



CITY OF HOUSTON

INVITATION TO BID

Issued: November 26, 2008

Bid Opening:

Sealed bids, in duplicate, will be received by the City Secretary of the City of Houston, in the City Hall Annex, Public Level, 900 Bagby, Houston, Texas 77002 until **10:30 A.M. Thursday, December 18, 2008**, and all bids will be opened and publicly read in the City Council Chamber, City Hall Annex, Public Level, 900 Bagby at 11:00 A.M. on that date for the purchase of:

HVAC REPLACEMENT AT FIRE STATION No. 44

for

THE GENERAL SERVICES DEPARTMENT

Bid No. S50-C23095

NIGP Code: 910-36

Buyer:

Questions regarding this solicitation should be addressed to Arturo Lopez, Senior Procurement Specialist, at **832-393-8731** or e-mail to **arturo.lopez@cityofhouston.net**

Electronic Bidding:

In order to submit a bid for the items associated with this procurement, you must fill in the pricing information on the "PLACE BID" page.

Prebid Conference:

A Pre-Bid Conference will be held for all Prospective Bidders in the Strategic Purchasing Division, Concourse Level (Basement), Conference Room, #1 City Hall, 901 Bagby, at **10:00 a.m. on Wednesday, December 10, 2008**. The site visit will be scheduled at the pre-bid conference.

All Prospective Bidders are urged to be present. It is the bidder's responsibility to ensure that they have secured and thoroughly reviewed all aspects of the solicitation documents prior to the Pre-Bid Conference. Any revisions to be incorporated into this solicitation document arising from discussions before, during and subsequent to the Pre-Bid Conference will be confirmed in writing by Letter(s) of Clarification prior to the bid due date. Verbal responses will not otherwise alter the specifications, terms and conditions as stated herein.

Bidding forms, specifications, and all necessary information should be downloaded from the Internet at www.houstontx.gov/purchasing/index.html. By registering and downloading this solicitation document, all updates to this solicitation document will be automatically forwarded via e-mail to any registered bidders. This information may also be obtained from the Supplier Assistance Desk, Strategic Purchasing Division, 901 Bagby, Concourse Level, Houston, Texas 77002.

The place of the bid opening may be transferred in accordance with Paragraph (b), (5) of Section 15-3 of The Code of Ordinances, Houston, Texas. The bid-opening meeting may be rescheduled in accordance with Paragraph (b), (6) of said Section 15-3.

The City reserves the right to reject any or all bids, or to accept any bid or combination of bids deemed advantageous to it.

City employees are prohibited from bidding on this solicitation in accordance with the Code of Ordinances Section 15-1.

***CONTENTS:**

- A. OFFER
- B. SCOPE OF WORK/SPECIFICATIONS
- C. GENERAL, SUPPLEMENTARY CONDITIONS AND BOND FORMS

*NOTE 1: Actual page numbers for each section may change when the solicitation document is downloaded from the Internet or because of letters of clarification. Therefore, bidders must read the solicitation document in its entirety and comply with all the requirements set forth therein.

*NOTE 2: To be considered for award please submit the electronic bid form and the forms listed in section A, including the signature page, which must be signed by a company official authorized to bind the company and a 10% Bid Bond.

SECTION A



FORMAL ONE-TIME BID

HVAC REPLACEMENT AT FIRE STATION No. 44
for
THE GENERAL SERVICES DEPARTMENT
Bid No. S50-C23095
NIGP Code: 910-36

To The Honorable Mayor
and City Council Members
of the City of Houston, Texas (the "City"):

The undersigned hereby offers to provide services necessary for the **HVAC Replacement at Fire Station No. 44, located at 675 Maxey Rd**, F.O.B. destination point Houston, Texas, in accordance with the City's Specifications and General Terms & Conditions and/or samples/drawings provided herein. When issued by the City of Houston, Letters of Clarification shall automatically become part of this bid document and shall supersede any previous specifications or provisions in conflict with Letters of Clarification. It is the responsibility of the bidder to ensure that it has obtained all such letters. By submitting a bid on this project, bidder shall be deemed to have received all Letters of Clarification and to have incorporated them into the bid.

The City may accept this bid offer by issuance of a Notice of Award Letter and/or a Purchase Order at any time on or before the 120th day following the day this Official Bid Form is opened by the City. This offer shall be irrevocable for 120 days after bid opening or for 90 days after City Council awards the bid, whichever comes last, but this period may be extended by written agreement of the parties.

The City reserves the right to INCREASE quantities during the twelve-month period following the issuance of the first purchase order subject to agreement in writing by the Prime Contractor/Supplier to honor the same bid price.

The City reserves the option, after bids are opened, to adjust the quantities listed on the electronic bid form upward or downward, subject to the availability of funds, and/or make award (s) on a line item basis.

SECTION A

Documents/forms must be downloaded from the City's Website
<http://www.houstontx.gov/purchasing/index.html>

Additional Required Forms to be Included with this bid:

In addition to the electronic Bid Form and the Official Signature Page, the Forms listed in Table 1 **must be completed and submitted to the Office of the City Secretary on or before the date and time the bid is due:**

| Table 1 |
|------------------------------------|
| Affidavit of Ownership |
| Fair Campaign Ordinance |
| Statement of Residence |
| Conflict of Interest Questionnaire |
| 10% Bid Bond |
| Contractor References |

Table 2 lists other documents and forms that should be viewed/downloaded from the City's website, but are not required to be submitted with the bid. The City will request these forms, as applicable, to be completed and submitted to the City by the recommended/successful bidder:

| Table 2 |
|--------------------------------------|
| Daily Work Sheet |
| Drug Forms |
| Sub Contractor |
| EEOC |
| Construction Addendum |
| Construction Insurance |
| 2006 Building Construction Wage Rate |

Questions concerning the Bid should be submitted in writing to: City of Houston, Strategic Purchasing Division, 901 Bagby, Room B506, Houston, TX 77002, Attn: Arturo Lopez or via fax: 832-393-8759 or via email (preferred method) to arturo.lopez@cityofhouston.net no later than 4:00 PM, Friday, December 12, 2008.

PERMITS:

Successful Contractor shall be responsible for securing any and all permits for proposed work. Any fee charged for these permits should be the responsibility of the Contractor and not the City of Houston.

CITY BUILDING CODES:

All work performed or equipment installed shall be in strict accordance with the City of Houston Building Codes. The Contractor will immediately correct any deficiencies discovered during work or after completion. Failure to correct deficiencies will result in the City having corrections made at the Contractor's expense.

PERFORMANCE BOND and PAYMENT BOND:

The successful Contractor(s) shall be required to provide a Performance and Payment Bond in the total amount (100%) of the Contract if the award is in excess of \$25,000.00.

The Performance and/or Payment Bond shall be in the same form as that distributed by the City, and attached hereto, all duly executed by this bidder (as "Principal") and by an incorporated surety company licensed to do business in the State of Texas. If the amount of the bond is greater than \$100,000.00 the surety must hold a certificate of authority from the United States Secretary of the Treasury.

The Contractor(s) shall be required to provide a Performance and/or Payment Bond as outlined above, which will be delivered to the City Purchasing Agent of the City, on or before the tenth (10th) day following the day the bidder receives notice from the City.

BID BOND:

The Contractor shall be required to provide and submit with the bid a Bid Bond in the amount of 10% of the total amount bid by the Contractor. The Bid Bond shall be in the same form as that distributed by the City, and attached hereto, all duly executed by this Bidder (as "Principal") and by a corporate surety company licensed to do business in the State of Texas, and if the amount of the bond is greater than \$100,000.00 the surety must hold a certificate of authority from the United States Secretary of the Treasury, or a Cashier's or a Certified check in a like amount. Company or personal checks are not acceptable.

MAINTENANCE BOND:

The Contractor shall furnish a maintenance bond in the total (100%) bid amount in the form required by the City (samples attached). One bond, also referred to as the One Year Maintenance Bond, will be conditioned upon Contractor's repair, replacement or restoration of any work or any portion of the work which is found to be defective or fails in any way to comply strictly with this contract or the plans and specifications for such work within a period of one (1) year from the date of acceptance of such work by the City Council or after the date that the "CO", or his designee in writing, determines, in a written notice to the Contractor, to be the date upon which the project is both substantially complete and available for the full and beneficial occupancy or use of the City.

QUALITY AND WORKMANSHIP

The bidder must be able to demonstrate upon request that it has performed satisfactorily, services similar to the services specified herein. The bidder will provide records of warranty and repair services performed for others upon request. The City of Houston shall be the sole judge whether the services performed are similar to the scope of services specified herein.

CONTRACTOR'S QUESTIONNAIRE

In order to receive bid award consideration, the bidder must be able to demonstrate that they are currently providing or have had at least one contract, for **HVAC Replacement Services** that is similar in size and scope to this contract. **Bidder must have references documenting that it has performed HVAC Replacement Services.** The reference(s) should be included in the space provided below. Please attach another piece of paper if necessary. If references are not included with the bid, the bidder shall be required to provide such references to the City of Houston within five working days from receipt of a written request from the City of Houston to do so. **Bidder's capability and experience shall be a factor in determining the Contractor's responsibility.**

1. Business Name: _____
Business Address: _____
City, State, Zip: _____
Name of Owner/Contact Person: _____
Phone: _____ Fax: _____ Email: _____
No. of Years providing Service to this business: _____

2. Business Name: _____
Business Address: _____
City, State, Zip: _____
Name of Owner/Contact Person: _____
Phone: _____ Fax: _____ Email: _____
No. of Years providing Service to this business: _____

3. Business Name: _____
Business Address: _____
City, State, Zip: _____
Name of Owner/Contact Person: _____
Phone: _____ Fax: _____ Email: _____
No. of Years providing Service to this business: _____

4. Business Name: _____
Business Address: _____
City, State, Zip: _____
Name of Owner/Contact Person: _____
Phone: _____ Fax: _____ Email: _____
No. of Years providing Service to this business: _____

SITE INSPECTION

The City of Houston reserves the right to inspect the bidder's current place of business to evaluate equipment condition and capabilities, staff experience, training and capabilities, and storage capabilities as they relate to the performance of this contract.

**SECTION B
SCOPE OF WORK**

- 1.0 General
 - 1.1 The Contractor shall provide all materials, labor, equipment, transportation, insurance, permits, bonds and other services necessary to provide two single package A/C units with electric cooling and gas heating (5-ton and 10-ton each) at Fire Station No. 44, located at 675 Maxey Rd.
 - 1.2 Units shall be installed on the concrete slab on the ground with horizontal discharge;
 - 1.3 Provide all new ductwork, ductwork insulation, air devices, fans and all accessories and controls as indicated on the drawings and specifications.
 - 1.4 Work shall result in a complete ready-to-use system.
 - 1.5 All work performed by the Contractor shall be in accordance with the latest City of Houston Building, Electrical, Plumbing Codes and other related City of Houston Standard Construction Specifications. In the event that more than one Code or standard addresses a construction issue, the most stringent requirement shall prevail. It is the responsibility of the Contractor to obtain and pay for all necessary permits.
- 2.0 Performance Time
 - 2.1 The Contractor shall have **30 calendar days** to complete all work associated with and required by the contract.

3.0 Division 15 – Mechanical Specifications 15000-1

| SECTION | DESCRIPTION | PAGE NUMBER |
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DIVISION 15 — MECHANICAL

4.0 Section 15010 — BASIC MECHANICAL AND PLUMBING REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Mechanical Plans and Specifications, are part of the project documents. Failure to comply shall NOT relieve Contractor of responsibility or be used as basis for additional compensation due to omission of Engineer of Record.

1.2 WORK INCLUDED

- 1.2.1 Refer to Mechanical plans for the complete scope of the Project.
- 1.2.2 Scope of work under the Mechanical Sections of specifications shall include systems as shown on drawings and as specified herein. Contractors shall provide supervision, labor, materials, equipment, machinery, plant, and items necessary to complete Mechanical systems. Items of equipment may be specified in singular; however, contractors shall provide number of items of equipment as indicated on drawings, and as required for complete systems. Work shall include all attendant accessories, etc. necessary to deliver complete and satisfactory operating systems acceptable to the Engineer of Records.
- 1.2.3 These specifications define the scope of work of the Mechanical Subcontractors for the guidance of the Prime Contractor to coordinate and be responsible for the work of all Subcontractors on the project, to furnish to the Owner a complete project.
- 1.2.4 If additional details or special conditions are required, it is the responsibility of Contractor to furnish same, as well as provide material and equipment usually furnished with such systems or required to complete installation, whether mentioned or not.
- 1.2.5. Indication on the drawings or mention in the Construction Documents of articles, materials, tests, operations or methods require that the Contractor or his Subcontractors provide each item indicated or mentioned of the quality or subject to the qualifications noted; perform according to conditions stated for each operation, and provide, therefore, all necessary labor, equipment, services and designate the quality and type of materials or equipment to be furnished.

1.3 DEFINITIONS

- 1.3.1 "As Directed": Wherever phrase "as directed" is used, it means "as directed by Engineer of Record or his authorized representative.
- 1.3.2 "Bidder": The bidder shall mean the same as "Contractor" for these specifications.

- 1.3.2 "By G.C.": Wherever word "General Contractor" or "G.C." is used, it means the Prime Contractor for the project. Any special feature or knowledge should be coordinated with him.
- 1.3.3 "Contractor": Wherever word "Contractor" is used, it means respective Plumbing, Heating, Ventilating and Air Conditioning, Systems or Fire Protection Contractor.
- 1.3.4 "Not in Contract": Items indicated on Drawings as "NIC" or noted "Not in Contract", are shown for convenience only and are not part of the Contractor's work unless specifically indicated.
- 1.3.5 "Owner": The term "Owner" herein refers to the individual or organization entering into a written contract for construction of the project and execution of the work defined by the plans and specifications.
- 1.3.6 "Provide": Wherever the word "provide" is used, it means "furnish and install, complete and ready for use."
- 1.3.7 "Subcontractor": See "Contractor".
- 1.3.8 Approval - written authority to proceed from the Engineer of Record

1.4 CONTRACTORS QUALIFICATIONS

- 1.4.1 The Contractor and his Subcontractors shall be experienced and qualified Contractors, in the field of heating, ventilating, air conditioning, and plumbing systems.
- 1.4.2 The owner specifically reserves the right to reject any Contractor who has previously failed to perform properly, or complete in a reasonable time, a contract of similar nature, or who has not paid his bills, or otherwise disregarded his obligations to subcontractors, material, supplier and/or employees.
- 1.4.3 The Contractor shall have had for a minimum of 5 consecutive years, the following:
 - 1.4.3.1 The contractor and subcontractors shall have a minimum of 5 years of experience in their fields and must present a list of minimum 5 similar projects completed by their company.
 - 1.4.3.2 A permanent place of business.
 - 1.4.3.3 Adequate personnel and equipment to do the work properly and expeditiously.
 - 1.4.3.4 A suitable financial status to meet the obligations incident to the work.
 - 1.4.3.5 Competent technical experience in plumbing, air conditioning, heating, and ventilating installation and service.
 - 1.4.3.6 The Contractor shall note in his quotation any and all exceptions to this Specification; failure to do so on any point will be interpreted as being in full compliance herewith.
 - 1.4.3.7 The owner reserves the right to reject any or all bids or to accept any bid considered advantageous. The owner also reserves the

right to waive any or all bid formalities.

1.5 SITE VISIT AND FAMILIARIZATION

1.5.1 The Contractor shall be familiar with the plans and specifications and shall have examined the premises and understand the conditions under which he will be obligated to operate in performing the contract.

1.6 GUARANTEE AND MAINTENANCE

1.6.1 Guarantee: The Contractor shall guarantee work as installed by him for a period of one (1) year after substantial completion date; said guarantee to require the Contractor to furnish all necessary materials and labor to replace any defective materials or workmanship without cost to the owner. Date of substantial completion shall be made a matter of written record by the Engineer of Record. When the manufacturer offers an extended warranty for an item or system, this warranty shall be transferred to or written in the name of the owner.

1.7 WORKMANSHIP

1.7.1 All work shall be executed by none but skilled mechanics, and be first class and complete in both effectiveness and appearance whether finally concealed or exposed.

1.7.2 Work shall conform to requirements, rules, regulations and ordinances of the local codes, Harris County, City of Houston and other authorities having jurisdiction, and with the standards promulgated pursuant to the Latest Edition of Federal Occupational, Safety and Health Act, whether shown on drawings or not and shall be completed to the entire satisfaction of the Engineer of Record. In cases where alterations to and/or deviations from specifications and accompanying drawings are required by said authority, the Contractor shall report same to the Engineer of Record, and secure approval in writing before work is started. In cases where requirements of specifications and accompanying drawings are in excess of Code and other similar requirements, the specifications and drawings shall govern.

1.7.3 The work shall comply with the latest adopted standards of local codes, amendments, ordinances and the American Society of Mechanical Engineers, the National Board of Fire Underwriters, the latest edition of National Electrical Code, and standards of ASHRAE and SMACNA.

1.8 DISCREPANCIES

1.8.1 Clarification shall be obtained from the Engineer of Record for the work under Division 15 as to discrepancies or omissions from the Contract documents, or questions as to the intent thereof.

1.8.2 Consideration will not be granted for misunderstanding of the amount of work to be performed. Tender of a proposal conveys full agreement of the items and conditions specified, shown, scheduled or required by the

nature of the project.

1.9 RELATED WORK SPECIFIED IN OTHER DIVISIONS

1.9.1 Painting of Equipment, Piping and Accessories: Finish painting will be performed under another Section. Priming coat for equipment and other items and/or materials subject to rust or corrosion shall be provided under Division 15.

1.10 DRAWINGS AND SPECIFICATIONS

1.10.1 The drawings are schematic in nature and indicate approximate locations of the various items of the systems except where specific locations are noted and dimensioned on the documents. These items are shown approximately to scale and attempt to show how these items should be integrated with building construction. Locate all the various items by on-the-job measurements, conformance with Contract Documents and cooperation with other trades.

1.10.2 When Mechanical drawings do not give exact details as to elevation of pipe, physically arrange the systems to fit the space available at elevations intended, with proper grades for functioning of systems involved. Piping is generally intended to be installed as high as possible against structure in a neat and workmanlike manner. Work shall be concealed in finished areas.

1.10.3 Should drawings disagree in themselves or with specifications, better quality or greater quantity work or materials shall be estimated upon, unless otherwise ordered by Engineer of Record, in writing. Figures given on drawings govern small scale drawings.

1.10.4 Exact locations of fixtures and equipment items shall be determined by references to general plans and to detail drawings, equipment drawings, rough-in drawings, certified construction drawings, etc. Minor relocations necessitated by conditions at the site or directed by the Engineer of Record shall be made without additional cost to the Owner.

1.10.5 Piping interferences shall be handled by giving precedence to pipe lines that require a stated grade for proper operation. Where space requirements conflict, contact the Engineer of Record.

1.11 SPECIFICATIONS

1.11.1 Titles to Divisions, Sections and Sub-Sections in these specification Contract Documents are introduced merely for convenience and shall not be taken as a correct, complete segregation of the several units of materials and labor. No responsibility, either direct or implied, is assumed by the Architect and/or Engineer for omissions or duplications by the Contractor or his Sub-Contractor due to real alleged error in arrangement of matters in these Documents.

1.12 REFERENCE IN AUTHORITY OF DOCUMENTS

1.12.1 In case the Specifications should not fully agree with drawings the better quality and or greater quantities of work shall be included in the bid. Figures given on Drawings govern scale measurements, and large scale details govern small scale drawings.

1.12.2 Explanatory notes in the Drawings shall be preferred to conflicting drawn out indications, if any. Where figures are lacking, scale measurements may be followed, but in all cases, the measurements are to be checked from the work in place. Should any variations be found, such must be referred to the Engineer of Record for instructions. Details or notes shown on the Drawings are typical for all similar conditions throughout the project.

1.12.3 Certified Construction Drawings of approved equipment and materials shall take precedence over catalog dimensions or sizes and shapes shown in these Documents. Certified Construction Drawings shall be the final authority in determining final installed conditions.

1.13 LAYING OUT WORK, MEASUREMENTS, LEVELS AND SURVEYS

1.13.1 Contractor shall base measurements, both horizontal and vertical, from established bench marks. Work shall agree with these established lines and levels. Verify measurements at the site and check corrections of the same as related to work, prior to fabrication of shop made items or ordering of factory-made items.

1.13.2 Before ordering any materials or doing any work, each Contractor shall verify all measurements at the building and shall be responsible for the correctness of the same. No extra charge or compensation will be allowed on account of differences between actual dimensions and the measurements indicated on the Drawings. Any differences that may be found shall be submitted to the Engineer of Record for consideration before proceeding with the work.

1.13.3 Should Contractor discover a discrepancy between actual measurements and those indicated, which prevents following good practice or intent of drawings and specifications, he shall notify the Engineer of Record and shall not proceed with work until he has received instructions from the Engineer of Record.

1.14 PERMITS, LICENSES, FEES, CODES & REFERENCES

1.14.1 Permits & Fees: Contractor shall give notices, apply for and obtain permits, licenses and pay fees, government sales taxes, and other costs, including utility connections or extensions in connection with his work. He shall file necessary plans, prepare documents and obtain necessary approvals of governmental departments having jurisdiction; obtain required certificates of inspection for his work, and deliver same to the Engineer of Record before request for acceptance and final payment.

1.14.2 Codes: All work shall be executed in accordance with the local, national

and state codes, ordinances and regulations governing the particular class of work involved. Should these specifications and the accompanying drawings conflict with code or ordinance requirements, the Contractor shall follow code or ordinance requirements only if such codes require a higher class of work than is outlined herein. On completion of the various portions of the work, the installation shall be tested by the constituted authorities and approved, and on final completion of the work, certificates of acceptance from the regulatory body under whose jurisdiction the work has been inspected shall be given to the Owner.

- 1.14.3 Contractor shall include, without extra cost to the Owner, any labor, materials, services, apparatus, or drawings, in order to comply with applicable codes, laws, ordinances, rules, and regulations whether or not shown on drawings and/or specified.
- 1.14.4 Materials furnished and work installed shall comply with National Fire Code of the NFPA; with requirements of local utility companies; and with requirements of governmental departments having jurisdiction.
- 1.14.5 Materials and equipment for electrical work shall bear approval label, or shall be listed by Underwriter's Laboratories.
- 1.14.6 References: In addition to state and local ordinances, the following industry standards apply, where applicable, except where requirements of the specifications are more stringent:
 - 1.14.6.1 AIEE - American Institute of Electrical Engineers.
 - 1.14.6.2 ASA - American Standard Association
 - 1.14.6.3 ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers
 - 1.14.6.4 ASME - American Society of Mechanical Engineers
 - 1.14.6.5 ASTM - American Society for Testing and Materials
 - 1.14.6.6 AWWA - American Water Works Association
 - 1.14.6.7 NEC - National Electrical Code
 - 1.14.6.8 NEMA - National Electrical Manufacturer's Association
 - 1.14.6.9 NFPA - National Fire Protection Association
 - 1.14.6.10 UL - Underwriter's Laboratories
 - 1.14.6.11 ANSI - American National Standards Institute
 - 1.14.6.12 ARI - American Refrigeration Institute
 - 1.14.6.13 MSS - Manufacturer's Standardization Society
 - 1.14.6.14 SMACNA - Sheet Metal and Air Conditioning Contractors' National Association

Where these standards have conflicting requirements, the more stringent requirement shall apply.

1.15 SUBSTITUTIONS AND DEVIATIONS

- 1.15.1 Intent of these specifications is to establish quality standards of material and equipment installed.
- 1.15.2 Substitutions: All materials, equipment, apparatus or products shall be new, unless noted otherwise, and of the quality indicated in the following

specifications. Where manufacturer's names are mentioned in the body of the specifications and/or included in a list of approved equipment, the products so mentioned have proved to be satisfactory under similar conditions of service and are the products acceptable for this installation except as outlined below.

- 1.15.3 It is not the Engineer of Record's intention to discriminate against any manufacturer or product, and any manufacturer desiring to submit his product for approval as an equal to that specified may do so by delivering a sample, or in the case of large equipment, a sample specification to the Engineer's office.
- 1.15.4 Naming of a manufacturer, brand or model number as part of the description of manufactured items shall be deemed to include any description or specifications of such item in that manufacturer's catalogs, advertisements or other representations. Should there be contradictions or variations in the manufacturer's literature currently available, the better quality or greater quantity of material or workmanship described shall be furnished under this contract.
- 1.15.5 Where two or more units of same type or class or equipment are required, provide units of a single manufacturer. Manufacturers' names and catalog numbers specified under sections of Divisions 15 and 16 are used to establish the minimum standard of design, performance, quality and serviceability.
- 1.15.6 The Engineer of Record will examine the data and samples so submitted and a written response will be issued. Only those products mentioned by name may be furnished in this project.
- 1.15.7 Where a substitute item alters the design or space requirements indicated on drawings, Contractor shall include items of cost for revised design and construction, including cost of allied trades involved.
- 1.15.8 Acceptance or rejection of proposed substitutions is subject to Engineer of Record approval. If the Engineer of Record and or Engineer so requests, Contractor shall submit samples of specified and substitute items for evaluation.
- 1.15.9 Where minor deviation requires a different quantity and arrangement of duct work, piping, wiring & conduit from that specified or indicated on drawings, Contractor shall provide such duct work, piping, structural supports & insulation, electrical wiring and conduit, and other additional equipment required by system at no additional cost to Owner.

1.16 MATERIALS AND EQUIPMENT

- 1.16.1 Materials, equipment and apparatus shall be new, unless noted otherwise, of first class quality, and shall be furnished, delivered, erected, connected, and finished in every detail, and shall be selected and arranged to fit properly into building spaces. Where no specific kind or quality is given, furnish a first-class standard article approved by the Engineer of Record.
- 1.16.2 Materials: Building materials, contractor's equipment, etc., may be stored on the premises but the placing of same shall be within the construction fence. When any room in the building is used as a shop, store room, etc., the one making use of such room will be held responsible for any repairs, patching, or cleaning arising from such use. Each subcontractor shall protect and be responsible for any damage to his work or material from the date of the agreement until the final payment is made, and will make good without cost to the Owner, any damage or loss that may occur during this period. The Contractor will handle all material as directed so that it may be inspected by the Engineer of Record's representative. All materials affected by the weather shall be covered and protected to keep them free from damage while they are being transported to the site as well as when they are stored on the site.
- 1.16.3 During the execution of the work, open ends of all piping and all openings in equipment shall be closed before leaving the work at anytime as to prevent the entrance of all foreign matter.
- 1.16.4 All drains shall be covered until placed in service to prevent the entrance of all foreign matter.
- 1.16.5 Each Contractor in performing his or her work shall take particular care not to damage the existing and new structure under construction. All finished floors, step treads and the Owner's equipment shall be covered to prevent any damage by workmen or their tools and equipment during the construction of the building. In addition, each Contractor shall protect any materials on the job site, whether a part of his contract or the property of another Contractor or the Owner.
- 1.16.6 Each Contractor shall be responsible for any damage done to the Owner's property or any adjacent property caused by activity in connection with his portion of the work. Any and all damages done to the building, building systems, or utilities shall be repaired to owner's satisfaction at no cost.
- 1.16.7 Equipment: Equipment installed on project shall have local representation, local factory- authorized service, and local stock or repair parts.
- 1.16.8 All mechanical and plumbing equipment shall be protected during the execution of the work.
- 1.16.9 Size of mechanical equipment shown on drawings is based on dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine if equipment he proposes to furnish will fit into the space. Shop drawings shall be prepared as required to indicate suitable arrangement.

- 1.16.10 Equipment shall be installed in a manner to permit access to all surfaces. Valves, motors, drives, lubrication devices, filters, panel boards, transformers, controller, disconnect switches and other accessory items shall be installed in a position to allow removal for service without disassembly of another part.
 - 1.16.11 The printed directions supplied by the manufacturer of each item of equipment shall be followed in the preparation, assembly, installation, erection, and cleaning of all manufactured equipment and/or materials, unless otherwise specified.
 - 1.16.12 Motor starters, other than those supplied as integral parts of equipment, will be furnished under Specification Division 16.
 - 1.16.13 Motors for driven equipment supplied under Division 15 shall be installed under Division 15.
 - 1.16.14 Motors shall have greased lubricated ball bearings, suitable mounting base, and connection boxes. Motors shall be Reliance, U.S. Motor, Baldor, or General Electric, and shall have a minimum of 1.15 service factor, and be so labeled.
 - 1.16.15 Motors shall be especially selected for quiet operation. Noisy operating motors shall be removed and replaced.
 - 1.16.16 Motors shall not be delivered to the job-site until ready to be installed.
 - 1.16.17 All motors shall be fully protected and kept dry during storage and after installation and prior to placing in service.
 - 1.16.18 Contractor shall not deliver, or receive, equipment at the job-site until ready for installation unless suitable protected space is provided to prevent weather or other damage.
- 1.17 FOUNDATIONS, SUPPORTS AND PIERS
- 1.17.1 Provide necessary foundations, supports, pads, bases and piers, as required and shown on drawings for equipment furnished under this contract.
 - 1.17.2 For equipment where foundations are indicated, refer to Structural drawings.
 - 1.17.3 Securely attach equipment to building in approved manner. Attachments shall be strong and durable and if not considered so by the Engineer of Record, shall be replaced as directed at no cost.
 - 1.17.4 When foundations or equipment supports are not detailed in these documents, Contractor shall provide equipment supports or foundation as recommended by the equipment manufacturer at no additional cost to owner.

1.18 OUTLET OPERATING AND VIBRATIONS

1.18.1 Systems shall operate under all load conditions without sound or vibration that is considered by the Engineer of Record to be objectionable. Sound or vibration exceeding universal standards either inside or outside a room where moving machine is installed, will be considered objectionable. Sound or vibration conditions shall be corrected by Contractor in an approved manner and/or by use of approved vibration eliminators, as recommended by the manufacturer, at Contractor's expense.

1.19 GENERAL AND SPECIAL CONDITIONS

1.19.1 In unfurnished spaces where pipe is exposed, install in a neat manner; install pipe lines to a continuous grade; install piping square to the building.

1.19.2 Be responsible for fitting equipment into the space assigned, or report to the Engineer of Record in writing prior to ordering of equipment. Failure to comply shall render Contractor liable for all expenses necessary to provide adequate space.

1.19.3 Provide minor details necessary for proper installation and operation as if herein specified or shown.

1.19.4 Each Contractor shall keep a competent superintendent or a foreman on the job at all times, and shall be fully responsible for the conduct and supervision of all work performed under his contract.

1.19.5 A periodic observation of the work by the Engineer of Record is only for the express purpose of verifying compliance with the contract documents. Such site visits by the Engineer of Record shall not be construed as construction supervision.

1.19.6 Each Contractor shall be solely responsible for providing a safe place for the performance of the work by his personnel and for taking safety precautions and/or providing safety appliances for his employees and for his Subcontractors.

1.20 COMPLETION SCHEDULE

1.20.1 The completion of this project and the acceptance and occupancy by the Owner within the time limits stipulated is an absolute necessity. Therefore, the Contractor shall carefully determine that all work, including delivery of materials and equipment to the job site, will permit compliance with the contractual deadline of completion.

- 1.20.2 Accessibility: Contractor is responsible for sufficiency of size of shafts and chases and adequate clearance in double partitions and hung ceilings, for proper installation of his work. Contractor shall cooperate with other Contractors working in the same space. Advise General Contractor of requirements and keep spaces and clearances to minimum sizes required.
- 1.20.3 Locate equipment that must be serviced, operated or maintained, in fully accessible positions. Equipment includes, but is not limited to, valves, clean outs, motors, controllers, and drain points. Furnish access doors if required. Minor deviations from drawings may be made to allow for better accessibility; however, changes must be approved by the Engineer of Record prior to installation.
- 1.20.4 Cooperation with Other Trades: Contractor shall give full cooperation to other trades. Where work will be installed in close proximity to, or will interfere with, work of other trades, Contractor shall assist in working out space conditions to make a satisfactory adjustment. Plan work sufficiently in advance of construction so conflicts can be ascertained and remedial procedures initiated. If adequate solutions can be reached by sleeving or casting into building members these methods shall be cleared with the Engineer of Record. If Contractor installs his work before coordinating with other trades, he or she shall make the necessary changes in his work to correct the condition without extra charge.
- 1.20.5 Contractor shall furnish, as required, necessary templates, patterns, setting plans, and shop details for proper installation of work and for purpose of coordinating adjacent work.

PART 2 – PRODUCTS

2.1 SHOP DRAWINGS AND PRODUCT DATA

- 2.1.1 Prior to commencement of installation of any equipment the Contractor shall submit copies of shop drawings and published engineering data. The copies shall be assembled in individual sets with the item being submitted indicated by the item number shown on drawings and/or specifications. Included shall be drawings and descriptive literature providing required dimensional, ratings and operational data on items tabulated below and all corrections in submission and resubmit if requested.
- 2.1.2 The Contractor shall be responsible for and bear any expense of alterations to the building or appurtenances resulting from the substitution of equipment to that specified in the Contract Documents.

2.1.3 Obtain, check, certify and submit complete shop drawings and brochures from Contractors, manufacturers, Suppliers, Vendors, etc., for all materials and equipment specified herein.

2.1.4 All shop drawings shall be checked by contractors for full compliance of plans and specifications. They shall be properly sealed, signed and dated by contractors before submitted to the Engineer of Record.

2.1.5 Shop drawings shall be submitted for the following items:

2.1.5.1 Single Package DX Unit

2.1.5.2 Fans

2.1.5.3 Air Devices

2.1.5.4 Insulation for Piping and Ductwork

2.1.5.5 Piping Systems, Valves, Fittings

2.1.5.6 Temperature Control systems

2.1.6 Any one group of similar equipment as described in the listings above must be the product of one manufacturer.

2.1.7 Approval of shop drawings does not release the Contractor from fully complying with all requirements of plans and specifications and providing satisfactorily operating mechanical and plumbing systems. Material and equipment shall be approved for final acceptance when construction is completed and all units and systems have been operated, tested, adjusted and balanced to the satisfaction of the Engineer. Should proposed approved alternate equipment involve rearrangement of designed equipment, a complete layout of the area involved shall be submitted by the Contractor, and shall be approved in writing before installation of any such items of equipment. Any additional expenses involved shall be a Contractor borne expense.

2.2 AS-BUILT DRAWINGS

2.2.1 The Contractor shall maintain a record set of black line prints at the project site which is dedicated to marking in "red" any variation in the work as compared to the general design drawings. This record set is to be carefully maintained and kept neat and clean and used for no other purpose.

2.2.2 The Contractor shall secure from the Engineer of Record a complete set of velum drawings of all heating, ventilating and air conditioning, and plumbing drawings, the cost of which shall be paid by the Contractor. At the conclusion of the work transfer all corrections on to the velum drawings using the marked in "red" record black line set and "cloud" all revisions so they are easily

identified.

- 2.2.3 The Contractor shall deliver the corrected reproducible drawings to the Engineer of Record upon completion of work. Final approval will not be given by the Engineer of Records until prints have been received by the Engineer of Records with all corrections made. The project will not be declared substantially complete until "As-Built" Drawings have been submitted and accepted by the Owner.

PART 3 – EXECUTION

3.1 IDENTIFICATION OF EQUIPMENT

- 3.1.1 Provide equipment nameplates on all items of heating, ventilating, air conditioning, and plumbing equipment. Nameplates shall include:
 - 3.1.1.1 Manufacturer's name, serial and model number.
 - 3.1.1.2 General engineering information.
 - 3.1.1.3 Electrical requirements.
- 3.1.2 The nameplates shall be attached to the equipment in conspicuous places with self-tapping stainless steel screws or contact adhesive where screws cannot be used. Prevent painting of name plates.

3.2 LUBRICATION, REFRIGERATION AND OIL

- 3.2.1 On completion of the job, and before any heating, ventilating, air conditioning, and plumbing equipment is put into operation, Contractor for this Section shall check and lubricate, but not over-lubricate, all bearings with high-grade oil or grease of type recommended by the equipment manufacturer.

3.3 OWNER'S MANUAL, SERVICE TOOLS

- 3.3.1 Prepare, in bound form and identified with lettering imprinted on the face of binder. Owner's Manual which shall consist of the following:
 - 3.3.1.1 Complete description of each item of equipment and apparatus furnished and installed under Division 15, including ratings, capacities and characteristics.
 - 3.3.1.2 Fully detailed, applicable parts lists, including all numbered parts, of each item of equipment and apparatus furnished and installed under Divisions 15 and 16.
 - 3.3.1.3 Manufacturers printed instructions describing operation, servicing and maintenance, and repair of each item of

equipment and apparatus.

- 3.3.1.4 Typewritten record of all tests made of materials, equipment and systems included under Division 15. Such records shall state the dates the tests were conducted, names of person(s) making and witnessing the tests, and citing unusual conditions relevant to the tests.
- 3.3.2 Owner's Manual be approved for content and format prior to final preparation. Submit (3) copies of Owner's Manual.
- 3.3.3 All tests shall have been made and approved and Owner's Manuals shall be complete, approved and delivered to the Owner's authorized representative prior to final acceptance of the work.
- 3.3.4 Provide and deliver to the owner any special tools required for maintenance of equipment and apparatus installed under Division 15.

3.4 FINAL REVIEW

- 3.4.1 Upon completion of the work, there shall be a final review of the entire system.
- 3.4.2 The system shall be operating properly.
- 3.4.3 Certificates and Documents required herein shall be in order and presented at least two weeks prior to the review.
- 3.4.4 After the review, any changes or corrections noted as necessary for the work to comply with these specifications and the drawings shall be accomplished without delay in order to secure final acceptance of the work.
- 3.4.5 The date for the final review shall be sufficiently in advance of the Contract completion date to permit the execution before the expiration of the contract of any adjustments and/or alterations which the final acceptance tests indicate as necessary for the proper functioning of all equipment. Any such modification shall be completed within the number of days allotted for completion of the contract. Retests shall be conducted as directed and shall be of such time duration as necessary to assure proper functioning of adjusted and altered items. Retests shall not relieve the Contractor of completion date responsibility.
- 3.4.6 A qualified person must be present at this final inspection to demonstrate the system and prove the performance of the equipment.

- 3.4.7 Upon completion of work, and at time designated by the Engineer of Record provide services of competent representative of the Contractors for a period of at least 8 hours or as specified in the individual component specifications to instruct the owner's representative in the operations and maintenance of the entire mechanical, electrical, and systems.
- 3.4.8 No portion of the total contract will be declared substantially complete until the automatic temperature control system has been demonstrated to be complete and functioning as intended. The temperature control system will be complete and functioning as intended when all of the space temperatures are maintained at plus or minus two degrees of set point.

END OF SECTION

DIVISION 15 — MECHANICAL

Section 15050 — MECHANICAL BASIC MATERIALS AND METHODS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Mechanical Plans and Specifications are part of the project documents. Failure to comply shall NOT relieve Contractor of responsibility or be used as basis for additional compensation due to omission of Engineer of Record.

1.2 WORK INCLUDED

- 1.2.1 This section specifies the requirements for providing basic mechanical and plumbing materials.
- 1.2.2 Work under this Section shall consist of the mechanical general work requirements of providing basic materials and methods of installation as shown on the Drawings and as specified in this Section.
- 1.2.3 Mechanical General Work Requirements: Provide and install all mechanical services, equipment, and appurtenances necessary for the proper installation and operation of the systems shown on the drawings and/or specified herein.
- 1.2.4 Provide all systems complete and operational as shown on the Mechanical and Plumbing drawings.

- 1.2.5 Provide all mechanical utility connections to Contractor furnished equipment.

1.3 STANDARDS

- 1.3.1 The Contractor shall comply with all Municipal, State, County, and Federal laws, ordinances, rules and regulations governing or relating to building and construction, employment standards, and public health and safety, where applicable. All Mechanical work shall conform to the requirements of the latest editions and applicable sections of the following standards.

- 1.3.1.1 ANSI: American National Standard Institute
- 1.3.1.2 AWS: American Welding Society
- 1.3.1.3 AWWA: American Water Works Association
- 1.3.1.4 OSHA: Occupational Safety and Health Administration
- 1.3.1.5 NFC: National Fire Codes
- 1.3.1.6 ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers
- 1.3.1.7 SMACNA: Sheet Metal and Air Conditioning Contractors Association
- 1.3.1.8 ASME: American Society of Mechanical Engineers
- 1.3.1.9 NEMA: National Electrical Manufacturers Association
- 1.3.1.10 UL: Underwriters Laboratories, Inc.
- 1.3.1.11 AGA: American Gas Association
- 1.3.1.12 SBC: Standard Building Code
- 1.3.1.13 CGA: Compressed Gas Association
- 1.3.1.14 AMCA: Air Moving and Condition Association
- 1.3.1.15 FM: Factory Mutual
- 1.3.1.16 ARI: Air Conditioning & Refrigeration Institute
- 1.3.1.17 MSS: Manufacturing Standardization Society of the Valve and Fittings Industry
- 1.3.1.18 ASTM: American Society for Testing and Materials
- 1.3.1.19 NFPA: National Fire Protection Association

1.4 MATERIALS

- 1.4.1 The work of this Section includes providing, cleaning and testing of heating, ventilating, and air conditioning systems, plumbing system improvements, and other special systems as specified herein and as shown on the plans including the following principal items.

- 1.4.1.1 Air handling equipment consisting of factory built single package DX units, water heaters, pumps, vibration isolation devices, fans, motors, drives, filters, dampers, controls and all required accessories.

- 1.4.1.2 Ductwork systems for supply air, return air, and toilet

exhaust. Systems shall be complete with ductwork, hangers, supports, access doors, controls, volume dampers, diffusers, registers, grilles, identification, and all required accessories.

1.4.1.3 Complete temperature control system including thermostats, all gauges and thermometers.

1.4.1.4 Insulation including duct insulation, domestic water piping insulation, drain piping insulation and equipment insulation.

1.5 QUALITY ASSURANCE

1.5.1 CONTRACTOR RESPONSIBILITY

1.5.1.1 The Specifications and accompanying Drawings are intended to encompass a system that will not interfere with the structural, electrical and architectural design of the existing buildings, and which will fit into the space provided.

1.5.1.2 As it is not within the scope of the Drawings to show all necessary offsets and obstructions, it shall be the responsibility of the Contractor to install his work in such a manner that it will conform to the structure, avoid obstructions and interferences, preserve headroom, and keep openings and passageways clear.

1.5.2 Provide all materials, components, and services in accordance with a quality control program that assures compliance with the applicable codes, standards, and this specification.

1.5.3 Provide qualified test personnel to perform test and inspection functions. Personnel qualifications shall be available to Owner upon request.

1.6 WORKMANSHIP

1.6.1 Labor shall be performed in a workmanlike manner by mechanics skilled in their particular trade. Pipe and equipment shall be installed square and plumb accessible for proper operation and service. Installation shall be consistent in completeness and appearance whether concealed or exposed.

1.7 SUBMITTALS

1.7.1 Submittals shall be presented according to the terms of the

contract and as specified in Section 01330.

1.7.2 Specific items to be submitted:

1.7.2.1 Submittals are required for the items listed in Part 2 – Products.

1.7.2.2 The following are required for each size and/or type of item identified.

1.7.2.2.1 Descriptive Literature

1.7.2.2.2 Dimensional Drawing

1.7.2.2.3 Manufacturer's Data Sheets

1.7.2.2.4 Installation Instructions

1.7.2.2.5 Operating Instructions

1.7.2.2.6 Maintenance Instruction

1.7.2.2.7 Operational Test Procedures

1.7.2.2.8 Maintenance Schedules

1.7.2.2.9 Special Tools Required for Maintenance & Testing

1.7.2.3 Identification Samples - Samples of identification type shall be submitted of each color, type of lettering and each type of material. Submittal shall include system on which each identification type is to be used.

1.7.3 For Equipment Systems, Contractor shall submit:

1.7.3.1 Layout Drawings

1.7.3.2 Start-up procedure for system

1.7.3.3 Interface requirements with the selected Energy Management System software, to include all setpoints.

1.8 ADJUSTING, BALANCING, AND TESTING

1.8.1 After completion of the installation, regulate, adjust and test all equipment and devices per the contract drawings and manufacturer's recommendations.

1.9 PRODUCT DELIVERY AND HANDLING

1.9.1 Materials shall be delivered in the manufacturer's original unopened packaging, labeled to indicate the manufacturer's name and product identification.

1.9.2 Delivered materials shall be handled to ensure that the packaging and labeling remain intact until installation of material. Materials shall be stored and protected from ground contact and from the

elements.

PART 2 – PRODUCTS

2.1 PIPE AND FITTINGS

2.1.1 Refer to General Piping Specification Section 15432.

2.2 MISCELLANEOUS INSTRUMENTATION

2.2.1 Pressure Safety Valves (PSV's):

2.2.1.1 PSV's shall be provided as follows:

2.2.1.1.1 Body and Trim - per system piping specification

2.2.1.1.2 Seats and Gaskets – Teflon

2.2.1.1.3 Set Pressure - As shown on the contract drawings or per equipment manufacturer.

2.2.1.2 All PSV's shall be provided with an isolation valve with locking device and a bleed valve under the PSV to allow for testing and servicing of the PSV.

2.2.2 Hose Bibb Faucets: Hose bibbs shall be brass, 125 psig, with 3/4 inch pipe connection, 3/4 inch hose connection and vacuum breaker.

2.3 PIPE HANGERS AND SUPPORTS

2.3.1 General: Material, design, fabrication and selection of Hangers and Supports shall comply with MSS SP-58 and MSS SP-69.

2.3.2 Hangers and Support Types: Types shall be as indicated, as required for the application and as follows:

2.3.2.1 For individual horizontal piping: MSS SP-58, Type 1, Type 4, Type 6 split ring, or Type 10.

2.3.2.2 For vertical piping: MSS SP-58, either Type 8 or Type 42 where supported from floors.

2.3.2.3 Any other support (other than above) used per MSS-SP-58 or other standards requires ENGINEER OF RECORD's approval.

2.3.3 Metal Framing (Continuous Slot Metal Channel System)

2.3.3.1 Channel: Steel, ASTM A-569, ASTM A-570; B-Line,

Superstrut or Unistrut support channel.

2.3.3.2 Configuration: Single channel or two single channels welded together, as indicated. Channels shall accept spring-held steel nuts.

2.3.3.3 Single Channel Dimensions: 1-5/8 inch by 1-5/8 inch, 12 gauge.

2.3.3.4 Double Channel Dimensions: 1-5/8 inch by 3-1/4 inch, 12 gauge.

2.3.3.5 General Fittings Dimensions, for Flat, Angular and U shapes: 1/4 inch thick by 1-5/8 inch wide, unless otherwise indicated.

2.3.3.6 Channel, Pipe Clamps and General Fittings Finish: Hot-dip galvanized after fabrication, ASTM A 386 or A 153, as applicable.

2.3.3.7 Nuts, Bolts and Screws Finish: Electrodeposited zinc coating, ASTM B 633, Class Fe/Zn 5, Type III.

2.3.4 Hanger Rods

2.3.4.1 Hanger rods shall be ASTM A 575 or ASTM A 576, threaded, hot-rolled steel, 3/8 inch diameter minimum with electrodeposited zinc coating, ASTM B 633, Fe/Zn 5, Type III.

2.3.4.2 Carrying Capacities:

| NOMINAL ROD DIAMETER IN INCHES | MAXIMUM SAFE LOAD IN POUNDS |
|--------------------------------|-----------------------------|
| 3/8 | 610 |
| 1/2 | 1,130 |
| 5/8 | 1,810 |
| 3/4 | 2,710 |
| 7/8 | 3,770 |
| 1 | 4,960 |
| 1 1/4 | 8,000 |
| 1 1/2 | 11,630 |

2.3.5 Trapeze, Multiple Pipe Hangers

2.3.5.1 Trapeze type, multiple pipe hangers shall be fabricated of two or more galvanized steel hanger rods, a steel

horizontal member and U-bolts, clamps and other attachments necessary for securing hanger rods and pipe.

2.3.5.2 The horizontal member shall be a continuous slot metal channel single or double, as indicated, or 2 to 4 inch angle iron as needed depending on pipe weight.

2.3.5.3 Loading Capacity

2.3.5.3.1 Hangers shall be capable of supporting a load equal to the sum of the weights of the pipes and liquid plus any loads due to thermal expansion, plus the weight of the hanger itself, plus 400 pounds.

2.3.6 Building Attachments

2.3.6.1 Top-beam C-clamps (MSS type 19): for use under roof installations with bar-joist construction to attach to top flange of structural shape. Side-beam or channel clamps (MSS type 20): for attaching to bottom flange of beams, channels or angles. Center-beam clamps (MSS type 21): for attaching to center of bottom flange of beams.

2.3.7 Fasteners

2.3.7.1 Concrete Expansion Anchors

2.3.7.1.1 Anchor: Anchors shall meet physical requirements of Federal Specification FF-S-325, Interim Amendment 3, Group VIII, Type 1.

2.3.7.1.2 Material: Steel, ASTM A 108.

2.3.7.1.3 Finish: Electrodeposited zinc coating, ASTM B 633, Class Fe/Zn 5, Type III.

2.3.7.2 Toggle Bolts: FS FF-B-588, Types, Classes, Styles and sizes as required.

2.3.7.3 Wood Screw: FS FF-S-111, Types, Styles and sizes as required.

2.4 PIPE SLEEVE SEALS

2.4.1 Standard service, non-insulating, for non-fire rated walls or floors; 3-hours fire rated service for fire walls or floors.

2.4.2 Manufacturer: Link-Seal by Thunderline Corporation, Wayne, Michigan 48184.

2.4.3 Sealing Compound:
Two-part silicone foam to prevent passage of fire, smoke, toxic gases and water. Acceptable Manufacturers:

2.4.3.1 Dow Corning 3-6548 Silicone RTV Foam by Dow Corning Corporation, Midland, Michigan 48640

2.4.3.2 Chase-Foam, CTC PR-855 by Chase Technology Corporation, 168 Railroad Street, Huntington Station, New York 11746

2.5 INSULATING (DIELECTRIC) PIPE JOINTS

2.5.1 Insulating Joint Resistance: t less than 1 megohm.

2.5.2 Insulating Joint Types: Insulating union, insulating coupling, or insulating flange, as indicated, or as required by the characteristics of the piping system. Insulating joint materials to be installed underground shall be able to withstand the coating application, temperature and the environment at the Work Site.

2.6 IDENTIFICATION

2.6.1 Piping and Ductwork Identification

2.6.1.1 Standard: ANSI A13.1 for lettering and arrow size and colors.

2.6.1.2 Material: Flexible vinyl, vinyl-coated cloth, or polyester tapes and bands with a pressure-sensitive adhesive back, and printed legends and arrows.

2.6.1.3 Legend: To describe the piping and ductwork systems as indicated.

2.6.2 Equipment Identification Nameplates

2.6.2.1 Material: stainless steel - 10 gauge material permanently mounted with hex screws or nuts that provides manufacturer data.

2.6.2.2 Dimensions and Legends:

2.6.2.2.1 One line: 7/8 inch high letters, 1-5/8 inch high nameplates,

2.6.2.2.2 Legend: As indicated in equipment schedule.

2.7 PRESSURE GAUGES

2.7.1 Accuracy: One percent of full scale.

2.7.2 Bourdon Tube: 316 stainless steel tube and connection, 1/2 inch NPT, bottom or back.

2.7.3 Movement: Stainless steel to be supplied with isolation diaphragm in corrosive service.

2.7.4 Case: Drawn or stamped 316 stainless steel, plastic lens face, 4-1/2 inches face diameter, mounting as required.

2.7.5 Face: Liquid Filled

2.7.6 Pressure Ranges

Location Pressure Range

Pump Suction (Suction Lift) 0 to * in. hg.

* = 1 1/2 times normal suction lift vacuum

Pump Suction and Discharge 0 to twice the normal

Operating pressure

2.8 ELECTRIC MOTORS, DRIVES, GUARDS

2.8.1 Electric Motors - Refer to Division 16 Specifications.

2.8.2 Guards:

2.8.2.1 Sprockets, pulleys, chains, couplings, projecting set screws, keys and other rotating parts which may present a hazard to personnel shall be enclosed or properly guarded per OSHA requirements.

2.8.2.2 Drive guards shall have an angle iron frame and expanded sheet metal shall be bolted or spot welded to the frame. The guard shall be easily removed and shall be supported on brackets from the equipment base. Openings shall be provided in the guard unit for taking rpm readings from both the motor and driven unit.

2.8.3 Belted drives shall consist of companion sheaves with matched belts. Adjustable drive sheaves for applications of 5 hp capacity or less are acceptable. All belts shall be rated at 200 percent motor ratings.

2.9 MOTOR STARTERS

2.9.1 Motor Starters – Refer to Division 16 Specifications.

2.10 ELECTRICAL WIRING

2.10.1 Electrical wiring shall be as specified in Division 16 Specifications.

2.11 ACCESS DOORS AND ACCESS PANELS

2.11.1 The Contractor shall furnish properly sized access doors or panels in concrete block and metal stud/gypsum board walls, and in suspended gypsum board ceilings for access to all valves and all equipment. The access door shall be identified with labels/tags with 1" high letters.

2.12 AIR MEASUREMENT TEST HOLE

2.12.1 Provide air measurement openings 3/4 inch diameter and not more than 12 inches on center in main ducts, in each duct branch, and at each split, to permit instrument insertion. Each opening shall have gasketed Ventlock No. 699 instrument test hole with cap.

PART 3 – EXECUTION

3.1 INSTALLATION

3.1.1 General

- 3.1.1.1 Install equipment square, plumb, and level with access for proper operation and maintenance.
- 3.1.1.2 Installations shall be consistent in completeness and appearance whether enclosed or exposed.
- 3.1.1.3 Follow manufacturer's approved written directions for assembling, erecting, installing, lubricating, and cleaning manufactured equipment and materials.
- 3.1.1.4 Cut materials accurately to measurements established at Work site; install without springing or forcing.
- 3.1.1.5 Do not weaken structural portions of buildings or structures.
- 3.1.1.6 Make final connections to all equipment.
- 3.1.1.7 Install counterflashing.
- 3.1.1.8 Make allowance for expansion and contraction by use of swing joints, loops, or changes in direction.
- 3.1.1.9 Install AWWA approved vacuum breakers at water outlets where hose connections are furnished.
- 3.1.1.10 Provide sleeves and inserts; coordinate location of sleeves, inserts, openings, and under floor lines in ample time to avoid cutting new construction.

3.2 Ductwork and Piping

- 3.21 Install ductwork and piping parallel with the lines of the building unless otherwise indicated.
- 3.22 Make changes in size and direction with fittings.

3.3 Access Panels

- 3.3.1 Install access doors and access panels for concealed items such as valves, control motors, control components, and fire dampers.
- 3.3.2 Located access panels and access doors in ample time to avoid cutting new construction.

3.2 OPENING, CUTTING AND PATCHING

- 3.2.1 Openings: Major openings required for piping, ductwork, and equipment required for the Work shall be provided with due care and consideration for the work of other trades and for the appearance and integrity of the building.
- 3.2.2 Location: The Contractor shall, at a time in advance of the Work, verify the openings as shown on the Architectural Drawings.
- 3.2.3 Cutting and Patching: All additional cutting and patching and reinforcement of construction of buildings shall be subject to approval by ENGINEER OF RECORD.

3.3 PIPING INSTALLATION

3.3.1 General

3.3.1.1 The general arrangement of the piping shall be as indicated on the Drawings. The piping line size, valve size and type shall be as shown on the drawings.

3.3.2 Piping Systems

3.3.2.1 Slope piping systems for drainage as specified in individual Sections.

3.3.2.2 Install isolation valves on hot and cold water supply to each fixture and piece of equipment.

3.3.2.3 Run pipe lines from drain valves to a safe point of discharge into the drainage system, a floor drain, or outside as required.

3.3.2.4 Use backflow preventors where required.

3.3.3 Above Ground Piping

3.3.3.1 Piping above ground shall be installed parallel to column lines and walls in exposed areas, leaving not less than 12 feet of headroom or as shown on the Drawings, and keeping access doors, openings and passageways clear.

3.3.3.2 Piping shall not be run through transformer vaults or other electrical or electronic equipment spaces and enclosures, except piping used for fire protection.

3.3.3.3 Piping shall be concealed from view in finished areas by locating runs in columns, hollow partitions or above suspended ceiling. Horizontal runs of pipe shall not be encased in solid partitions.

3.3.3.4 Piping banks shall be installed so as not to obstruct access to equipment requiring accessibility for maintenance and inspection.

3.3.3.5 Unions and Flanges: Unions and/or flanges shall be installed where required to facilitate removal of valves or equipment.

3.4 VALVES

3.4.1 Check Valves: Swing check valves shall be installed for proper direction of flow, in horizontal position only, with hinge pin oriented horizontally.

3.4.2 Globe Valves: Globe valves shall be installed to ensure line pressure under the valve seat.

3.5 PIPE ESCUTCHEON

3.5.1 Pipe escutcheons shall be installed on each pipe penetration through floors, walls, partitions and ceilings where penetration is exposed to view, and on the exterior of the building. Escutcheons shall be secured to the pipe or insulation and shall cover the penetration hole. Insulation integrity

shall be maintained.

3.5.2 Dimensions: Pipe sleeves shall be sized to permit free movement of piping and insulation, if any, but a minimum of two pipe sizes larger than the piping run, unless otherwise recommended by the sleeve seal manufacturer. The length of the sleeve shall be equal to the thickness of construction, except floor sleeves. Floor sleeves shall be ¼ inch longer than the thickness of construction for non-sloped floors, and ¾ inch longer than the thickness of construction for floors sloped to drain.

3.5.3 Installation:

3.5.3.1 Pipe sleeves shall be supported to prevent movement during placement of concrete or during installation of other work around sleeves. Sleeves shall be covered to prevent entrance of concrete or other foreign materials.

3.5.3.2 Sleeves shall be installed flush to the surfaces except floor sleeves. Non-sloped-floor sleeves shall be installed ¼ inch above finish floor, sloped-floor sleeves shall be installed ¾ inch above finish floor.

3.6 PIPE SLEEVES SEALS

3.6.1 Pipe sleeves seals shall be installed in accordance with the seal manufacturer's written instructions to form a watertight seal between the pipe and sleeve. Seals shall be installed so the heads of bolts are a maximum of ¾ inch from the surface of the penetrated structure. On exterior walls, the heads of bolts shall be a maximum of ¾ inch from the exterior surface.

3.6.2 Sealing compound shall be applied in accordance with the sealing compound manufacturer's written instructions.

3.6.2 Sealing compound shall be applied between pipe and pipe-penetrated structures where pipe sleeves cannot be used. Sealing compound thickness shall be the same as the structure thickness.

3.7 IDENTIFICATION

3.7.1 Coordination

3.7.1.1 Identification shall be installed after surfaces are insulated, covered or finished, and approved by ENGINEER OF RECORD.

3.7.1.2 Nameplates in accordance with Section 2.08 shall be attached in a neat manner to the center top or center middle of the equipment using self-tapping stainless steel screws. When attached, nameplates shall be readable when looking at the equipment front, and shall not be obscured, hidden or painted over. Adhesive type Dymo nameplates are not acceptable.

3.7.2 Ductwork Identification

3.7.2.1 Services identified: Air supply, return, exhaust, and intake air

- ductwork shall be identified with signs (per 2.08A) indicating the ductwork service, and arrows indicating the direction of flow.
- 3.7.2.2 Location: Identification signs and arrows shall be on ducts installed in each space where ductwork is exposed to view or concealed only by removable ceiling.
 - 3.7.2.3 Signs shall be located where ductwork originates or continues into concealed enclosures, at a maximum of 30 foot spacings along runs exposed to view, and near each branch, wye or tee.
- 3.7.3 Piping Identification: Identification and arrows shall be installed per ANSI A 13.1.
- 3.7.3.1 At a maximum of 30 foot spacing wherever piping is exposed to view in occupied spaces, machine or equipment rooms, accessible maintenance spaces, exterior non-concealed locations, and in trenches.
 - 3.7.3.2 Near each branch, wye or tee excluding short takeoffs for fixtures or terminal units.
 - 3.7.3.3 Near locations where pipes pass through walls, floors or ceilings, or enter non-accessible enclosures.
 - 3.7.3.4 At access doors, manholes and similar access points which permit view of concealed piping.
 - 3.7.3.5 Near major equipment and other points of origin and termination.
 - 3.7.3.6 On piping above removable ceiling.
- 3.7.4 Valve Identification: Valve tags shall be provided on every valve, strainer, trap and cleanout, excluding valves within factory-fabricated equipment, plumbing fixtures faucets, convenience and lawn-watering hose bibbs, and shut-off valves at plumbing fixtures. Valve tags shall be attached to valves, strainers, traps and cleanouts using bead chains or S hooks without damaging insulation.
- 3.7.5 Equipment Identification: Nameplates shall be installed on:
- 3.7.5.1 Access doors
 - 3.7.5.2 Pumps, condensers and similar motor-driven equipment.
 - 3.7.5.3 Heat exchangers, coils, and similar equipment.
 - 3.7.5.4 Fans and blowers.
 - 3.7.5.5 Packaged HVAC equipment and split system units.

3.8 PIPE HANGERS AND SUPPORTS

3.8.1 General

- 3.8.1.1 Hangers and supports shall be adequately and safely attached to the building structure or structural members, installed rigid and secure so that raceways and other equipment are also secure, plumb, level and true alignment with related and adjoining work. Screws, bolts, nuts, clamps, fittings or other fastening devices shall be made up tight.
- 3.8.1.2 Pipe hangers and supports shall be installed to support piping from building structure, and shall comply with MSS SP-58 and SP-69. (See section 2.03 for type of supports).

- 3.8.1.3 Parallel runs shall be supported together on trapeze hangers where possible. Hanger spacings shall comply with MSS SP-69 and 3.09F of this specification. Where piping of various sizes is to be supported together by trapeze hangers, hangers shall be spaced for the smallest pipe size.
 - 3.8.1.4 Support horizontal steel and copper piping as shown on the drawings and in accordance with MSS SP-58 and SP-69.
 - 3.8.1.5 Install hangers to provide a minimum of 1/2 inch clear space between finished covering and adjacent work.
 - 3.8.1.6 Place a hanger within 1 foot of each horizontal elbow.
 - 3.8.1.7 Where ever possible, use hangers which are vertically adjustable after piping is erected.
 - 3.8.1.8 Support horizontal soil pipe at each hub and spigot.
 - 3.8.1.9 Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.
 - 3.8.1.10 Support riser pipes at the floor with heavy galvanized wrought iron pipe clamps. Size clamps in proportion to weight of pipe and fluid. Install clamps to bear on supporting structure on both arms.
 - 3.8.1.11 Do not support one pipe from another pipe, from ductwork, or from equipment.
 - 3.8.1.12 Provide Guides and Anchors where required to control expansion, stress and loads on piping and equipment.
- 3.8.2 Copper Tubing Support: Copper tubing shall be hung or supported in fiberglass tubing trays to provide continuous support of tubing independently of pipe or equipment used.
- 3.8.3 Provisions for Movement: Hangers and supports shall be designed and installed so as to allow controlled movement of piping systems, and to facilitate action of expansion joints, expansion loops and expansion bends to ensure pipeline integrity. Where required, provision shall be made to install Guides and Anchors.
- 3.8.4 Load Distribution: Hangers and supports shall be installed so that stresses from movement and loads will not be transmitted to connected valves and equipment. Also, Hangers shall be capable of supporting all concurrent loads due to weight and other load cases such as expansion.
- 3.8.5 Slopes: Hangers and supports shall be installed to provide the indicated pipe slopes.
- 3.8.6 Spacing:
- 3.8.6.1 Maximum spacing of hangers for individual steel pipes shall be as follows:
 - 1/2" to 3/4" 5 feet
 - 1" to 1-1/2" 7 feet
 - 2" to 2-1/2" 10 feet
 - 3" to 4" 12 feet
 - 6" to 8" 15 feet
- NOTE: Maximum spacing of Hangers for copper piping shall be as per MSS-SP-69, Table 3.

- 3.8.6.2 Trapeze hanger spacing shall be based on the smallest diameter pipe on the hanger.

3.9 DUCT CONSTRUCTION, HANGERS AND SUPPORTS

- 3.9.1 Comply with SMACNA HVAC Duct Construction Standards, 1st Edition and as shown on the drawings.
- 3.9.2 All supply, return, outside, toilet exhaust and general exhaust air ductwork shall be constructed, supported and installed in accordance with SMACNA 1 inch W.G. class, Table 1-4 and its associated figures and tables.
- 3.9.3 Duct hangers and supports shall be in accordance with applicable sections of SMACNA Section IV.

3.10 EQUIPMENT SUPPORTS, BASES AND ANCHORS

- 3.10.1 Mechanical equipment such as piping, ductwork and fans shall be anchored to the structure with due care and in complete coordination with the structural systems design. Fastening devices and anchors installed after concrete has been poured shall require careful placement to ensure that damage to reinforcing steel or violation of structural integrity does not occur.
- 3.10.2 The Contractor shall be responsible for locating the anchors.
- 3.10.3 Concrete housekeeping pads and equipment supports shall be provided for all equipment and have dimensions as required to provide complete support of the equipment being furnished. Concrete pads shall extend a minimum of 4 inches beyond the outside dimension of equipment base. Equipment pads shall have a minimum of 1/2-inch top coat of approved cement grout, troweled to smooth and level finish. Minimum pad height shall be 6 inches or as shown on the drawings.
- 3.10.4 Dimensional drawings and tie down bolts for all equipment shall be provided in accordance with approved equipment manufacturer's requirements.

3.11 FLASHING

- 3.11.1 Flash and counterflash where mechanical equipment passes through weather or waterproofed walls, floors, and roofs.
- 3.11.2 Flash vent and soil pipes projecting above a finished roof surface with lead worked 1 inch minimum into the hub, 8 inches minimum clear on the sides, with minimum 24 inches x 24 inches sheet size. For pipes through outside walls, turn the flange back into the wall and caulk completely.
- 3.11.3 Flash floor drains over finished areas with lead, 10 inches clear on the sides, with minimum 36 inches x 36 inches sheet size. Fasten flashing to drain clamp device.

- 3.11.4 Provide curbs for mechanical roof installations, 8 inches high minimum. Flash and counterflash with steel, soldered and waterproofed. Curbs shall mate with its associated mechanical equipment.

3.12 PROTECTIVE COATINGS APPLICATION

- 3.12.1 Welds, after being approved by ENGINEER OF RECORD, shall be covered with two coats of waterproof coating in accordance with the coating manufacturer's written instructions. Copper materials shall be primed before applying coating. The first coat of waterproofing shall be allowed to completely dry before the second coat is applied.
- 3.12.2 After the coating has dried, coating shall be tested for bond to the metal surface by attempting to pry the coating with a knife. Peeled or unbonded coating, as opposed to coating being removed in small pieces, shall be completely removed and replaced.

3.13 FLUSHING

3.13.1 General

- 3.13.1.1 All piping shall be flushed after installation in accordance with these specifications. Strainer screens shall be removed during flushing operations, except for screens protecting control equipment. Screens protecting control equipment shall be cleaned during flushing, if necessary, and after flushing is completed.
- 3.13.1.2 The Contractor shall provide fittings at points in the piping networks to allow flushing completed segments of piping systems as the Work progresses.

3.13.2 Water Flushing

- 3.13.2.1 After fabrication is completed and immediately prior to pressure testing the completed system, all HVAC piping shall be flushed with water until the effluent is clean and contains no visible particulate matter. Flushing pressure shall be sufficient to produce a velocity of at least 10 feet per second in the largest pipe section. The method used for disposal of flushing water shall be submitted to and be approved by ENGINEER OF RECORD.

3.14 DISINFECTION OF POTABLE WATER SYSTEM PIPING

- 3.14.1 The potable water system, and any part installed or repaired, shall be disinfected before it is placed in operation. The pipe system shall be flushed with clean potable water until dirty water does not appear at the points of outlet, then the system, or part thereof, shall be filled with a water-chlorine solution containing at least 50 parts per million of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24 hours. Alternatively, the system, or part thereof, shall be filled with a water-chlorine solution containing at least 200 parts per million of

chlorine and allowed to stand for 3 hours.

- 3.14.2 After the allowed standing time, the system shall be flushed with clean potable water until chlorine does not remain in the water coming from the system. The procedure shall be repeated if it is shown by an AWWA standard bacteriological examination that contamination still persists in the system.

3.15 INSTALLATION OF INSULATION

- 3.15.1 After satisfactory test completion, and ENGINEER OF RECORD written approval thereof, piping shall be insulated in accordance with the Drawings and Specifications.

3.16 FACTORY FINISH

- 3.16.1 Mechanical and plumbing equipment except plumbing fixtures, grilles and louvers, and underground piping shall have hard surface factory-applied.
- 3.16.2 The Contractor shall protect this finish from damage during construction operations until written acceptance of Work by ENGINEER OF RECORD.
- 3.16.3 The Contractor shall satisfactorily restore any such finishes that become stained or damaged.

3.17 ADJUSTING AND CLEANING

3.17.1 Motor-Driven Equipment

- 3.17.1.1 After installation, verify correct drive alignment of motor-driven equipment with flexible couplings.

3.17.2 Cleaning and Adjusting of Piping Systems

- 3.17.2.1 Clean equipment, pipes, and valves of grease, metal cuttings, and sludge that may have accumulated from operation of system during test.
- 3.17.2.2 Repair all stoppage, discoloration, and other damage to the finish, furnishings, or part of building due to failure to properly clean the piping system.
- 3.17.2.3 When work is complete, adjust and balance domestic hot-water systems for uniform circulation and quiet operation.
- 3.17.2.4 Adjust flush valves and automatic control devices for proper operation.

END OF SECTION

DIVISION 15 — MECHANICAL

Section 15070 — VIBRATION ISOLATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Mechanical plans and specifications are part of project documents. Failure to comply shall not relieve contractor of responsibility or be used as basis for additional compensation due to omission of Engineer of Record.

1.1.2 WORK INCLUDED:

1.1.2.1 It is the intent of this Specification to provide vibration isolation supports for all equipment, piping and ductwork as may be required to prevent transmission of vibration to the building structure. Expected noise levels in various parts of the building shall conform to noise criteria recommendations as set forth in the ASHRAE 2004 HVAC Systems and Equipment. The mid-point of the range of NC criteria curves shall apply. It will be the Contractor's responsibility to select and install vibration isolators which will enable the noise criteria standards to be met, to the extent that the noise can be controlled by the vibration isolators.

1.1.2.2 The vibration isolation manufacturer, or his qualified representative, shall be responsible for providing such supervision as may be necessary to assure correct installation and adjustment of the isolators. Upon completion of the installation and after the system is put into operation, the manufacturer, or his representative, shall make a final inspection and submit his report to the Architects and Engineers in writing certifying the correctness of installation and compliance with approved submittal data.

1.1.3 SUBMITTALS:

1.1.3.1 Submittal data shall show type, size and deflection of each isolator proposed and any other information as may be required for the Engineers to check isolator selections for compliance with the Specifications. All steel bases and concrete inertia bases, where indicated on the Drawings as being required, shall be completely detailed. Include clearly outlined procedures for installing and adjusting the Isolators.

1.1.4 TECHNICAL REQUIREMENTS

1.1.4.1 All vibration isolation devices, including auxiliary steel bases and pouring forms, shall be designed and furnished by a single manufacturer or supplier.

1.1.4.2 Unless otherwise noted, spring type vibration isolators shall be used for all equipment driven by motors of 3 HP and larger. Deflections as tabulated are minimums and it shall be the responsibility of the isolation manufacturer to determine the amount of spring deflection required for each isolator to achieve optimum performance, prevent the transmission of objectionable vibration and meet the noise criteria referenced herein.

- 1.1.4.3 Unless otherwise, noted, equipment driven by motors 2 HP and smaller shall be isolated by means of Type RVD elastomeric mounts of Type BRD elastomeric hangers properly sized for 1/2" deflection.
- 1.1.5 All spring isolators shall be completely stable in operation and shall be designed for not less than 30% reserve deflection beyond actual operating conditions. Open spring isolator shall be designed such that the K_x/K_y ratio shall be 1.0 or greater for stability.
- 1.1.6 All elastomeric isolators shall be of neoprene or high quality synthetic rubber with anti-ozone and anti-oxidant additives.
- 1.1.7 Steel components shall be cleaned and painted. All nuts, bolts, and washers shall be zinc-electroplated. Structural steel bases shall be thoroughly cleaned of welding slag and primed with zinc-chromate or metal etching primer.
- 1.1.8 All isolators exposed to the weather shall have PVC or neoprene coated springs and hot-dipped galvanized steel components. Aluminum components shall be etched and painted. Nuts, bolts and washers may be zinc-electroplated.
- 1.1.9 Isolators for equipment installed outdoors shall be designed to provide adequate restraint due to normal wind conditions and to withstand wind loads of 30#/sq. ft. applied to any exposed surface of the isolated equipment.
- 1.1.10 Air handling equipment subjected to excessive horizontal air thrust shall be furnished with isolated thrust resisters to limit displacement to 1/4".
- 1.1.11 Height saving brackets used with isolator shaving 2.5" deflection or greater shall be of the precompression type to limit exposed bolt length.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- 2.1.1 Model numbers of Amber/Booth products are included for identification. Products of the following additional manufacturers will be acceptable provided they comply with all of the requirements of the Specification: Mason Insuatrics, Consolidated Kinetics, Korfund Dynamics Corporation.

2.2 VIBRATION ISOLATORS

- 2.2.1 Isolator types shall be one or more of the following as listed under "Equipment Isolation".

2.2.1.1 Floor Mounts:

- 2.2.1.1.1 Type SW - An adjustable, free-standing, open-spring mounting with combination leveling and equipment

fastening bolt. The spring shall be welded to the spring mounting baseplate and compression plate for stability. The isolator shall be designed for a minimum Kx/Ky (Horizontal-to-Vertical spring rate) of 1.0. An elastomeric pad having a minimum thickness of 1/4" shall be bonded to the baseplate. Nuts, adjusting bolts and washers shall be zinc-electroplated to prevent corrosion.

2.2.1.1.2 Type SP-NRE - A pad type mounting consisting of two layers of 3/8" thick ribbed or waffled elastomeric pads bonded to a 16-gauge galvanized steel separator plate. Pads shall be sized for approximately 20 to 40 psi load and a deflection of 0.12" to 0.16".

2.2.1.2 Hangers Mounts:

2.2.1.2.1 Type BS - A spring hanger consisting of a rectangular steel box capable of 200% minimum overload without visible deformation, coil spring, spring retainers, Neoprene impregnated fabric washer, and steel washer.

2.2.1.2.1 Type PBS - A spring hanger consisting of a rectangular steel box capable of 200% minimum overload without visible deformation with the addition of a load transfer plate to hold the equipment or piping at a fixed elevation during installation and to permit transferring the load to the spring after installation, a coil spring, spring retainers, Neoprene impregnated fabric washer and steel washer.

2.3 ISOLATION BASES

2.3.1 Base types shall be one or more of the following, as listed under "Equipment Isolation".

2.3.1.1 Type CPF - A concrete inertia base, consisting of perimeter steel concrete pouring form (CPF), reinforcing bars welded in place, bolting templates with anchor bolts and height-saving brackets for side mounting of the isolators. Brackets for use with isolators having 2.5" deflection or greater shall be of the precompression type to limit exposed bolt length. The perimeter steel members shall have a minimum depth of 1/12 of the longest span, but not less than 6" deep. The base shall be sized with a minimum overlap of 4" around the base of the equipment and, in the case of belt-driven equipment, 4" beyond the end of the drive shaft. Fan bases are to be supplied with NEMA standard motor slide rails. The bases for pumps shall be sized to support the suction elbow of end suction pumps and both the suction and discharge elbows of horizontal split-case pumps. The bases shall be T-shaped where necessary to conserve space.

2.4 EQUIPMENT ISOLATION

| <u>EQUIPMENT</u> | <u>ISOLATOR TYPE</u> | <u>MIN. DEFL.</u> | <u>BASE TYPE</u> |
|------------------------|--------------------------|-----------------------|----------------------|
| Air Handling Units | | | |
| Floor Mtd: Up to 15 HP | SW | 1.0 | ---- |
| 20 HP & Over SW | 2.0 | ---- | |
| Pumps | | | |
| Up to 5 HP | SW | 0.4 | CPF |
| 7-1/2 HP & Over | SW | 1.0 | CPF |

2.5 PIPING ISOLATION

- 2.5.1 All pumped water piping 1-1/2" and larger within mechanical equipment rooms and 2" and larger outside mechanical equipment rooms shall be isolated by means of spring type vibration isolation hangers or floor mounts as may be required to create the effect of a completely floating mechanical system. Isolators for equipment are described elsewhere in this Specification. It shall be the responsibility of the vibration isolation manufacturer to coordinate the selection of piping supports with equipment supports to provide for a carefully engineered isolation system designed to accommodate expansion and contraction while isolating and supporting the pipe and equipment.
- 2.5.2 Riser diagrams shall be prepared by the vibration isolation manufacturer and submitted for approval. These diagrams shall show anticipated vertical expansion and contraction of various segments of the piping and spring deflection changes. If flexible connectors or expansion loops to relieve stress are required in the riser system, they shall be furnished whether shown or not at no expense to the Owner. Type and design shall be submitted to the Engineer for approval. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist in the design proposed when installed in accordance with submittals and these specifications.
- 2.5.3 Expansion loops and flexible connector shown on the plans may be omitted provided analysis shows that the piping and equipment connections are not overstressed by their removal. Calculations showing the resultant stress shall be submitted to the Engineer for approval.
- 2.5.4 Hangers for horizontal piping shall be installed at regular intervals as per hanger schedule. Pipe risers up through 16" shall be supported at intervals of every third floor building. Pipe risers 18" and over, every second floor.
- 2.5.5 The first two piping supports away from any given piece of equipment to which piping is connected shall be selected for an operating spring deflection equal to that specified for the equipment isolators, but not to exceed 2". All other supports for horizontal piping shall have a minimum operating deflection of 3/4" with capability of 50% additional travel-to-solid. To prevent excessive transfer of piping load from floor to floor, all riser

support springs shall have a deflection capability of four times the expansion or contraction to be accommodated by the support with the additional runout capability to absorb the movement.

- 2.5.6 Provide Type 301 acoustic seals at all wall, ceiling, or floor openings through which pipe runs from equipment rooms into adjoining occupied spaces. The acoustic seals shall consist of an S-shaped molded synthetic rubber seal attached with stainless steel clamps to the pipe wall sleeves and to carrier piping.
- 2.5.7 Isolator Types: Vibration isolators shall be of the following types:
 - 2.5.7.1 Type PBS – for first two hangers in horizontal piping adjacent to isolated equipment and for all hangers on 8” and larger pipe, except the first two hanger points adjacent to riser shall be Type BS.
 - 2.5.7.2 Type BS – for remaining hangers in horizontal piping.
 - 2.5.7.3 Type SW – for pipe risers. Isolator base plates shall be provided with holes for bolting and isolation grommets.

2.6 FLEXIBLE PIPE CONNECTIONS

- 2.6.1 Provide flexible pipe connections as indicated, as manufactured by Vibration Mountings, Inc., “Type RXJ”, steel reinforced rubber expansion joints. Furnish with Integral full-face duct and rubber flanges, metal backup rings, and Spring-Flex two bolt expansion limit control.

END OF SECTION

DIVISION 15 — MECHANICAL

Section 15075 — Mechanical Identification

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Mechanical plans and specifications are part of project documents. Failure to comply shall not relieve contractor of responsibility or be used as basis for additional compensation due to omission of Engineer of Record.

1.2 WORK INCLUDED

- 1.2.1 Furnish and install all identification and labeling of mechanical equipment as specified below or as notes on drawings.
- 1.2.2 Condensing units, air handling units, water heaters, fans and any other equipment designated by the Engineer shall be identified and labeled.

1.3 QUALITY ASSURANCE

- 1.3.1 All markers shall conform to ANSI and OSHA standards for marker length,

background color, letter size and letter color as related to the content of the pipe or the covering.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- 2.1.1 Setton
- 2.1.2 Labelmaster
- 2.1.3 Craftmark Identification Systems

2.2 NAMEPLATES

- 2.2.1 The following shall be identified with engraved name plates as described hereafter: Single Package Units, Water Heaters, Fans
- 2.2.2 Unless otherwise specified, nameplates shall be black phenoli with chamfered edges engraved with minimum 3/16" letters to white core. Attachment will be made by plated screws. Adhesive attachments will not be accepted.

2.3 MARKERS

- 2.3.1 All piping shall be identified with pipe markets indicating direction of the flow.

PART 3 – EXECUTION

3.1 INSTALLATION

- 3.1.1 Nameplates on materials and equipment furnished will be maintained in original condition. Whenever possible, equipment shall be installed so that nameplates are readily visible. Damaged or unreadable nameplates shall be replaced. Where equipment is modified, nameplates shall be appropriately corrected.
- 3.1.2 Location on all underground piping shall be marked by the use of underground warning tape, colored with printed message. Tape to be buried directly over pipe, 6" below finished grade. Tape to be polyethylene, 6" wide. Tape for metallic pipe to be .004" thick; tape for non-metallic pipe to consist of two layers of polyethylene with a metallic film ribbon between.
- 3.1.3 Underground warning tapes to be as follows:
 - Gas Piping - Yellow, legend "Gas Line Buried Below", Seton No. 210 GAS, for metallic pipe; Seton No. 2 GAS, for non-metallic pipe.
 - Sewer Piping - Green, legend "Sewer Line Buried Here". Seton No. 210 SEW for 23 metallic pipe; Seton No. 23 SEW for non-metallic pipe.
 - Water Piping - Blue, legend "Water Line Buried Below". Seton 210 WAT for metallic pipe; Seton No. 2 WAT for non-metallic pipe.

END OF SECTION

DIVISION 15 — MECHANICAL

Section 15082 — Ductwork Insulation

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Mechanical plans and specifications are part of project documents. Failure to comply shall not relieve contractor of responsibility or be used as basis for additional compensation due to omission of Engineer of Record.

1.2 WORK INCLUDED

- 1.2.1 Duct Insulation

1.3 REFERENCES

- 1.3.1 ASTM C553 – Mineral Fiber Blanket and Felt Insulation
- 1.3.2 ASTM C612 – Mineral Fiber Block and Board Thermal Insulation
- 1.3.3 ASTM E 84 – Surface Burning Characteristics of Building Materials

1.4 SUBMITTALS

- 1.4.1 Include product description, list of materials, and thickness for each service and location.

1.5 QUALITY ASSURANCE

- 1.5.1 Applicator: Company specializing in ductwork insulation application with minimum of three years experience.
- 1.5.2 Materials: UL listed; flame spread/fuel contributed/smoke developed rating of 25/25/50 in accordance with ASTM E 84.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- 2.1.1 Owens-Corning Fiberglass Corporation
- 2.1.2 Certainteed Corporation
- 2.1.3 Knauf Corporation
- 2.1.4 Manville Corporation

2.1.5 Armacell AP/Armaflex

2.2 MATERIALS

2.2.1 Type A: Flexible glass fiber duct wrap, ASTM C553; commercial grade, "k" value of 0.25 at 75 degrees F; 1.5 lb/cu ft minimum density; 0.002 inch foil scrim kraft facing flame spread and smoke developed index 25/50.

2.2.2 Type B: Flexible elastomeric closed cell sheet or roll, ASTM C534; "k" value of 0.25 at 75 degrees F; water vapor permeability 0.05 perm/in, flame spread and smoke developed index 25/50, Armacell AP/Armaflex or equal.

2.2.3 Adhesives: Waterproof vapor barrier type, Childers CP-82.

2.2.4 Finish: Vapor barrier finish coating, Childers CP-11.

2.2.5 Jacket: Aluminum Jacketing as manufactured by Childers from 1100, 3003, 3004, 3105 or 5010 aluminum alloy with smooth option, ASTM B-209, 0.020" (0.5 mm) thickness. All jacketing shall have an integrally bonded moisture barrier over entire surface in contact with insulation

PART 3 – EXECUTION

3.1 PREPARATION

3.1.1 Install exterior materials after ductwork has been tested and approved.

3.1.2 Clean surfaces for adhesives.

3.2 INSTALLATION

3.2.1 Install materials in accordance with manufacturer's instructions.

3.2.2 Insulation (Types A) Application for exterior of duct in interior of Building:

3.2.2.1 Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.

3.2.2.2 Install without sag on underside of ductwork. Use 4 inch wide strips of adhesive on 8 inch centers or mechanical fasteners where necessary to prevent sagging. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

3.2.2.3 Insulate standing seams and stiffeners which protrude through the insulation with 1-1/2 inch thick, unfaced, flexible blanket insulation. Cover with glass cloth and coat with vapor barrier finish coating.

3.2.2.4 On circumferential joints, the 2 inch flange on the facing shall be secured with 9/16 inch outward clinch staples on 2 inch centers, and taped with a minimum 3 inch wide strip of glass fabric and finish coating.

3.2.2.5 Cover seams, joints, pin penetrations and other breaks in finish

coating reinforced with glass cloth.

3.2.3 Exterior duct Insulation (Type B) Application

3.2.3.1 All exterior ductwork shall be externally insulated with Armacell AP/Armaflex sheet insulation or equal. Insulation shall be installed according to Manufacturer's brochure "Installation of Armaflex insulations" for specified insulation type. Insulation shall be installed using Armaflex 520 black adhesive. Full adhesive coverage attachment shall be applied to entire surface of both ductwork and insulation. After insulation is installed weather-resistant protective finish Armaflex WB shall be applied.

3.2.4 Exterior Ductwork Jacketing:

3.2.4.1 Ductwork located outdoors shall be protected with aluminum metal jacketing with moisture barrier. Longitudinal joints shall be applied so they will shed water and shall be sealed completely closed with 2" lap connected with 1" hem overlap joint located on side of duct and turned down to shed water. Jacket shall be strapped 12" on center with 1/2" wide stainless steel strapping and wing seals. Entire installation shall be in accordance with the jacket manufacturer's recommendations. Exterior ductwork shall be pitched to allow rain water run off. Insulation Contractor shall coordinate with sheet metal contractor prior to ductwork fabrication.

3.3 SCHEDULE

3.3.1 Provide insulation for all ductwork in accordance with the following schedule:

END OF SECTION

DIVISION 15 — MECHANICAL

Section 15086 — Piping Insulation

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Mechanical plans and specifications are part of project documents. Failure to comply shall not relieve contractor of responsibility or be used as basis for additional compensation due to omission of Engineer of Record.

1.1.2 WORK INCLUDED

- 1.1.2.1 Furnish and install thermal insulation for mechanical and plumbing piping systems including jackets and accessories.
- 1.1.2.2 Mechanical and plumbing systems include horizontal roof drains, waste lines (which receive condensate from air handling units or

evaporators), refrigerant suction lines, condensate drain lines, and hot and cold water lines.

1.2 SUBMITTALS

- 1.2.1 Include product description, list of materials, and thickness for equipment scheduled.

1.3 QUALITY ASSURANCE

- 1.3.1 Applicator: Company specializing in insulation application with three years minimum experience.
 - 1.3.2 Insulation and Covering: Flame spread/fuel contributed/smoke developed rating of 25/25/50 in accordance with ASTM E 84.
- ## 1.4 ENVIRONMENTAL REQUIREMENTS

- 1.4.1 Maintain ambient temperatures and conditions required by manufacturers of adhesive and insulation.

PART 2 – PRODUCTS

2.1 MATERIALS

- 2.1.1 Insulation shall be unicellular foamed elastomeric rubber meeting ASTM C534 11 and ASTM D-1056-SBE-41. Insulate for use in return air plenums shall, in addition, have flame spread rating of 25 or less and a smoke developed rating of 50 or less as tested by ASTM E-84-75.
- 2.1.2 Insulation shall be manufactured by Armaflex Insulation.
- 2.1.3 Equivalent insulation by other manufacturers, meeting these specifications will be considered.

PART 3 – EXECUTION

3.1 PREPARATION

- 3.1.1 Install exterior materials after piping has been tested and approved.
- 3.1.2 Clean surfaces for adhesives.

3.2 INSTALLATION

- 3.2.1 Insulated piping as follows:
 - 3.2.1.1 Refrigerant suction lines in return air plenums and elsewhere where called for: Insulate with Armstrong AP Armaflex SS, ½" wall thickness.
 - 3.2.1.2 Condensate lines in return air plenums as described above: Insulate with Armstrong AP Armaflex SS, ½" wall thickness.
 - 3.2.1.3 Refrigerant suction lines not in return air plenum: Insulate with Armstrong AP Armaflex SS, ¾" wall thickness.

- 3.2.1.4 Condensate lines not in return air plenum and as described above: Insulate with Armstrong AP Armaflex SS, ½" wall thickness.
- 3.2.1.5 Water piping: Insulate with Armstrong AP Armaflex SS, 1" wall thickness.
- 3.2.2 Insulation shall be installed per manufacturer's published procedures including the use of the recommended adhesive.
- 3.2.3 Exposed insulation, both inside and outside shall be finished with two coats of vinyl lacquer per manufacturer's published procedures.
- 3.2.4 Insulated piping shall be supported with appropriate hangers as elsewhere specified.

END OF SECTION
DIVISION 15 — MECHANICAL

Section 15400 — Plumbing Systems Fixtures and Trim

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Mechanical plans and specifications are part of project documents. Failure to comply shall not relieve contractor of responsibility or be used as basis for additional compensation due to omission of Engineer of Record.

1.2 WORK INCLUDED

- 1.2.1 Piping and Fittings
- 1.2.2 Cold Water Systems
- 1.2.3 Hot Water Systems
- 1.2.4 Soil and Waste Piping Systems
- 1.2.5 Plumbing Equipment
- 1.2.6 Plumbing Fixtures and Trim
- 1.2.7 Storm, Sanitary and Water

1.3 REFERENCES

- 1.3.1 The following codes and reference standards are considered minimum requirements for materials, workmanship and safety. Use only the most current editions of the following:

ASTM – American Society for testing and Materials
ASME – American Society of Mechanical Engineers

ASSE – American Society Sanitary Engineering
CISPI – Cast Iron Soil Pipe Institute
NFPA – National Fire Protection Association
Local Plumbing Code
Local Building Code
Local Gas Code

1.4 SUBMITTALS

- 1.4.1 In general, Shop Drawings shall consist of published ratings of capacity data, detailed Construction Drawings, wiring and control diagrams where applicable, performance curves, installation instructions and other pertinent data and as defined in Specification Section 01300.
- 1.4.2 The following items require Shop Drawings:
 - Floor Drains
 - Insulation
 - Shock Absorbers
 - Plumbing Fixtures and Trim
 - Pumps and Motor Controllers
 - Pipe Hangers
 - Hose Bibbs
 - Wall Hydrants

1.5 GENERAL REQUIREMENTS

- 1.5.1 Provide new fixtures, free from flaws and blemishes with finished surfaces clear, smooth and bright.
- 1.5.2 Provide approved plumbing fittings. Visible parts of fixture brass and accessories shall be chrome plated.
- 1.5.2 Fixtures and fittings shall be as scheduled on the Drawings.
- 1.5.3 Protect fixtures against use and damage during construction.
- 1.5.4 Backflow Preventer – furnish and install where required by the City Code and the Authorities having jurisdiction.

1.6 JOB CONDITIONS

- 1.6.1 Check millwork Shop Drawings. Confirm location and size of fixtures and openings before rough-in and installation.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- 2.1.1 Provide and install items as listed in the Schedule on the Drawings.
- 2.1.2 Manufacturer named items are for standard of quality and do not necessarily limit supply to named manufacturer.

2.2 PIPE SYSTEM MATERIALS

- 2.2.1 Above-ground sanitary drainage and vent pipe shall be standard weight cast iron piping and fitting and shall conform to ASTM A 74 and A 888; CISPI 301.
- 2.2.2 Underground and under slab sanitary drainage and vent pipe shall be Polyvinyl Chloride (PVC) Schedule 40 plastic pipe (Type DWV) and shall conform to ASTM D2665; ASTM D2949; ASTM F 891.
- 2.2.3 Hot and cold water piping shall be seamless copper water tube, ASTM B-88, Type "L", hard drawn temper. Copper piping that may be routed under concrete driveways shall be installed in a PVC continuous sleeve.
- 2.2.4 Fittings – Pipe fittings shall be approved for installation with the piping material installed and shall conform to the respective pipe standards.

2.3 PIPE JOINTS

- 2.3.1 Joints in cast iron pipe shall be as follows: 1) bell and spigot joints – caulk solid or a positive-seal one piece elastomeric compression type gasket; 2) hubless pipe – approved neoprene gaskets and stainless steel retaining sleeves.
- 2.3.2 Joints in copper pipe shall be made using wrought copper, solder-joint type, lead-free solder. Joints to be soldered shall be thoroughly cleaned and polished with Emery cloth.
- 2.3.3 Threaded joints, screwed joints, shall conform to American National Taper pipe thread A.S.A. B-2, 1-1960. All burrs shall be removed. Pipe ends shall be reamed and filed out to size of bore, and all chips shall be removed. A non-toxic compound or a 1" teflon coated tape shall be used and only then on male threads.

2.4 VALVES

- 2.4.1 Valves, stop cocks, etc., shall be provided and installed where shown or as necessary to make systems complete. Valves shall be provided on inlet and outlet connections to apparatus and fixtures, by-passes, etc. Exact location shall be worked out on site. Necessary drain valves shall be provided to drain piping system. Valves shall be Nibco, Stockham or Victaulic.
- 2.4.2 Valves in water lines shall be Stockham or Nibco T-113 for 2" pipe and smaller and T-133 for 2-1/2" and larger. All valves shall have threaded connections or solder ends (Nibco S-111 or S-121).
- 2.4.3 The supply of both hot and cold water to each fixture hereinafter specified shall be equipped with stop valves. Valves, cocks, etc. shall be nickel plated or chromium plated to correspond to pipe finish. Provide chrome escutcheons for all supplies through wall.
- 2.4.4 See Schedule on Drawings for wall hydrants, hose bibbs and stop valves to plumbing fixtures.

2.5 UNIONS AND FLANGES

- 2.5.1 Unions or flanges shall be used in piping where dismantling of adjacent valves or equipment would be facilitated by the installation of a union or unions.
- 2.5.2 At connections between pipes of dissimilar metal provide an approved dielectric union to prevent galvanic corrosion.

2.6 PIPE SLEEVES

- 6.1 Provide standard weight steel pipe sleeves sized to allow the pipe covering to pass through wall, floor and roof construction. Pipe sleeves shall be provided large enough to pass the pipe and covering. Seal with G.E. 1204 neutral rubber Silicone. Where pipe passes through floors above finished space extend sleeve (1") one-inch above finish level of upper floor. Sleeves in walls shall be flush with finished surface.

2.7 EXPANSION AND CONTRACTION

- 2.7.1 Provide for the expansion and contraction of piping, using swing joints and install anchors, where necessary, to prevent the movement of pipe to certain points, such as base elbows, or other points where piping turns up through rigid building construction. Anchors shall be designed of heavy fabricated steel to prevent movement of pipe under the stresses encountered.

2.8 AIR CHAMBERS

- 2.8.1 Air chambers of the same diameter and material as the supply pipes and 24" long shall be provided on both hot and cold water branches to each plumbing fixture. Air chambers shall be concealed in partitions or chases.

2.9 FLASHING

- 2.9.1 Furnish and install on each vent pipe passing through the roof a six pound seamless lead flashing assembly burned into a 24" square sheet. Extend 12" up and turn down into pipe cavity for 2". Furnish and install Josam #1760 vandal proof hooded vent cap on all vents.
- 2.9.2 Roof drain flashing shall be a monolithic sheet membrane laminated to the built-up roofing material. Flashing to be Nobleflex Brand laminated roof drain flashing or equal.

2.10 PIPE HANGERS AND SUPPORTS

- 2.10.1 The Contractor shall support horizontal runs of piping from construction above, by means of approved type hangers or clamps, designed to receive hanger rods. Individual hangers for pipes shall be of the adjustable swivel pipe ring type equal to Grinnel No. 101 or 104. Wherever practical banks of horizontal piping shall be supported by means of adjustable unistrut trapeze hangers. Cooperate with other Contractors for group piping. Provide stachion pipe supports at vertical

pipe runs as required. Supports to be provided so that no weight is transferred directly to a pump or other equipment.

- 2.10.2 Insulated pipe shall have wide galvanized steel shields not less than 16-gauge, 12" length on a 60° arc around insulation with ring hangers over this to prevent cutting insulation. High density insulation shall be provided between the pipe and the steel shield. This insulation shall be calcium silicate for high temperature or cellular glass for low temperature.

2.11 PIPING SUPPORT SPACINGS

- 2.12 Vertical risers and stacks shall be supported at floor with riser clamps having adequate bearing on floor slabs. Seal openings after installation. Vertical risers shall be supported a minimum of 15' O.C. On plastic piping systems the vertical clamps should be the Grinnell 261 riser clamp installed below a fitting or coupling or a special collar made from pipe stock bonded to the pipe. Length of collar to be equal to the diameter of the pipe.
- 2.13 Support piping so that no weight from piping system is bearing upon plumbing equipment.

2.14 SANITARY SEWER SYSTEM

- 2.14.1 Provide drain, waste and vent piping for fixtures and equipment shown on Drawings. Provide reducers, increasers, special flanges and fittings where required between piping work and fixtures. Extend vents 12" above roof.
- 2.14.2 Drainage lines in the buildings 3" in diameter and smaller shall have a slope of 1/4" per ft. toward the main sewer and in no case shall slope be less than 1/8" per ft. Horizontal pipe shall be run in straight lines in a uniform grade. Changes in direction of flow or horizontal lines shall be made with "Y" and 1/8" bends.
- 2.14.3 Cleanouts shall be installed in each change of direction greater than 45°, at ends of lines, at base of risers and at points required by local code. Cleanouts shall be the same size as pipe up to 4" and shall be 4" for larger pipe diameters. Cleanouts shall be as scheduled on the Drawings.
- 2.14.4 Furnish and install floor drains as shown on the Drawings. Drains shall be cast iron body and be provided with cast iron, deep seal "P" traps. Drain strainers in finished areas shall have polished Nikaloy or bronze finish with rough finished strainers acceptable only in Mechanical Rooms. Pipe and fittings shall be Cast Iron bell-and spigot pipe.

2.15 INSULATION

- 2.15.1 Thermal and vapor proof insulation shall be applied to surfaces after pressure tests, and when surfaces have been properly cleaned. Insulation shall be applied in accordance with manufacturer's suggested recommendations. Insulation shall be preformed fiberglass pipe insulation with FRK self-sealing jacket.

- 2.15.2 All domestic hot water piping shall be insulated with 1" fiberglass.
- 2.15.3 Insulate storm drain laterals, roof drain fixtures and roof drain risers in nonaccessible chases. Insulation shall be 1" thickness fiberglass.
- 2.15.4 Where piping is exposed to the elements or on vertical risers in Mechanical Rooms, the insulation shall receive two coats of approved vapor barrier mastic reinforced with glass fabric.
- 2.15.5 Piping exposed within a finished area shall be externally jacketed with .016 aluminum or .010 stainless steel. Jacket shall include Z-Lock closure and stainless steel pop rivets with a maximum spacing of 18 inches on center.
- 2.15.6 Insulate piping as required to prevent freezing of any water pipe exposed to outside temperatures.

2.13 PLUMBING FIXTURES

- 2.13.1 Furnish and install the plumbing fixtures, complete in every detail as shown on the Drawings. Fixtures must be delivered to the buildings properly crated and in perfect condition. Brass pipe to be seamless brass tubing, fittings shall be heavy cast brass of the best quality. Nipples shall be extra heavy. Exposed pipe shall be chromium plated. Fixture model numbers are from American Standard Catalog; however, Kohler, Eljer or Crane fixtures of equal quality will be acceptable.
- 2.13.2 Plumbing fixtures shall be as scheduled on the Drawings.

2.14 ACCESS PANELS

- 2.14.1 Install access panels at locations shown on Drawings and in all locations where required to service valves and piping.
- 2.14.2 Panels shall be Karp DSC-214 PL for plaster and DSC-214 for lay-in ceilings, dry wall, etc. All panels shall be prime coated steel and sized as required to service valves but in no case less than 12" x 12".

PART 3 – EXECUTION

3.1 INSTALLATION – PLUMBING SYSTEMS

- 3.1.1 Lubricate cleanout plugs with mixture of graphite and linseed oil. Prior to building turnover remove cleanout plugs, re-lubricate and re-install using only enough force to ensure permanent leak-proof joint.
- 3.1.2 Install vacuum breakers or backflow preventers on plumbing lines where contamination of domestic water may occur and on boiler make-up lines, hose bibs (wall hydrants) cooling tower and flush valves. Route full size drain from the backflow preventer to the nearest floor drain or exterior wall
- 3.1.3 All piping shall be suspended from structural steel.

3.1.4 Pipe hangers shall be installed at each change in direction of piping to properly support pipe and fittings and spaced according to Section 2.10. Provide braces and supports to prevent piping movement or swing.

3.1.5 See Specification Section 15010 for excavation and backfill.

3.2 INSTALLATION – PLUMBING FIXTURES AND TRIM

3.2.1 Install each fixture with trap, easily removable for servicing and cleaning. At completion thoroughly clean plumbing fixtures and equipment.

3.2.2 Provide chrome plated rigid supplies to fixtures with screw driver stops, reducers and escutcheons.

3.2.3 Install wall mounted lavatories, and urinals with approved wall carriers, model to suit installation. Fixtures to be installed with chrome plated acorn style nuts and washers are required.

3.2.4 Solidly attach floor mounted water closets to floor with lag screws. Lead flashing shall not hold closet in place. Floor and wall type fixtures to be installed with chrome plated acorn style nuts and washers as required.

3.2.5 Install hose and faucets and hose connections with vacuum breakers.

3.3 SERVICE CONNECTIONS

3.3.1 Provide new storm and sanitary sewer services and connect to existing services. Before commencing work check invert elevation required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

3.3.2 Connect to existing water service as indicated on the Drawings.

3.4 WORK SPECIFIED IN OTHER SECTIONS

3.4.1 Painting; however, equipment furnished under this Section shall be kept clean and free of corrosion.

3.4.2 Cutting, patching and furring; however, the location of inserts and openings shall be determined and coordinated with other job requirements in ample time to avoid cutting new construction. Sleeves and inserts shall be set under this Section.

3.4.3 Electric wiring and connections of equipment; however, motors, starters and controls with wiring diagrams shall be furnished as part of the work of this Section.

3.4.4 Owner furnished equipment; however, the work of this Section includes roughing-in and final connection. Provide stops on water supply connections to equipment, traps, tailpieces, etc.

3.4.5 Air conditioning and heating; however, utility services for mechanical equipment shall be run to within 2'-0" of equipment. Final connection shall

be by Mechanical Contractor.

3.5 TESTING

- 3.5.1 Piping shall be thoroughly tested for leaks and approved by the local authorities having jurisdiction before being covered or concealed. Local rules and regulations shall govern the extent of the test of each system.
- 3.5.2 Sanitary drain lines in the building and under the building shall be tested by filling with water to top of vents and proven tight at joints. Such tests shall be made before cover up. Water shall stand in pipes for not less than six hours.
- 3.5.3 Water lines in the building shall be tested after installation, at a hydrostatic pressure of 125 psi. Tests shall be maintained for at least six hours.
- 3.5.4 Architect shall be notified at least 24 hours prior to any tests in order for him or his representative to be present at test.

3.6 STERILIZATION OF WATER PIPING

- 3.6.1 After installation of new water piping the system shall be sterilized in strict accordance with the regulations of the Texas State Health Department.

END OF SECTION

DIVISION 15 — MECHANICAL

Section 15480 — Natural Gas Piping Systems

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Mechanical plans and specifications are part of project documents. Failure to comply shall not relieve contractor of responsibility or be used as basis for additional compensation due to omission of Engineer of Record.

1.2 WORK INCLUDED

- 1.2.1 Scope of the Work shall include the furnishing and complete installation of the Natural Gas Piping System covered by this Section, with all auxiliaries, ready for owner's use.

PART 2 – PRODUCTS

2.1 GAS PIPING SYSTEM

- 2.1.1 Furnish and install a gas piping system, as indicated on the drawings and as specified herein.
- 2.1.2 All gas piping above ground shall be Schedule 40 black steel as

manufactured by National Tube, Republic, Youngstown, or approved equal. Pipe thickness shall be in accordance with ANSI B36.10, latest edition.

- 2.1.3 All gas piping 2 ½" or larger shall have welded connections made with bevel-ended pipe by certified welders.
- 2.1.4 Piping under 2 ½" in size shall be made with screwed malleable fittings. Socket-weld fittings are acceptable. Screwed joints will not be permitted any size piping installed in furred ceilings, chases, on roof or underground.
- 2.1.5 All pipe fittings shall be of materials as follows:
- 2.1.6 All welding fittings shall be done by certified welder and shall be used full line size, except as specified herein, for each and every tee, branch, elbow, etc., with reducers after fittings, if required.
- 2.1.7 All screwed fittings shall be Crane, or approved equal, Class 150 malleable iron. Screwed threads shall be in accordance with American Pipe Thread Standards.
- 2.1.8 All underground gas piping shall be of the same materials, shall be welded and shall meet the same working pressure requirements specified herein, except that it shall be coated and protected as follows:
- 2.1.9 All underground gas piping, fittings, joints, and valves shall be thoroughly covered with Koppers, or approved equal, Bitumastic Pipeline Coatings. All underground pipes shall be machine wrapped in accordance with Gulf Coast Pipe Coating Corporation specification A-1, which in general requires the following:
- 2.1.10 Cleaning and priming of the pipe.
- 2.1.11 Application of 3/32" Koppers, or approved equal, coal tar enamel.
- 2.1.12 Wrapping with 15# fiberglass and felt.
- 2.1.13 Covering with 60# kraft paper. Wrappings shall be 4" wide with ½" overlap. Tie wire shall be stainless steel, 14 GA minimum at 18" maximum centers.
- 2.1.14 All underground joints, fittings, elbows, tees, valves, etc., shall have the same protective covering applied in the field as is specified for matching wrapped pipe herein. Protective covering shall have no gaps, spaces, or areas of any size unprotected.
- 2.1.15 Gas piping installed in unventilated spaces shall be routed in properly vented continuous sleeve.
- 2.1.16 Gas piping run inside building shall be exposed and sleeved through wall penetrations. Where it penetrates wall or attic space, it shall be run in schedule 40 steel sleeve, or schedule 40 PVC, vented to exterior.

- 2.1.17 Gas valves shall be DeZuirck Series 425 or 435 Eccentric valves with RS 49 plug seals. UL listing is required for gas shut off valves.
- 2.1.18 Gas pressure regulator shall be capable of reducing 75 psi pressure gas to 0.5 psi gas at cubic feet per hour capacities required by Gas Demand. Install per A.G.A. Bulletin 90. Regulators shall be as manufactured by Rockwell, Fisher-Governor or approved equal.
- 2.1.19 Hangers and Supports:
- 2.1.19.1 Hangers and supports shall be as manufactured by "Unistrut" or "Fee and Mason".
- 2.1.19.2 The contractor shall support horizontal runs of piping from construction above, by means of approved type hangers clamps, designed to receive hanger rods. Wherever practical banks of horizontal piping shall be supported by means of adjustable unistrut trapeze hangers. Cooperate with other Contractors for group piping. Provide stachion pipe supports at vertical pipe runs as required. Supports to be provided so that no weight is transferred directly to equipment.
- 2.1.19.3 Hangers and supports shall be as follows:
- 2.1.19.3.1 Inserts: Unistrut #1 UPC; #10 ½ nut.
- 2.1.19.3.2 Supports:
- 2.1.19.3.3 Multiple run: Unistrut #P-1000; #P-1100 clamps, channels or angles and U bolts.
- 2.1.19.3.4 Single run: Fee and Mason #239.
- 2.1.19.3.5 Riser clamps: Fee and Mason #231.
- 2.1.19.3.6 Piping saddles: 'Pipe Shields, Inc.', 'Insulshield' or 'Unigrip'.

PART 3 – EXECUTION

3.1 GAS PIPING SYSTEM INSTALLATION

- 3.1.1 All equipment shall be installed in accordance with the manufacturers recommendations and printed installation instructions.
- 3.1.2 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractor's price shall include all items required as per manufacturer's requirements.
- 3.1.3 Branch runs shall be made off the top of main lines. Horizontal lines shall pitch toward the appliance and shall terminate with dirt leg and valve. Connections to appliances shall be hard piped or approved UL connector.
- 3.1.4 Piping Support Spacing:
1. ½" to ¾" pipe: 8 feet maximum
 2. 1" to 1 ¼" pipe: 12 feet maximum.
 3. 1 ½" to 2" pipe: 15 feet maximum.

4. 2 ½" and larger pipe: 18 feet maximum.
- 3.1.5 Provide lever handle gas valve to each piece of equipment and where indicated.
- 3.1.6 Gas lines entering building shall be valved on the exterior of the building above grade.
- 3.1.7 Gas piping on roof shall be supported at appropriate intervals to prevent sagging and to prevent piping from resting directly on roof. Piping supports shall be equipment type roof support, heavy-gauge galvanized steel construction and counter flashing, mitered and welded corner seams integral base plate, 2 X 4 pressure treated wood nailer. Piping support shall be plate model ES, or equal. Piping shall be installed on piping support with unistrut clamps with adequate clearance between pipe and clamp.
- 3.1.8 All necessary precautions shall be taken as required to prevent damage to the roofing due to welding or cutting of pipe. Any damage shall be repaired by the roofing contractor, payment of which will be made by the responsible party. Extent and nature of repairs necessary will be as approved by Houston ISD Construction Services Division.
- 3.1.9 Pressure regulators shall be installed where required at the exterior of the building. At each regulator require a test tee with nipple and cap downstream, and unions and gas cocks each side of regulator.
- 3.1.10 All piping interior and exterior shall be painted. Interior color shall be according to the adopted color codes. Piping exposed to view shall be painted to comply with color scheme. Piping on roof shall be painted with aluminum industrial coating.
- 3.1.11 Piping shall be appropriately labeled as described in Section 15050, Mechanical Basic Materials and Methods.
- 3.1.12 Provide expansion loops where runs or piping cross expansion joints in building.
- 3.1.13 Pipe and Fittings – In Sleeve to Island Lab Tables:
- 3.1.14 Corrugated stainless steel tubing meeting ASTM A240, type 304, with polyethylene jacketing, flame retardant. ASTM E84 index flame 25, smoke 20, with cast bronze fittings. Gastite or approved equivalent.
- 3.1.15 Pipe and Fittings - In Utility Trench to Island Lab Tables:
Pipe as specified in paragraph 2.01 above, run in utility trench similar to ABT, Inc., Polyduct Utility Trench, 39.2" long sections x 12" wide, x 7" deep rectangular polymer concrete, non-sloping, flat bottom, solid cover steel floor plate to unitized frame.
- 3.1.16 Gas Pressure Regulator:
Size the gas pressure regulator in accordance with the manufacturer's recommendations for flow quantities and reduced pressure, as shown.

Provide Equimeter regulators or approved equal, suitable for outdoor installation. Regulators outside exposed to weather shall be installed with vent in vertical down position.

3.1.17 Drip Legs. Install a capped drip leg 6" long at the base of each vertical rise.

3.1.18 Coating and Wrapping. Coat and wrap underground piping in accordance with the service utility standards.

3.1.19 Sleeves:

3.1.19.1 Encase gap piping running in or through solid portions or above ceilings with thin wall metal conduit. Sleeve piping and fittings shall be two pipe sizes, but not less than 1" larger than encased gas piping. Vent sleeve to outside, or to nearest ventilated space discharging to outside.

3.1.19.1.1 Encase gas piping running below slab in Sch. 40 PVC, minimum size two pipe sizes larger than gas pipe. Vent conduit to ventilated space inside building and with a 3/4" vent with 3/4" return bend 4" above finish grade outside building.

3.2 TESTING GAS PIPING

3.2.1 Apply 50 psig air pressure.

3.2.2 Test joints with a soap solution while lines are under pressure.

3.2.3 Repair leaks.

3.2.4 Make a final 24 hour standing pressure test with air at 20 psi before connecting equipment.

3.3 PAINT EXPOSED OUTSIDE GAS PIPE

3.3.1 Gas pipe on wall to roof and gas pipe on roof shall be protected from rust.

3.3.2 Paint pipe with a flat alkyd coating, clean pipe prior to painting by preparing surface by hand tool cleaning per SSPC-SP2-82, applying one coat of Glidden Y-590 Rustmaster Metal Primer White and top coat of Yellow Alkyd Flat Enamel.

END OF SECTION

DIVISION 15 — MECHANICAL

Section 15730 — UNITARY AIR CONDITIONING EQUIPMENT

PART 1 – GENERAL

1.1 SUMMARY

1.1.1 Section Includes: Single Packaged Units with DX cooling gas heating

1.1.2 REFERENCES

1.1.3 American National Standards Institute (ANSI):

- 1.1.3.1 ANSI/ASHRAE 15 Safety Standard for Refrigeration Systems.
- 1.1.3.2 ANSI/ASHRAE/IESNA 90.1 Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings.
- 1.1.3.3 ANSI Z21.47 Gas-Fired Central Furnaces.

1.1.4 Air-Conditioning and Refrigeration Institute (ARI):

- 1.1.4.1 ARI 210/240 Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
- 1.1.4.2 ARI 270 Sound Rating of Outdoor Unitary Equipment.
- 1.1.4.3 ARI 340/360 Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.
- 1.1.4.4 ARI 370 Sound Rating of Large Outdoor Refrigerating and Air Conditioning Equipment.

1.1.5 American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE):

- 1.1.5.1 ASHRAE 52.2 Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (ANSI approved).
- 1.1.5.2 ASHRAE 62.1 Ventilation for Acceptable Indoor Air Quality.

1.1.6 U.S. Energy Policy Act of 1992 (EPACT).

1.1.7 U.S. National Appliance Energy Conservation Act (NAECA):

- 1.1.7.1 NAECA 1988.

1.1.8 National Fire Protection Association (NFPA):

- 1.1.8.1 NFPA 90A Installation of Air Conditioning and Ventilation Systems.

1.1.9 Underwriters Laboratories, Inc. (UL):

- 1.1.9.1 UL 1995 Standard for Safety for Heating and Cooling Equipment.

1.2 SYSTEM DESCRIPTION

1.2.1 Design Requirements: Provide products and systems that have been manufactured, fabricated and installed to following criteria:

- 1.2.1.1 ANSI/ASHRAE/IESNA 90.1.
- 1.2.1.2 ANSI Z21.47.
- 1.2.1.3 UL 1995.

1.2.2 Performance Requirements:

- 1.2.2.1 Packaged Gas Electric:
 - 1.2.2.1.1 Natural Gas Supply Pressure: 7 in. w.c. (1.7 kPa)..
- 1.2.2.2 Packaged Cooling:
 - 1.2.2.2.1 For Electrical Requirements refer to drawings.

1.2.3 ARI Rated Net Cooling Efficiency: To meet or exceed ASHRAE Standard 90.1 at rated airflow not less than 350 cfm/ton.

1.3 SUBMITTALS

1.3.1 General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures.

1.3.2 Product Data: Submit product data, including manufacturer's product sheet, for specified products.

1.3.3 Shop Drawings:

1.3.3.1 Submit shop drawings in accordance with Submittal Procedures.

1.3.3.2 Indicate:

1.3.3.2.1 Equipment, Equipment Performance, Electrical data, piping and connections, together with valves, strainers, control assemblies, thermostatic controls, auxiliaries and hardware, and recommended ancillaries which are mounted, wired and piped ready for final connection to building system, its size and recommended bypass connections.

1.3.3.2.2 Piping, valves and fittings shipped loose showing final location in assembly.

1.3.3.2.3 Control equipment shipped loose, showing final location in assembly.

1.3.3.2.4 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, mounting curb details, sizes and location of mounting bolt holes; include mass distribution drawings showing point loads.

1.3.3.2.5 Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers.

1.3.3.2.6 Details of vibration isolation.

1.3.3.2.7 Estimate of sound levels to be expected across individual octave bands in dB.

1.3.3.2.8 Type of refrigerant used.

1.3.4 Quality Assurance:

1.3.4.1 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

1.3.4.2 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and

criteria and physical requirements.
1.3.4.3 Manufacturer's Instructions: Manufacturer's installation instructions.

1.3.5 Manufacturer's Field Reports: Manufacturer's field reports specified.

1.3.6 Closeout Submittals: Submit the following:

1.3.6.1 Warranty: Warranty documents specified.

1.3.6.2 Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance. Include names and addresses of spare part suppliers.

1.3.6.3 Provide brief description of unit, with details of function, operation, control and component service.

1.4 QUALITY ASSURANCE

1.4.1 Qualifications:

1.4.1.1 Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project with a minimum 5 years of experience.

1.4.1.2 Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.

1.4.2 Regulatory Requirements: Provide Packaged gas / DX cooling unit that complies with the following requirements:

1.4.2.1 ARI 210/240.

1.4.2.2 ARI 270.

1.4.2.3 ARI 340/360.

1.4.2.4 ASHRAE 52.2.

1.4.2.5 NFPA 90A.

1.5 DELIVERY, STORAGE & HANDLING

1.5.1 General: Comply with Division 1 Product Requirements.

1.5.2 Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

1.5.3 Packing, Shipping, Handling and Delivery:

1.5.3.1 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

1.5.3.2 Ship, handle and unload units according to manufacturer's instructions.

1.5.4 Storage and Protection:

- 1.5.4.1 Store materials protected from exposure to harmful weather conditions.
- 1.5.4.2 Factory shipping covers to remain in place until installation.

1.6 PROJECT CONDITIONS

- 1.6.1 Installation Location: Confirm design conditions and temperature.

1.7 WARRANTY

- 1.7.1 Project Warranty: Refer to Conditions of the Contract for project warranty Provisions.
- 1.7.2 Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
- 1.7.3 Warranty: Commencing on Date of Installation.
 - 1.7.3.1 Compressors: 5 years (limited).
 - 1.7.3.2 Integrated Modular Control: 3 years (limited).
 - 1.7.3.3 Other System Components: 1 year (limited).
 - 1.7.3.4 Stainless Steel Heat Exchangers: 15 years (limited).

PART 2 – PRODUCTS

2.1 SINGLE PACKAGE UNITS

- 2.1.1 Acceptable Manufacturer:
 - 2.1.1.1 Lennox Industries Inc.
 - 2.1.1.2 Trane
 - 2.1.1.3 York
- 2.1.2 Products/Systems shall include the following equipment:
 - 2.1.2.1 Cabinet: Weatherproofing tested and certified to AGA Rain test standards and soundproofing tested to ARI 270.
 - 2.1.2.1.1 Heavy gauge steel panels and full perimeter heavy gauge galvanized steel base rails.
 - 2.1.2.1.2 Raised edges around duct and power entry openings in bottom of unit.
 - 2.1.2.1.3 Airflow Configuration: Horizontal airflow.
 - 2.1.2.1.4 Power Entry: Electrical and gas lines brought through horizontal access knockouts.
 - 2.1.2.1.5 Exterior Panels: Constructed of heavy gauge, galvanized steel with 2-layer enamel paint finish.
 - 2.1.2.1.6 Insulation: All panels adjacent to conditioned air fully insulated with nonhygroscopic fiberglass insulation. Unit base fully insulated.
 - 2.1.2.1.7 Base Rail: Full perimeter base rail with rigging holes; 3 sides with fork slots.

- 2.1.2.1.8 Access Panels: Hinged for compressor/controls/heating areas, blower access and air filter/economizer access; and, sealed with quarter-turn latching handles and tight air and water seal.
- 2.1.2.2 Compressor:
 - 2.1.2.2.1 Copeland scroll type, hermetically sealed.
- 2.1.2.3 Fans, General: Centrifugal, forward curved impellers, statically and dynamically balanced. [Multi] V-belt drive with adjustable variable pitch motor pulley.
 - 2.1.2.3.1 Condenser Fan: Low sound operating, PVC coated fan guard, direct drive propeller type fans to discharge vertically.
 - 2.1.2.3.2 Condenser Fan Motor: Permanently lubricated, permanent split capacitor; totally enclosed from weather, dust and corrosion; permanently lubricated ball bearings; resiliently mounted; overload protected.
- 2.1.2.4 Evaporator Coils:
 - 2.1.2.4.1 Pressure and leak tested to 500 psi (3445 kPa), nonferrous coils with enhanced aluminum fins mechanically bonded to durable copper tubes.
- 2.1.2.5 Condenser Coils:
 - 2.1.2.5.1 Pressure and leak tested to 500 psi (3445 kPa), nonferrous coils with enhanced aluminum fins mechanically bonded to durable copper tubes.
- 2.1.2.6 Air Distribution:
 - 2.1.2.6.1 Equipment capable of down-flow (vertical) or side (horizontal) handling of conditioned air.
 - 2.1.2.6.2 Optional Equipment:
 - 2.1.2.6.2.1 Horizontal conversion kit for horizontal air handling.
- 2.1.2.7 Filters:
 - 2.1.2.7.1 To meet NFPA 90A, air filter requirements
- 2.1.2.8 Heat Exchanger: Removable for servicing; stainless steel.
- 2.1.2.9 Gas Heating System:
 - 2.1.2.9.1 Tubular heat exchanger and inshot type gas burners constructed of aluminized steel.
 - 2.1.2.9.2 Direct spark ignition; electronic flame sensor controls;

flame rollout switch; limit controls and automatic redundant dual gas valve with staging control and combustion air proving switch on combustion air inducer.

2.1.2.9.3 Complete service access provided for controls and wiring.

2.1.2.10 Refrigeration System:

2.1.2.10.1 Self-sealing, discharge, suction and liquid line service gauge ports, freeze-stats, expansion valves and full refrigerant charge.

2.1.2.10.2 R410a

2.1.2.10.3 Copper tubing not to touch sharp metal surfaces.

2.1.2.10.4 Compressor Circuits: Automatic reset, high pressure switch; automatic reset, low pressure switch; liquid line filter-drier.

2.1.2.10.5 Capable of operating down to 0 degrees F (-17 degrees C) without installation of additional controls.

2.1.2.11 Supply Air Blower:

2.1.2.11.1 Constant air volume with adjustable pulleys with motor/drive combinations and optional drive kits.

2.1.2.11.2 Centrifugal supply air blower with permanently lubricated ball bearings and adjustable belt drive.

2.1.2.11.3 Blower assembly slides out of unit and is accessible for servicing.

2.1.2.11.4 Blower wheel statically and dynamically balanced.

2.1.2.12 Integrated Modular Control (IMC):

2.1.2.12.1 Solid state control board to operate unit.

2.1.2.12.2 Built-in functions include: Blower on/off delay; built-in control parameter defaults; service relay output; dirty filter switch input; dehumidistat input, economizer control; Gas valve delay between stages; DDC compatible; unit diagnosis; diagnostics code storage; indoor air quality input; low ambient controls; minimum run time; night setback mode; smoke alarm mode; low pressure control; thermostat bounce delay; 3-digit display; degrees F or degrees C display, 2-stage heat/4-stage cool thermostat compatible and warm-up mode.

2.1.2.13 Gas Heating Controls:

2.1.2.13.1 Remote thermostats as indicated.

2.1.2.13.2 Built-in fused disconnect switch.

2.1.2.13.3 Four stages of heating control from Thermostat with optional four stage board.

2.1.2.13.4 Supply fan to turn on 40 seconds after heating demand is received with 8 – 60 second adjustable

- time delay.
- 2.1.2.13.5 Supply fan to turn off 120 seconds after heating demand has ended with 80 – 300 second adjustable time delay.
 - 2.1.2.13.6 Adjustable delay time of 30 Value between 30 - 160 seconds between low and high fire of 2-stage gas valve system.
 - 2.1.2.13.7 Heat off delay of 100 [Value between 30 - 300 seconds after thermostat heating demand has ended.
 - 2.1.2.13.8 To turn off heat and keep supply air fan running if overheat limit occurs.
 - 2.1.2.13.9 Adjustable maximum overheat limit trip count during heating cycle of 3 (Value between 1 – 15), with digital output, limit indicator.
 - 2.1.2.13.10 To report error with each occurrence of overheat limit trip and to identify limit that tripped. Error code stored in nonvolatile memory.
 - 2.1.2.13.11 To shut off gas heat if flame rollout occurs and to report error identifying rollout switch.
 - 2.1.2.13.12 Maximum flame rollout switch trip count of 3 during heating cycle, with digital output, limit indicator. Maximum count limit adjustable from 1 - 6 counts.
 - 2.1.2.13.13 To turn off heat if induced airflow is too low and to report error identifying pressure switch.
 - 2.1.2.13.14 Maximum induced airflow pressure switch trip count of [3] during heating cycle, with digital output, limit indicator. Maximum count limit adjustable from 1 - 6 counts.
 - 2.1.2.13.15 Error reported if gas valve not energized 2 minutes after heating demand; gas valve identified.
 - 2.1.2.13.16 Maximum ignition failure count of [3] with digital output, limit indicator. Maximum count limit adjustable from 1 - 6 counts.
 - 2.1.2.13.17 To shut off gas valve if flame not sensed. Error reported and stored in nonvolatile memory.
 - 2.1.2.13.18 Delay between stages on gas valve.
 - 2.1.2.13.19 To shut off unit if gas valve is energized with no demand for heat. Error reported and stored in nonvolatile memory.

2.1.2.14. Cooling Controls:

- 2.1.2.14.1 Provide Smoke detectors in supply.
- 2.1.2.14.2 Remote controlled outside [And return] air dampers with damper operator and means for adjusting outside air quantity.
- 2.1.2.14.3 Motorized outside air damper with spring return damper operator and control package to automatically vary outside air quantity. Outside air normally closed.
- 2.1.2.14.4 Tight-fitting parallel blade dampers with neoprene

- or suitable gaskets, synthetic bushings and 1% maximum leakage.
- 2.1.2.14.5 Damper Operation: 24 V, spring return motor with gear train sealed in oil.
 - 2.1.2.14.6 Mixed Air Controls: Maintain 55 degrees F (13 degrees C) mixed air temperature (adjustable).
 - 2.1.2.14.7 Up to 2 stages of cooling from Thermostat without need for additional controls.
 - 2.1.2.14.8 Up to 3 stages of cooling when used with relay and 3-stage thermostat or DDC Controller.
 - 2.1.2.14.9 Up to 4 stages of cooling standard with room sensor.
 - 2.1.2.14.10 To allow blower on delay of up to 60 seconds after cooling demand is received. Default value of zero.
 - 2.1.2.14.11 To allow blower off delay of up to 240 seconds after cooling demand has ended. Default value of zero.
 - 2.1.2.14.12 Minimum compressor on time of 240 seconds on 3-phase units, adjustable between 60 - 510 seconds.
 - 2.1.2.14.13 Minimum compressor off time of 300 seconds on single-phase units, adjustable from 60 - 510 seconds.
 - 2.1.2.14.14 Default maximum high pressure switch trip occurrence during cooling or dehumidification cycle of [3]. Trip occurrence limit adjustable from 1 - 8 occurrences. If maximum limit reached, compressor locked out and digital output for service activated.
 - 2.1.2.14.15 Default maximum low pressure switch trip occurrence during cooling or dehumidification cycle of [3]. Trip occurrence limit adjustable from 1 - 8 occurrences. If maximum limit reached, compressor locked out and digital output for service activated.
 - 2.1.2.14.16 Low pressure trip read delay of [5] minutes if compressor off time has been less than 4 hours and outdoor temperature is less than 70 degrees F (21 degrees C). Delay adjustable from 0 - 34 minutes. Temperature set point adjustable from 10 degrees F (-12 degrees C) to 100 degrees F (38 degrees C). Compressor off time adjustable from 1 - 6 hours.
 - 2.1.2.14.17 Low pressure trip read delay of [15] minutes if compressor off time has been 4 hours or greater and outdoor temperature is less than 70 degrees F (21 degrees C). Delay adjustable from 0 - 34 minutes. Temperature set point adjustable from 10 degrees F (-12 degrees C) to 100 degrees F (38 degrees C). Compressor off time adjustable from 1 - 6 hours.
 - 2.1.2.14.18 Low pressure trip read delay of [2] minutes if compressor off time has been less than 4 hours and outdoor temperature is 70 degrees F (21 degrees C) or greater. Delay adjustable from 0 - 34 minutes.

- 2.1.2.14.19 Temperature set point adjustable from 10 degrees F (-12 degrees C) to 100 degrees F (38 degrees C). Compressor off time adjustable from 1 - 6 hours.
- 2.1.2.14.20 Low pressure trip read delay of [8] minutes if compressor off time has been 4 hours or greater and outdoor temperature is 70 degrees F (21 degrees C) or greater. Delay adjustable from 0 - 34 minutes.
- 2.1.2.14.21 Temperature set point adjustable from 10 degrees F (-12 degrees C) to 100 degrees F (38 degrees C). Compressor off time adjustable from 1 - 6 hours.
- 2.1.2.14.22 Each pressure switch trip occurrence (either high or low) to record error in nonvolatile memory and identify compressor circuit.
- 2.1.2.14.23 Low outdoor air temperature compressor lockout set point of 0 degrees F (-18 degrees C) for each compressor circuit. Low outdoor temperature limit set point individually adjustable for each compressor circuit from 80 degrees F (27 degrees C) to -30 degrees F (-34 degrees C).
- 2.1.2.14.24 Maximum allowable evaporator freeze-stat trip occurrence of [3] during cooling demand with limit adjustable from 1 - 4 occurrences. Control to shut off compressor each time freeze-stat trip occurs and record error code in nonvolatile memory. If maximum limit reached, compressor locked out and digital output for service activated.
- 2.1.2.14.25 Condenser Fan Control:
 - 2.1.2.14.25.1 On units with multiple condenser fans, [6] second time delay between condenser fan shutoff and restart to prevent reverse rotation of fan. Time delay adjustable between 0 - 16 seconds.
 - 2.1.2.14.25.2 On units with 4 condenser fans, first stage low outdoor temperature set point of 55 degrees F (13 degrees C) that reduces airflow through condenser by turning off some fans. Set point adjustable between 60 degrees F (16 degrees C) and 10 degrees F (-12 degrees C).
 - 2.1.2.14.25.3 On units with 6 condenser fans, second stage low outdoor temperature set point of 40 degrees F (4 degrees C) to reduce airflow through condenser by turning off all fans. Set point adjustable between 60 degrees F (16 degrees C) and 10 degrees F (-12 degrees C).
 - 2.1.2.14.25.4 On units with 6 condenser fans, condenser fan on delay of [2]

seconds. Adjustable between 0 - 240 seconds.

PART 3 – EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- 3.1.1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions and manufacturer data sheets.

3.2 EXAMINATION

- 3.2.1 Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

3.3 INSTALLATION

- 3.3.1 Install Commercial Packaged gas/DX Cooling unit in accordance with manufacturer's instructions.
- 3.3.2 Run drain line from cooling coil condensation drain pan to discharge.

3.4 PERFORMANCE VERIFICATION

- 3.4.1 Ensure performance verification of every part of the unit including, but not necessarily limited to, the following components, as a factory-built and packaged unit: (a) mixing chamber or plenum with outside air and return air dampers; filters; either (i) heating coil or (ii) gas-fired heating unit; DX refrigeration system (generally with air-cooled condenser DX cooling coil with drain pan); supply fan with motor and drive.

3.4.1.1 General:

- 3.4.1.1.1 Perform starting and adjusting single package unit verification as follows:

3.4.1.1.2 Settings:

- 3.4.1.1.2.1 Set outside air and return air dampers for minimum outside air.
- 3.4.1.1.2.2 Set outside air and return air dampers for percentage of outside air required by design and repeat measurements of fan capacity.

3.4.1.1.3 Measurements:

- 3.4.1.1.2.3 Measure supply fan capacity.
- 3.4.1.1.2.4 Measure pressure drop of each component of air handling unit.

3.4.1.1.4 Measure DBT, WBT of SA, RA, EA.

- 3.4.1.1.5 Measure air cooled condenser discharge DBT.
- 3.4.1.1.6 Measure flow rates (minimum and maximum) of SA, RA, EA.
- 3.4.1.1.7 Measure radiated and discharge sound power levels under maximum heating demand and under maximum cooling demand with compressors running.
- 3.4.1.1.8 Measure DX refrigeration system performance as specified.

3.4.1.2 Simulations:

- 3.4.1.2.1 Simulate maximum cooling load and measure refrigerant hot gas and suction temperatures and pressures.
- 3.4.1.2.2 Simulate maximum heating load and:
 - 3.4.1.2.2.1 Verify temperature rise across heat exchanger.
 - 3.4.1.2.2.2 Perform flue gas analysis.
 - 3.4.1.2.2.3 Verify combustion airflow to heat exchanger.
 - 3.4.1.2.2.4 Simulate minimum heating load and repeat measurements.

3.4.1.3 Control Strategies:

- 3.4.1.3.1 Verify operating control strategies, including:
 - 3.4.1.3.1.1 Heat exchanger operating and high limit.
 - 3.4.1.3.1.2 Early morning warm-up cycle.
 - 3.4.1.3.1.3 Freeze protection.
 - 3.4.1.3.1.4 Economizer cycle operation, temperature of changeover.
 - 3.4.1.3.1.5 Alarms.
 - 3.4.1.3.1.6 Voltage drop across thermostat wiring.
 - 3.4.1.3.1.7 Operation of remote panel, including pilot lights, failure modes.

3.4.1.4 Operation and Adjustment:

- 3.4.1.4.1 Check for smooth, vibrationless correct rotation of supply fan impeller.
- 3.4.1.4.2 Adjust impeller speed as necessary and repeat measurement of fan capacity.
- 3.4.1.4.3 Reduce differences between fan capacity at minimum and maximum outside air less than [5] %.
- 3.4.1.4.4 Reduce difference between fan capacity at full cooling and fan capacity at full heating to less than [5] %.
- 3.4.1.4.5 OAD: Verify for proper travel.
- 3.4.1.4.6 Use smoke test to verify no short-circuiting of EA, relief air to outside air intake.
- 3.4.1.4.7 Check for smooth, vibrationless, correct rotation of

- power exhaust impeller.
- 3.4.1.4.8 Check capacity of heating unit.
- 3.4.1.4.9 Refer to other sections of these specifications for PV procedures for other components.

3.5 COMPLETION AND CLEANUP

- 3.5.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

DIVISION 15 — MECHANICAL

Section 15785 — Motors and Motor Controllers

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Mechanical plans and specifications are part of project documents. Failure to comply shall not relieve contractor of responsibility or be used as basis for additional compensation due to omission of Engineer of Record.

1.2 WORK INCLUDED

- 1.2.1 Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

1.3 REFERENCES

- 1.3.1 NEMA ICS-2 - Industrial Control Devices, Controllers and Assemblies. Furnish and install electric motors required for equipment furnished under this division.

1.4 SUBMITTALS

- 1.4.1 Include product data on motors, motor starters and combination motor starters, relays, pilot devices and switching and overcurrent protective devices. Include trip ratings, size and UL listing.
- 1.4.2 Where similar items of equipment are utilized, include separate data sheet for each item, individually identified as to function.
- 1.4.3 Provide Operation and Maintenance manual.

1.5 QUALITY ASSURANCE

1.5.1 WARRANTY:

Warrant the Work specified herein for one year and motors for five years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

1.5.2 Provide motor starters under this division by same manufacturer where possible.

PART 2 – PRODUCTS

2.1 ELECTRIC MOTORS

2.1.1 APPROVED MANUFACTURERS: Provide motors by a single manufacturer as much as possible.

- 2.1.1.1 Baldor
- 2.1.1.2 Allis-Chalmers
- 2.1.1.3 Siemens-Allis
- 2.1.1.4 Gould
- 2.1.1.5 General Electric
- 2.1.1.6 Westinghouse

2.1.2 TEMPERATURE RATING: Provide insulation as follows:

- 2.1.2.1 Class b: 40 degrees C maximum
- 2.1.2.2 Class F:
 - 2.1.2.2.1 Between 40 degrees C and 65 degrees C maximum.
 - 2.1.2.2.2 Totally enclosed motors.

2.1.3 STARTING CAPABILITY: As required for service indicated five starts minimum per hour.

2.1.4 PHASES AND CURRENT: Verify electrical service compatibility with motors to be used.

- 2.1.4.1 Up to ½ HP: Provide permanent split, capacitor-start single phase with inherent overload protection.
- 2.1.4.2 ½ HP and Larger: Provide squirrel-cage induction polyphase.
- 2.1.4.3 Provide two separate windings on 2-speed polyphase motors.
- 2.1.4.4 Nameplate voltage shall be the same as the circuit's normal voltage, serving the motor.

2.1.5 SERVICE FACTOR: 1.15 for polyphase; 1.35 for single phase.

2.1.6 FRAMES: U-frames 1.5 h.p. and larger.

2.1.7 BEARINGS: Provide sealed re-greasable ball bearings; with top mounted alemite lubrication fittings and bottom side drains minimum average life 100,000 hours typically, and others as follows:

- 2.1.7.1 Design for thrust where applicable.
- 2.1.7.2 Permanently Sealed: Where not accessible for greasing.
- 2.1.7.3 Sleeve-Type with Oil Cups: Light duty fractional hp motors or polyphase requiring minimum noise level.

2.1.8 ENCLOSURE TYPE: Provide enclosures as follows:

- 2.1.8.1 Concealed Indoor: Open drip proof.
- 2.1.8.2 Exposed Indoor: Guarded.
- 2.1.8.3 Outdoor Typical: Type II. TEFC.
- 2.1.8.4 Outdoor Weather Protected: Type I. TEAO.
- 2.1.8.5 Battery Room Exhaust Fans: Shall have explosion proof motors.

2.1.9 OVERLOAD PROTECTION: Built-in sensing device for stopping motor in all phase legs and signaling where indicated for fractional horse power motors.

2.1.10 NOISE RATING: "Quiet" except where otherwise indicated.

2.1.11 EFFICIENCY: Minimum full load efficiency listed in the following table, when tested in accordance with IEEE Test Procedure 112A, Method B, including stray load loss measure.

2.2 MOTOR CONTROLLERS (STARTERS)

2.2.1 All motor controllers (for equipment furnished under Division 15) shall be furnished under Division 15 and installed under Division 16 unless otherwise noted on the plans.

2.2.2 Motor starters shall be furnished as follows:

- 2.2.2.1 Motor starters shall be across the line magnetic type rated in accordance with NEMA Standards, sizes and horsepower ratings. Starters shall be mounted in general purpose enclosure unless otherwise indicated on plans.
- 2.2.2.2 Starters shall be equipped with double break silver alloy contacts. All contacts shall be replaceable without removing power wiring or removing starter from enclosure. Starter must have straight through wiring.
- 2.2.2.3 Coils shall be of molded construction.
- 2.2.2.4 Overload relays shall be the melting alloy type with a replaceable control circuit module. Thermal units shall be of one piece construction and interchangeable. The starter shall be inoperative if the thermal unit is removed.
- 2.2.2.5 NEMA Size 0 through 7 starters shall be suitable for the addition of at least four external auxiliary contact of any arrangement normally open or normally closed. Sizes 0-7 external auxiliary contacts shall be field convertible. Size 00 and Size 8 starters shall be suitable for the addition of up to three external auxiliary

contacts of any arrangement normally open or normally closed.

2.2.2.6 All magnetic starters with “hand-off-auto” selector switch and pilot light shall be Square D Class 8536, Form CP, three-pole, three phase of NEMA size applicable with three melting alloy overload relays and three position HO-A switch and pilot light in cover of general purpose enclosure.

2.2.2.7 For single phase motors not equipped with overload protection, provide a manual motor starter, Square D Class 2510. This manual starter may be used for control or disconnect purposes.

2.2.3 APPROVED MANUFACTURERS: Controller numbers are based on first named manufacturer. Other manufacturer’s equivalent products are approved.

2.2.3.1 Allen Bradley

2.2.3.2 Square D

2.2.3.3 General Electric

PART 3 – EXECUTION

3.1 All equipment shall be installed in accordance with the manufacturer’s recommendations and printed installation instructions.

3.2 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractor’s price shall include all items required as per manufacturer’s requirements.

3.3 INSTALLATION

3.3.1 GENERAL: Install in a professional manner. Any part or parts not meeting this requirement shall be replaced or rebuilt without extra expense to Owner.

3.3.2 Install rotating equipment in static and dynamic balance.

3.3.3 Provide foundations, supports, and isolators properly adjusted to allow minimum vibration transmission within the building.

3.3.4 Correct objectionable noise or vibration transmission in order to operate equipment satisfactorily as determined by the Engineer.

3.3.5 Install motor control equipment in accordance with manufacturer’s instructions.

3.3.6 Select and install heat elements in motor starters to match installed motor characteristics.

3.3.7 MOTOR DATA: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor and voltage/phase rating. Provide phenolic nameplate on cover exterior to indicate motor served.

3.3.8 Mount on housekeeping pad for floor mounted equipment.

3.3.9 Mount in accessible location to allow sufficient room for maintenance on itself and adjacent items.

END OF SECTION

DIVISION 15 — MECHANICAL

Section 15818 — Ductwork

PART 1 – GENERAL

1.1 WORK INCLUDED

1.1.1 Ductwork and Plenums

1.1.2 Fasteners

1.1.3 Sealants

1.1.4 Duct Accessories

1.2 REFERENCE STANDARDS

1.2.1 Fabricate in accordance with 1994 UMC Standards, SMACNA Duct Manuals and ASHRAE Handbooks. All low pressure ductwork rated below 2-inches W.G. shall meet SMACA Seal Class "C".

1.2.2 Construct ductwork to NFPA 90A, Air Conditioning and Ventilating Systems NFPA 90B, Standard for the Installation of Warm Air Heating and Air Conditioning Systems and NFPA 96, Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.

1.3 DEFINITIONS

1.3.1 Duct Sizes: Inside clear dimensions. For acoustically lined or internally insulated ducts, maintain sizes inside lining or insulation.

1.4 SUBMITTALS

1.4.1 Submit Shop Drawings for ductwork systems in accordance with Specification Section 15010.

1.4.2 Submit Shop Drawings of all ductwork layouts including enlarged plans and elevations of all air handling equipment and submit sample details of duct fittings including particulars such as gage sizes, welds, and configurations prior to start of work.

1.4.3 Submit product data.

- 1.4.4 Confirm ductwork has been fabricated and installed in accordance with recommendations and SMACNA Standards.

PART 2 – PRODUCTS

2.1 MATERIALS

- 2.1.1 Ducts: Galvanized steel ASTM A 527-71, lock forming quality, having zinc coating of 1.25 ounces per square foot for each side.
- 2.1.2 Fasteners: Use rivets and bolts throughout; sheet metal screws accepted on low pressure ducts.
- 2.1.3 Sealant: Water resistant, fire resistive, compatible with mating materials.
- 2.1.4 Flexible fibrous glass ducts: Flexible duct consisting of polyester film liner duct permanently bonded to a coated steel wire helix and wrapped with flexible fibrous glass insulation, enclosed by reinforced foil type vapor barrier jacket. Insulation to have a “c” value at 75°F maximum 0.23 btu in./sq. ft. deg. F. hr.

2.2 FABRICATION AND SEALANTS

- 2.2.1 Complete metal ducts within themselves with no single partition between ducts. Where width of duct exceeds 18-inches, cross break for rigidity. Open corners are not acceptable.
- 2.2.2 Lap metal ducts in direction of air flow. Hammer down edges and slips to leave smooth duct interior.
- 2.2.3 Construct tees, bends, and elbows with radius of not less than 1-1/2 times width OD duct on center line. Where not possible and where rectangular elbows used, provide steel air foil type turning vanes Elgen 2” hollow turning vanes, or equal. Where acoustical lining is required, provide turning vanes of perforated metal type with fiberglass inside.
- 2.2.4 Increase duct sizes gradually, not exceeding 15 degrees (0.26 rad.) divergence wherever possible. Maximum divergence upstream of equipment to be 30 degrees and 45 degrees downstream.
- 2.2.5 Provide splitter dampers at each duct split. Splitter dampers to be #14-gauge galvanized steel, and shall operate smoothly in any position. Damper blade length shall be 2 times the width of the smallest split. All volume dampers shall have bronze bearings and shall be opposed blade type. Furnish and install adjustable locking and indicating devices for each damper. Where ducts are concealed, use Young No. 1 Damper-Regulators.
- 2.2.6 Provide Metalaire “Airtrol” (or equal) air extractor at each junction of branch and trunk duct where duct is not split. Extractor shall have operating rod and locking quadrant for accessible duct and Young Regulator for duct not accessible.

- 2.2.7 All ductwork shall be adequately supported by galvanized steel hangers spaced not more than five feet center to center. Ducts shall be anchored securely to the building in an approved manner to be completely free from vibration under all conditions of operation. Sheet metal ducts shall be properly braced and reinforced with galvanized steel angles, or other structural members.
- 2.2.8 Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where shown, specified, or required for access to equipment for cleaning and inspection.

2.3 SCHEDULE: DUCT SYSTEMS (REFER TO SECTION 2.01)

- 2.3.1 Supply air ductwork; rectangular or round galvanized sheet metal ductwork, and fittings. Pre-insulated flexible ductwork shall be used for duct connections to diffusers. Flexible duct runs shall be limited to eight-foot lengths or less.
- 2.3.2 Return and exhaust air ducts shall be rectangular or round galvanized sheet metal ductwork and fittings. Use radius fittings wherever possible.
- 2.3.3 Outside air ductwork shall be rectangular galvanized sheet metal ductwork and fittings.
- 2.3.4 Return air plenums shall be rectangular galvanized sheet metal ductwork. Fabricate plenums upstream of fan of 16-gauge material. Fabricate plenums upstream of filters min. 18-gauge material.
- 2.3.5 See Specification Section 15082 for duct insulation.

2.4 DUCT ACCESSORIES

2.4.1 Access Doors

- 2.4.1.1 Fabricate rigid and close-fitting doors of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum 1-inch thick insulation with sheet metal cover.
- 2.4.1.2 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. Provide an additional hinge for larger sizes.

2.4.2 Dampers

- 2.4.2.1 Fabricate of galvanized steel, minimum 16-gage and provide with quadrants or adjustment rod and lock screw.
- 2.4.2.2 Fabricate splitter dampers of double thickness sheet metal to streamline shape, properly stiffened to avoid vibration. Size on basis of straight air volume proportioning.
- 2.4.2.3 Fabricate multi-blade, damper of opposed blade pattern with maximum blade sizes 12-inch x 72-inch. Assemble center and edge crimped blade in prime coated or galvanized channel frame

with suitable hardware.

2.4.2.4 Fabricate multi-blade, parallel action gravity balanced backdraft dampers with blades a maximum of six-inch width having felt or flexible vinyl sealing edges, linked together in rattle-free manner and with adjustment device to permit setting for varying differential static pressure.

2.4.3 Flexible connections

2.4.3.1 Fabricate of neoprene coated flameproof fabric approximately two-inch wide tightly crimped into metal edging strip and attach to ducting and equipment by screws or bolts at six-inch intervals.

2.4.4 Spin-In Duct Connections

2.4.4.1 Factory assembled fittings of galvanized steel construction suitable for connection to galvanized steel ductwork.

2.4.4.2 Factory assembled fittings of galvanized steel construction suitable for connection to 1" thick fiberglass ductboard.

2.4.4.3 Fittings shall include locking quadrant operated damper and 45°F air extractor.

2.4.4.4 All spin-in fittings up to 8" shall be of 30-gauge material; fittings above 8" shall be minimum of 26-gauge material.

2.5 DUCTWORK SUPPORTS AND SLEEVES

2.5.1 Duct hangers shall be attached with "C" clamps to structural beams. All materials shall be galvanized. Hangers shall be steel straps when concealed and rods and trapeze hanger when ductwork is exposed. Straps shall be connected to the duct with two sheet metal screws on side, minimum and one on the bottom. Spacing shall be a maximum of five-feet on center.

2.5.2 Duct Hanger Schedule: Rectangular
Duct Width Min. Rod Strap Trapeze
Up to 36" --- 1" x 16 ga. P1000 Unistrut
37 thru 60" 3/8" 1" x 16 ga. P1000 Unistrut
61" Up 3/8" 1 1/2" x 12 ga. P1000 Unistrut

2.5.3 Duct Hanger Schedule: Round Duct
External Insulation: 6" x 16 ga. Saddle w/1" x 16 ga. Straps
Internal Insulation: 1" x 16 ga.
Flexible Round Duct: Nylon reinforced polyester saddle strap suspended by 18 ga. Wire

2.5.4 Duct Sleeves: 22-gage galvanized steel, duct insulation and vapor barrier shall extend through sleeve, sleeves shall be sized as required by the thickness of the insulation. The space between the duct or duct insulation and the opening shall be packed with suitable material.

PART 3 – EXECUTION

3.1 INSTALLATION

- 3.1.1 Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- 3.1.2 Clean duct system to remove accumulated dust. Ducts shall be closed on ends between phases of fabrication to assure that no foreign material enters the ducts. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.
- 3.1.3 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- 3.1.4 At each point where ducts pass through partitions, seal joints around duct with noncombustible material.
- 3.1.5 Provide access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, and elsewhere as indicated. Review locations prior to fabrication.
- 3.1.6 Provide 4" x 4" quick opening access doors for inspection at balancing dampers.
- 3.1.7 Provide balancing dampers at points on low pressure supply, return, and exhaust systems as required for air balancing.
- 3.1.8 Provide flexible connections immediately adjacent to equipment in ducts associated with fans and equipment subject to forced vibration.
- 3.1.9 Flexible fibrous glass ducts shall be connected to the spin-in fitting, round sheet metal duct or the round inlet to an air device in the following manner:
 - 3.1.9.1 Pull the interior liner with steel wire helix over the round duct and tape.
 - 3.1.9.2 Clamp the liner to the taped down duct with stainless steel band clamp with worm drive. Clamps to be Thermaflex "Snaplock", Ideal 56 Series Snaplock or approved equal.
 - 3.1.9.3 Pull the insulation and vapor barrier jacket over the clamp and seal with 2 wraps of duct tape.

3.2 DUCT SEALANT

- 3.2.1 Low pressure galvanized round ductwork seams and joints sealed with united McGill, United Duct Sealer or approved equal. Sealant shall be installed as follows:
 - 3.2.1.1 Apply sealer to male section with a brush.
 - 3.2.1.2 Insert fitting into duct or collar and secure with sheet metal screws.

- 3.2.1.3 Apply sealant to outside of assembled joint in a 2-inch wide band, making sure all screw heads are covered.
- 3.2.1.4 Allow the sealant to cure for 48 hours before pressure testing for leaks.
- 3.2.2 Low pressure rectangular galvanized ductwork seams and joints shall be sealed with Hardcast Two-Part Sealing System. Cover the seam or joint with Type DT tape set in Type FTA-20 adhesive. Coat the exterior of the tape with an additional coating of adhesive.

END OF SECTION

DIVISION 15 — MECHANICAL

Section 15838 — Fans

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1. Drawings and general provisions of the Contract apply to this Section.

1.2 SUMMARY:

- 1.2.1 This Section includes the following:

- 1.2.1.1 Ceiling-mounted ventilators.
- 1.2.1.2 In-line centrifugal fans.

- 1.2.2 Related Sections: The following Sections contain requirements that relate to this Section:

- 1.2.2.1 Division 15 Section "Vibration Control" for vibration hangers and supports.
- 1.2.2.2 Division 15 Section "Control Systems Equipment" for control devices.
- 1.2.2.3 Division 16 Section "Disconnect Switches".
- 1.2.2.4 Division 16 Section "Motor Controllers" for motor starters.

1.3 PERFORMANCE REQUIREMENTS:

- 1.3.1 Project Altitude: Base air ratings on actual site elevations.
- 1.3.2 Project Altitude: Base air ratings on sea-level conditions.
- 1.3.3 Operating Limits: Classify according to AMCA 99.
- 1.3.4 Fan Unit Schedule: The following information is described in an equipment schedule on the Drawings.
 - 1.3.4.1 Fan performance data including capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

- 1.3.4.2 Fan arrangement including wheel configuration, inlet and discharge configurations, and required accessories.

1.4 SUBMITTALS

- 1.4.1 General: Submit each item in this Article according to the Conditions of the Contract.
- 1.4.2 Product Data including rated capacities of each unit, weights (shipping, installed, and operating), furnished specialties, accessories, and the following:
 - 1.4.2.1 Certified fan performance curves with system operating conditions indicated.
 - 1.4.2.2 Certified fan sound power ratings.
 - 1.4.2.3 Motor ratings and electrical characteristics plus motor and electrical accessories.
 - 1.4.2.4 Material gages and finishes, including color charts.
 - 1.4.2.5 Dampers, including housings, linkages, and operators.
- 1.4.3 Shop Drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.
- 1.4.4 Coordination Drawings, according to Division 15 Section "Basic Mechanical Requirements," for reflected ceiling plans drawn accurately to scale and coordinating penetrations and units mounted above ceiling. Show the following:
 - 1.4.4.1 Roof framing and support members relative to duct penetrations.
 - 1.4.4.2 Ceiling suspension assembly members.
 - 1.4.4.3 Size and location of initial access modules for acoustical tile.
 - 1.4.4.4 Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- 1.4.5 Wiring diagrams detailing wiring for power and control systems and differentiating clearly between manufacturer-installed and field-installed wiring.
- 1.4.6 Maintenance data for power ventilators to include in the operation and maintenance manual specified in Division 1 and in Division 15 Section "Basic Mechanical Requirements."
- 1.5.1 Electrical Component Standard: Provide components that comply with NFPA 70 and that are listed and labeled by UL where available.
- 1.5.2 Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.
 - 1.5.2.1 The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
 - 1.5.2.2 Listing and Labeling Agency Qualifications: A "Nationally

Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

- 1.5.3 AMCA Compliance: Provide products that meet performance requirements and are licensed to use the AMCA Seal.
- 1.5.4 NEMA Compliance: Provide components required as part of fans that comply with applicable NEMA standards.
- 1.5.5 UL Standard: Provide power ventilators that comply with UL 705.

1.6 PROJECT CONDITIONS

- 1.6.1 Field Measurements: Verify dimensions by field measurements. Verify clearances.
- 1.6.2 Do not operate fans until ductwork is clean, filters are in place, bearings are lubricated, and fans have been commissioned.

1.7 COORDINATION AND SCHEDULING

- 1.7.1 Coordinate the size and location of structural steel support members.
- 1.7.2 Coordinate the installation of roof curbs, equipment supports, and roof penetrations. Roof specialties are specified in Division 7 Sections.

1.8 EXTRA MATERIALS

- 1.8.1 Furnish one set of belts for each belt-driven fan that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

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

- 2.1.1.1 Cook
- 2.1.1.2 Greenheck
- 2.1.1.3 ACME

2.2 CEILING-MOUNTED VENTILATORS

- 2.2.1 Description: Centrifugal fans designed for installing in ceiling or wall, or for concealed in-line applications.
- 2.2.2 Housing: Galvanized steel lined with acoustical insulation.
- 2.2.3 Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

- 2.2.4 Grille: Stainless-steel, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- 2.2.5 Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- 2.2.6 Variable-Speed Controller: Solid-state control to reduce speed from 100 percent to less than 50 percent.
- 2.2.7 Accessories: Manufacturer's standard roof jack or wall cap, and transition fittings.

2.3 IN-LINE CENTRIFUGAL FANS

- 2.3.1 Description: In-line, belt-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, drive assembly, motor and disconnect switch, mounting brackets, and accessories.
- 2.3.2 Housing: Split, spun-aluminum housing, with aluminum straightening vanes; inlet and outlet flanges; and support bracket adaptable to floor, side wall, or ceiling mounting.
- 2.3.3 Direct-Drive Units: Motor encased in housing out of air stream, factory wired to disconnect located on outside of fan housing.
- 2.3.4 Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
- 2.3.5 Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- 2.3.6 Accessories: The following accessories are required as indicated:
 - 2.3.6.1 Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
 - 2.3.6.2 Companion Flanges: For inlet and outlet duct connections.
 - 2.3.6.3 Fan Guards: Expanded metal in removable frame. Provide belt guards for units not connected to ductwork.

2.4 MOTORS

- 2.4.1 Refer to Division 15 Section "Motors" for general requirements for factory-installed motors.
- 2.4.2 Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B.
- 2.4.3 Enclosure Type: The following features are required as indicated:
 - 2.4.1 Open drip proof motors where satisfactorily housed or remotely located during operation.
 - 2.4.2 Guarded drip proof motors where exposed to contact by employees or building occupants.

2.5 FACTORY FINISHES

- 2.5.1 Sheet Metal Parts: Prime coat before final assembly.
- 2.5.2 Exterior Surfaces: Baked-enamel finish coat after assembly.
- 2.5.3 Aluminum Parts: No finish required.

2.6 SOURCE QUALITY CONTROL

- 2.6.1 Testing Requirements: The following factory tests are required as indicated:
 - 2.6.1.1 Sound Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings From Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA Seal.
 - 2.6.1.2 Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 – EXECUTION

3.1 EXAMINATION

- 3.1.1 Examine areas and conditions for compliance with requirements of installation tolerances and other conditions affecting performance of the power ventilators. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- 3.2.1 Install power ventilators according to manufacturer's written instructions.
- 3.2.2 Support units using the vibration-control devices indicated. Vibration-control devices are specified in Division 15 Section "Vibration Control."
 - 3.2.2.1 Suspend units from structural steel support frame using threaded steel rods and vibration isolation springs.
 - 3.2.2.2 Ceiling Units: Suspend units from structure using steel wire or metal straps.
- 3.2.3 Install units with clearances for service and maintenance.
- 3.2.4 Label units according to requirements specified in Division 15 Section "Mechanical Identification."

3.3 CONNECTIONS

- 3.3.1 Duct installation and connection requirements are specified in other Division 15 Sections. Drawings indicate the general arrangement of ducts

and duct accessories. Make final duct connections with flexible connectors.

3.3.2 Electrical: Conform to applicable requirements in Division 16 Sections.

3.3.3 Grounding: Ground equipment. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

3.4.1 Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise the field assembly of components and installation of fans, including duct and electrical connections, and to report results in writing.

3.5 ADJUSTING

3.5.1 Adjust damper linkages for proper damper operation.

3.5.2 Adjust belt tension.

3.5.3 Lubricate bearings.

3.6 CLEANING

3.6.1 After completing installation, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.

3.6.2 Clean fan interiors to remove foreign material and construction debris. Vacuum clean fan wheel and cabinet.

3.7 COMMISSIONING

3.7.1 Final Checks before Startup: Perform the following operations and checks before startup:

3.7.1.1 Verify that shipping, blocking, and bracing are removed.

3.7.1.2 Verify that unit is secure on mountings and supporting devices and that connections for piping, ducts, and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnects.

3.7.1.3 Perform cleaning and adjusting specified in this Section.

3.7.1.4 Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.

3.7.1.5 Lubricate bearings, pulleys, belts, and other moving parts with factory recommended lubricants.

3.7.1.6 Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in the fully

- open position.
- 3.7.1.7 Disable automatic temperature-control operators.
- 3.7.2 Starting procedures for fans are as follows:
 - 3.7.2.1 Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
 - 3.7.2.2 Measure and record motor voltage and amperage.
- 3.7.3 Shut unit down and reconnect automatic temperature-control operators.
- 3.7.4 Refer to Division 15 Section "Testing, Adjusting, and Balancing" for procedures for air-handling-system testing, adjusting, and balancing.
- 3.7.5 Replace fan and motor pulleys as required to achieve design conditions.

3.8 DEMONSTRATION

- 3.8.1 Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
- 3.8.2 Review data in the operation and maintenance manuals. Refer to Division 1 Section "Contract Closeout."
- 3.8.3 Schedule training with Owner, through Architect, with at least 7 days' advance notice.
- 3.8.4 Demonstrate operation of power ventilators. Conduct walking tour of the Project. Briefly identify location and describe function, operation, and maintenance of each power ventilator.

END OF SECTION

DIVISION 15 — MECHANICAL

Section 15862 — Air Filters

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Mechanical plans and specifications are part of project documents. Failure to comply shall not relieve contractor of responsibility or be used as basis for additional compensation due to omission of Engineer of Record.

1.2 WORK INCLUDED

- 1.2.1 Disposable media filters.
- 1.2.2 Filter frames.

1.3 REFERENCES

- 1.3.1 UL 900 - Test Performance of Air Filter Units.
- 1.3.2 ASHRAE 52 - Method of Testing Air Cleaning Devices used in General Ventilation for Removing Particulate Matter.

1.4 SUBMITTALS

- 1.4.1 Include filter media, filter performance data, filter assembly and filter frames.
- 1.4.2 Provide Operation and Maintenance manual.

1.5 QUALITY ASSURANCE

- 1.5.1 Provide filter media that is UL 900 listed, Class 2, as approved by local authorities.
- 1.5.2 Provide all filters as product of one manufacturer.
- 1.5.3 Assemble filter components to form filter banks from products of one manufacturer.

1.6 EXTRA MATERIALS

- 1.6.1 Provide one spare set of disposable media filters at project final acceptance for each piece of equipment requiring filters.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- 2.1.1 American Air Filter
- 2.1.2 Carn-Farr
- 2.1.3 Continental

2.2 DISPOSABLE PANEL FILTERS

- 2.2.1 Media: 2 inch thick, high efficiency, fiber blanket, factory sprayed with flameproof, non-drip, non-volatile adhesive. Provide industry standard sizes as required for installation.
- 2.2.2 Rating: 500 FPM face velocity, 0.17 inch WG initial resistance, 0.65 inches WG recommended final resistance. Minimum efficiency is 25% as per ASHRAE 52-76 dust spot rating and average ASHRAE arrestance is 90%.
- 2.2.3 Provide filter media in permanent removable frames.
- 2.2.4 Holding Frames: 18 gauge minimum galvanized steel frame with 11 gauge galvanized steel rod grid on inlet and outlet side, hinged with pull

and latch mechanism.

2.3 FILTER FRAMES

- 2.3.1 Fabricate filter frames and supporting structures of 16 gauge galvanized steel or extruded aluminum T-section construction with necessary gasketing between frames and walls.
- 2.3.2 Standard Sizes: Provide for interchangeability of filter media of other manufacturers; for panel filters, size for required installation of filter media minimum 2 inch thick; for extended surface and high efficiency particulate filters provide for upstream mounting.
- 2.3.3 Side Servicing Housings: Flanged for connection of ductwork, of reinforced 16 gauge galvanized steel; access doors with continuous gasketing and positive locking devices on both sides; extended aluminum tracks or channels for primary and secondary filters with positive sealing gaskets.

PART 3 – EXECUTION

3.1 INSTALLATION

- 3.1.1 Install air cleaning devices in accordance with manufacturer's instructions.
- 3.1.2 Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.
- 3.1.3 Do not operate fan system until filters, temporary or permanent, are in place. Replace temporary filters used during construction.
- 3.1.4 Install static pressure taps upstream and downstream of filters. Mount on outside of filter housing or filter plenum, in accessible position. Adjust and level.

END OF SECTION
DIVISION 15 — MECHANICAL

Section 15880 — Diffusers, Registers, and Grilles

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Mechanical plans and specifications are part of project documents. Failure to comply shall not relieve contractor of responsibility or be used as basis for additional compensation due to omission of Engineer of Record.

1.2 SUMMARY

- 1.2.1 This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

1.3 DEFINITIONS

- 1.3.1 Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.
- 1.3.2 Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.
- 1.3.3 Register: A combination grille and damper assembly over an air opening.

1.4 SUBMITTALS

- 1.4.1 Product Data: For each model indicated, include the following:
 - 1.4.1.1 Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
 - 1.4.1.2 Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
 - 1.4.2.3 Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size, and accessories furnished.
 - 1.4.2.4 Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods assembly of components.
- 1.4.2 Coordination Drawings: Reflected ceiling plans and wall elevations drawn to scale to show locations and coordination of diffusers, registers, and grilles with other items installed in ceilings and walls.
- 1.4.3 Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for diffusers, registers, and grilles with factory-applied color finishes.
- 1.4.4 Samples for Verification: Of diffusers, registers, and grilles, in manufacturer's standard sizes, showing the full range of colors. Prepare Samples from the same material to be used for the Work.

1.5 QUALITY ASSURANCE

- 1.5.1 Product Options: Drawings and schedules indicate specific requirements of diffusers, registers, and grilles and are based on the specific requirements of the systems indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."
- 1.5.2 NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

PART 2 – PRODUCTS

2.1 MANUFACTURED UNITS

- 2.1.1 Diffusers, registers, and grilles are scheduled on Drawings.

- 2.1.2 Products: Subject to compliance with requirements, provide one of the following:
 - 2.1.2.1 MetalAire
 - 2.1.2.2 Price Industries
 - 2.1.2.3 Titus
- 2.1.3 Material, finish, duct connection, face style, mounting and patterns should match existing.
- 2.1.4 Accessories: Include the following:
 - 2.1.4.1 Equalizer deflectors.
 - 2.1.4.2 Smudge ring.
 - 2.1.4.3 Plaster ring.
 - 2.1.4.4 Extractor.
 - 2.1.4.5 Operating keys.

2.2 SOURCE QUALITY CONTROL

- 2.2.1 Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 – EXECUTION

3.1 EXAMINATION

- 3.1.1 Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- 3.2.1 Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.
- 3.2.2 Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of the panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- 3.2.3 Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- 3.3.1 After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.4 CLEANING

- 3.4.1 After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION

DIVISION 15 — MECHANICAL

Section 15895 — Duct Accessories

PART 1 – GENERAL

1.1 WORK INCLUDED

- 1.1.1 VOLUME CONTROL DAMPERS
- 1.1.2 ROUND DUCT TAPS
- 1.1.3 FIRE DAMPERS
- 1.1.4 BACKDRAFT DAMPERS
- 1.1.5 AIR TURNING DEVICES
- 1.1.6 FLEXIBLE DUCT CONNECTIONS
- 1.1.7 DUCT ACCESS DOORS
- 1.1.8 DUCT TEST HOLES

1.2 RELATED WORK

- 1.2.1 SECTION 15818 – Ductwork
- 1.2.2 SECTION 15880 – Diffusers, Registers and Grilles

1.3 REFERENCES

- 1.3.1 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- 1.3.2 SMACNA - Low Pressure Duct Construction Standards.
- 1.3.3 UL 33 - Heat Responsive Links for Fire-Protection Service.
- 1.3.4 UL 555 and 555S - Fire Dampers and Ceiling Dampers.
- 1.3.5 E477 - Method of testing duct liner and prefabricated silencers for

associated noise and airflow performance.

1.4 SUBMITTALS

- 1.4.1 Submit shop drawings and product data under provisions of Division 1.
- 1.4.2 Provide shop drawings for shop fabricated assemblies indicated, including volume control dampers duct access doors duct test holes. Provide product data for hardware used.
- 1.4.3 Submit manufacturer's installation instructions under provisions of Division 1, for fire dampers.

PART 2 – PRODUCTS

2.1 VOLUME CONTROL DAMPERS

- 2.1.1 Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards, and as indicated.
- 2.1.2 Fabricate splitter dampers of material same gage as duct to 24 inches size in either direction, and two gages heavier for sizes over 24 inches.
- 2.1.3 Fabricate splitter dampers of double thickness sheet metal to streamline shape. Secure blade with continuous hinge or rod. Operate with minimum 1/4 inch diameter rod in self aligning, universal joint, action flanged bushing, with set screw.
- 2.1.4 Fabricate single blade dampers for duct sizes to 9-1/2 x 24 inches.
- 2.1.5 Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12 x 72 inches.
 - 2.1.5.1 Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
 - 2.1.5.2 On outside air, return air, and all other dampers required to be low leakage type, provide galvanized blades and frames, six inches wide maximum, with replaceable EPT rubber seals on blade edges and stainless steel side seals. Provide blades in a double sheet corrugated type construction for extra strength. Provide channel shape frames for strength and blade linkage enclosure to keep linkage out of the air stream. Construction leakage not to exceed 1/2%, based on 2,000 fpm and 4 inch static pressure.
- 2.1.6 Provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.
- 2.1.7 Provide locking, indicating quadrant regulators on single and multi-blade dampers. Where rod lengths exceed 30 inches provide regulator at both ends.

- 2.1.8 On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
- 2.1.9 Manufacturer: Subject to compliance with requirements, provide dampers of one of the following:
 - 2.1.9.1 Air Balance, Inc.
 - 2.1.9.2 Airguide Corp.
 - 2.1.9.3 American Warming & Ventilating, Inc.
 - 2.1.9.4 Arrow Louver and Damper; Div. of Arrow United Industries, Inc. Louvers & Dampers, Inc.
 - 2.1.9.5 Penn Ventilator Co.
 - 2.1.9.6 Ruskin Mfg. Co.

2.2 ROUND DUCT TAPS

- 2.2.1 Taps to trunk duct for round flexible duct shall be spin-in fitting with locking quadrant butterfly damper, model No. GS-04 by Air Deflections, Inc. or approved equal for run outs to air distribution devices (24 gauge).
- 2.2.2 Taps to trunk duct for round flexible duct shall be conical spin-in fitting model No. GSC-01 by Air Deflections, Inc. or approved equal for run outs to terminal units (22 gauge).

2.3 ACCEPTABLE MANUFACTURERS - FIRE DAMPERS

- 2.3.1 Louvers and Dampers Inc.
- 2.3.2 Ruskin.
- 2.3.3 Nailor Hart Industries.
- 2.3.4 Alternates: Under provisions of Division 1.

2.4 FIRE DAMPERS

- 2.4.1 Fabricate in accordance with NFPA 90A and UL 555, and as indicated.
- 2.4.2 Provide curtain type dampers of galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream.
- 2.4.3 Fabricate multiple blade fire dampers with 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.
- 2.4.4 Fusible links, UL 33, shall separate at 160 degrees F.
- 2.4.5 Dampers shall be Ruskin IBD-2, style "C", "CR" or "CO" or approved equal.

2.5 ACCEPTABLE MANUFACTURERS - BACKDRAFT DAMPERS

2.5.1 American Warming and Vent.

2.5.2 Louvers and Dampers Inc.

2.5.3 Ruskin.

2.6 BACKDRAFT DAMPERS

2.6.1 Gravity backdraft dampers, size 18 x 18 inches or smaller, furnished with air moving equipment, may be air moving equipment manufacturer's standard construction.

2.6.2 Fabricate multi-blade, parallel action gravity balanced backdraft dampers of 16 gage galvanized steel, or extruded aluminum, with blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.7 ACCEPTABLE MANUFACTURERS - AIR EXTRACTOR DEVICES

2.7.1 Young Regulator.

2.7.2 Titus.

2.7.3 Tuttle and Bailey.

2.8 AIR EXTRACTOR DEVICES

2.8.1 On duct sizes less than 12 x 12, multi-blade device with blades aligned in short dimension; steel or aluminum construction; with individually adjustable blades, mounting straps.

2.8.2 Multi-blade device with radius blades attached to pivoting frame and bracket, steel or aluminum construction, with worm drive mechanism with 18-inch long removable key operator.

2.9 TURNING VANES

2.9.1 Square throat elbows with turning vanes shall be used where indicated on the Drawings. Square throat elbows fabricated using single thickness turning vanes up to duct dimensions 12" x 12" will be acceptable. All other square throat elbows shall be fabricated using double thickness turning vanes. Square throat elbows shall be constructed in accordance with Figure No. 2-3, latest SMACNA Factory manufactured elbows that comply with these requirements shall be acceptable.

2.9.2 Fabricated Turning Vanes: Provide fabricated turning vanes and vane runners, constructed in accordance with SMACNA "HVAC Duct Construction Standards".

2.9.3 Manufactured Turning Vanes: Provide turning vanes constructed of 1-1/2" wide curved blades set at 3/4" o.c., supported with bars perpendicular to blades set at 2" o.c., and set into side strips suitable for mounting in

ductwork.

2.9.4 Acoustic Turning Vanes: Provide acoustic-turning vanes constructed of airfoil shaped aluminum extrusion with perforated faces and fiberglass fill.

2.9.5 Manufacturer: Subject to compliance with requirements, provide turning vanes of one of the following:

2.9.5.1 Aero Dyne Co.

2.9.5.2 Airsan Corp.

2.9.5.3 Anemostat Products Div.; Dynamics Corp. of America.

2.9.5.4 Barber-Colman Co.

2.9.5.5 Duro Dyne Corp.

2.9.5.6 Environmental Elements Corp.; Subs, Koppers Co., Inc.

2.9.5.7 Hart & Cooley Mfg. Co.

2.9.5.8 Register & Grille Mfg. Co., Inc.

2.10 ACCEPTABLE MANUFACTURERS - FLEXIBLE DUCT CONNECTIONS

2.10.1 Metaledge.

2.10.2 Ventglass.

2.11 FLEXIBLE DUCT CONNECTIONS TO AIR MOVING EQUIPMENT

2.11.1 General: Provide flexible duct connections wherever duct connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsion movement, and also capable of absorbing vibration of connected equipment.

2.11.2 Fabricate in accordance with SMACNA Low or Medium Pressure Duct Construction Standards, and as indicated.

2.11.3 UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 20 oz per sq. yd, approximately 6 inches wide, crimped into metal edging strip.

2.11.4 Manufacturer: Subject to compliance with requirements, provide flexible connections of one of the following:

2.11.4.1 American/Elgen Co.; Energy Div.

2.11.4.2 Duro Dyne Corp.

2.11.4.3 Flexaust (The) Co.

2.11.4.4 Ventfabrics, Inc.

2.12 ACCEPTABLE MANUFACTURERS - DUCT ACCESS DOORS

2.12.1 American Warming and Vent.

2.12.2 Ruskin.

2.12.3 Titus.

2.13 DUCT ACCESS DOORS

- 2.13.1 General: Provide where indicated, duct access doors of size indicated. Review locations prior to fabrication.
- 2.13.2 Construction: Construct of same or greater gage as duct served. Fabricate rigid and close-fitting doors of galvanized steel with sealing gaskets and quick fastening locking devices. Provide insulated doors for insulated duct; for externally insulated duct insulation shall be replaceable without field cutting or patching. Provide flush frames for un-insulated duct, extended frames for externally insulated duct. Fabricate in accordance with SMACNA Low or Medium Pressure Duct Construction Standards.
- 2.13.3 Access doors smaller than 12 inches square may be secured with sash locks.
- 2.13.4 Provide one side hinged, other side with one handle-type latch for doors 12" high and smaller, 2 handle-type latches for larger doors. Provide two hinges and two sash locks for sizes up to 18 inches square, three hinges and two compression latches with outside and inside handles for sizes up to 24 x 48 inches. Provide an additional hinge for larger sizes.
- 2.13.5 Access doors with sheet metal screw fasteners are not acceptable.
- 2.13.6 Label access doors with 1/2" high black stencil "fire damper access" or purpose of access door.
- 2.13.7 Manufacturer: Subject to compliance with requirements, provide duct access doors of one of the following:
- 2.13.7.1 Air Balance Inc.
 - 2.13.7.2 Duro Dyne Corp.
 - 2.13.7.3 Register & Grille Mfg. Co., Inc.
 - 2.13.7.4 Ruskin Mfg. Co.
 - 2.13.7.5 Ventifabrics, Inc.

2.14 DUCT HARDWARE

- 2.14.1 General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
- 2.14.1.1 Cut or drill temporary test holes in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
 - 2.14.1.2 Permanent test holes shall be factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation. Provide in duct at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.

2.14.2 Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for all damper lengths. Provide extended quadrant locks and end extended bearing plates for externally insulated duct.

2.14.3 Manufacturer: Subject to compliance with requirements, provide duct hardware of one of the following:

2.14.3.1 Ventfabrics, Inc.

2.14.3.2 Young Regulator Co.

2.15 DAMPER REGULATORS

2.15.1 Damper regulators located in insulated duct shall be Ventlok No. 637 or 638 selected for insulation thickness. Damper regulators located in uninsulated duct shall be Ventlok No. 620, 635, or 555-1/2", selected for rod size.

2.15.2 Damper regulators for dampers behind inaccessible wall or ceilings shall be Ventlok No. 688 or Young Regulator No. 315, chrome plated. Approval by contractor shall be obtained before locating.

PART 3 – EXECUTION

3.1 INSPECTION

3.1.1 Examine areas and conditions under which duct accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF DUCT ACCESSORIES

3.2.1 Install duct accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.

3.2.2 Install turning vanes in square or rectangular 90 degree elbows in supply, return, outside air and exhaust air systems whether or not indicated on floor plans.

3.2.3 Coordinate with other work, including duct, as necessary to interface installation of duct accessories properly with other work.

3.2.4 Balancing Dampers

3.2.4.1 Provide at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts and as required for air balancing. Use splitter dampers only where indicated.

3.2.4.2 All regulators mounted on externally insulated duct shall have 16 gauge elevated platforms at least 1/8 inch higher than the thickness of the insulation. Damper shaft shall have Ventlock No.

607 bearing mounted on duct within elevated platform. If duct is inaccessible the operating handle shall be extended and the regulator installed on the face of the wall or ceiling. Where regulators are exposed in finished parts of the building, they shall be flush type, Ventlock No. 666. All regulators shall be manufactured by Ventlock, or approved equal.

3.2.4.3 All dampers in externally insulated duct shall have bushing and or extension to prevent damper damage to insulation.

3.2.5 Fire Dampers:

3.2.5.1 Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges. Fire dampers shall be installed in a manner which will conform to the conditions of their UL listing.

3.2.5.2 Demonstrate re-setting of fire dampers to authorities having jurisdiction and Owner's representative.

3.2.6 Access Doors:

3.2.6.1 An access door shall be furnished and installed at each fire damper. Additional access doors shall also be provided by sheet metal contractor where indicated on the Drawings. Access doors or panels shall be insulated in insulated ducts. Provide a 12" x 12" access door in a duct 14" and wider, 8" x 8" access door in a duct 10" and narrower. If duct a dimension is 8" install 6" x 6" access door. Larger panels shall be in accordance with Figure 6-11 and 6-12, except with Ventlok No. 310 handles. All access doors and panels larger than 16" x 12" shall be not less than No. 20 gauge steel.

3.2.6.2 All access panels in inaccessible ceilings and walls, where required shall be furnished and installed.

3.2.7 Provide backdraft dampers on exhaust fans, exhaust ducts nearest to outside and where indicated backdraft dampers may be associated equipment manufacturer's standard.

3.2.8 Provide flexible duct connections immediately adjacent to equipment in ducts associated with fans and motorized equipment. Provide at least one inch slack at all flexible duct connections. The flexible connections shall be stitched and not stapled and shall be airtight. They shall be installed so as to provide 1" movement in all six modes of vibrations for connections 12" and larger. Provide 1/2" for smaller connections.

3.2.9 Figure No. 2-17 of latest SMACNA shall be referred to for all flexible duct connections. Angle flanges shall be provided for all duct and equipment connections larger than 18" in width, height or diameter.

3.2.10 Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire, fire/smoke and/or smoke

dampers, and elsewhere as required for access into the duct for items installed in the duct. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.

- 3.2.11 Provide duct test holes where indicated and required for testing and balancing purposes.

3.3 FIELD QUALITY CONTROL

- 3.3.1 Operate installed duct accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leak-proof performance.

3.4 ADJUSTING AND CLEANING

- 3.4.1 Adjusting: Adjust duct accessories for proper settings, install fusible links in fire dampers and adjust for proper action.
 - 3.4.1.1 Label access doors in accordance with Division-15 section "Mechanical Identification".
 - 3.4.1.2 Final positioning of manual dampers is specified in Division- 15 section "Air Balancing".
- 3.4.2 Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.5 EXTRA STOCK

- 3.5.1 Furnish extra fusible links to Owner, one link for every 10 installed of each temperature range; obtain receipt.

END OF SECTION

DIVISION 15 — MECHANICAL

Section 15910 — Automatic Temperature Controls

PART 1 – GENERAL

1.1 WORK INCLUDED

- 1.1.1 Complete system of electrical controls.
- 1.1.2 Control devices, components and materials.
- 1.1.3 Associated miscellaneous control devices.
- 1.1.4 Instructions for Owners.

1.2 SUBMITTALS

- 1.2.1 Submit in accordance with Section 15010.

- 1.2.2 Provide complete operating data, system drawings, and wiring diagram. Also include written detailed operational description of sequence and description and engineering data on each control system component.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

2.1.1 Honeywell

2.1.2 Lennox

2.1.3 Carrier

2.1.4 Trane

2.2 SYSTEM REQUIREMENTS

- 2.2.1 All HVAC control wiring to be in conduit. Electrical Contractor to furnish outlet box and conduit between air handling units and compressor/condenser unit. Conduit to contain pull wire. HVAC Contractor to install and connect all low voltage wiring.

2.3 TEMPERATURE CONTROLS

- 2.3.1 Provide electronic thermostat with auto change over, 365-day programmable.
- 2.3.2 Provide electronic humidistat.

PART 3 – EXECUTION

3.1 INSTALLATION

- 3.1.1 Check and verify location of thermostats and humidistats with plans and room details before installation.

END OF SECTION

DIVISION 15 — MECHANICAL

Section 15950 — Testing, Adjusting and Balancing (TAB)

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Mechanical plans and specifications are part of project documents. Failure to comply shall not relieve contractor of responsibility or be used as basis for additional compensation due to omission of Engineer of Record.

1.2 WORK INCLUDED

- 1.2.1 Testing sanitary and storm drainage system
- 1.2.2 Testing domestic water system
- 1.2.3 Testing mechanical piping systems
- 1.2.4 Adjusting and balancing of air flow systems
- 1.2.5 Testing and adjusting of air conditioning equipment

1.3 SUBMITTALS

- 1.3.1 Submit for approval air balancing reports including air handling unit's fans and air distribution devices. Submittals shall be in accordance with Section 01300 of the Specifications.

1.4 QUALITY ASSURANCE

- 1.4.1 Perform air flow tests and sound level measurements in accordance with applicable ADC Equipment Test Codes and ASHRAE Standards.

PART 2 – TESTING

2.1 GENERAL

- 2.1.1 Furnish instruments necessary for tests. Such instruments shall be approved for calibration and accuracy. Furnish labor necessary to run the tests and obtain the required information. If tests indicate conditions that fail to meet the requirements for work, make necessary corrections and adjustments and retest the work until approval is received.
- 2.1.2 Architect and Engineer shall be notified at least 24 hours prior to any tests in order for him or his representative to be present at test.
- 2.1.3 Test plumbing piping systems for leaks and obtain approval by Engineer and Local Authorities having jurisdiction. Submit acceptable proof of such approval before such work is covered or concealed. Local codes and regulations govern the extent of the test of each system.

2.2 SANITARY AND STORM DRAINAGE SYSTEM

- 2.2.1 Those within the building footprint shall be tested by filling full to the top with water and held so for 24 hours. Such test shall be made after rough-in is completed and before fixtures are connected. Correct defects at once by removing defective material and replacing it with sound material and repeating water test until defects are eliminated.
- 2.2.2 Before backfilling and connecting to sewers, test piping under slabs with a hydrostatic head of not less than 15-feet for a period of two hours. Test other parts of the systems, after various sections of piping are installed but before fixtures are connected, by plugging outlets and filling

completely with water to its top. Provide Y's as required to facilitate plugging. Test for six hours without drop in water level.

2.3 DOMESTIC WATER SYSTEMS

- 2.3.1 Test domestic hot and cold water systems at a hydrostatic pressure of 125 psi. Test shall be maintained for at least six hours.

2.4 AIR FLOW SYSTEMS

- 2.4.1 Adjust and balance to required quantities. Performance of these systems shall be proven to comply with project requirements before they will be approved.

2.5 HVAC EQUIPMENT

- 2.5.1 Upon completion of this work submit three days prior notice that it and the building system is ready for a running test. Duration of the test shall be eight hours. The test must prove that the system is capable of uniform conditioning of the spaces and to be noiseless and draftless when delivering the required quantities of air. Obtain approval of measured air quantities and temperatures.
- 2.5.2 Refrigeration systems shall be tested for refrigerant leaks using soap solution and halide torch or electronic leak detector. System shall be tested at least two times after start-up at intervals of 14 days. Certify the condition of the system in writing after each test.
- 2.5.3 Check and test out the entire control system to insure proper sequence and operation.
- 2.5.4 Show comparison of actual ampere input of motor with nameplate rating.
- 2.5.5 Clean system and make other adjustments necessary to produce results as called for in the Specifications.

PART 3 – BALANCING

3.1 GENERAL

- 3.1.1 Each air distribution system shall be balanced to provide the air quantities shown on the Drawings. This includes exhaust air. Balancing shall be accomplished with exhaust fans in operation.
- 3.1.2 Each individual supply outlet shall be balanced to within plus or minus 10% of the design air quantity, but the total air in the system shall be within plus or minus 5% of the design air quantity. The fresh air quantity for each system shall be within minus 10%. Balancing shall be performed with the system in the cooling mode and with the cooling coil wet.

3.2 BALANCING REPORT

- 3.2.1 A form of the Contractor's choice shall be used to record the balanced air

quantity at each opening. The form shall include, as a minimum, specified quantity (shown on the Drawings), "K" factor for the device, velocity, and actual CFM. The form shall be presented to the Architect at the final inspection.

- 3.2.2 Any and all air quantities are subject to verification by the Engineer, with the Contractor furnishing the measuring equipment used for balancing the systems. The measuring equipment shall be equal to Shortridge Instruments Inc. "Flowhood" CFM-83.
- 3.2.3 The balancing form shall also include the recording of comparison of actual ampere input of all motors with their nameplate rating.

END OF SECTION

**SECTION B1
BUILDING WAGE SCALE**

**A PDF version of this Building Wage Scale
can be viewed on the following web link**

[http://purchasing.houstontx.gov/Construction/Construction Wage Rate for Buildings 2006.pdf](http://purchasing.houstontx.gov/Construction/Construction_Wage_Rate_for_Buildings_2006.pdf)

**SECTION C
GENERAL CONDITIONS**

A PDF version of the General Conditions can be viewed on the following web link:

http://purchasing.houstontx.gov/Construction/Construction_General_Conditions_October_2006.pdf

Document 00800

SUPPLEMENTARY CONDITIONS

The following Paragraphs amend and supplement the 2005 edition of General Conditions. Unaltered portions of General Conditions remain in effect.

ARTICLE 3 - THE CONTRACTOR

3.5 *LABOR: Insert the following Paragraph 3.5.3.1.1.*

3.5.3.1.1 Contractor shall make good faith efforts to comply with the City ordinances regarding Minority and Women Business Enterprises (MWBE) and Persons with Disabilities Business Enterprises (PDBE) participation goals which are as follows:

- .1 the MWBE goal is 0 percent, and
- .2 the PDBE goal is 0 percent.

3.28 CONTRACTOR DEBT

3.28.1 IF CONTRACTOR, AT ANY TIME DURING THE TERM OF THIS AGREEMENT, INCURS A DEBT, AS THE WORD IS DEFINED IN SECTION 15-122 OF THE HOUSTON CITY CODE OF ORDINANCES, IT SHALL IMMEDIATELY NOTIFY CITY CONTROLLER IN WRITING. IF CITY CONTROLLER BECOMES AWARE THAT CONTRACTOR HAS INCURRED A DEBT, IT SHALL IMMEDIATELY NOTIFY CONTRACTOR IN WRITING. IF CONTRACTOR DOES NOT PAY THE DEBT WITHIN 30 DAYS OF EITHER SUCH NOTIFICATION, CITY CONTROLLER MAY DEDUCT FUNDS IN AN AMOUNT EQUAL TO THE DEBT FROM ANY PAYMENTS OWED TO CONTRACTOR UNDER THIS AGREEMENT, AND CONTRACTOR WAIVES ANY RECOURSE THEREFORE.

ARTICLE 8 - TIME

8.1 *PROGRESS AND COMPLETION: Delete Paragraph 8.1.6. and replace with the following 8.1.6.*

8.1.6.1 Contractor shall credit the City by Change Order for inspection services for overtime work or work performed on Sundays or Legal Holidays. The

amount Contractor credits the City will be **\$50.00 per hour** per inspector for inspection services.

ARTICLE 9 - PAYMENTS AND COMPLETION

- 9.1 *UNIT PRICE WORK: Delete Section 9.1 in its entirety and insert the following Section 9.1.*
- 9.1 References to Unit Prices in individual Specification sections are not applicable to the Contract. Include payment for portions of the Work required by these sections in the Stipulated Price for the Contract.
- 9.12 ***LIQUIDATED DAMAGES:*** *Insert the following Paragraph 9.12.1.1.*
- 9.12.1.1 The amount of liquidated damages provided in General Conditions Paragraph 9.12.1 payable by Contractor or Surety for each and every day of delay beyond Contract Time, are **\$500.00 per day.**

ARTICLE 11 - INSURANCE AND BONDS

- 11.2 ***INSURANCE TO BE PROVIDED BY CONTRACTOR:*** *Delete Paragraph 11.2.8. and replace with the following 11.2.8.*
- 11.2.1.4 Contractor shall provide Owners and Contractor's Protective Liability Insurance only if the contractor's bid price is equal to or greater than \$100,000.00.
- 11.2.8 ***Endorsement of Primary Insurance:*** Each policy except Workers' Compensation Insurance must contain an endorsement that the policy is primary insurance to any other insurance available to additional insured with respect to claims arising under the Contract.

CITY OF HOUSTON -- BIDDER'S BOND

(Must be in an amount at least 10% of the bid. If the bid is upon alternates this bond must be for at least 10% of the highest amount for which the bidder offers to do any or all the work bid upon.)

THE STATE OF TEXAS

§
§

KNOW ALL MEN BY

THESE PRESENTS:
COUNTY OF HARRIS

§

THAT WE, _____ as principal and the other subscriber hereto as Surety, do hereby acknowledge ourselves to be held and firmly bound to the City of Houston, a municipal corporation in the sum of \$ _____ Dollars (\$ _____).

The condition of this obligation is that: ---

WHEREAS, the said principal is submitting to the City of Houston his or its bid for the doing for the City of Houston of certain work and construction of which the following is a brief description, to-wit: ---

Bid No. S50-C23095

HVAC Replacement at Fire Station No. 44

in accordance with the plans and specifications for such work upon which such bid is made, to which plans and specifications reference is made for a more full description of the work and construction referred to.

NOW, THEREFORE, if the said bidder is awarded the contract for such work, the said bidder will, within the time provided in the specifications, enter into a contract with the City therefore upon the form and to the purpose and intent provided in the specifications, will furnish insurance as required in the specifications and will furnish a good and sufficient construction surety bond executed by said bidder and one corporate surety organized under the laws of the State of Texas or authorized to do business in the State of Texas and having a fully paid up capital stock of not less than \$100,000.00 and duly licensed and qualified by the Board of Insurance Commissioners of the State of Texas, which bond shall be for an amount equal to 100 percent of the contract price and shall be conditioned in accordance with the requirements stated in the specifications upon which such bid is being submitted.

In the event said bidder is unable or fails to execute said contract for the work proposed to be done, is unable or fails to furnish insurance as specified or is unable or fails to furnish said construction bond in the amount and condition as aforesaid, the undersigned principal and surety shall be liable to said City of Houston for the full amount of this obligation which is here and now agreed upon and admitted as the amount of the damages which will be suffered by the City of Houston on account of the failure of such bidder to so comply with the terms of this bid.

Executed this _____ day of _____, A.D. 2008.

PRINCIPAL

By _____

By _____

Surety

ONE-YEAR MAINTENANCE BOND

THAT WE, _____, as Principal, hereinafter called Contractor, and the other subscriber hereto, _____, as Surety, do hereby acknowledge ourselves to be held and firmly bound to the City of Houston, a municipal corporation, in the sum of \$_____, for the payment of which sum well and truly to be made to the City of Houston and its successors, the said Contractor and Surety do bind themselves, their heirs, executors, administrators, successors, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Contractor has on or about this day executed a Contract in writing with the City of Houston for _____, all of such work to be done as set out in full in said Contract documents therein referred to and adopted by the City Council, all of which are made a part of this instrument as fully and completely as if set out in full herein.

NOW THEREFORE, if the said Contractor shall comply with the provisions of Paragraph 11.5.1 of the General Conditions, and correct work not in accordance with the Contract documents discovered within the established one-year period, then this obligation shall become null and void, and shall be of no further force and effect; otherwise, the same is to remain in full force and effect.

Notices required or permitted hereunder shall be in writing and shall be deemed delivered when actually received or, if earlier, on the third day following deposit in a United States Postal Service post office or receptacle, with proper postage affixed (certified mail, return receipt requested), addressed to the respective other party at the address prescribed in the Contract documents, or at such other address as the receiving party may hereafter prescribe by written notice to the sending party.

IN WITNESS THEREOF, the said Contractor and Surety have signed and sealed this instrument on the respective dates written below their signatures and have attached current Power of Attorney.

ATTEST, SEAL: (if a corporation)

WITNESS: (if not a corporation)

Name of Contractor

By: _____

Name:

Title:

By: _____

Name:

Title:

Date:

ATTEST/SURETY WITNESS:

(SEAL)

Full Name of Surety

Address of Surety for Notice

Telephone Number of Surety

By: _____

Name:

Title:

Date:

By: _____

Name:

Title: Attorney-in-Fact

Date:

This Ordinance or Contract has been reviewed as to form by the undersigned legal assistant and have been found to meet established Legal Department criteria. The Legal Department has not reviewed the content of these documents.

Legal Assistant

Date

PERFORMANCE BOND

THAT WE, _____, as Principal, (the "Contractor"), and the other subscriber hereto, _____, as Surety, do hereby acknowledge ourselves to be held and firmly bound to the City of Houston (the "City"), a municipal corporation, in the penal sum of \$_____ for the payment of which sum, well and truly to be made to the City, its successors and assigns, Contractor and Surety do bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Contractor has on or about this day executed a Contract in writing with the City for _____

_____ all of such work to be done as set out in full in said Contract documents therein referred to and adopted by the City Council, all of which are made a part of this instrument as fully and completely as if set out in full herein.

NOW THEREFORE, if the said Contractor shall faithfully and strictly perform the Contract in all its terms, provisions, and stipulations in accordance with its true meaning and effect, and in accordance with the Contract documents referred to therein and shall comply strictly with each and every provision of the Contract and with this Bond, then this obligation shall become null and void and shall have no further force and effect; otherwise the same is to remain in full force and effect. Should the Contractor fail to faithfully and strictly perform the Contract in all its terms, including but not limited to the indemnifications thereunder, the Surety shall be liable for all damages, losses, expenses and liabilities that the City may suffer in consequence thereof, as more fully set forth herein.

It is further understood and agreed that the Surety does hereby relieve the City or its representatives from the exercise of any diligence whatever in securing compliance on the part of the Contractor with the terms of the Contract, and the Surety agrees that it shall be bound to take notice of and shall be held to have knowledge of all acts or omissions of the Contractor in all matters pertaining to the Contract. The Surety understands and agrees that the provision in the Contract that the City will retain certain amounts due the Contractor until the expiration of 30 days from the acceptance of the Work is intended for the City's benefit, and the City will have the right to pay or withhold such retained amounts or any other amount owing under the Contract without changing or affecting the liability of the Surety hereon in any degree.

It is further expressly agreed by Surety that the City or its representatives are at liberty at any time, without notice to the Surety, to make any change in the Contract documents and in the Work to be done hereunder, as provided in the Contract, and in the terms and conditions thereof, or to make any change in, addition to, or deduction from the Work to be done hereunder; and that such changes, if made, shall not in any way vitiate the obligation in this Bond and undertaking or release the Surety there from.

It is further expressly agreed and understood that the Contractor and Surety will fully indemnify and save harmless the City from any liability, loss, cost, expense, or damage arising

out of Contractor's performance of the Contract.

If the City gives Surety notice of Contractor's default, Surety shall, within 45 days, take one of the following actions:

1. Arrange for Contractor, with consent of the City, to perform and complete the Contract; or
2. Take over and assume completion of the Contract itself, through its agents or through independent contractors, and become entitled to the payment of the balance of the Contract Price.

If the Surety fails to take either of the actions set out above, it shall be deemed to have waived its right to perform and complete the Contract and receive payment of the balance of the Contract Price and the City shall be entitled to enforce any remedies available at law, including but not limited to completing the Contract itself and recovering any cost in excess of the Original Contract Price from the Surety.

This Bond and all obligations created hereunder shall be performable in Harris County, Texas. This Bond is given in compliance with the provisions of Chapter 2253, Texas Government Code, as amended, which is incorporated herein by this reference.

Notices required or permitted hereunder shall be in writing and shall be deemed delivered when actually received or, if earlier, on the third day following deposit in a United States Postal Service post office or receptacle, with proper postage affixed (certified mail, return receipt requested), addressed to the respective other Party at the address prescribed in the Contract documents, or at such other address as the receiving party may hereafter prescribe by written notice to the sending party.

EXECUTED in multiple originals this _____ day of _____, 20_____.

ATTEST/SEAL: (if a corporation)
WITNESS: (if not corporation)

(Name of Principal)

(Address of Principal)

By: _____
Name:
Title:
Date:

By: _____
Name:
Title:
Date:

ATTEST/SEAL
SURETY WITNESS:

(Name of Surety)

(Address of Surety)

By: _____
Name:
Title:
Date:

By: _____
Name:
Title:
Date:

REVIEWED:

This Bond has been reviewed as to form by the undersigned Paralegal and has been found to meet established Legal Department criteria.

Date

Paralegal

STATUTORY PAYMENT BOND

THAT WE, _____, as Principal, hereinafter called Contractor and the other subscriber hereto, _____, as Surety, do hereby acknowledge ourselves to be held and firmly bound unto the City of Houston, a municipal corporation, in the sum of \$_____ for the payment of which sum, well and truly to be made to the City of Houston, and its successors, the said Contractor and Surety do bind themselves, their heirs, executors, administrators, successors, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Contractor has on or about this day executed a contract in writing with the City of Houston for _____

_____ all of such work to be done as set out in full in said Contract documents therein referred to and adopted by the City Council, all of which are made a part of this instrument as fully and completely as if set out in full herein;

NOW, THEREFORE, if the said Contractor shall pay all claimants supplying labor and materials to him or a Subcontractor in the prosecution of the Work provided for in the Contract, then, this obligation shall be void; otherwise the same is to remain in full force and effect;

PROVIDED HOWEVER, that this Bond is executed pursuant to the provisions of Chapter 2253, Texas Government Code, as amended, and all liabilities on this Bond shall be determined in accordance with the provisions of said Article to the same extent as if it were copied at length herein.

IN WITNESS THEREOF, the said Contractor and Surety have signed and sealed this instrument on the respective dates written below their signatures and have attached current Power of Attorney.

ATTEST, SEAL: (if a corporation)
WITNESS: (if not a corporation)

Name of Contractor

By: _____
Name:
Title:

By: _____
Name:
Title:
Date:

ATTEST/SURETY WITNESS:
(SEAL)

Full Name of Surety

Address of Surety for Notice

Telephone Number of Surety

By: _____
Name:
Title:
Date:

By: _____
Name:
Title: Attorney-in-Fact
Date:

This Ordinance or Contract has been reviewed as to form by the undersigned legal assistant and have been found to meet established Legal Department criteria. The Legal Department has not reviewed the content of these documents.

Legal Assistant

Date