. Rated Strength, Features, and Application Requirements for Restraint Components: As defined in reports by an agency acceptable to authorities having jurisdiction.
   1. Structural Safety Factor: Strength in tension, shear, and pullout force of components used shall be at least five times the maximum seismic forces to which they will be subjected.

B. Angle and Channel-Type Brace Assemblies: Steel angles or steel slotted-support-system components; with accessories for attachment to braced component at one end and to building structure at the other end.

C. Cable Restraints: ASTM A 603, zinc-coated, steel wire rope attached to steel or stainless-steel thimbles, brackets, swivels, and bolts designed for restraining cable service.

1. Available Manufacturers:

   a. Amber/Booth Company, Inc.
   b. Mason Industries, Inc.
   c. Or approved equal

2. Seismic Mountings, Anchors, and Attachments: Devices as specified in Part 2 "Support, Anchorage, and Attachment Components" Article, selected to resist seismic forces.
3. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections Reinforcing steel angle clamped to hanger rod, of design recognized by an agency acceptable to authorities having jurisdiction.
4. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to type and size of anchor bolts and studs used.
5. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to type and size of attachment devices used.

2.4 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 – EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 for application of hangers and supports for electrical equipment and systems, except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
   1. Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
   2. Secure raceways and cables to these supports with two-bolt conduit clamps single-bolt conduit clamps using spring friction action for retention in support channel.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

E. All conduits, whether individual or grouped, shall be mounted as tight to structure as possible.

3.2 SUPPORT AND SEISMIC-RESTRAINT INSTALLATION

A. Comply with NECA 1 for installation requirements, except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Install seismic-restraint components using methods approved by the evaluation service providing required submittals for component.

D. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 Spring-tension clamps.
5. To Light Steel: Sheet metal screws.
6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and seismic criteria at Project.

B. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so expansion anchors will be a minimum of 10 bolt diameters from edge of the base.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of the base.
2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
6. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete.

3.5 INSTALLATION OF SEISMIC-RESTRAINT COMPONENTS

A. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Restraint Cables: Provide slack within maximums recommended by manufacturer.

D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

3.6 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Make flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross expansion and seismic-control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to electrical equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.7 LIGHT FIXTURE

A. Installation:
1. Pendant fixtures: In addition to the normal chain or conduit or cable mounting, each pendant fixture shall have one zinc coated, high strength, steel rope cable with connections designed for cable service run between fixture and structure above.
2. Recessed lay-in type fluorescent fixtures shall be secured to the ceiling tee bar by running a self-tapping screw through the vertical part of the tee bar main runners only and the fixture at each of the four corners of the fixture. In addition, support the fixture from the structure above with two 12 gauge steel wires attached to the fixture at diagonally opposite corners.
3. Surface and wall mounted fixtures shall be secured with a minimum of four bolts or screws.
   Do not use clips or fasteners. The bolts or screws shall be run through or into a structural member, slab, stud or other support added for this purpose. Do not secure or support the weight of the fixtures from gypboard on walls or any ceiling material. Fixtures attached to ceiling tees shall be attached to the main runners

only with at least two positive clamping devices. Rotational spring catches or other clips shall not be used. A 12 gauge steel wire shall be attached to each clamping device and to the structure above. Chain hangers shall be secured to the fixture and the structure with screws or bolts. Do not use clips or fasteners.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing: Test pullout resistance of seismic anchorage devices.
   1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
   2. Schedule test with Owner, through Designer, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
   3. Obtain Designer’s approval before transmitting test loads to structure. Provide temporary load-spreading members.
   4. Test at least four of each type and size of installed anchors and fasteners selected by Designer.
   5. Test to 90 percent of rated proof load of device.
   6. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Record test results.

END OF SECTION

CONSTRUCTION DRAWINGS

PACKAGED UNIT REPLACEMENT

GERMANTOWN ECONOMIC DEVELOPMENT BUILDING
CITY OF GERMANTOWN
1920 SOUTH GERMANTOWN ROAD
GERMANTOWN, TN 38138

CONSTRUCTION DOCUMENTS

SEPTEMBER 2, 2020

BOARD OF MAYOR AND ALDERMAN
Mike Palazzolo - Mayor
Scott Sanders - Alderman
Mary Anne Gibson - Alderman
Dean Massey - Alderman
Forrest Owens - Alderman
Rocky Janda - Alderman

_____CITY ADMINISTRATOR
Patrick Lawton

HNA ENGINEERING

11880 CRANSTON DR. STE. 104
ARLINGTON, TN 38002
WWW.HNAENGINEERING.COM

SHEET LIST

M001	LEGENDS, NOTES - MECHANICAL
M101	FLOOR PLANS - MECHANICAL
M201	DETAILS AND SCHEDULES - MECHANICAL
E001	SCHEDULES & LEGENDS - ELECTRICAL
E101	FLOOR PLAN - ELECTRICAL

CODE INFORMATION

2015 INTERNATIONAL BUILDING CODE WITH LOCAL AMENDMENTS
2015 INTERNATIONAL EXISTING BUILDING CODE WITH LOCAL AMENDMENTS
2015 INTERNATIONAL MECHANICAL CODE WITH LOCAL AMENDMENTS
2015 INTERNATIONAL GAS CODE WITH LOCAL AMENDMENTS
2015 INTERNATIONAL PLUMBING CODE WITH LOCAL AMENDMENTS
2012 NATIONAL ELECTRIC CODE WITH LOCAL AMENDMENTS
2015 INTERNATIONAL ENERGY CONSERVATION CODE WITH LOCAL AMENDMENT

SCOPE OF WORK

Work includes all necessary mechanical and electrical work required to remove the existing packaged unit and installing the new packaged unit.

SUPPLY DUCT IN SECTION

RETURN DUCT IN SECTION

MANUAL ISOLATION VALVE

MOTORIZED VALVE

STRAINER

E-STOP BUTTON

UNION

CONNECT NEW TO EXISTING

NEW WORK

EXISTING WORK TO BE REMOVED

EXISTING WORK TO REMAIN

-1E	INDICATES EXISTING EQUIPMENT
CD	CONDENSATE
P-1	HYDRONIC PUMP
B-1	GAS-FIRED HOT WATER BOILER
HWS	HOT WATER SUPPLY
HWR	HOT WATER RETURN
PKU-1	PACKAGED UNIT
MOCP	MINIMUM OVERCURRENT PROTECTION
MCA	MINIMUM CIRCUIT AMPS
EST	ESTIMATED
MAX	MAXIMUM
MIN	MINIMUM
ENT	ENTERING
LVG	LEAVING
DN	DOWN
AFF	ABOVE FINISHED FLOOR
TYP	TYPICAL

1 LEGEND - MECHANICAL

□OT TO □C□LE

1. PROVIDE LABOR AND FURNISH AND INSTALL ALL NECESSARY MATERIALS FOR A COMPLETE SYSTEM. ANY APPLIANCES OR MATERIALS OBVIOUSLY A PART OF THE SYSTEM AND NECESSARY FOR ITS PROPER OPERATION, ALTHOUGH NOT SPECIFICALLY MENTIONED HEREIN, SHALL BE FURNISHED AND INSTALLED AS IF CALLED FOR IN DETAIL.
2. WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH ALL STATE AND LOCAL CODES.
3. ATTAIN AND PAY FOR ALL REQUIRED PERMITS AND FEES.
4. DRAWINGS ARE GENERALLY DIAGRAMMATIC AND DO NOT NECESSARILY SHOW FITTING AND DETAIL. INSTALL DUCTS, EQUIPMENT, PIPING, ETC., IN A NEAT WORKMANLIKE MANNER, AND IN ACCORDANCE WITH GOOD PRACTICE FOR A COMPLETE WORKABLE INSTALLATION. AVOID CONFLICT WITH OTHER WORK; MAKE ADEQUATE PROVISIONS FOR PREVENTING NOISE AND VIBRATION. ARRANGE EQUIPMENT INTO THE AVAILABLE SPACE IN A MANNER TO MAKE ALL WORKING PARTS ACCESSIBLE FOR MAINTENANCE AND SERVICE.
5. MATERIALS AND WORKMANSHIP SHALL BE GUARANTEED AGAINST DEFECTS FOR ONE YEAR.
6. PROTECT ALL MATERIALS AND EQUIPMENT FROM DAMAGE.
7. CONTRACTOR SHALL FURNISH TESTING & BALANCING REPORT TO ENGINEER & OWNER PRIOR TO FINAL INSPECTION TO VERIFY REQUIRED PERFORMANCE HAS ACHIEVED.
8. HVAC WORK INDICATED DIAGRAMATICALLY, EXACT LOCATION OF ALL COMPONENTS ARE TO BE DETERMINED IN THE FIELD AND BY THE ACTUAL BUILDING CONDITIONS.
9. ALL WORK SHALL BE COORDINATED WITH ALL OTHER TRADES BEFORE ANY INSTALLATION IS MADE.
10. ALL EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH STATE CODES, MANUFACTURER'S APPROVED PUBLISHED LITERATURE, AND AUTHORITIES HAVING JURISDICTION. LITERATURE SHALL BE KEPT ON JOB SITE AT ALL TIMES.
11. INSTALLATION OF ALL EQUIPMENT SHALL PERMIT ACCESSIBILITY FOR SERVICE AND/OR REPLACEMENT.
12. COORDINATE VOLTAGE AND PHASE OF EACH PIECE OF EQUIPMENT WITH ELECTRICAL CONTRACTOR BEFORE ORDERING.
13. ALL MISCELLANEOUS STRUCTURAL SUPPORTS REQUIRED FOR HVAC EQUIPMENT INSTALLATIONS SHALL BE PROVIDED BY HVAC CONTRACTOR.
14. COMPLETION AND TESTS SHALL INCLUDE CLEANING AND LUBRICATION OF ALL EQUIPMENT, AND ADJUSTMENTS FOR PROPER OPERATION. ADJUST DAMPERS, REGISTERS AND DIFFUSERS FOR PROPER AIR DISTRIBUTION. CHECK SYSTEM UNDER ACTUAL OPERATING CONDITIONS AND MAKE ADJUSTMENTS FOR A UNIFORM TEMPERATURE THROUGH THE CONDITIONED SPACE.
15. LOCATIONS SHOWN FOR EQUIPMENT ARE APPROXIMATE LOCATIONS. CONTRACTOR SHALL COORDINATE WITH THE FIELD CONDITIONS FOR THE EXACT LOCATION AND MODIFY DUCTS/PIPES ACCORDINGLY.
16. ALL EXTERIOR WALL AND ROOF PENETRATIONS SHALL BE SEALED WATERPROOF.
17. PROVIDE FIRESTOP WHERE PIPES, CONDUITS, BUS DUCTS, WIRES, DUCTS, AND SIMILAR BUILDING SERVICE EQUIPMENT PENETRATING RATED FLOORS AND WALLS.
18. ALL CEILING EQUIPMENT SHALL BE INSTALLED IN SUCH A WAY THAT LIGHTS, PIPING, AND DUCTWORK DO NOT BLOCK ACCESS TO UNITS AND RELATED ACCESSORIES.
19. ALL PIPING AND DUCTS IN FINISHED ROOMS OR SPACES SHALL BE CONCEALED IN CHASES OR ABOVE SUSPENDED CEILINGS UNLESS OTHERWISE NOTED.
20. ACCESS PANELS IN SUSPENDED CEILINGS ARE REQUIRED FOR ALL VALVES, DAMPERS, CONTROLS, ETC., AND SHALL BE FURNISHED AND INSTALLED UNDER ARCHITECTURAL SPECIFICATIONS.
21. VERIFY LOCATION OF NEW EQUIPMENT AND APPURTENANCES.
22. COORDINATE THE HEATING, VENTILATION, AND AIR CONDITIONING WORK WITH THE WORK OF ALL OTHER TRADES INVOLVED WITH THIS PROJECT.
23. DUCTWORK DIMENSIONS ARE INSIDE CLEAR DIMENSIONS.
24. PROVIDE A MINIMUM OF 7 DAYS NOTICE TO THE OWNER PRIOR TO SHUT-DOWN OF ANY MECHANICAL OR PLUMBING SYSTEMS.

2 SEISMIC NOTES - MECHANICAL

□OT TO □C□LE

1. REFER TO 2015 INTERNATIONAL BUILDING CODE.
2. SEISMIC RESTRAINTS SHALL NOT BE REQUIRED FOR THE FOLLOWING INSTALLATIONS:
   - A. PIPING IN MECHANICAL ROOMS (EXCEPT GAS PIPING) LESS THAN 1-1⁄4 INCH INSIDE DIAMETER
   - B. ALL OTHER PIPING (EXCEPT GAS PIPING) LESS THAN 2-1⁄2 INCH INSIDE DIAMETER.
   - C. ALL RECTANGULAR DUCTS LESS THAN 6 SQ. FT. IN CROSS-SECTIONAL AREA.
   - D. ALL ROUND DUCTS LESS THAN 28 INCHES IN DIAMETER.
   - E. ALL PIPING SUSPENDED BY INDIVIDUAL HANGERS 12 INCHES OR LESS IN LENGTH FROM THE TOP OF THE PIPE TO THE BOTTOM OF THE SUPPORT FOR THE HANGER.
   - F. ALL DUCTS SUSPENDED BY HANGERS 12 INCHES OR LESS IN LENGTH FROM THE TOP OF THE DUCT TO THE BOTTOM OF THE SUPPORT FOR THE HANGER.

3 NOTES - MECHANICAL

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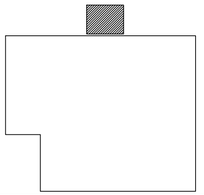

Project
PACKAGED UNIT REPLACEMENT
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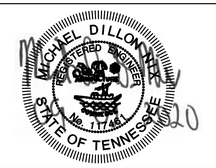
1920 SOUTH GERMANTOWN ROAD
GERMANTOWN, TN 38138

Sheet Name
LEGEND, NOTES - MECHANICAL



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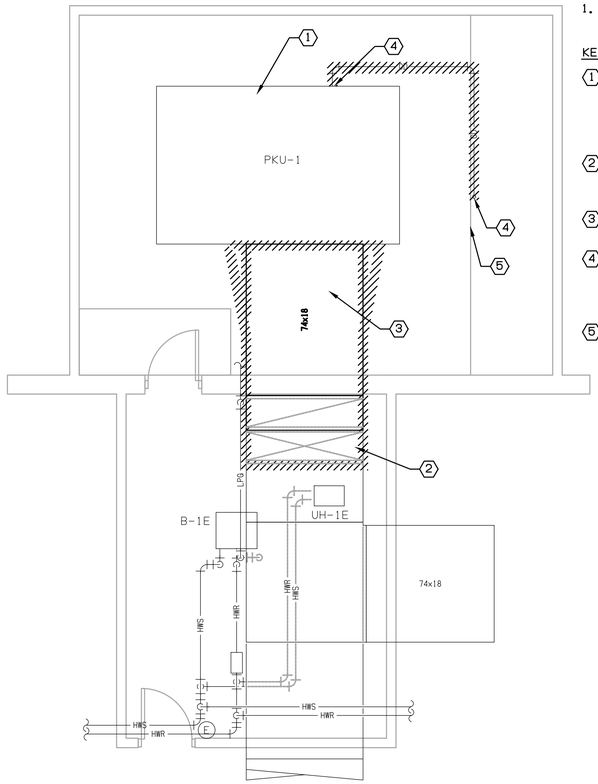


GENERAL NOTES:

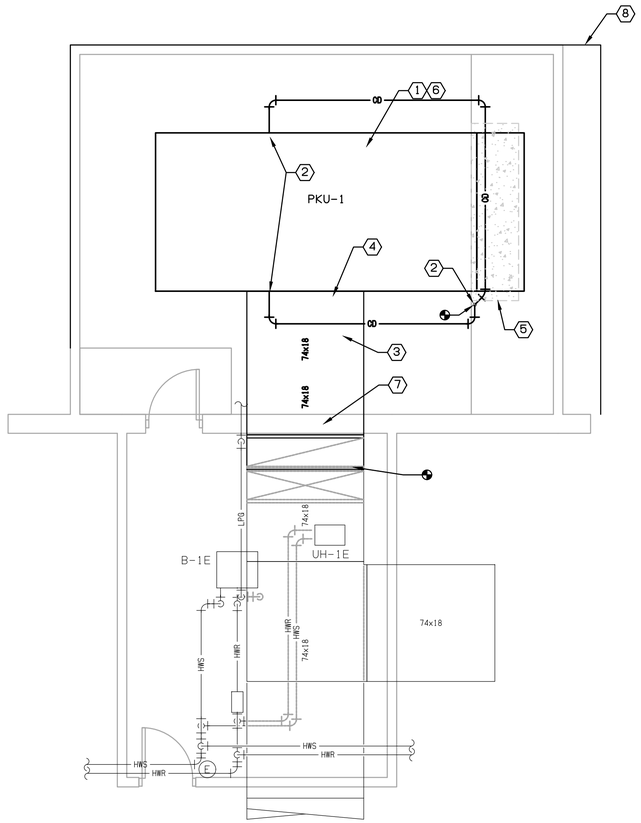
1. PRIOR TO DEMOLITION MEASURE SA, RA, AND OA CFMS AT PKU-1.

KEY NOTES:

1. REMOVE EXISTING PKU AS INDICATED. REMOVE ALL RELATED PIPING, DUCTS, ELECTRICAL, CONTROLS, ETC. AS REQUIRED FOR REMOVAL OF EXISTING UNIT AND INSTALLATION OF NEW UNIT.
2. REMOVE EXISTING SAD AND RAD FROM EXISTING UNIT LOCATION BACK INTO BUILDING WHERE DUCTS TURN UP.
3. REMOVE EXISTING METAL GRATE OVER TOP OF DUCTS.
4. REMOVE EXISTING CD PIPING FROM UNIT CONNECTION BACK TO CONNECTION AT STUB UP FROM PIPING BELOW GRADE. REMOVE STUB UP DOWN TO BELOW GRADE.
5. REMOVE PORTION OF METAL GRATE FOR INSTALLATION OF NEW CONCRETE. SEE 2/M101 FOR MORE INFORMATION.

1 DEMO FLOOR PLAN - MECHANICAL

1/4" = 1'-0"



GENERAL NOTES:

1. COORDINATE EXACT LOCATION OF ALL NEW WORK WITH ALL EXISTING CONDITIONS. OFFSET/EXTEND NEW WORK AS REQUIRED TO AVOID CONFLICTS WITH EXISTING CONDITIONS.
2. UNDER ALTERNATE #1, REMOVE EXISTING FENCE AND INSTALL NEW AS SHOWN. PROVIDE 4x4 TREATED WOOD POSTS AT 8'-0" ON CENTER, CEDAR WOOD PICKETS, TREATED 2x4 RUNNERS (1 AT TOP, 1 AT MIDDLE, 1 AT BOTTOM), AND 2x8 CEDAR WOOD TOP CAP. SET POSTS IN FOOTING. FOOTING SHALL BE 18" IN DIAMETER AND 3'-0" DEEP WITH 4000 PSI CONCRETE.

KEY NOTES:

1. INSTALL NEW PKU ON NEW 24" HIGH PLENUM CURB.
2. CONNECT NEW 1" CD PIPING TO UNIT CD CONNECTION. ROUTE 1-1/2" TO NEW STUB UP FROM BELOW GRADE PIPING. EXTEND EXISTING PIPING BELOW GRADE TO NEW LOCATION AS SHOWN. INSTALL NEW DEEP SEAL TRAP BELOW GRADE.
3. INSTALL NEW METAL GRATE WALK PLATFORM OVER NEW DUCTS. PAINT METAL FLAT BLACK.
4. ROUTE NEW SAD AND RAD FROM PLENUM CURB THRU EXISTING WALL TO EXISTING SAD AND RAD IN MECHANICAL ROOM. REPAIR EXTERIOR WALL TO MATCH EXISTING CONDITIONS. PENETRATIONS SHALL BE SEALED WEATHER TIGHT. ALL NEW EXTERIOR DUCTS SHALL BE INSULATED WITH A MINIMUM R-8 INSULATION AND WRAPPED WITH ALUMINUM JACKET.
5. NEW CONCRETE FOR UNIT SUPPORT.
6. INSTALL NEW CONTROLLER IN UNIT FOR CONNECTION TO EXISTING DELTA CONTROLS SYSTEM.
7. REPAIR WALL AS REQUIRED TO MATCH EXISTING CONDITIONS AND MAKE WEATHER-TIGHT.
8. OUTLINE OF NEW FENCE.

2 FLOOR PLAN - MECHANICAL

1/4" = 1'-0"

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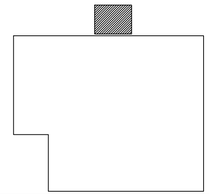

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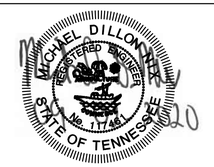
FLOOR PLAN - MECHANICAL



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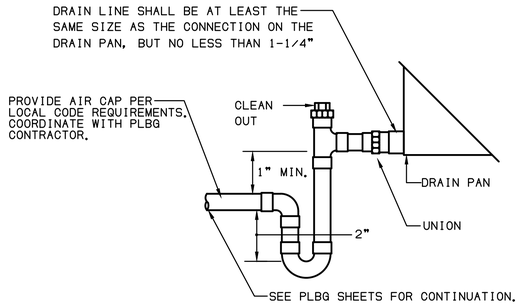

1 CONDENSATE DRAIN TRAP DETAIL

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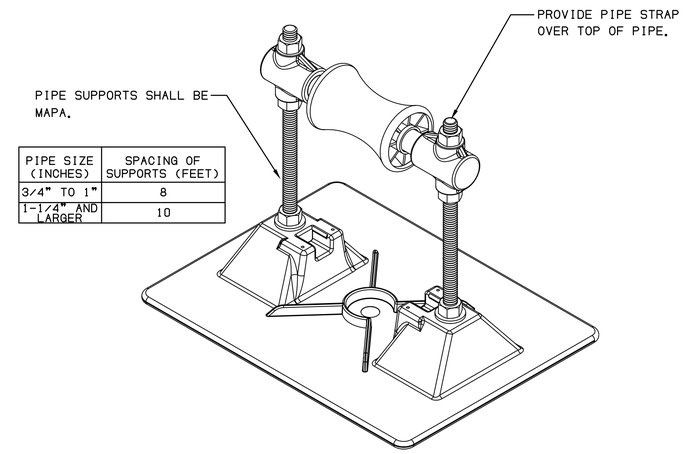

PIPE SIZE (INCHES)	SPACING OF SUPPORTS (FEET)
3/4" TO 1"	8
1-1/4" AND LARGER	10

2 PIPING SUPPORT DETAIL

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PACKAGED UNIT SCHEDULE

GENERAL DATA					ELECTRICAL DATA					DX COOLING COIL DATA					COMMENTS
MARK	SA CFM	OSA CFM	EXT SP IN. WG	SEER/EER	SUPPLY MOTOR HP	EXHAUST MOTOR HP	MCA	MOCP	VOLTS/ PHASE	REFRIGERANT	ENT AIR TEMP °Fdb	ENT AIR TEMP °Fwb	SENSIBLE BTU/HR	TOTAL BTU/HR	
PKU-1	13,580	980	3.0	10.3 EER	20	10	122	125	460/3	R-410A	80	67	346,020	300,620	1 2

1. PKU TO BE AAON RN-040-3-0-BB04 OR EQUAL BY TRANE OR DAIKIN. PROVIDE FACTORY INSTALLED TERMINAL BLOCKS FOR FIELD INSTALLED DELTA CONTROLS PACKAGE, SINGLE POINT ELECTRICAL CONNECTION, 24" HIGH PLENUM CURB, INTEGRAL DISCONNECT, 0-100% DUAL ENTHALPY ECONOMIZER WITH POWERED EXHAUST WITH VFD AND SHAFT GROUNDING RING, BUILDING MULTI-ZONE VAV, SUPPLY FAN VFD WITH BYPASS AND SHAFT GROUNDING RING, HOT GAS BYPASS LEAD STAGE, 4 STAGES OF COOLING, VFD CONDENSER FAN FOR HEAD PRESSURE CONTROL, PHASE AND BROWN OUT PROTECTION, STAINLESS STEEL DRAIN PANS, HAIL GUARDS, HINGED ACCESS DOORS, AND CONDESATE LEVEL MONITORING DEVICE.
2. ELECTRICAL CONTRACTOR TO PROVIDE AND WIRE SUPPLY AND RETURN DUCT SMOKE DETECTORS. WIRING SHALL INCLUDE, BUT NOT LIMITED TO WIRING BETWEEN DETECTOR AND UNIT AND WIRING BETWEEN DETECTOR AND FIRE ALARM PANEL. MECHANICAL CONTRACTOR TO MOUNT DETECTORS.

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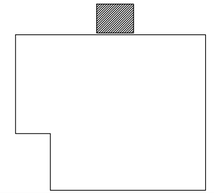

Project
PACKAGED UNIT REPLACEMENT GERMANTOWN ECONOMIC DEVELOPMENT BUILDING

1920 SOUTH GERMANTOWN ROAD
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Sheet Name
DETAILS AND SCHEDULES - MECHANICAL

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RECEPTACLE SCHEDULE

CALLOUT	SYMBOL	VOLTS	NOTE 1	NOTE 2	NOTE 3
Duplex Outlet–GFCI/WP	⊖	120V 1P 2W	GFCI PROTECTED DUPLEX RECEPTACLE, MTD AT 18" AFF TO BOTTOM, UOI	PROVIDE HEAVY DUTY, LOCKABLE, WHILE–IN–USE COVER	IF OUTLET IS NOT EASILY ACCESSIBLE, PROVIDE GFCI BREAKER

DEVICE NOTE

1. ALL SWITCHES, RECEPTACLES, DEVICES, AND FACEPLATE FINISHES ARE TO BE COORDINATED WITH OWNER/ARCHITECT.

EQUIPMENT SCHEDULE

CALLOUT	SYMBOL	VOLTS	AMPS	KVA	HP	CIRCUIT	CUSTOM PANEL DESCRIPTION
PKU–1	⊛	480V 3P 3W	122	101.43		EX. MDP–1,3,5	PACKAGED UNIT 1

SYMBOL LEGEND

Existing Conditions		DEVICE, FIXTURE, OR EQUIPMENT TO BE DEMOLISHED
Existing Conditions	– – – –	DASHED DEVICE OR LIGHT FIXTURE INDICATES EXISTING TO REMAIN, UOI.
Power		FEEDER RUN OVERHEAD – CONCEALED IN OR ABOVE CEILING IN WALL OR EXPOSED ON STRUCTURE – #12 COPPER CONDUCTORS IN 0.75"C CONDUIT, UOI. #10 INDICATES #10 AWG CU
Power		FEEDER RUN CONCEALED BELOW FLOOR, IN WALL OR BELOW GRADE
Power		INDICATES GROUNDING CONDUCTOR – #12 COPPER GROUNDING CONDUCTOR, UOI. #10 INDICATES #10 AWG CU
Power		PANELBOARD

ELECTRICAL SYMBOLS

- NONFUSED DISCONNECT SWITCH – SIZE AS INDICATED
- FUSED DISCONNECT SWITCH – SIZE AS INDICATED
- COMBINATION STARTER/DISCONNECT – SIZE AS INDICATED
- $ TOGGLE SWITCH
- ———— FEEDER/BRANCH RUN OVERHEAD – CONCEALED IN OR ABOVE CEILING, IN WALL, OR EXPOSED ON STRUCTURE
- – – – – – EMERGENCY, NIGHT LIGHT, OR FEEDER/BRANCH CONCEALED BELOW FLOOR, IN WALL, OR BELOW GRADE
- P-16 HOME RUN TO CIRCUIT PANEL, NEUTRAL/HOT/GROUND. #12 COPPER, UOI

ABBREVIATIONS

GC	GENERAL CONTRACTOR
EC	ELECTRICAL CONTRACTOR
MC	MECHANICAL CONTRACTOR
UOI	UNLESS OTHERWISE INDICATED
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
WP	WEATHERPROOF
a, b, c, etc.	DENOTES SWITCHING SCHEME
AFF	ABOVE FINISHED FLOOR
AC	MOUNT ABOVE COUNTER
MTD	MOUNTED
AFG	ABOVE FINISHED GRADE
BFG	BELOW FINISHED GRADE
SPD	SURGE PROTECTIVE DEVICE
STB	SHUNT TRIP BREAKER
EX	EXISTING
EP	EXPLOSION PROOF
OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED
FACP	FIRE ALARM CONTROL PANEL
FAA	FIRE ALARM ANNUNCIATOR PANEL

DRAWING LEGEND

DRAWING NO.	DESCRIPTION
E001	Legend & Schedules – Electrical
E101	Floor Plan – Demo & Mech Power

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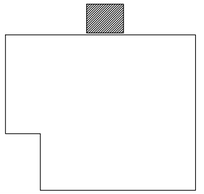

Project
PACKAGED UNIT REPLACEMENT GERMANTOWN ECONOMIC DEVELOPMENT BUILDING
1920 SOUTH GERMANTOWN ROAD
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Sheet Name
Schedules & Legends - Electrical

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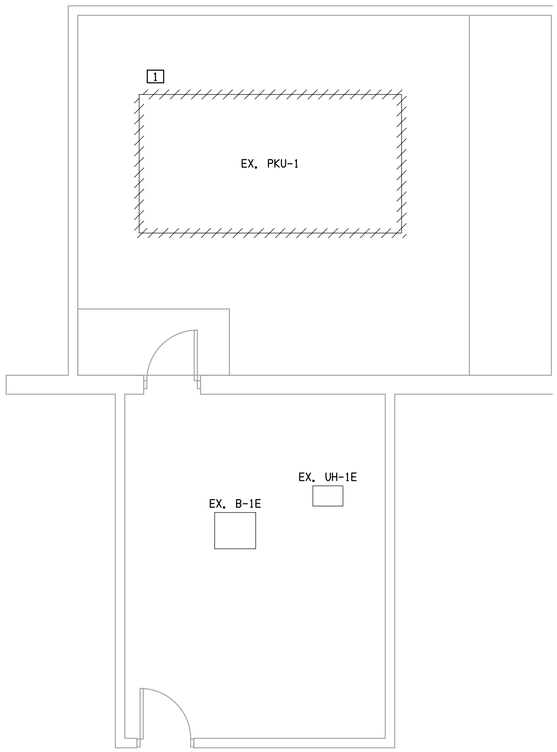
GENERAL DEMOLITION NOTES

1. CONTRACTOR TO VERIFY EXISTING CONDITIONS.
2. EC SHALL MAINTAIN ALL CIRCUIT CONTINUITY. EC SHALL COORDINATE ALL REQUIREMENTS OF MECHANICAL EQUIPMENT WITH MECHANICAL CONTRACTORS PRIOR TO ROUGH-IN.
3. CONTRACTOR SHALL SEAL ALL PENETRATIONS RESULTING FROM DEMOLISHED CONDUIT PENETRATIONS.

KEYED NOTES

1. CONTRACTOR SHALL DEMOLISH EXISTING 100A/3P BREAKER AND FEEDER FROM EX. MDP SERVING DEMOLISHED PKU-1.



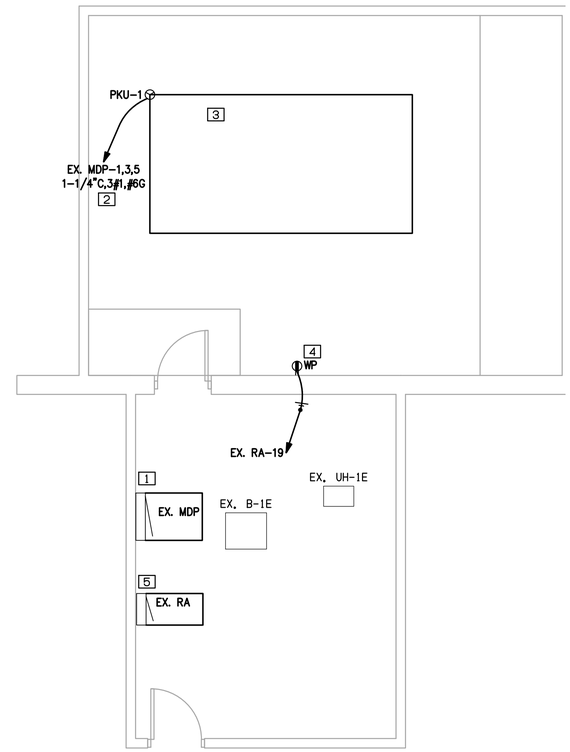
1 Demo Floor Plan - Mech. Power - Electrical
1/4"=1'-0"

POWER NOTES

1. CONTRACTOR SHALL PROVIDE ALL CONNECTIONS AS REQUIRED FOR ALL MECHANICAL EQUIPMENT. COORDINATE EXACT REQUIREMENTS PRIOR TO ROUGH-IN.
2. CONTRACTOR SHALL PROVIDE UPDATED, TYPE-WRITTEN PANEL SCHEDULES FOR ALL MODIFIED PANELS.

KEYED NOTES

1. CONTRACTOR SHALL PROVIDE NEW 125A BREAKER IN EXISTING WESTINGHOUSE PANELBOARD, "EX MDP".
2. FIELD COORDINATE EXACT ROUTING WITH OWNER FOR NEW FEEDER. SEAL ALL PENETRATIONS.
3. PROVIDE TWO DUCT MOUNTED SMOKE DETECTORS AND CONNECT TO FIRE ALARM SYSTEM. UNIT SHALL BE SHUTDOWN IN THE EVENT OF FIRE ALARM ACTIVATION. PROVIDE ALL EXPANSION AND PROGRAMMING TO OWNER'S EXISTING SIMPLEX SYSTEM AS REQUIRED.
4. CONTRACTOR SHALL PROVIDE NEW COURTESY OUTLET. FIELD COORDINATE EXACT LOCATION WITH OWNER.
5. CONTRACTOR SHALL PROVIDE NEW BREAKER IN EXISTING SQUARE D TYPE NQOD PANELBOARD.



2 Floor Plan - Mech. Power - Electrical
1/4"=1'-0"

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Sheet Name
Floor Plan - Electrical

JOSHUA D. HOLGREEN REGISTERED ENGINEER No. 113780 STATE OF TENNESSEE

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E101

PRIME CONTRACTOR NAME & ADDRESS

_____

_____

_____

License Number _____

Date of Expiration _____

Classification _____

SUBCONTRACTORS

ELECTRICAL:

Name _____

Address _____

City & State _____

Expiration Date _____

Classification _____

PLUMBING:

Name _____

Address _____

City & State _____

Expiration Date _____

Classification _____

HVAC:

Name _____

Address _____

City & State _____

Expiration Date _____

Classification _____

MASONRY:

Name _____

Address _____

City & State _____

Expiration Date _____

Classification _____

BID DUE

Date _____

Time _____

Project Name _____

ATTENTION: ALL CONTRACTORS

State law (Tennessee Code Annotated, Section 62-6-119) requires that the name, license number, expiration date thereof, and license classification of the contractors applying to bid for the prime contract and for the electrical plumbing, heating, ventilation and air conditioning contracts appear on the outside of the envelope containing the bid except when the bid is in an amount less than $25,000. Effective July 1, 2010, the amendment to Public Chapter 78 now requires the Masonry contractor to also be listed on the bid envelope, unless the portion is less than $100,000 (including materials and labor). Failure to include the aforesaid information on this envelope will result in your bid not being opened and disqualifying your bid from consideration.

CITY OF GERMANTOWN
Procurement Department
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