CITY OF HOUSTON
INVITATION TO BID

Issued: August 7, 2009

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, **August 27, 2009,** 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 INSTALLATION AT FIRE STATION No. 20
FOR THE GENERAL SERVICES DEPARTMENT
Bid No. S50-C23357
NIGP Code: 910-36

Buyer:
Questions regarding this solicitation should be addressed to Arturo Lopez, Senior Procurement Specialist**, at 832-393-8731or 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, August 19, 2009**. **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 INSTALLATION AT FIRE STATION No. 20
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 to install **HVAC Systems at Fire Station No. 20, located at 6902 Navigation @ Macario Garcia,** 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
Formal Instructions for Bidding, Terms and Conditions
Sample Insurance Over $50,000.00
Drug Forms
Bond Package for Construction; (Performance, One-Year Maintenance and Statutory Payment)
2009 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, August 21, 2009.**

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.

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.

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.

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, to install **HVAC Systems** that is similar in size and scope to this contract. **Bidder must have references documenting that it has performed HVAC Installation 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 furnish and install two 6 ton DX split systems with electric heat, and one 12,000 BTU Mini Split AC unit, at Fire Station No. 20, located at 6902 Navigation @ Macario Garcia.

1.2 All three condensing units shall be installed on concrete slabs on the ground. Indoor units shall be installed on an interior mezzanine.

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 after receipt of the written Notice to Proceed from City.

FIRE STATION NO. 20
Project No. 09065.000
May 21, 2009

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SECTION 15050

BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B. The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore, shall be submitted to the Architect for approval as soon as practicable. No such departures shall be made without the prior written approval of the Architect.

C. Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, such reference shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Architect, expressed in writing, is equal to that specified.

1.02 SCOPE OF WORK

A. The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form the complete and functioning systems in all of its various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The contractor shall review all pertinent drawings, including those of other contracts prior to commencement of Work.

B. This Division requires the furnishing and installing of all items Specified herein, indicated on the Drawings or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C. The approximate locations of Mechanical (HVAC) and Plumbing items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building, and will in all cases be subject to the Review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E. All discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to the bidding, where this cannot be done at least 7 working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G. It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified later or necessary for a complete and functioning heating, ventilating and air conditioning system shall be considered a part of the overall "Scope".

H. The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

I. Participate in commissioning as described in 01800 and 15995.

1.03 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the approved shop drawings.

B. All duct or pipe or equipment locations as indicated on the documents do not indicate every transition, offset, or exact location. All transitions, offsets clearances and exact locations shall be established by actual field measurements, coordination with the structural, architectural and reflected ceiling plans, and other trades. Submit shop drawings for approval.

C. All transitions, offsets and relocations as required by actual field conditions shall be performed by the contractor at no additional cost to the owner.

D. Additional coordination with electrical contractor may be required to allow adequate clearances of electrical equipment, fixtures and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts or equipment locations.

1.04 SITE VISIT AND FAMILIARIZATION

A. Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

B. Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

C. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.05 WORK SPECIFIED IN OTHER SECTIONS

A. Finish painting is specified. Prime and protective painting are included in the work of this Division.

B. Owner and General Contractor furnished equipment shall be properly connected to Mechanical (HVAC) and Plumbing systems.

C. Furnishing and installing all required Mechanical (HVAC) and Plumbing equipment control relays and electrical interlock devices, conduit, wire and J-boxes are included in the Work of this Division.

1.06 PERMITS, TESTS, INSPECTIONS

A. Arrange and pay for all permits, fees, tests, and all inspections as required by governmental authorities.

1.07 DATE OF FINAL ACCEPTANCE

A. The date of final acceptance shall be the date of owner occupancy, or the date all punch list items have been completed or final payment has been received. Refer to Division One for additional requirements.

B. The date of final acceptance shall be documented in writing and signed by the architect, owner and contractor.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Deliver products to the project at such time as the project is ready to receive the equipment, pipe or duct properly protected from incidental damage and weather damage.

C. Damaged equipment, duct or pipe shall be promptly removed from the site and new, undamaged equipment, pipe and duct shall be installed in its place promptly with no additional charge to the Owner.

1.09 NOISE AND VIBRATION

A. The heating, ventilating and air conditioning systems, and the component parts there of, shall be guaranteed to operate without objectionable noise and vibration.

B. Provide foundations, supports and isolators as specified or indicated, properly adjusted to prevent transmission of vibration to the Building structure, piping and other items.

C. Carefully fabricate ductwork and fittings with smooth interior finish to prevent turbulence and generation or regeneration of noise.

D. All equipment shall be selected to operate with minimum of noise and vibration. If, in the opinion of the Architect, objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of the Work, the Contractor shall rectify such conditions without extra cost to the Owner.

1.10 APPLICABLE CODES

A. Obtain all required permits and inspections for all work required by the Contract Documents and pay all required fees in connection thereof.

B. Arrange with the serving utility companies for the connection of all required utilities and pay all charges, meter charges, connection fees and inspection fees, if required.

C. Comply with all applicable codes, specifications, local ordinances, industry standards, utility company regulations and the applicable requirements of the following nationally accepted codes and standards:

1. Air Moving & Conditioning Association, AMCA.
2. American Standards Association, ASA.
3. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE.
4. American Society of Mechanical Engineers, ASME.
5. American Society of Plumbing Engineers, ASPE.
6. American Society of Testing Materials, ASTM.
7. American Water Works Association, AWWA.
8. National Bureau of Standards, NBS.
9. National Fire Protection Association, NFPA.
10. Sheet Metal & Air Conditioning Contractors' National Association, SMACNA.
11. Underwriters' Laboratories, Inc., UL.
12. International Energy Conservation Code, IECC.

D. Where differences existing between the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards,

utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, the more stringent or costly application shall govern. Promptly notify the Engineer in writing of all differences.

E. When directed in writing by the Engineer, remove all work installed that does not comply with the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, correct the deficiencies, and complete the work at no additional cost to the Owner.

1.11 DEFINITIONS AND SYMBOLS

A. General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 1.

B. Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D. Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E. Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F. Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G. Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H. Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I. Installer: Entity (person or firm) engaged by the Contractor or its subcontractor or Sub-contractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or when so noted by other identified installers or entities.

K. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L. Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by 1993 ASHRAE Fundamentals

Handbook, chapter 34 "Abbreviations and Symbols", ASME and ASPE published standards.

1.12 DRAWINGS AND SPECIFICATIONS

A. These Specifications are intended to supplement the Drawings and it will not be the province of the Specifications to mention any part of the work which the Drawings are competent to fully explain in every particular and such omission is not to relieve the Contractor from carrying out portions indicated on the Drawings only.

B. Should items be required by these Specifications and not indicated on the Drawings, they are to be supplied even if of such nature that they could have been indicated thereon. In case of disagreement between Drawings and Specifications, or within either Drawings or Specifications, the better quality or greater quantity of work shall be estimated and the matter referred to the Architect or Engineer for review with a request for information and clarification at least 7 working days prior to bid opening date for issuance of an addendum.

C. The listing of product manufacturers, materials and methods in the various sections of the Specifications, and indicated on the Drawings, is intended to establish a standard of quality only. It is not the intention of the Owner or Engineer to discriminate against any product, material or method that is equal to the standards as indicated and/or specified, nor is it intended to preclude open, competitive bidding. The fact that a specific manufacturer is listed as an acceptable manufacturer should not be interpreted to mean that the manufacturers' standard product will meet the requirements of the project design, Drawings, Specifications and space constraints.

D. The Architect or Engineer and Owner shall be the sole judge of quality and equivalence of equipment, materials and methods.

E. Products by other reliable manufacturers, other materials, and other methods, will be accepted as outlined, provided they have equal capacity, construction, and performance. However, under no circumstances shall any substitution be made without the written permission of the Architect or Engineer and Owner. Request for prior approval must be made in writing 10 days prior to the bid date without fail.

F. Wherever a definite product, material or method is specified and there is not a statement that another product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method is the only one that shall be used without prior approval.

G. Wherever a definite material or manufacturer's product is specified and the Specification states that products of similar design and equal construction from the specified list of manufacturers may be substituted, it is the intention of the Owner or Engineer that products of manufacturers that are specified are the only products that will be acceptable and that products of other manufacturers will not be considered for substitution without approval.

H. Wherever a definite product, material or method is specified and there is a statement that "OR EQUAL" product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method or an "OR EQUAL" product, material or method may be used if it complies with the specifications and is submitted for review to the Engineer as outline herein.

I. Where permission to use substituted or alternative equipment on the project is granted by the Owner or Engineer in writing, it shall be the responsibility of the Contractor or Subcontractor involved to verify that the equipment will fit in the space available which includes allowances for all required Code and maintenance clearances, and to coordinate all equipment structural support, plumbing and electrical requirements and provisions with the Mechanical (HVAC) and Plumbing Design Documents and all other trades, including Division 16.

J. Changes in architectural, structural, electrical, mechanical, and plumbing requirements for the substitution shall be the responsibility of the bidder wishing to make the substitution. This shall include the cost of redesign by the affected designer(s). Any additional cost incurred by affected subcontractors shall be the responsibility of this bidder and not the owner.

K. If any request for a substitution of product, material or method is rejected, the Contractor will automatically be required to furnish the product, material or method named in the Specifications. Repetitive requests for substitutions will not be considered.

L. The Owner or Engineer will investigate all requests for substitutions when submitted in accordance with above and if accepted, will issue a letter allowing the substitutions.

M. Where equipment other than that used in the design as specified or shown on the Drawings is substituted (either from an approved manufacturers list or by submittal review), it shall be the responsibility of the substituting Contractor to coordinate space requirements, building provisions and connection requirements with his trades and all other trades and pay all additional costs to other trades, the Owner, the Architect or Engineer, if any, due to the substitutions.

1.13 SUBMITTALS

A. Coordinate with Division 1 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded the Contractor shall submit a minimum of eight (8) complete bound sets of shop drawings and complete data covering each item of equipment or material. The first submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive shop drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain one (1) copy each of all shop drawings for their files. Where full size drawings are involved, submit one (1) print and one (1) reproducible sepia or mylar in lieu of eight (8) sets. All literature pertaining to an item subject to Shop Drawing submittal

shall be submitted at one time. A submittal shall not contain information from more than one Specification section, but may have a section subdivided into items or equipment as listed in each section. The Contractor may elect to submit each item or type of equipment separately. Each submittal shall include the following items enclosed in a suitable binder:

1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
2. An index page with a listing of all data included in the Submittal.
3. A list of variations page with a listing all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.
4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
6. Identification of each item of material or equipment matching that indicated on the Drawings.
7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
8. Additional information as required in other Sections of this Division.
9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

B. Refer to Division 1 for additional information on shop drawings and submittals.

C. Equipment and materials submittals and shop drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space

allotted. Review of shop drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D. Where shop drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E. Shop drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:

1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.
2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.
3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.
4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous shop drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.
5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all shop drawings.
6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F. Materials and equipment which are purchased or installed without shop drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

H. Submittals are required for, but not limited to, the following items:

1. Pipe Material and Specialties.
2. Pipe Fabrication Drawings.
3. Basic Materials.
4. Air Cooled Condensing Units.
5. Noise and Vibration Controls.
6. Plumbing Fixtures and Specialties.
7. Plumbing Equipment.
8. Sanitary DWV Fittings, Pipe and Accessories.
9. Domestic Hot and Cold Water Pipe, Fittings and Accessories.
10. HVAC Pipe and Duct Insulation.
11. Plumbing Valves.
12. Portable Pipe Hanger and Equipment Supports.
13. Duct Specialties.
14. Duct Fabrication Drawings.
15. Air Distribution Devices.
16. Fan Coil Units.
17. Filters.
18. Fans.
19. Fire Dampers and Fire Smoke Dampers.
20. Temperature Controls and Control Sequences.
21. Test, Adjust and Balance Reports.
22. Testing, Adjusting and Balancing Contractor Qualifications.
23. Coordination Drawings.

I. Refer to other Division 15 sections for additional shop drawing requirements. Provide samples of actual materials and/or equipment to be used on the Project upon request of the Owner or Engineer.

1.14 COORDINATION DRAWINGS

A. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:
    a. Wall and type locations.
    b. Clearances for installing and maintaining insulation.
    c. Locations of light fixtures and sprinkler heads.
    d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
    e. Equipment connections and support details.
    f. Exterior wall and foundation penetrations.
    g. Routing of storm and sanitary sewer piping.
    h. Fire-rated wall and floor penetrations.
    i. Sizes and location of required concrete pads and bases.
    j. Valve stem movement.
    k. Structural floor, wall and roof opening sizes and details.
2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.

B. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

C. By submitting shop drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.15 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Special Project Requirements, in addition to the requirements specified in Division 15, indicate the following installed conditions:

1. Duct mains and branches, size and location, for both exterior and interior; locations of dampers, fire dampers, duct access panels, and other control devices; filters, fuel fired heaters, fan coils, condensing units, and roof-top A/C units requiring periodic maintenance or repair.
2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion

compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.

3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
4. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
5. Contract Modifications, actual equipment and materials installed.

B. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.

C. The Contractor shall maintain a set of clearly marked black line record "AS-BUILT" prints on the job site on which he shall mark all work details, alterations to meet site conditions and changes made by "Change Order" notices. These shall be kept available for inspection by the Owner, Architect or Engineer at all times.

D. Refer to Division 1 for additional requirements concerning record drawings. If the Contractor does not keep an accurate set of as-built drawings, the pay request may be altered or delayed at the request of the Architect. Mark the drawings with a colored pencil. Delivery of as-built prints and reproducibles is a condition of final acceptance.

E. The record prints shall be updated on a daily basis and shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed pipe or duct, locations of all concealed valves, controls and devices and any deviations from the work shown on the Construction Documents which are required for coordination. All dimensions shall include at least two dimensions to permanent structure points.

F. Submit three prints of the tracings for approval. Make corrections to tracings as directed and delivered "Auto Positive Tracings" to the architect. "As-Built" drawings shall be furnished in addition to shop drawings.

G. When the option described in paragraph F., above is not exercised then upon completion of the work, the Contractor shall transfer all marks from the submit a set of clear concise set of reproducible record "AS-BUILT" drawings and shall submit the reproducible drawings with corrections made by a competent draftsman and three (3) sets of black line prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The reproducible record "AS-BUILT" drawings shall have the Engineers Name and Seal removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

(NAME OF GENERAL CONTRACTOR)

BY:_____

(SIGNATURE)

(NAME OF SUBCONTRACTOR)

BY:_____
(SIGNATURE)

1.16 OPERATING MANUALS

A. Prepare maintenance manuals in accordance with Division 1 and in addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.17 CERTIFICATIONS AND TEST REPORTS

A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and schedule date for each test. This detailed completion and test schedule shall be submittal at least 90 days before the projected Project completion date.

B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.

C. Submit 4 copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D. Certifications and test reports to be submitted shall include, but not be limited to those items outlined in Section of Division 15.

1.18 MAINTENANCE MANUALS

A. Coordinate with Division 1 for maintenance manual requirements, unless noted otherwise bind together in “D ring type” binders by National model no. 79-883 or equal, binders shall be large enough to allow ¼” of spare capacity. Three (3) sets of all approved shop drawing submittals, fabrication

drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections and labeled for easy reference and shall utilize the individual specification section numbers shown in the Mechanical Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 15 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

B. Prepare maintenance manuals in accordance with Special Project Conditions, in addition to the requirements specified in Division 15, include the following information for equipment items:

1. Identifying names, name tags designations and locations for all equipment.
2. Valve tag lists with valve number, type, color coding, location and function.
3. Reviewed shop drawing submittals with exceptions noted compliance letter.
4. Fabrication drawings.
5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
6. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions, servicing instructions and lubrication charts and schedules.
8. Equipment and motor name plate data.
9. Wiring diagrams.
10. Exploded parts views and parts lists for all equipment and devices.
11. Color coding charts for all painted equipment and conduit.
12. Location and listing of all spare parts and special keys and tools furnished to the Owner.
13. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

C. Refer to Division 1 for additional information on Operating and Maintenance Manuals.

D. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer a minimum of 14 working days prior to the beginning of the operator training period.

1.19 OPERATOR TRAINING

A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include 12 hours of on site training in three 4 hour shifts.

B. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

C. Refer to other Division 15 Sections for additional Operator Training requirements.

1.20 FINAL COMPLETION

A. At the completion of the work, all equipment and systems shall be tested and faulty equipment and material shall be repaired or replaced. Refer to Sections of Division 15 for additional requirements.

B. Clean and adjust all air distribution devices and replace all air filters immediately prior to final acceptance.

C. Touch up and/or refinish all scratched equipment and devices immediately prior to final acceptance.

1.21 CONTRACTOR'S GUARANTEE

A. Use of the HVAC and Plumbing systems to provide temporary service during construction period will not be allowed without permission from the Owner in writing and if granted shall not be cause warranty period to start, except as defined below.

B. Contractor shall guarantee to keep the entire installation in repair and perfect working order for a period of one year after its completion and final acceptance, and shall furnish free of additional cost to the Owner all materials and labor necessary to comply with the above guarantee throughout the year beginning from the date of issue of Substantial Completion, Beneficial Occupancy by the Owner or the Certificate of Final Payment as agreed upon by all parties.

C. This guarantee shall not include cleaning or changing filters except as required by testing, adjusting and balancing.

D. All air conditioning compressors shall have parts and labor guarantees for a period of not less than 5 years beyond the date of final acceptance.

E. Refer to Sections in Division 15 for additional guarantee or warranty requirements.

1.22 TRANSFER OF ELECTRONIC FILES

A. Project documents are not intended or represented to be suitable for reuse by Architect/Owner or others on extensions of this project or on any other project. Any such reuse or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner's risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney's fees arising out of or resulting thereof.

B. Because data stored in electric media format can deteriorate or be modified inadvertently, or otherwise without authorization of the data's creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

C. When transferring documents in electronic media format, Engineer makes no representations as to the long term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.

D. Any reuse or modifications will be Contractor's sole risk and without liability or legal exposure to Architect, Engineer or any consultant.

E. The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect's written consent.

It is agreed that "MEP" hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The contract documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement Between Architect and Owner.

If the client, Architect/Owner, or developer of the project requires electronic media for "record purposes", then an AutoCAD based compact disc ("CD") will be prepared. The "CD" will be submitted with all title block references intact and will be formatted in a "plot" format to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.

F. At the Architect/Owner's request, Engineer will prepare one "CD" of electronic media to assist the contractor in the preparation of submittals. The Engineer will prepare and submit the "CD" to the Architect/Owner for

distribution to the contractor. All copies of the “CD” will be reproduced for a cost of reproduction fee of Five Hundred Dollars ($500.00) per “CD”.

The “CD” will be prepared and all title blocks, names and dates will be removed. The “CD” will be prepared in a “.dwg” format to permit the end user to revise the drawings.

G. This Five Hundred Dollars ($500.00) per “CD” cost of reproduction will be paid directly from the Contractor to the Engineer. The “CD” will be prepared only after receipt of the Five Hundred Dollars ($500.00). The Five Hundred Dollars ($500.00) per “CD” cost of reproduction is to only recover the cost of the man-hours necessary to reproduce the documents. It is not a contractual agreement between the Contractor and Engineer to provide any engineering services, nor any other service.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide materials and equipment manufactured by a domestic United States manufacturer.

B. Access Doors: Provide access doors as required for access to equipment, valves, controls, cleanouts and other apparatus where concealed. Access doors shall have concealed hinges and screw driver cam locks.

C. All access panels located in wet areas such as restrooms, locker rooms, shower rooms, kitchen and any other wet areas shall be constructed of stainless steel.

D. Access Doors: shall be as follows:

1. Plastic Surfaces: Milcor Style K.
2. Ceramic Tile Surface: Milcor Style M.
3. Drywall Surfaces: Milcor Style DW.
4. Install panels only in locations approved by the Architect.

PART 3 - EXECUTION

3.01 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected via reviewed submittals.

B. Refer to equipment specifications in Divisions 2 through 16 for additional rough-in requirements.

3.02 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with architectural action markings on submittal, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, resolve conflicts and route proposed solution to the Architect for review.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location and label.
11. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Provide roof curbs for all roof mounted equipment. Coordinate with roof construction for pitched roof. Provide roof curb to match roof slope. Refer to architectural drawings and details.
14. The equipment to be furnished under this Specification shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component

parts of the system need not be the product of the same manufacturer.

15. The architectural and structural features of the building and the space limitations shall be considered in selection of all equipment. No equipment shall be furnished which will not suit the arrangement and space limitations indicated.
16. Lubrication: Prior to start-up, check and properly lubricate all bearings as recommended by the manufacturer.
17. Where the word "Concealed" is used in these Specifications in connection with insulating, painting, piping, ducts, etc., it shall be understood to mean hidden from sight as in chases, furred spaces or suspended ceilings. "Exposed" shall be understood to mean the opposite of concealed.
18. Identification of Mechanical Equipment:
    a. Mechanical equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Shop drawings shall include dimensions and lettering format for approval. Attachments shall be with escutcheon pins, self-tapping screws, or machine screws.
    b. Tags shall be attached to all valves, including control valves, with nonferrous chain. Tags shall be brass and at least 1-1/2 inches in diameter. Nameplate and tag symbols shall correspond to the identification symbols on the temperature control submittal and the "as-built" drawings.

3.03 CUTTING AND PATCHING

A. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer/Owner's observation of concealed Work, without additional cost to the Owner.
7. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers; refer to the materials and methods required for the surface and building components being patched; Refer to Section "DEFINITIONS" for definition of "Installer."

C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, mechanical ducts and HVAC units, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.04 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER

A. The Owner will cooperate with the Contractor, however, the following provisions must be observed:

1. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Sub-Contractors and the Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.
2. During the construction of this project, normal facility activities will continue in existing buildings until renovated areas are completed. Plumbing, fire protection, lighting, electrical, communications, heating, air conditioning, and ventilation systems will have to be maintained in service within the occupied spaces of the existing building.

END OF SECTION

SECTION 15140

SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Pipe, and equipment hangers, supports and associated anchors.

B. Sleeves and seals.

C. Flashing and sealing equipment and pipe stacks.

1.02 RELATED WORK

A. Section 15240 - Vibration Isolation.

B. Section 15260 - Piping Insulation.

C. Section 15280 - Equipment Insulation.

D. Section 15330 – Wet Pipe Fire Protection Sprinkler System.

E. Section 15410 - Plumbing Piping and Valves.

F. Section 15530 – Refrigerant Piping

1.03 REFERENCES

A. ANSI/ASME B31.1 - Power Piping.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems.

C. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.

1.04 QUALITY ASSURANCE

A. Supports for Sprinkler Piping: In conformance with NFPA 13.

B. Supports for Standpipes: In conformance with NFPA 14.

1.05 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Indicate hanger and support framing and attachment methods.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 to 4 Inches Carbon steel, adjustable, clevis.

C. Hangers for Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for pipe sizes 6 inches and over.

E. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

F. Wall Support for Pipe Sizes 4 Inches and Over: adjustable steel yoke and cast iron roll.

G. Vertical Support: Steel riser clamp.

H. Floor Support for Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

I. Floor Support for Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and

stand, steel screws, and concrete pier or steel support.

J. Roof Pipe Supports and Hangers: Galvanized Steel Channel System as manufactured by Portable Pipe Hangers, Inc. or approved equal.

For pipes 2-1/2" and smaller – Type PP10 with roller
For pipes 3" through 8" – Type PS
For multiple pipes – Type PSE - Custom

K. Copper Pipe Support and Hangers: Electro-galvanized with thermoplastic elastomer cushions; Unistrut "Cush-A-Clamp" or equal. Hangers: Plastic coated; Unistrut or equal.

L. For installation of protective shields refer to specification section 15140-3.03.

M. Shields for Vertical Copper Pipe Risers: Sheet lead.

N. Pipe Rough-In Supports in Walls/Chases: Provide preformed plastic pipe supports, Sioux Chief "Pipe Titan", Holdrite or equal.

2.02 HANGER RODS

A. Galvanized Hanger Rods: Threaded both ends, threaded one end, or continuous threaded.

2.03 FLASHING

A. Metal Flashing: 20 gage galvanized steel.

B. Lead Flashing: 4 lb. /sq. ft. sheet lead for waterproofing; 1 lb./sq. ft. sheet lead for soundproofing.

C. Caps: Steel, 20 gage minimum; 16 gage at fire resistant elements.

D. Coordinate with roofing contractor/architect for type of flashing on metal roofs.

2.04 EQUIPMENT CURBS

A. Fabricate curbs of hot dipped galvanized steel.

2.05 SLEEVES

A. Sleeves for Pipes through Non-fire Rated Floors: Form with 18 gage galvanized steel, tack welded to form a uniform sleeve.

B. Sleeves for Pipes through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Form with steel pipe, schedule 40.

C. Sleeves for Pipes through Fire Rated and Fire Resistive Floors and Walls, and Fireproofing: Prefabricated fire rated steel sleeves including seals, UL listed.

D. Sleeves for Round Ductwork: Form with galvanized steel.

E. Sleeves for Rectangular Ductwork: Form with galvanized steel.

F. Fire Stopping Insulation: Glass fiber type, non-combustible, U.L. listed.

G. Caulk: Paintable 25-year acrylic sealant.

H. Pipe Alignment Guides: Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted, two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

2.06 FABRICATION

A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

B. Design hangers without disengagement of supported pipe.

C. Design roof supports without roof penetrations, flashing or damage to the roofing material.

2.07 FINISH

A. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.01 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as follows:

PIPE SIZE	MAX. HANGER SPACING	HANGER DIAMETER
(Steel Pipe)		
1/2 to 1-1/4 inch	7’-0”	3/8"
1-1/2 to 3 inch	10'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(Copper Pipe)		
1/2 to 1-1/4 inch	5'-0"	3/8"
1-1/2 to 2-1/2 inch	8'-0"	3/8"

3 to 4 inch	10'-0"	3/8"
6 to 8 inch	10'-0"	1/2"
(Cast Iron)		
2 to 3 inch	5'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(PVC Pipe)		
1-1/2 to 4 inch	4'-0"	3/8"
6 to 8 inch	4'-0"	1/2"
10 and over	4'-0"	5/8"

B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

C. Place a hanger within 12 inches of each horizontal elbow and at the vertical horizontal transition.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

B. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

C. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

D. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

E. Support riser piping independently of connected horizontal piping.

F. Install hangers with nut at base and above hanger; tighten upper nut to hanger after final installation adjustments.

G. Portable pipe hanger systems shall be installed per manufactures instructions.

3.02 Insulated Piping: Comply with the following installation requirements.

A. Clamps: Attach galvanized clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.

B. Saddles: Install galvanized protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.

C. Shields: Install protective shields MSS Type 40 on cold and chilled water piping that has vapor barrier. Shields shall span an arc of 180 degrees and shall have dimensions in inches not less than the following:

NPS	LENGTH	THICKNESS
1/4 THROUGH 3-1/2	12	0.048
4	12	0.060
5 & 6	18	0.060
8 THROUGH 14	24	0.075
16 THROUGH 24	24	0.105

D. Piping 2" and larger provide galvanized sheet metal shields with calcium silicate at hangers/supports.

E. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.03 EQUIPMENT BASES AND SUPPORTS

A. Provide equipment bases of concrete.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct support of steel members. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.04 FLASHING

A. Provide flexible flashing and metal counter flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 8 inches minimum above finished roof surface with lead worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter flash and seal.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.

D. Seal floor shower mop sink and all other drains watertight to adjacent materials.

E. Provide curbs for mechanical roof installations 8 inches minimum high above

roofing surface. Contact architect for all flashing details and roof construction. Seal penetrations watertight.

3.05 SLEEVES

A. Set sleeves in position in formwork. Provide reinforcing around sleeves.

B. Extend sleeves through floors minimum one inch above finished floor level. Caulk sleeves full depth with fire rated thermfiber and 3M caulking and provide floor plate.

C. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with U.L. listed fire stopping insulation and caulk seal air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

D. Fire protection sleeves may be flush with floor of stairways.

END OF SECTION

SECTION 15170

MOTORS AND MOTOR CONTROLLERS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 15050, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

A. 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.

B. WORK SPECIFIED ELSEWHERE:

1. Painting
2. Automatic temperature controls.
3. Power control wiring to motors and equipment.

1.03 WARRANTY

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

1.04 SUBMITTALS

A. SHOP DRAWINGS: Indicate size material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures variations, and accessories.

C. MOTOR NAMEPLATE INFORMATION: Manufacturer's name, address, utility and operating data.

D. Refer to Division One for additional information.

1.05 DELIVERY AND STORAGE

A. DELIVERY: Deliver clearly labeled, undamaged materials in the manufacturers' unopened containers.

B. TIME AND COORDINATION: Deliver materials to allow for minimum storage time at the project site. Coordinate delivery with the scheduled time of installation.

C. STORAGE: Store materials in a clean, dry location, protected from weather and abuse.

PART 2 - PRODUCTS

2.01 ELECTRIC MOTORS

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

1. Baldor
2. Marathon
3. Siemens-Allis
4. General Electric
5. U.S. Motor

B. TEMPERATURE RATING: Provide insulation as follows:

1. CLASS B: 40 degrees C maximum.
2. CLASS F:
   a. Between 40 degrees C and 65 degrees C maximum.
   b. Totally enclosed motors.

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

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

used.

1. UP TO 1/2 HP: Provide permanent split, capacitor-start single phase with inherent overload protection.
2. 3/4 HP AND LARGER: Provide squirrel-cage induction polyphone.
3. Provide two separate windings on 2-speed polyphone motors.
4. Name plate voltage shall be the same as the circuit's normal voltage, serving the motor.

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

F. FRAMES: U-frames 1.5 hp. and larger.

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

1. Design for thrust where applicable.
2. PERMANENTLY SEALED: Where not accessible for greasing.
3. SLEEVE-TYPE WITH OIL CUPS: Light duty fractional hp. motors or polyphase requiring minimum noise level.

H. ENCLOSURE TYPE: Provide enclosures as follows:

1. CONCEALED INDOOR: Open drip proof.
2. EXPOSED INDOOR: Guarded.
3. OUTDOOR TYPICAL: Type II. TEC.
4. OUTDOOR WEATHER PROTECTED: Type I. TEA.

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

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

K. 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.

Motor Horsepower	NEMA Efficiency INDEX Letter	Minimum Efficiency %
	1800 RPM Synchronous Speed	
7.5-10	F	89.5
15-20	E	91.0
25-30	E	92.4
40	D	93.0
50	C	93.0
60	C	93.6
75	C	94.1
100-125	B	94.5
150-200	B	95.0

1200 RPM Synchronous Speed		
3-5	G	87.5
7.5	G	89.5
10	F	89.5
15	F	90.2
20	E	90.2
25-30	E	91.7
40-50	D	93.0
60	D	93.6
75	C	93.6
100-125	C	94.1
150-200	B	95.0

2.02 MOTOR CONTROLLERS (STARTERS)

A. 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.

1. Starters shall be provided for 3 phase motors 3/4 horsepower and greater.

B. Motor starters shall be furnished as follows.

1. GENERAL: Motor starters shall be Square D Company Class 8536 across-the-line magnetic type, full-voltage, non-reversing (FAVOR) starter. All starters shall be constructed and tested in accordance with the latest NEMA standards, sizes and horsepower. ICE sizes are not acceptable. Starters shall be mounted in a general purpose dead front, painted steel enclosure and surface-mounted. Provide size and number of poles as shown and required by equipment served. Provide two speed, two winding or two speed, single winding motor starter as required for two speed motors.
2. CONTACTS: Magnetic starter contacts shall be double break solid silver alloy. All contacts shall be replaceable without removing power wiring or removing starter from panel. The starter shall have straight-through wiring.
3. OPERATING COILS: Operating coils shall be 120 volts and shall be of molded construction. When the coil fails, the starter shall open and shall not lock in the closed position.
4. OVERLOAD RELAYS: Provide manual reset, trip-free Class 20 overload relays in each phase conductor in of all starters. Overload relays shall be melting alloy type with visual trip indication. All 3 phases and single phase starters shall have one overload relay in each underground conductor. Relay shall not be field adjustable from manual to automatic reset. Provide 6 overload relays for two speed motor starters.
5. PILOT LIGHTS: Provide a red running pilot light for all motor starters. Pilot lights shall be mounted in the starter enclosure cover. Pilot lights shall be operated from an interlock on the motor starter and shall not be wired across the operating coil.

6. CONTROLS: Provide starters with HAND-OFF-AUTOMATIC switches. Coordinate additional motor starter controls with the requirements of Division 15. Motor starter controls shall be mounted in the starter enclosure cover.
7. CONTROL POWER TRANSFORMER: Provide a single-phase 480 volt control power transformer with each starter for 120 volt control power. Connect the primary side to the line side of the motor starter. The primary side shall be protected by a fuse for each conductor. The secondary side shall have one leg fused and one leg grounded. Arrange transformer terminals so that wiring to terminals will not be located above the transformer.
8. AUXILIARY CONTACTS: Each starter shall have one normally open and one normally closed convertible auxiliary contact in addition to the number of contacts required for the "holding interlock", remote monitoring, and control wiring. In addition, it shall be possible to field-install three more additional auxiliary contacts without removing existing wiring or removing the starter from its enclosure.
9. UNIT WIRING: Unit shall be completely pre-wired to terminals to eliminate any interior field wiring except for line and load power wiring and HVAC control wiring.
10. ENCLOSURES: All motor starter enclosures shall be NEMA 1, general purpose enclosures or NEMA-3R if mounted exposed to high moisture conditions. Provide NEMA 4X when located by cooling towers.
11. POWER MONITOR: Provide a square "D" 8430 MPS phase failure and under-voltage relay, base and wiring required for starters serving motors 5 horsepower and larger. Set the under-voltage setting according to minimum voltage required for the motor to operate within its range.

C. APPROVED MANUFACTURERS: Controller numbers are based on first named manufacturer. Provide one of the following manufacturer's.

1. Siemens.
2. Square D.
3. General Electric.

2.03 COMBINATION MOTOR STARTERS

A. GENERAL: Combination motor starters shall consist of a magnetic starter and a fusible or non-fusible disconnect switch in a dead front, painted steel NEMA 1 enclosure unless otherwise noted and shall be surface-mounted. Size and number of poles shall as shown and required by equipment served. Combination motor starters shall be as specified for motor starters in Paragraph 2.01/B, except as modified herein.

B. DISCONNECT SWITCH: Disconnect switches shall be as specified in Section 16490.

C. APPROVED MANUFACTURERS: Controller numbers are based on first named manufacturer. Provide one of the following manufacturer's.

1. Siemens.
2. Square D.
3. General Electric.

PART 3 - EXECUTION

3.01 All equipment shall be installed in accordance with the manufacturers' recommendations and printed installation instructions.

3.02 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractors' price shall include all items required as per manufacturers' requirements.

3.03 INSTALLATION

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

B. Install rotating equipment in static and dynamic balance.

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

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

END OF SECTION

SECTION 15190

SYSTEM IDENTIFICATION AND PIPE MARKING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 15050, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

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.

1.03 Refer to Architectural Sections for additional requirements.

PART 2 - PRODUCTS

2.01 VALVE AND PIPE IDENTIFICATION

A. Valves:

1. All valves shall be identified with a 1-1/2" diameter brass disc wired onto the handle. The disc shall be stamped with 1/2" high depressed black filled identifying numbers. These numbers shall be numerically sequenced for all valves on the job.

2. The number and description indicating make, size, model number and service of each valve shall be listed in proper operational sequence, properly typewritten. Three copies to be turned over to Owner at completion.

3. Tags shall be fastened with approved meter seal and 4 ply 0.018 smooth copper wire. Tags and fastenings shall be manufactured by the Seton Name Plate Company or approved equal.

4. All valves shall be numbered serially with all valves of any one system and/or trade grouped together.

B. Pipe Marking:

1. All interior visible piping located in accessible spaces such as above accessible ceilings, equipment rooms, attic space, under floor spaces, etc., shall be identified with all temperature pipe markers as manufactured by W.H. Brady Company, 431 West Rock Ave., New Haven, Connecticut, or approved equal.

2. All exterior visible piping shall be identified with UV and acid resistant outdoor grade acrylic plastic markers as manufactured by Set Mark distributed by Seton Nameplate Company. Factory location 20 Thompson Road, Branford, Connecticut, or approved equal.

3. Generally, markers shall be located on each side of each partition, on each side of each tee, on each side of each valve and/or valve group, on each side of each piece of equipment, and, for straight runs, at equally spaced intervals not to exceed 75 feet. In congested area, marks shall be placed on each pipe at the points where it enters and leaves the area and at the point of connection of each piece of equipment and automatic control valve. All markers shall have directional arrows.

4. Markers shall be installed after final painting of all piping and equipment and in such a manner that they are visible from the normal maintenance position. Manufacturer's installation instructions shall be closely followed.

5. Markers shall be colored as indicated below per ANSI/OSHA Standards:

SYSTEM	COLOR	LEGEND

Sanitary Sewer	Green	Vent Sanitary Sewer
Storm Drain	Green	Storm Drain
Domestic Water	Green	Domestic Water
Domestic Hot Water Supply	Yellow	Domestic Hot Water Supply
Domestic Hot Water Recirculating	Yellow	Domestic Hot Water Return
Fire Protection	Red	Fire Protection
Automatic Sprinkler	Red	Fire Sprinkler
Gas	Yellow	Natural Gas

C. Pipe Painting:

1. All piping exposed to view shall be painted as indicated or as directed by the Architect in the field. Confirm all color selections with Architect prior to installation.

2. The entire fire protection piping system shall be painted red.

3. All piping located in mechanical rooms and exterior piping shall be painted as indicated below:

System	Color
Storm Sewer	White
Sanitary Sewer Waste and Vent	Light Gray
Domestic Cold Water	Dark Blue
Domestic Hot Water Supply and Return	Orange
Hot Water Supply and Return	Reddish Orange

PART 3 - EXECUTION

3.01 All labeling equipment shall be installed as per manufacturers printed installation instructions.

3.02 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractors' price shall include all items required as per manufacturers' requirements.

3.03 All piping shall be cleaned of rust, dirt, oil and all other contaminants prior to

painting. Install primer and a quality latex paint over all surfaces of pipe.

END OF SECTION

SECTION 15240

SOUND AND VIBRATION CONTROL

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Vibration and sound control products.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of Contract including General and Supplementary Conditions and Division One specification sections, apply to work of this section

B. This section is Division-15 Basic Materials and Methods section, and is part of each Division-15 section making reference to vibration control products specified herein.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of vibration control products, of type, size, and capacity required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Vibration and sound control products shall conform to ASHRAE criteria for average noise criteria curves for all equipment at full load conditions.

C. Except as otherwise indicated, sound and vibration control products shall be provided by a single manufacturer.

1.04 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Amber/Booth Company, Inc.

B. Mason Industries, Inc.

C. Kenetics Noise Control.

2.02 GENERAL

A. Provide vibration isolation supports for equipment, piping and ductwork, to prevent transmission of vibration and noise to the building structures that may cause discomfort to the occupants.

B. Model numbers of Amber/Booth products are included for identification. Products of the additional manufacturers will be acceptable provided they comply with all of the requirements of this specification.

2.03 SUSPENDED FANS AND FAN COIL UNITS

A. Provide Amber/Booth type BSS spring hangers sized for 1'' static deflection.

2.04 PIPING

A. Provide spring and rubber-in-shear hangers, Amber/Booth type BSR in mechanical equipment rooms, for a minimum distance of 50 feet from isolated equipment for all chilled water and hot water piping 1-1/2'' diameter and larger. Springs shall be sized for 1'' deflection.

B. Floor supported piping is required to be isolated with Amber/Booth type SW-1 open springs sized for 1'' deflection.

C. Furnish line size flexible connectors at supply and return of pumps, amber/booth style 2800 single sphere EPDM construction, connector shall include 150 lb. cadmium plated carbon steel floating flanges.

2.05 CORROSION PROTECTION

A. All vibration isolators shall be designed and treated for resistance to corrosion.

B. Steel components: PVC coated or phosphated and painted with industrial grade enamel. Nuts, bolts, and washers: zinc-electroplated.

PART 3 - EXECUTION

3.01 All equipment shall be installed in accordance with the manufacturers recommendations and printed installation instructions.

3.02 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.

3.03 If internal isolation option is used on air handling units, the mechanical contractor shall verify proper adjustment and operation of isolators prior to start-up. All shipping brackets and temporary restraint devices shall be removed.

3.04 The vibration isolation supplier shall certify in writing that he has inspected the installation and that all external isolation materials and devices are installed correctly and functioning properly.

END OF SECTION

SECTION 15260

PIPING INSULATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 15050, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

A. 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.

B. Furnish and install piping insulation to:

1. Interior domestic hot and cold water piping.
2. Exterior domestic cold water piping.
3. Chilled water and heating hot water piping.
4. Drain bodies and horizontal downspouts.
5. Condensate drainage piping.
6. Refrigerant piping.
7. All pipes subject to freezing conditions shall be insulated.

C. Work specified elsewhere.

1. Painting.
2. Pipe hangers and supports.

D. For insulation purpose piping is defined as the complete piping system including supplies and returns, pipes, valves, automatic control valve bodies, fittings, flanges, strainers, thermometer well, unions, reducing stations, and orifice assemblies.

1.03 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either

defective or nonconforming materials or workmanship.

B. Defects shall include, but not be limited to, the following:

1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.04 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, project variations, and accessories.

1.05 DELIVERY AND STORAGE

A. DELIVERY: Deliver undamaged materials in the manufacturer's unopened containers. Containers shall be clearly labeled with the insulation's flame and smoke ratings.

PART 2 - PRODUCTS

2.01 It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

2.02 The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved prior to installation.

2.03 A sample quantity of each type of insulation and each type application shall be installed and approval secured prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

2.04 All insulation shall have composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) fire and smoke hazard as tested by Procedure ASTM E084, NFPA 255 and UL 723 not exceeding:

Flame Spread 25
Smoke Developed 50

2.05 Accessories, such as adhesives, mastics and cements shall have the same

component ratings as listed above.

2.06 All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

2.07 APPROVED MANUFACTURERS

A. Calcium silicate materials shall be as manufactured by Johns Manville.

B. Glass fiber materials shall be as manufactured by Johns Manville, Knauf, or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer.

C. Adhesives shall be as manufactured by Childers, Foster, HB Fuller or Armstrong, and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

D. Armaflex elastomeric cellular thermal insulation by Armstrong.

E. Phenolic foam insulation shall be as manufactured by Kooltherm Insulation (Koolphen).

F. Metal jacketing and fitting covers shall be as manufactured by Childers or RPR Products.

2.08 MATERIALS

A. INTERIOR DOMESTIC WATER PIPE: provide fiberglass pipe insulation with all service jackets with self sealing lap joint.

B. EXTERIOR DOMESTIC WATER PIPE: Provide elastomeric cellular thermal, or preformed phenolic foam pipe insulation with secured metal jacketing.

C. DRAIN BODIES AND DOWN SPOUTS: Insulate horizontal roof drain down spouts, underside of roof drain bodies, chilled water waste lines from drinking fountain to junction with main waste stacks, and branch lines including traps and exposed underside of floor drains receiving cooling coil condensate, same as water piping where exposed to building occupant view. When concealed, insulation may be same as specified for external duct wrap.

D. CONDENSATE DRAINAGE PIPING: Fire resistant fiberglass insulation; insulation not required when piping is exposed on roof.

E. REFRIGERANT PIPING: Refrigerant pipe insulation shall be model "AP-2000", fire rated for use in environmental air plenums. Apply manufacturers recommended finish and sealant for exterior applications.

F. METAL JACKETING: Utilize Childers “Strap-On” jacketing. Provide preformed fitting covers for all elbows and tees.

PART 3 - EXECUTION

3.01 All insulation shall be installed in accordance with the manufacturers' recommendations and printed installation instructions, including high density inserts at all hangers and pipe supports to prevent compression of insulation.

3.02 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.

3.03 Pipes located outdoors or in tunnels shall be insulated same as concealed piping; and in addition shall have a jacket of 0.016 inch thick, smooth aluminum with longitudinal modified Pittsburg Z-Lock seam and 2 inch overlap. Jacketing shall be easily removed and replaced without damage. All butt joints shall be sealed with gray silicone. Galvanized banding is not acceptable.

3.04 All insulated piping located over driveways shall have an aluminum shield permanently banded over insulation to protect it from damage from car antennas.

3.05 WATER PIPE INSULATION INSTALLATION

A. The insulation shall be applied to clean, dry pipes with all joints firmly butted together. Where piping is interrupted by fittings, flanges, valves or hangers and at intervals not to exceed 25 feet on straight runs, an isolating seal shall be formed between the vapor barrier jacket and the bare pipe. The seal shall be by the applications of adhesive to the exposed insulation joint faces, carried continuously down to and along 4 inches of pipe and up to and along 2 inches of jacket.

B. Pipe fittings and valves shall be insulated with pre-molded or shop fabricated glass fiber covers finished with two brush coats of vapor barrier mastic reinforced with glass fabric.

C. All under lap surfaces shall be clean and free of dust, etc. before the SSL is sealed. These laps shall be firmly rubbed to insure a positive seal. A brush coat of vapor retarder shall be applied to all edges of the vapor barrier jacket.

3.06 STANDBY-GENERATOR ENGINE EXHAUST PIPING

A. Entire engine exhaust pipe from exhaust manifold to outside terminal shall be enclosed in a 1" thick layer of calcium silicate insulation shall cover the first layer.

B. A second insulating layer of 1" thick calcium silicate shall cover the first layer.

C. Joints for the first and second layer shall be staggered.

D. Apply aluminum jacket over outer layer of insulation.

E. Insulate exhaust muffler in the same manner as the exhaust piping.

3.07 FIRE RATED INSULATION

A. All pipe penetrations through walls and concrete floors shall be fire rated by applying USG Thermafiber in the space between the concrete and the pipe.

B. The fire rating shall be additionally sealed by using 3M brand model CP 25 or 303 fire barrier caulk and putty.

C. All fire rating material shall be insulated in accordance with manufacturer's printed instructions.

PART 4 - SCHEDULES

4.01 LOW TEMPERATURE SURFACES	MINIMUM INSULATION THICKNESS BASED ON FIBERGLASS
A. Exposed exterior domestic water pipe:	1½ inch
B. Interior domestic cold water pipe exposed to freezing temperatures:	1 inch
C. Condensate drain lines:	¾ inch
D. Drains receiving condensate:	1 inch
E. Concealed horizontal leader from roof drain:	1½ inch blanket wrap
Exposed horizontal leader from roof drain:	1 inch thick rigid with all service jackets
F. Refrigerant Piping	
(1) 1½“ and smaller	1 inch
(2) Larger than 1½ inch	1½ inch

4.02 HIGH TEMPERATURE SURFACES	MINIMUM INSULATION THICKNESS
A. Domestic Hot Water and Hot Water Circulating Piping	1 inch

END OF SECTION

SECTION 15290

DUCT INSULATION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Ductwork system insulation.

1.02 RELATED SECTIONS

A. Section 15050 - Basic Materials and Methods

B. Section 15170 - Motors and Motor Controllers

C. Section 15190 - System Identification and Pipe Marking

1.03 QUALITY ASSURANCE

A. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

B. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1. Exception: Outdoor mechanical insulation may have flame spread index of 75 and smoke developed index of 150.

C. Duct and plenum insulation shall comply with minimum R-value requirements of 2000 International Energy Conservation Code.

D. Adhesive and other material shall comply with NFPA and NBFU Standards No. 90A and 90B.

1.04 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in unopened containers with manufacturer's stamp, clearly labeled with flame and smoke rating, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.01 GENERAL DESCRIPTION

A. The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved before any insulation is installed.

B. A sample quantity of each type of insulation and each type of application shall be installed and approval secured prior to proceeding with the main body of the work.

2.02 ACCEPTABLE MANUFACTURERS

A. Glass fiber materials shall be as manufactured by Knauf, Certain-Teed, Johns-Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer.

B. Adhesives shall be as manufactured by Minnesota Mining, Arabol, Benjamin-Foster, Armstrong or Insulmastic, Inc., and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

C. Ceramic fiber materials shall be as manufactured by Primer Refractories, A.P. Green Refractories or approved equal.

PART 3 - EXECUTION

3.01 GENERAL

A. All insulation shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

3.02 EXTERNAL DUCT INSULATION

A. Fasten all longitudinal and circumferential laps with outward clinching staples 3" on center. On rectangular ducts over 24" wide apply as above and hold insulation in place on bottom side with mechanical pins and clips on 12" centers.

B. Seal all joints, fastener penetrations and other breaks in vapor barrier with 3 inch wide strips of white glass fabric embedded between two coats of vapor barrier mastic, Childers CP-30 or approved equal.

C. All external duct insulation shall be Johns Manville Type 100 fiberglass duct wrap insulation with reinforced aluminum facing or approved equal.

D. External duct wrap is required on all outside air ducts and supply air ducts that are not internally insulated. Duct wrap shall be provided as follows:

1. 1½" thick, 1.0 PCF density minimum when ducts are located in conditioned spaces.
2. 2" thick with a minimum installed R-value of 5 when ducts are located in unconditioned spaces, such as ceiling plenum space.

3.03 DUCT LINER

A. Duct liner shall be kept clean and dry during transportation, storage and installation. Care should be taken to protect the liner from exposure to the elements or damage from mechanical abuse.

B. All portions of duct designed to receive duct liner shall be completely covered with liner as specified. The smooth, black, acrylic-coated surfaces with flexible glass cloth reinforcement shall face the airstream. All duct liner shall be cut to assure tight, overlapped corner joints. The top pieces shall be supported by the sidepieces. Duct liner shall be installed following the guidelines in the NAIMA "Duct Liner Installation Standard".

C. The duct liner shall be tested according to erosion test method in UL 181 and shall be guaranteed to withstand velocities in the duct system up to 5000 fpm without surface erosion.

D. Duct liner shall be adhered to the sheet metal with full coverage of an approved adhesive that conforms to ASTM C 916, and all exposed leading edges and transverse joints shall be coated with Permacote factory-applied or field-applied edge coating and shall be neatly butted without gaps. Shop or field cuts shall be liberally coated with Johns Manville SuperSeal® duct butter and Edge Treatment or approved adhesive.

E. Metal nosings shall be securely installed over transversely oriented liner edges facing the airstream at forward discharge and at any point where lined duct is preceded by unlined duct.

F. When velocity exceeds 4000 fpm (20.3 m/sec), use metal nosing on every leading edge. Nosing may be formed on duct or be channel or zee attached by screws, rivets or welds.

G. The liner shall further be secured with Graham welding pins and washers on not more than 18 inch centers both vertical and horizontal surfaces, and the pins and washers shall be pointed up with adhesive.

H. Duct liner shall be Johns Manville Linacoustic RC fiberglass duct liner with factory-applied edge coating or approved equal. The liner shall meet the Life Safety Standards as established by NFPA 90A and 90B, FHC 25/50 and Limited Combustibility and the air stream surface coating should contain an immobilized, EPA-registered, anti microbial agent so it will not support microbial growth as tested in accordance with ASTM G21 and G22. The duct liner shall conform to the requirements of ASTM C 1071, with an NRC not less than .70 as tested per ASTM C 423 using a Type "A" mounting, and a thermal conductivity no higher than .25 BTU•in/(hr•ft^2•°F) at 75°F mean temperature.

I. Duct liner is required on all rectangular return air ductwork, return air boots

and supply air ductwork downstream of the terminal units. Duct liner shall be provided as follows:

1. 1” Thick, 1.5 PCF density minimum when ducts are located in conditioned spaces.
2. 1 ½” Thick with a minimum installed R-value of 5 when ducts are located in unconditioned spaces, such as ceiling plenum space.
3. 2” Thick with a minimum installed R-value of 8 when ducts are located outdoors.

J. Line supply and return ductwork at connection of HVAC unit to a point of 15 feet upstream and downstream of the equipment with Johns Manville, Linacoustic HP with an R-value of 5 or approved equal for thermal insulation and noise control. The liner shall meet the safety standards as indicated above with NRC not less than 0.75 as tested per ASTM C423 using a type “A” mounting and thermal conductivity no higher than 0.24 BTU•in/(hr•ft^2•F) at 75°F mean temperature. Attach with full cover coat of cement, duct dimensions up to 16 inches, provide stick clips or screws and cap for dimension over 16 inches, space 16 inches o.c. maximum. Provide sheet metal liner cap over all leading edges of internal insulation exposed to air stream.

3.04 EXPOSED DUCTWORK LOCATED INDOORS

A. Duct routed exposed shall be internally lined as specified.

B. Round duct routed exposed shall be double wall with solid inner liner and 1’’ thick layer of fiberglass insulation as manufactured by United McGill Company model no. Acousti-27 or approved equal.

3.05 AIR DEVICE AND MISCELLANEOUS DUCT INSULATION

A. The backside of all supply air devices shall be insulated with taped and sealed 1½ inch thick external duct wrap.

B. The contractor shall install an additional layer of 1½ inch thick external fiberglass duct wrap on any portion of the supply air, return air, outside air, or exhaust air system that has condensation forming during any period of operation. The insulation shall be taped and sealed and located until all evidence of the condensation had been eliminated at no additional cost to the owner.

3.06 KITCHEN GREASE HOOD EXHAUST DUCT

A. All kitchen range hood exhaust duct shall be enclosed with 2 hours fire rated enclosure.

B. The duct enclosure shall be sealed around the duct at the points of penetration.

C. The enclosure shall be separated from the duct by at least 3 inches and not more than 12 inches.

D. Cleanout openings at exhaust duct with access openings at the fire rated enclosure and access doors shall be provided at each duct offset and as required for proper operation and maintenance.

E. As an alternate method, the contractor may use the “3M FireMaster Fastwrap” along with “3M Fire Barrier 1000 N/S Silicone Sealant”, Johns Manville firetemp Wrap SL2 or approved equals in lieu of the fire rated enclosure, providing the product used shall meet UL requirements and be approved by the local authority have jurisdiction. This application shall follow the manufacturers’ strict installation instructions and guidelines.

F. Insulation and all other requirements shall be provided per local codes.

END OF SECTION

SECTION 15410

PLUMBING PIPING AND VALVES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe and pipe fittings.

B. Valves.

C. Sanitary sewer piping system.

D. Storm water piping system.

E. Domestic water piping system.

F. Compressed air piping system.

1.02 RELATED SECTIONS

A. Section 02222 - Excavating.

B. Section 02223 - Backfilling.

C. Section 02225 - Trenching.

D. Section 15140 - Supports and Anchors.

E. Section 15190 - Mechanical Identification.

F. Section 15240 - Vibration Isolation.

G. Section 15260 - Piping Insulation.

H. Section 15430 - Plumbing Specialties.

I. Section 15440 - Plumbing Fixtures.

J. Section 15450 - Plumbing Equipment.

1.03 REFERENCES

A. ANSI B31.1 - Power Piping.

B. ANSI B31.9 - Building Service Piping.

C. ASME - Boiler and Pressure Vessel Code.

D. ASME Sec. 9 - Welding and Brazing Qualifications.

E. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800.

F. ASME B16.3 - Malleable Iron Threaded Fittings.

G. ASME B16.4 - Cast Iron Threaded Fittings Class 125 and 250.

H. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings

I. ASTM A47 - Ferritic Malleable Iron Castings.

J. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

K. ASTM A74 - Cast Iron Soil Pipe and Fittings.

L. ASTM B32 - Solder Metal.

M. ASTM B42 - Seamless Copper Pipe.

N. ASTM B306 - Copper Drainage Tube (DWV).

O. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120.

P. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR).

Q. ASTM D2466 - Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

R. ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

S. ASTM D2729 - Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

T. ASTM D2846 - Chlorinated Polyvinyl Chloride (CPVC) Pipe, Fittings, Solvent Cements and Adhesives for Potable Hot Water Systems.

U. ASTM F493 - Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

V. AWWA C111- Rubber-Gasket Joints for Ductile Iron and Gray-Iron Pressure Pipe and Fittings.

W. AWWA C651 - Disinfecting Water Mains.

X. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.

Y. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.

1.04 SUBMITTALS

A. Submit under provisions of Division One.

B. Product Data: Provide data on pipe materials, Pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.05 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of valves.

1.06 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.07 QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating cast or marked on valve body.

B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.

C. Welders Certification: In accordance with ASME Sec 9.

D. Foreign pipe, fittings or valves are unacceptable.

E. Piping shall be labeled along entire length indicating size, class, material specification, manufacturers name and country of origin.

1.08 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 5 years documented experience and must be a domestic manufacturer.

B. Installer: Company specializing in performing the work of this section with minimum 5 years documented experience.

1.09 REGULATORY REQUIREMENTS

A. Perform Work in accordance with plumbing and building codes having jurisdiction.

B. Conform to applicable codes for the provision and installation of all required backflow prevention devices.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

D. No PVC pipe or fittings will be allowed for any areas where pipe is to penetrate a fire rated assembly or to be installed in a return air plenum unless the entire length of all such piping is encased within a minimum 2 hour fire rated enclosure.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division One.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system. Tape will not be allowed as an acceptable end cover.

1.11 EXTRA MATERIALS

A. Furnish under provisions of Division One.

B. Provide two repacking kits for each size valve.

PART 2 - PRODUCTS

2.01 SANITARY SOIL WASTE AND VENT PIPING, BURIED BEYOND 5 FEET OUTSIDE OF BUILDING

A. Cast Iron Pipe: ASTM A 74 service weight.

1. Fittings: Cast iron, ASTM A 74 drainage pattern.
2. Joints: Hub and spigot, ASTM C 564 neoprene, compression type gaskets or lead and oakum.

2.02 SANITARY SOIL, WASTE AND VENT PIPING, BURIED WITHIN 5 FEET OF BUILDING, BELOW GRADE

A. Cast Iron Pipe: ASTM A 74 service weight.

1. Fittings: Cast iron, ASTM A 74 drainage pattern.
2. Joints: Hub and spigot, ASTM C 564 neoprene, compression type gaskets or lead and oakum.

2.03 SANITARY SOIL, WASTE AND VENT PIPING, WITHIN BUILDING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A 888, hubless, service weight.

1. Fittings: Cast iron, ASTM A 888 drainage pattern.
2. Joints: No hub, ASTM C 564 neoprene gaskets with ASTM C1540 wide bodied stainless steel clamp and solid shield assembly constructed of type 300 series stainless steel. Couplings shall have four clamps for pipe sizes up to and including 4” and shall have six clamps for pipe sizes over 4” through 10”. Clamp assemblies shall conform to FM 1680 where required by the administrative authority.

B. Copper Tubing: ASTM B 306, DWV, sizes 2" and smaller.

1. Fittings: ASME B 16.23 cast bronze, or ASME B16.29, wrought copper.
2. Joints: ASTM B 32, solder, Grade 50B.

C. Brass Pipe: ASTM B 43, chrome plated.

1. Fittings: ASME B 16.23 cast bronze, chrome plated.
2. Joints: ASTM B 32, solder, Grade 50B.

D. Steel Pipe: ASTM A 53, Schedule 40, galvanized, sizes 2-1/2" and smaller, for waste and vent piping only, steel soil pipes not permitted.

1. Fittings: Malleable iron, galvanized.
2. Joints: ASME B16.3 screwed.

2.04 STORM WATER PIPING, BURIED BEYOND 5 FEET OUTSIDE OF BUILDING

A. Pipe and fittings shall be same as specified for sanitary piping system.

2.05 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING, BELOW GRADE

A. Pipe and fittings shall be same as specified for sanitary soil, waste and vent piping system.

2.06 STORM WATER PIPING, WITHIN BUILDING, ABOVE GRADE

A. Pipe and fittings shall be same as specified for sanitary soil, waste and vent piping system.

2.07 DOMESTIC WATER PIPING, BURIED BEYOND 5 FEET OUTSIDE OF BUILDING

A. PVC Pipe: ASTM D 1785 schedule 80.

1. Fittings: ASTM D 2467 PVC.
2. Joints: ASTM D 2855, solvent weld with ASTM D 2564 solvent cement.

2.08 DOMESTIC WATER PIPE, BURIED WITHIN 5 FEET OF BUILDING, BELOW GRADE

A. Copper Tubing: ASTM B 88, Type K, soft annealed.

1. Fittings: ASME B 16.18, cast bronze, ASTM B 16.22 wrought copper alloy or ASTM B 16.26 cast bronze for flared fittings.
2. Joints: Sweat solder or flared. Note: No joints will be permitted in pressure water pipe below slab on grade. All such piping must be brought up above finished floor line a minimum of 12” before joining. Exception may be taken when pipe is fully enclosed in pressure rated sleeve and pre-approved by the Architect and Engineer.

B. Ductile Iron Pipe: ANSI/AWWA C151.

1. Fittings: Ductile or gray cast iron, standard thickness.
2. Joints: ANSI/AWWA C111, rubber gasket with 3/4 inch diameter rods. Note: No joints are to be permitted in pressure water pipe below slab on grade except at exterior wall pipe entry from below floor.

2.09 DOMESTIC WATER PIPING, WITHIN BUILDING, ABOVE GRADE

A. Copper Tubing: ASTM B 88, Type L, hard drawn.

1. Fittings: ASME B 16.18, cast bronze, or ASTM B 16.22 wrought copper alloy.
2. Joints: ASTM B 32, solder.

B. Steel Pipe: ASTM A 53, Schedule 40, galvanized.

1. Fittings: ANSI B 16.3 Malleable iron, 150 lb. galvanized.
2. Joints: Screwed for sizes less than 4", flanged or mechanical cut grooved couplings for sizes 4" and larger.

2.10 COMPRESSED AIR PIPING SYSTEM

A. Steel Pipe: ASTM A 53, Schedule 40, galvanized.

1. Fittings: ANSI B 16.3 Malleable iron, 150 lb. galvanized.

2. Joints: Screwed for sizes less than 4", flanged or mechanical cut grooved couplings for sizes 4" and larger.

2.11 FLANGES AND UNIONS

A. Pipe size 2 inches and under:

1. Ferrous pipe: ANSI B16.39, 150 psig malleable iron threaded unions.
2. Copper tube and pipe: 150 psig bronze unions with soldered ends.
3. Ferrous pipe: ANSI B16.5, 150 psig forged steel flanges; screwed neck, 1/16" thick preformed neoprene gaskets.

B. Pipe size 2-1/2 inches and larger:

1. Ferrous pipe: 150 psig forged steel slip-on flanges; weld neck, 1/16" thick preformed neoprene gaskets.
2. Copper tube and pipe: 150 psig slip-on bronze flanges; 1/16" thick preformed neoprene gaskets.

C. Dielectric Connections:

1. Pipe size 2 inches and under: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
2. Pipe size 2-1/2 inch and larger: flange, connection as above, with water impervious isolation barrier.

2.12 GATE VALVES

A. Manufacturers:

1. Nibco No. T-111 up to 2-1/2"; F-617-O 3" and over.
2. Other acceptable manufacturers offering equivalent products.
   a. Crane No. 428 up to 2-1/2"; 465-1/2 3" and over.
   b. Stockham No. B-100 up to 2-1/2"; G-623 3" and over.
   c. Grinnell No. 3010 up to 2-1/2"; 6020A 3" and over.
   d. Kitz No. 24 1/2"-3"; No. 72 Flanged 2”-14”

B. Up to and including 2-1/2" Inches: Bronze body, bronze trim, rising stem, hand wheel, inside screw, solid wedge threaded ends.

C. Over 3" Inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, solid wedge, flanged ends.

D. Provide bronze tee or cast iron square nut operator for all valves installed below ground.

1. Valves 2-1/2" and smaller shall be equipped with ASTM B62 solid red bronze tee securely affixed to the valve stem.
2. Valves 3" and larger shall be equipped with a standard 2" square combination nut/socket securely affixed to the valve stem.
3. Provide owner with two extended tee handle operating wrenches for each type of valve head installed.

2.13 BALL VALVES

A. Manufacturers:

1. Nibco No. T-585-70-66
2. Other acceptable manufacturers offering equivalent products.
   a. Crane No. 9303-B
   b. Stockham Model S-216BR-1R-T
   c. Grinnell No. 3700-6
   d. Kitz No. 68M

B. Up to and including 2 Inches: Bronze two 600 PSI piece body full port, stainless steel ball and stem, Teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends with union.

C. Ball valves used for balancing shall have memory stops.

2.14 SWING CHECK VALVES

A. Manufacturers:

1. Nibco No. T-413-B up to 2-1/2"; F-918 3" and over.
2. Other acceptable manufacturers offering equivalent products.
   a. Crane No. 37 up to 2-1/2"; 372 3" and over.
   b. Stockham No. B-319; up to 2-1/2"; G931 3" and over.
   c. Grinnell No. 3300 up to 2-1/2"; 6300A 3" and over.
   d. Kitz No. 22 up to 3”; No. 78 2”-10”

B. Up to and including 2-1/2 Inches: Bronze swing disc, screwed ends.

C. Over 2-1/2 Inches: Iron body, bronze trim, swing disc, renewable disc and seat, flanged ends. Include outside lever and adjustable weight where required for quiet operation.

2.15 SPRING LOADED (SILENT) CHECK VALVES

A. Manufacturers:
1. Nibco No. W-910
2. Other acceptable manufacturers offering equivalent products.
   a. Grinnell No. 402

B. Iron body, bronze trim, stainless steel spring, renewable composition disc, screwed, wafer, or flanged ends.

2.16 SOLDER

A. 95.5% tin, 4% copper, 0.5% silver.

B. Lead free, antimony free, zinc-free.

C. Silvabrite 100, by Engelhard Corporation or approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Coordinate and verify excavations under provisions of Division Two.

B. Verify that all excavations are to the required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale, oil and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Install, clean bank sand backfill in trench to a minimum of 6 inches below pipe, and to cover all piping a minimum of 12 inches above pipe.

3.03 INSTALLATION

A. Install all materials in accordance with manufacturer's published instructions.

B. All exposed sewer and water pipe in toilet rooms or other finished areas of the building shall be chromium plated.

C. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

D. Route piping in orderly manner, parallel and perpendicular to building column grid lines, unless indicated otherwise on drawings, and maintain gradients.

E. Install piping to conserve building space and not conflict with other trades or interfere with intended use of space.

F. Group piping whenever practical at common elevations.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Provide clearance for installation of insulation and access to valves and fittings. Valves installed beyond reasonable reach shall be provided with chain operator.

I. Provide access doors where valves and operable fittings are not exposed. Access doors shall be of approved types set in locations pre-approved by submittal to the Architect.

J. Establish elevations of buried piping outside the building to ensure not less than 2 feet of cover, or maximum depth of frost penetration, which ever is the greater.

K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

L. Provide encasement for and support of utility meters in accordance with requirements of utility companies.

M. Gate valves installed below grade shall be covered with an adjustable cast iron roadway box extended to grade. Cover shall be cast iron with 'water' cast on top and set flush to finished paving or 2" above finished earthen grade. Box shall be supported from undisturbed soil or concrete base and shall not introduce any stress to piping under all traffic conditions.

N. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting.

O. Excavate in accordance with Division Two.

P. Backfill in accordance with Division Two.

Q. Install bell and spigot pipe with bell end upstream.

R. Maintain uniformity in the installation of piping materials and joining methods. Do not mix materials types.

S. Install valves with stems upright or horizontal, not inverted.

T. Solder joints shall be wiped clean at each joint, remove excess metal while molten and flux residue when cooled.

U. No PVC pipe or fittings will be allowed for any areas where pipe is installed in return air plenum unless the entire length of all such piping is encased within a minimum 2 hour fire rated enclosure.

V. Installations of thermoplastic piping systems shall be in strict conformity to the manufacturers published instructions. Under ground drainage pipe installations shall be in conformity to ASTM D 2321.

W. Installation of solvent cement joints for PVC piping shall be in strict conformity to the requirements outlined in ASTM D 2855.

X. Waste nipple from wall to tapped tee shall be schedule 40 threaded galvanized steel pipe or brass or copper with threaded adapter.

Y. Provide approved PVC slip by cast iron no hub adaptor at each transition from underground PVC piping to above ground cast iron pipe using heavy duty wide bodied no hub couplings as specified elsewhere in this section. Transition shall be made as close as possible to floor for sanitary DWV piping systems and at test tee “minimum 12 in. A.F.F.” for storm drainage piping. Support vertical cast iron pipe from floor anchors using riser clamp and galvanized all thread rod as specified in section 15140.

3.04 APPLICATION

A. Install union downstream of all valves at equipment or apparatus connections.

B. Install male adapters each side of threaded valves in copper piped system. Sweat solder adapters to tube prior to make-up of threaded connections.

C. Install gate valves for shut-off and to isolate all equipment items, distinct parts of systems, or vertical risers.

D. Each plumbing fixture shall have a shut-off valve on each hot water and cold water supply line.

E. Each plumbing water rough-in stub out shall be fitted with a shut off valve.

F. Install globe, ball or butterfly valves for throttling, bypass, or balancing (manual flow control) services.

G. Ball valves installed in insulated piping shall be fitted with extended lever operators of sufficient length to raise handle above the insulation jacket material. Where valve is used for throttling service valve handle shall be equipped with adjustable memory stop device.

H. Provide spring loaded, non-slam, check valves on discharge of water pumps.

3.05 ERECTION TOLERANCES

A. All drainage lines in the building shall have 1/4 inch to the foot fall where possible and not less than 1/8 inch to the foot fall toward the main sewer. Pipe must be so laid that the slope will be uniform and continuous. Permission shall be secured from the Architect and Engineer before proceeding with any Work where existing conditions prevent the installation at minimum grade specified.

B. Slope all water piping and arrange to drain at low points. Provide loose key operated, polished chrome, sill cock flush to wall where fixture stop will not suffice for this requirement.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, all domestic water systems shall be complete, thoroughly flushed clean and free of all foreign matter or erection residue.

B. Ensure PH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. On building side of the main shut off valve, provide a 3/4" connection through which chlorine can be introduced into the water piping

D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, in sufficient quantity to obtain 50 to 80 mg/L residual free chlorine solution throughout the entire domestic water piping systems.

E. Bleed water from outlets as required to ensure complete distribution and test for disinfectant residual at a minimum 15 percent of total outlets.

F. Maintain disinfectant in system for 24 hours.

G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

I. Take samples no sooner than 24 hours after flushing, from 5 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SERVICE CONNECTIONS

A. Provide new sanitary and storm sewer services connecting to existing building services or utility lines as shown on the drawings.

B. Before commencing work, field verify invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover as required.

C. Provide new domestic water service connecting to existing building services or utility lines as shown on plans. Assure connections are in compliance with requirements of the jurisdiction having authority.

D. Extension of services to the building shall be fabricated from the same materials as the utility service lines or those materials specified herein.

E. Should points of connection vary from those indicated on the drawings contractor shall properly allow for this in the actual connections field fabricated.

3.08 RODDING SEWERS

A. All sanitary soil and waste lines, both in the building and out, shall be rodded out after completion of the installation.

B. This Work shall be done, as part of the contract, to make certain that all lines are clear, and any obstruction that may be discovered shall be removed immediately. Rodding shall be accomplished by utilizing a rotary cutter, which shall be full size of pipe being cleaned.

3.09 TESTING OF PLUMBING PIPING SYSTEMS

A. During the progress of the work and upon completion, tests shall be made as specified herein and as required by Authorities Having Jurisdiction, including Inspectors, Owner or Architect. The Architect or duly authorized Construction Inspector shall be notified in writing at least 2 working days prior to each test or other Specification requirement which requires action on the part of the Construction Inspector.

B. Tests shall be conducted as part of this work and shall include all necessary instruments, equipment, apparatus, and service as required to perform the tests with qualified personnel. Submit proposed test procedures, recording forms, and test equipment for approval prior to the execution of testing.

C. Tests shall be performed before piping of various systems have been covered or furred-in. For insulated piping systems testing shall be accomplished prior to the application of insulation.

D. All piping systems shall be tested and proved absolutely tight for a period of not less than 24 hours. Tests shall be witnessed by the Architect or an authorized representative and pronounced satisfactory before pressure is removed or any water drawn off.

E. Leaks, damage or defects discovered or resulting from test shall be repaired or replaced to a like new condition. Leaking pipe joints, or defective pipe, shall be removed and replaced with acceptable materials. Test shall be repeated after repairs are completed and shall continue until such time as the entire test period expires without the discovery of any leaks.

F. Wherever conditions permit, each piping system shall thereafter be subjected to its normal operating pressure and temperature for a period of no less than five 5 days. During that period, it shall be kept under the most careful observation. The piping systems must demonstrate the propriety of their installation by remaining absolutely tight during this period.

G. Domestic Water:

1. .Pressure test at one and one half times the normal working pressure or 125 psig, which ever is the greater, for 24 hours.

H. Sanitary Soil, Waste and Vents and Storm Sewer:

1. After the rough-in soil, waste and vent and other parts of the sanitary sewer including branch laterals have been set from the lowest level, at point of connection to existing utility lines, to above the floor line, all outlets shall be temporarily plugged or capped, except as are required for testing as described herein. Ground work shall not permit the backfill of trenches to cover any joints until the completion of testing. Back fill shall be limited to mid sections of full joints of piping only. For pipe in ground the piping shall be readied as described herein and filled with water to a verifiable and visible level to 10' above the lowest portions of the system being tested.
2. On multi-level buildings only one floor level shall be tested at a time. Each floor shall be tested from a level below the structure of the floor, or the outlet of the building in the case of the lowest level, to a level of 12 inches above the floor immediately above the floor being tested, or the top of the highest vent in the case of the highest building level. The pipes for the level being tested shall be filled with water to a verifiable and visible level as described above and be allowed to remain so for 24 hours. If after 24 hours the level of the water has been lowered by leakage, the leaks must be found and stopped, and the water level shall again be raised to the level described, and the test repeated until, after a 24 hour retention

period, there shall be no perceptible lowering of the water level in the system being tested.

3. Should the completion of these tests leave any reasonable question or doubt of the integrity of the installation, additional tests including peppermint smoke, or other measures shall be performed to demonstrate the reliability of these systems to the complete satisfaction of the Owner's duly authorized representative. Such tests shall be conducted and completed before any joints in plumbing are concealed or made inaccessible.

3.10 COMPLETE FUNCTIONING OF WORK

A. All work fairly implied as essential to the complete functioning of the systems shown on the Drawings and Specification shall be completed as part of the work of this Division unless specifically stated otherwise. It is the intention of the Drawings and Specification to establish the type and function of systems but not to set forth each item essential to the functioning of any system. In case of doubt as to the work intended or in the event of amplification or clarification thereof, the Contractor shall call upon the Architect for Supplementary Instructions and Drawings, etc.

END OF SECTION

SECTION 15411

NATURAL GAS PIPING SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 15050, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

A. Scope of the Work shall include the furnishing, complete installation and testing of the gas piping system, with all metering, valves, piping and auxiliaries, ready for owner's use.

B. Coordinate with the gas company and pay all fees and permits required for a complete and operating gas service to the project.

PART 2 - PRODUCTS

2.01 All gas piping above ground shall be Schedule 40 black steel as manufactured by National Tube, Republic, Youngstown, or approved equal domestic manufacturer.

2.02 All gas piping larger than 2” shall be of welded construction. Screwed fittings will only be permitted for size 2" and smaller. Unions and valves will not be permitted above furred ceiling areas or in walls or chases.

2.03 All pipe fittings shall be of materials as follows:

A. All welding fittings shall be factory-made and shall be full line size, for each tee, branch, elbow, etc., with reducers after fittings, if required.

B. All screwed fittings shall be Crane, or approved equal, Class 150 malleable iron. Screw joints shall be made up with graphite and oil or Teflon tape. Screwed threads shall be in accordance with American Pipe Thread Standards.

C. All piping and fittings shall be from a domestic manufacturer.

2.04 All underground gas piping with 5 pound working pressure or less shall be as follows:

A. The pipe shall be yellow polyethylene with socket heat fusion joints and fittings. Pipe sizes 1-1/2" and 2" shall be SDR 11, (PE 2406) and pipe sizes 3" and 4" shall be SDR 11.5 (PE 2406).

B. All socket heat fusion fittings shall be D.O.T. approved and meet ASTM D-2513 and ANSI B31.8 codes.

C. All gas valves shall be polyethylene ball type, doubled union, rated for natural gas use. All valves shall be placed in a cast-iron valve box of an adequate size for accessibility and maintenance.

D. All transition meter risers shall be D.O.T. approved anode-less service type, fusion coupled and PE 2406 rated.

E. The contractor shall take thermal expansion under consideration during installation. The contractor shall follow all requirements set by the manufacturer to protect the system from damage due to thermal expansion.

F. The contractor shall provide detector tape approximately 12" above all gas piping.

G. Wrap pipe with 18 gauge minimum copper tracer wire.

2.05 Gas piping installed in unventilated spaces shall be routed in properly vented continuous sleeve where required by the building code.

2.06 Gas valves shall be U.L. listed as follows:

A. Ball Valves: Nibco T585-70-UL for ¼” to 1” and T580-70-UL for 1-¼” to 3”.

B. Plug Valves: DeZurick Series 425 or 435 Eccentric valves with RS 49 plug seals.

2.07 Gas pressure regulators shall be capable of reducing 75 psi pressure gas to 0.5 psi gas at capacities required by Gas Demand. Install per A.G.A. Bulletin 90. Regulators shall be as manufactured by Rockwell, Fisher-Governor or approved equal.

2.08 All gas regulators located inside the building shall be vented to atmosphere with schedule 40 black steel pipe. This includes all regulators provided with mechanical and plumbing equipment and all other regulators provided under this contract. Vent piping shall be the full size of regulatory port opening, or as recommended by regulator manufacturer, and shall run independent of any other regulator vent through to point of termination.

PART 3 - EXECUTION

3.01 All piping shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

3.02 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

3.03 All underground gas piping shall be laid on 6" of wet compact bank sand approximately 24" below grade. Backfill trench with wet compacted bank sand to 6" above pipe. The remainder of backfill shall be selected backfill and shall meet all compaction requirements set forth by the general trenching and backfill requirements.

3.04 Provide lever handle gas valve, drip leg and union to each piece of equipment and where indicated.

3.05 All gas lines entering building shall be valved on the exterior of the building above grade.

PART 4 - TESTING

4.01 TESTING OF GAS PIPING SYSTEMS

A. All gas system testing shall be in compliance with local codes or as required in NFPA 54 National Fuel Gas Code whichever is the more stringent requirement.

B. All work shall be performed by a Journeyman Plumber holding current State and local licenses.

C. All tests shall be accomplished during normal working hours and after having given due notification to building owner, construction manager or designee, of tests to be performed. All tests shall be performed in the presence of and witnessed by the building owners representative or designee

D. All gas system piping shall be subjected to a pneumatic test pressure of 60 psig for not less than 2 hours upon completion of all rough-in work and prior to covering. While the systems are subjected to this air pressure test, all joints shall have soapy water solution applied and shall be observed for

leaks. During test period there shall be no perceptible drop in test gage pressure

E. A final test shall be performed after all portions of the piping system are completely installed and covered. The entire system shall be tested, with all system outlets plugged or capped, before any equipment or appliances are connected to the piping.

1. Final test shall be with mercury, measured with a manometer or slope gage. Test pressures shall in no case be less than one and one half times the normal operating pressure or as listed below; which ever is the greater:
   a. 10.5 inches mercury (5 psig) for 4 ounce system.
   b. 21.0 inches mercury (10 psig) for 8 ounce system.

2. Tests shall be for a period of not less than 30 minutes and shall prove absolutely tight, showing no perceptible drop, for the entire test period.

F. Purge air from test piping before connecting equipment or appliances. Purge air to outdoors or to ventilated space of sufficient volume to prevent accumulation of flammable mixtures.

END OF SECTION

SECTION 15430

PLUMBING SPECIALTIES

PART 1 - GENERAL

1.04 WORK INCLUDED

A. Roof and floor drains.

B. Interceptors.

C. Cleanouts.

D. Backflow preventors.

E. Water hammer arrestors.

F. Thermostatic mixing valves.

G. Hose bibbs hydrants.

1.05 RELATED WORK

A. Section 15140 - Supports and Anchors.

B. Section 15410 - Plumbing Piping.

C. Section 15440 - Plumbing Fixtures.

D. Section 15450 - Plumbing Equipment.

1.06 REFERENCES

A. ANSI/ASSE 1012 - Backflow Preventers with Immediate Atmospheric Vent.

B. ANSI/ASSE 1011 - Hose Connection Vacuum Breakers.

C. ANSI/ASSE 1013 - Backflow Preventers, Reduced Pressure Principle.

D. ANSI/ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.

E. ANSI A112.21.1 - Floor Drains.

F. ANSI A112.21.2 - Roof Drains.

G. ANSI A112.26.1 - Water Hammer Arresters.

H. PDI WH-201 Water Hammer Arresters

I. AWWA C506 - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.

1.07 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by same manufacturer throughout.

1.08 SUBMITTALS

A. Submit under provisions of Division One.

B. Submit shop drawings and product data under provisions of Division One.

C. Include component sizes, rough-in requirements, service sizes, and finishes.

D. Manufacturer's Installation Instructions: Indicate assembly and support requirements.

1.09 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of equipment, cleanouts, and backflow preventers.

1.10 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Operation Data: Indicate frequency of treatment required for interceptors.

C. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division One.

B. Accept specialties on site in original factory packaging. Inspect for damage.

1.12 EXTRA MATERIALS

A. Furnish under provisions of Division One.

B. Provide two loose keys for hose bibbs and spare hose end vacuum breakers.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS - ROOF DRAINS

A. Wade

B. Zurn

C. J.R. Smith

D. Substitutions: Under provisions of Division One.

E. Roof Drains
1. Roof Drains: ANSI A112.21.2; Galvanized cast iron body with sump, removable cast aluminum dome strainer, membrane flange and membrane clamp with integral gravel stop, with adjustable underdeck clamp roof sump receiver waterproofing flange controlled flow weir leveling frame adjustable extension sleeve (for insulation) perforated or slotted ballast guard extension for inverted roof.
2. Roof Overflow Drains (OD): Galvanized cast iron body and clamp collar and bottom clamp ring; pipe extended to 2 inches above flood elevation.

2.02 ACCEPTABLE MANUFACTURERS - PLANTER DRAINS

A. Wade

B. Zurn

C. J.R. Smith

D. Substitutions: Under provisions of Division One.

E. Planter Drains

1. ANSI A112.21.2; Galvanized cast iron body with sump, removable cast aluminum dome strainer with stainless steel screen, membrane flange and membrane clamp with integral gravel stop; with adjustable underdeck clamp waterproofing flange leveling frame, extension sleeve (for insulation).

2.03 ACCEPTABLE MANUFACTURERS - CLEANOUTS

A. Wade

B. Zurn

C. J.R. Smith

D. Substitutions: Under provisions of Division One.

E. Cleanouts
1. Exterior Surfaced Areas (CO-1): Square cast nickel bronze access frame and non-skid cover.
2. Exterior Unsurfaced Areas (CO-2): Line type with lacquered cast iron body and round epoxy coated gasketted cover.
3. Interior Finished Floor Areas (CO-3): Galvanized cast iron, two piece body with double drainage flange, weep holes, reversible clamping collar, and adjustable nickel-bronze strainer, round with scoriated cover in service areas and round with depressed cover to accept floor finish in finished floor areas.
4. Interior Finished Wall Areas (CO-4): Line type with lacquered cast iron body and round epoxy coated gasketted cover, and round stainless steel access cover secured with machine screw.
5. Interior Unfinished Accessible Areas (CO-5): Calked or threaded type., Provide bolted stack cleanouts on vertical rainwater leaders.

2.04 ACCEPTABLE MANUFACTURERS - HOSE BIBBS/HYDRANTS

A. Wade

B. Zurn

C. J.R. Smith

D. Substitutions: Under provisions of Division One.

E. HOSE BIBBS/HYDRANTS
1. Bronze or brass, replaceable hexagonal disc, hose thread spout, [chrome plated where exposed] to interior and [to exterior] with lockshield and removable key, integral vacuum breaker in conformance with ANSI/ASSE 1011.
2. Wall Hydrant: ANSI/ASSE 1019; non-freeze, self-draining type with chrome plated lockable recessed box hose thread spout, lockshield and removable key, and vacuum breaker.
3. Floor Hydrant: ANSI/ASSE 1019; chrome plated lockable recessed box, hose thread spout, lockshield and removable key and vacuum breaker.

2.05 RECESSED VALVE BOX

A. Manufacturers:
1. Wade.
2. Other acceptable manufacturers offering equivalent products.
3. Zurn.
4. J.R. Smith.
5. Sioux Chief
6. Guy Gray
7. Washing Machine: Plastic preformed rough-in box with brass long shank valves with wheel handles, socket for waste, slip in finishing cover.
8. Refrigerator: Plastic preformed rough-in box with brass valves with wheel handle, slip in finishing cover.

2.06 BACK WATER VALVES

A. Manufacturers:
1. Wade.
2. Other acceptable manufacturers offering equivalent products.
3. Zurn.
4. J.R. Smith.
5. ANSI A112.21.2; Lacquered cast iron body and cover, brass valve, access cover, extension sleeve and cover.

2.07 ACCEPTABLE MANUFACTURERS - BACKFLOW PREVENTORS

A. Watts.

B. Wilkins.

C. Febco.

D. Substitutions: Under provisions of Division One.

E. BACKFLOW PREVENTERS
1. Reduced Pressure Backflow Preventers: ANSI/ASSE 1013; bronze body with bronze and plastic internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve which opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.
2. Double Check Valve Assemblies: ANSI/ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

2.08 ACCEPTABLE MANUFACTURERS - WATER HAMMER ARRESTORS

A. P.P.P.

B. Zurn.

C. J.R. Smith

D. Substitutions: Under provisions of Division One.

E. WATER HAMMER ARRESTORS

1. ANSI A112.26.1; sized in accordance with PDI WH-201, precharged suitable for operation in temperature range -100 to 300 degrees F (-73 to 149 degrees C) and maximum 250 psig (1700 kPa) working pressure.

2.09 ACCEPTABLE MANUFACTURERS – GREASE and OIL INTERCEPTORS

A. Park Environmental Equipment Co.

B. Zurn.

C. J.R. Smith.

D. Substitutions: Under provisions of Division One.

E. Grease Interceptors

1. Construction: Epoxy coated fabricated steel or Precast concrete for fully recessed (shallow rough-in) flush with floor or (deep rough-in) installation, with anchor flange, multi-weir baffle assembly, integral deep seal trap, removable integral flow control, and non-skid epoxy coated steel cover with gasket set flush with grade, securing handle, and enzyme injection port as required.

F. Oil Interceptors

1. Construction: Epoxy coated fabricated steel or Precast concrete for fully recessed (shallow rough-in) flush with floor or (deep rough-in) installation, with anchor flange, multi-weir bucket assembly, integral deep seal trap, adjustable draw-off assembly, and non-skid epoxy coated steel cover with gasket set flush with grade, and securing handle;

2.10 ACCEPTABLE MANUFACTURERS - THERMOSTATIC MIXING VALVES

A. Leonard.

B. Powers.

C. Symmons.

D. Substitutions: Under provisions of Division One.

E. Thermostatic Mixing Valves

1. Provide thermostatic mixing valve, capacity as scheduled at 45 psi differential, with check valve, volume control shut-off valve on outlet, stem type thermometer on outlet, strainer stop check on inlet, mounted in lockable cabinet of 16 gage (1.5 mm) prime coated steel.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate cutting of roof or forming of floor construction to receive drains to required invert elevations.

3.02 INSTALLATION AND APPLICATION

A. Install specialties in accordance with manufacturer's instructions to permit intended performance.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Pipe relief from back flow preventer to nearest drain.

END OF SECTION

SECTION 15440

PLUMBING FIXTURES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 15050, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

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.

A. WORK INCLUDED: Include the following Work in addition to items normally part of this Section:

1. Plumbing fixtures.
2. Drains and cleanouts.

B. WORK SPECIFIED ELSEWHERE:

1. Piping systems.

2. Pipe valves and fittings.
3. Plumbing systems testing.

1.03 WARRANTY

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

B. Defects shall include, but not be limited to, the following:

1. Noisy operation.
2. Noticeable deterioration of finish.
3. Leakage of water.

1.04 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

C. OPERATION AND MAINTENANCE INSTRUCTIONS: Provide pre-printed operating and maintenance instructions for each item specified. Instruct and demonstrate the proper operation and maintenance to the Owner's designated representative.

1.05 DELIVERY AND STORAGE

A. DELIVERY: Deliver clearly labeled, undamaged materials in the manufacturers' unopened containers.

B. TIMING AND COORDINATION: Deliver materials to allow for minimum storage time at the project site. Coordinate delivery with the scheduled time of installation.

C. STORAGE: Store materials in a clean, dry location, protected from weather and abuse.

1.06 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

B. Confirm and field coordinate that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

PART 2 - PRODUCTS

2.01 MATERIALS

A. PLUMBING FIXTURES:

1. GENERAL: Provide plumbing fixtures as specified on drawings. The approved equal products manufacturers are as follows:
   a. Water closet, urinals, lavatories, bath tubs and showers: American Standard, Kohler, Eljer.
   b. Stainless steel sinks: Elkay, Just and Moen.
   c. Mop sinks: Stern-Williams, Fiat
   d. Faucets: American Standard, Kohler, Eljer,
   e. Faucets: Chicago, T&S Brass, Zurn
   f. Faucets: Moen, Delta Commercial, Speakman
   g. Shower valves: Leonard, Powers, Symmons, Chicago
   h. Shower Systems: Bradley, Acorn, Willoughby
   i. Flush Valves: Sloan "Royal"
   j. Flush Valves: Sloan "III", Zurn "Aqua Vantage"
   k. Flush Valves: Sloan "Regal", Zurn "Aqua Flush"
   l. Drinking fountains: Halsey Taylor, Elkay, and Acorn Aqua.
   m. Floor drains and roof drains: Zurn, J.R. Smith, Mifab, Josam and Wade.
   n. Emergency Fixtures: Bradley, Chicago, Haws, Speakman and Encon
2. CHAIR CARRIERS: ANSI/ASME A112.6.1.; Adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers. As manufactured by Zurn, J. R. Smith, Josam or Wade.
3. DRINKING FOUNTAIN & URINAL WALL SUPPORTS: ANSI/ASME A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs. As manufactured by Zurn, J. R. Smith, Josam or Wade.
4. TRAPS, STOPS AND RISERS: Heavy pattern as manufactured by McGuire, Chicago or Zurn.

B. CLEANOUTS:

1. GENERAL: Provide cleanouts as shown on Drawings and as required by the city building code.
2. ACCEPTABLE MANUFACTURERS: Zurn, J. R. Smith, Mifab, Josam and Wade.
3. TYPES:
   a. FINISHED FLOOR CLEANOUTS: Provide cast iron, adjustable floor level assembly with round nickel bronze top and gasket cover.
   b. RESILIENT OR TILE FINISHED FLOOR CLEANOUTS: Provide cast iron, adjustable assembly with round nickel-bronze top with gasketed water tight cover and depressed top to receive flooring finish material.
   c. DRY WALL CLEANOUTS: Provide cast iron tee and counter sink bronze plug with square nickel bronze frame and stainless steel cover.
   d. Provide membrane clamp rings for slab on grade cleanouts.
   e. All cleanouts shall have tapered bronze plugs.
   f. All cleanouts outside of building on grade shall be set in a

18" x 18" x 4" thick concrete pad.

PART 3 - EXECUTION

3.01 PREPARATION

A. EXAMINATION OF CONDITIONS: Examine conditions affecting this Work. Report unsatisfactory conditions to the proper authority and do not proceed until those conditions have been corrected. Commencing Work implies acceptance of existing conditions as satisfactory to the outcome of this Work.

3.02 INSTALLATION

A. Install fixtures in locations and heights as shown on Drawings or as directed by the Architect.

B. Install materials plumb, level, securely, and in accordance with manufacturer's recommendations.

C. All rough-in pipe openings, for final connections with all supply waste soil and vent systems shall be closed with caps or plugs during early stages of construction and installation. Tape shall not be considered sufficient protection.

D. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

E. Provide gate valves in piping serving batteries of fixtures. Label stops "Hot" and "Cold." Valves to be located above accessible ceiling. If ceiling are not accessible, provide access panels of adequate size to make valves fully accessible.

F. Plumbing fixtures shall be supported by a concealed chair carrier where required to properly support the fixture specified. All carriers to be securely mounted, bolted and checked prior to concealment.

G. Caulk around fixtures with best grade white silicone caulking. Do not use grout.

H. All handles on supply and drainage fittings or other brass items shall be properly lined up and adjusted. Fittings shall not be left in any haphazard manner.

I. All fixtures shall have individual chrome plated loose key cutoff stops on supply lines. Where same are not specified as a part of the fixture trim, they shall be installed as close to fixtures as possible in the hot and cold water supply.

J. Install each fixture with trap, easily removable for servicing and cleaning.

K. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

L. Hot and cold water riser air chambers: Provide air chambers for hot and/or cold water riser located at the rough-in tee at all fixtures. The air chamber shall be of the same materials and the next larger diameter than the required rough-in supply pipe and a minimum of 24" tall. The contractor may install water hammer arrestors in lieu of air chambers. Water hammer arrestors shall be PDI Certified and sized and placed as recommended by manufacture. Provide an accessible isolation valve and proper access to arrestor for replacement.

3.03 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.04 ADJUSTING

A. Adjust work under provisions of Division One.

B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.05 CLEANING

A. Clean work under provisions of Division One.

B. At completion clean plumbing fixtures and equipment.

3.06 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Division One.

B. Do not permit use of fixtures.

3.07 ADA ACCESSIBLE FIXTURES

A. Install fixtures to heights, indicated on architectural drawings.

B. Handicapped fixtures shall be installed to required heights, shall be of types suitable for, and supplied with controls properly installed, to comply with requirements as directed by ADA Accessibility of Federal Registry, Part III, Department of Justice 28 CFR 36 and comply with all state and local ADA Code requirements.

C. Exposed accessible sink or lavatory p-trap and angle valve assemblies shall be insulated with the fully molded, Truebro, Handi Lav-guard insulation kit. Provide the proper model for fixtures specified. All kits shall be White or as selected by Architect.

D. Wall mounted drinking fountains and coolers which protrude into passages or corridor space, whether single or paired with adjacent accessible fixture, shall be supplied with skirt or apron to lower the underside clearance of non-accessible fixture equal to that required for accessible fixture.

END OF SECTION

SECTION 15450

PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Water Heaters.

B. Packaged water heating systems

C. Hot water storage tanks.

D. Water softeners.

E. In-line circulator pumps.

F. Water pressure booster system.

G. Sump Pumps

1.02 RELATED SECTIONS

A. Section 11400 - Food Services Equipment.

B. Section 15140 - Supports and Anchors.

C. Section 15240 - Vibration Isolation.

D. Section 15410 - Plumbing Piping.

E. Section 15430 - Plumbing Specialties.

F. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.03 REFERENCES

A. ANSI/ASHRAE 90A - Energy Conservation in New Building Design.

B. ASME Section VIIID - Pressure Vessels; Boiler and Pressure Vessel Codes.

C. ANSI/NFPA 54 - National Fuel Gas Code.

D. ANSI/NFPA 70 - National Electrical Code.

E. ANSI/UL 1453 - Electric Booster and Commercial Storage Tank Water Heaters.

1.04 SUBMITTALS

A. Submit under provisions of Division One.

B. Shop Drawings:

1. Include heat exchanger dimensions. size of tappings, and performance data.
2. Include dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

C. Product Data:

1. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.
2. Indicate pump type, capacity, power requirements, and affected adjacent construction.
3. Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
4. Provide electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions.

1.05 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with authorities having jurisdiction.

B. Provide pumps with manufacturer's name, model number, and rating/capacity identified.

C. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:

1. American Gas Association (AGA).
2. National Sanitation Foundation (NSF).
3. American Society of Mechanical Engineers (ASME).
4. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
5. National Electrical Manufacturers' Association (NEMA).
6. Underwriters Laboratories (UL).

D. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.07 REGULATORY REQUIREMENTS

A. Conform to AGA NSF ANSI/NFPA 54 ANSI/NFPA 70 ANSI/UL 1453 requirements for water heaters.

B. Conform to ASME Section VIIID for manufacture of pressure vessels for heat exchangers.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section Division One.

B. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.09 WARRANTY

A. Provide five year warranty under provisions of Division One.

B. Warranty: Include coverage of domestic water heaters, water storage tanks, and packaged water heating systems.

1.10 EXTRA MATERIALS

A. Furnish under provisions of Division One.

B. Provide two sets of electric heater elements.

PART 2 - PRODUCTS

2.01 COMMERCIAL GAS FIRED WATER HEATER

A. Manufacturers:

1. A.O. Smith.
2. Other acceptable manufacturers offering equivalent products.
   a. Sellers.
   b. State.
   c. Rheem.

B. Type: Automatic, natural gas-fired, vertical storage.

C. Tank: Glass lined welded steel ASME labeled, 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.

D. Accessories: Brass water connections and dip tube, drain valve, high-density magnesium anode, and ASME rated temperature and pressure relief valve.

E. Approval: By AGA as automatic storage water heater and automatic circulating tank water heater for operation at 180 degrees F.

F. Controls: Automatic direct immersion thermostat with temperature range adjustable minimum 175 degrees F (97 degrees C) differential, automatic reset high temperature limiting thermostat, factory set at 205 degrees F (96 degrees C), gas pressure regulator, multi-ribbon or tubular burner, 100 percent safety shut-off pilot and thermocouple, intermittent electronic ignition monitoring pilot and main flame, trial for re-ignition for momentary loss of flame, shut down of pilot and main burner in 2-4 seconds after loss of flame, and automatic flue damper and power venter.

2.02 COMMERCIAL ELECTRIC WATER HEATERS

A. Manufacturers:
   1. A.O. Smith
   2. Other acceptable manufacturers offering equivalent products.
      a. P.V.I.
      b. Rheem.
      c. State.

B. Type: Factory-assembled and wired, electric, vertical storage tank.

C. Tank: Glass lined welded steel; 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.

D. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F (16 to 82 degrees C), flanged or screw-in nichrome elements, high temperature limit thermostat.

E. Accessories: Brass water connections and dip tube, drain valve, high-density magnesium anode, and ASME rated temperature and pressure relief valve.

2.03 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Manufacturer:

   1. Wessels.
   2. Other acceptable manufacturers offering equivalent products.
      a. State.
      b. Zurn.
      c. A.O. Smith

B. Construction: Welded steel, tested and stamped in accordance with Section 8D of ASME Code; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

C. Accessories: Pressure gage and air-charging fitting, tank drain; pre-charge to 12 psig.

2.04 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:

1. Bell & Gossett.
2. Other acceptable manufacturers offering equivalent products.
   a. TACO.
   b. Grundfos

B. Casing: Bronze, rated for 125 psig working pressure.

C. Impeller: Bronze.

D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.

E. Seal: Carbon rotating against a stationary ceramic seat.

F. Drive: Flexible coupling.

PART 3 - EXECUTION

3.01 WATER HEATER INSTALLATION

A. Install water heaters in accordance with manufacturer's instructions and to AGA NSF ANSI/NFPA 54 UL requirements.

B. Coordinate with plumbing piping and related work to achieve operating system.

3.02 PUMP INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Ensure shaft length allows sump pumps to be located minimum 24 inches below lowest invert into sump pit and minimum 6 inches clearance from bottom of sump pit.

C. Provide air cock and drain connection on horizontal pump casings.

D. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.

E. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and over.

F. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

G. Align and verify alignment of base mounted pumps prior to start-up.

END OF SECTION

SECTION 15481

COMPRESSED AIR SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-15 Basic Mechanical Materials and Methods sections apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of compressed air systems work, is indicated on drawings and schedules, and by requirements of this section.

B. Refer to Division-16 sections for the following work; not work of this section.

1. Power supply wiring from power source to power connection on compressed air equipment. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.
2. Interlock wiring between electrically-operated compressed air equipment units; and between equipment and field-installed control devices.
   a. Interlock wiring specified as factory-installed is work of this section.

C. Provide the following electrical work as work of this section, complying with requirements of Division-16 sections:

1. Control wiring between field-installed controls, indicating devices, and unit control panels.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of compressed air systems equipment and products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer Qualifications: Firm with at least 3 years of successful installation experience on projects with compressed air systems work similar to that required for project.

C. Codes and Standards:

1. ASME Compliance: Provide compressed air pressure vessels and relief valves in accordance with ASME "Boiler and Pressure Vessel Code"; provide ASME Code Symbol Stamp.
2. ASME Compliance: Fabricate and install compressed air systems in accordance with ASME B31.9 "Building Services Piping".
3. CGA Compliance: Fabricate and install compressed air systems in accordance with CGA Standards (Compressed Gas Association).
4. UL Compliance: Provide electrical components which are UL listed and have UL label affixed.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for compressed air systems materials and products.

B. Record Drawings: At project closeout, submit record drawings of installed piping, and compressed air systems products; in accordance with requirements of Division 1.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

D. Maintenance Data: Submit maintenance data and parts lists for compressed air systems materials and products. Include this data, product data, shop drawings, record drawings, and wiring diagrams in maintenance manual; in accordance with requirements of Division 1.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver compressed air equipment, including compressed air dryers and receiver tanks with factory-installed skid; with accessories as scheduled on the plans.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Dayton - Speedaire

B. Saylor Beall

C. Ingersoll Rand

D. Champion

2.02 BASIC IDENTIFICATION

A. General: Provide identification complying with Division-15 Basic Mechanical Materials and Methods section "Mechanical Identification", in accordance with the following listing:

1. Piping Above Ground: Plastic pipe markers.
2. Valves: Plastic valve tags.

2.03 BASIC PIPES AND PIPE FITTINGS

A. General: Provide pipes and pipe fittings complying with Division-15 Basic Mechanical Materials and Methods.

B. All Sizes: Copper tube, hard-temper for exposed locations, soft-temper for underground and concealed locations; Type "L"; wrought-copper, solder-joint fittings

2.04 BASIC SUPPORTS AND ANCHORS

A. General: Provide supports and anchors, complying with Division-15 Basic Mechanical Materials and Methods section "Supports and Anchors", in accordance with the following listing:

1. Extension split pipe clamp, copper plated, hinged or 2-bolt for pipe support from any substrate.

2.05 VALVES

A. Shutoff Valves: Provide compressed air shutoff valves, bronze-body, double seal, full port, union ball type, with seat seals and stem seals. Design so quarter turn of lever-type valve handle is maximum travel between open and closed positions. Design for working pressure of 300 psi minimum. Provide valves with color-coded gas identification labels.

2.06 BASIC VIBRATION CONTROL

A. General: Provide vibration control products complying with Division-15 Basic Mechanical Materials and Methods section "Vibration Control", in accordance with the following listing:

2.07 COMPRESSED AIR EQUIPMENT AND ACCESSORIES

A. General: Provide air compressor system, size as specified on drawings.

B. The air compressor system shall be of a single point connection, base mounted design consisting of two compressor, two motors, and regulator, integral pre-wired control panel and corrosion resistant air receiver. The complete package shall be pre-wired, pre-piped, and assembled on one common base with single point connection for electrical.

C. Compressor Module: The compressor shall be a continuous duty rated. The design shall be single stage, air-cooled, rated for 120 psig discharge pressure. The compressor shall be v-belt driven with totally enclosed belt guard. The drive motor shall be a NEMA rated, open drip proof, 3600

RPM, with 1.15 service factor suitable for 208 or 230/460V electrical service.

D. Isolation System: The compressor and motor shall be fully isolated from the air receiver by means of a four point spring isolation system.

E. Air Receiver: The vertical air receiver shall be corrosion resistant, ASME coded, National Board Certified, rated for a minimum 150 psig design pressure, and include a liquid level gauge glass, safety relief valve, manual drain valve, and a timed automatic solenoid drain valve.

F. Dryer System: The air drying system shall consist of a hi – temp refrigerated type. The dryer shall be individually sized for peak calculated demand and capable as scheduled on the plans.

G. Control System: The duplex mounted and wired control system shall be NEMA 12 and U.L. labeled. This control system shall provide automatic lead/lag sequencing with circuit breaker disconnects for each compressor with external operators, full voltage motor starters with overload protection, redundant 120V control circuit transformers, visual and audible unit alarm with isolated contacts for remote alarm, hand-off-auto lighted selector switches, pressure gauge, and duplexed runtime hour meters. Automatic alternation of both compressors based on a first-on/first-off principle, with provisions for simultaneous operation if required, automatic activation of reserve unit if required, visual and audible alarm indication for high discharge air temperature shutdown with isolated contacts for remote alarm shall be included.

PART 1 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which compressed air systems and equipment are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF BASIC IDENTIFICATION

A. General: Install mechanical identification in accordance with Division-15 Basic Mechanical Materials and Methods section "Mechanical Identification".

3.03 INSTALLATION OF COMPRESSED AIR PIPING

A. General: Install piping in accordance with Division- 15 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings".

3.04 INSTALLATION OF SUPPORTS AND ANCHORS

A. Install supports and anchors, in accordance with Division-15 Basic Mechanical Materials and Methods section "Supports and Anchors". Locate spacing for supports and anchors in accordance with piping manufacturer's recommendations.

B. Support Spacing: Install piping supports at the following maximum intervals:

1. 1/2" Pipe Size: 6' o.c.
2. 3/4" to 1" Pipe Size: 8' o.c.
3. 1-1/4" or Larger Pipe Size: 10' o.c.
4. Vertical Piping: Every floor level.

3.05 INSTALLATION OF VALVES

A. Shutoff Valves: Provide shutoff valves where indicated, on plans.

3.06 INSTALLATION OF EQUIPMENT AND ACCESSORIES

A. Install equipment and accessories where indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that compressed air equipment and accessories comply with requirements and serve intended purposes.

B. Coordinate with other work including plumbing, as necessary to interface installation of compressed air piping and equipment with other work.

C. Support: Install equipment on 4" high reinforced concrete pads, 4" larger on each side than equipment base. Cast anchor bolt inserts into pad.

D. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-16 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

3.07 EQUIPMENT CONNECTIONS

A. General: Connect compressed air systems to mechanical equipment as indicated, and comply with equipment manufacturer's instructions where not otherwise indicated.

3.08 FIELD QUALITY CONTROL

A. Test compressed air alarms for proper operation at high pressure, low pressure.

END OF SECTION

SECTION 15530

REFRIGERANT PIPING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 15050, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

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.

PART 2 - PRODUCTS

2.01 GENERAL

Provide for the systems as shown. Submit shop drawings of piping systems showing all traps, pipe sizes, and accessories; drawing to be marked "Approved", and signed by a representative of the Application Engineering Department of the condensing unit manufacturer. Pipe sizes shall be as recommended by unit manufacturer. Refer to piping schematic on drawings.

2.02 MATERIAL

A. PIPE: Copper ACR tubing.

B. FITTINGS: Wrought copper streamlined sweat fitting.

C. SOLDER: Sil-Fos, except on valves use solder recommended by valve manufacturer.

2.03 ACCESSORIES

All accessories shall be UL listed and rated in accordance with ARI Standard 710.

A. On systems 7-1/2 tons and larger, each separate refrigerant circuit shall have a separate filter dryer. Each filter dryer shall have a replaceable core and a three valve bypass. The filter drier shall be full line size and installed in the refrigerant liquid line. The filter shall have a minimum 4-3/4 inches diameter shell with removable flange and gasket. Flange shall be tapped for 1/4 inch FPT access valve. Size filter-drier for maximum 2.0 psi pressure drop at evaporator operating temperature. Similar to Mueller Brass Company model Drymaster micro-guard refillable filter series SD-485 through SD19217 or Sporlan catch-all.

B. On systems less than 7-1/2 tons, the filter dryer shall be the sealed type sizes as above. One drier per refrigerant circuit.

C. Liquid-Moisture Indicator shall be installed in liquid refrigerant line full line size similar to Mueller Brass Company model "Vuemaster" with soldered ends.

D. Thermostatic expansion valve shall have adjustable super heat and be as manufactured by Sporlan.

2.04 EVACUATION

A. Evacuate moisture completely by applying a commercial vacuum pump for a minimum of 24 hours. Moisture indicator shall indicate a completely moisture-free condition at time of final inspection. The vacuum pump shall run until the system indicates a maximum of 35 degrees FDB. The system shall be flushed with the operating refrigerant and the vacuum pump connected and rerun to repeat the evacuation. Evaluation shall be performed under supervision of the Engineer.

2.05 REFRIGERANT AND OIL

A. Contractor shall leave the refrigeration system with a full charge of refrigerant and oil and shall be responsible for the maintenance of a full charge of refrigerant and oil in the systems for a period of one year from date of acceptance.

B. Should any leaks in the refrigeration system occur during the guarantee period, the Contractor shall eliminate such leaks and recharge system to a full charge of refrigerant and oil at no cost to the Owner.

PART 3 - EXECUTION

3.01 All equipment and piping shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

3.02 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

END OF SECTION

SECTION 15625

FUEL FIRED UNIT HEATERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Gas fired unit heaters.

B. Gas fired industrial heaters.

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 15950 - Controls and Instrumentation:
Installation of thermostats and other controls components.

B. Section 16180 - Equipment Wiring Systems: Installation and wiring of thermostats and other controls components.

1.03 RELATED SECTIONS

A. Section 15170 - Motors: Fan motors.

B. Section 15240 - Vibration Isolation.

C. Section 15290 - Ductwork Insulation: Duct Liner.

1.04 REFERENCES

A. ANSI/ASHRAE 103 - Heating Seasonal Efficiency of Central Furnaces and Boilers, Methods of Testing.

B. ANSI/NEMA MG 1 - Motors and Generators.

C. ANSI/NFPA 31 - Installation of Oil Burning Equipment.

D. ANSI/NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.

E. ANSI/NFPA 211 - Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances.

F. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

1.05 SUBMITTALS

A. Submit under provisions of Division 1.

B. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

C. Product Data: Provide manufacturer's literature and data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

D. Manufacturer's Installation Instructions: Indicate rigging, assembly, and installation instructions.

1.06 OPERATION AND MAINTENANCE DATA

A. Submit operation data under provisions of Division 1.

B. Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listing.

1.07 WARRANTY

A. Provide one year warranty under provisions of Division 1.

B. Warranty: Include coverage for 10 year, non-prorated warranty for heat exchangers and draft diverters.

PART 2 - PRODUCTS

2.01 UNIT HEATERS

A. Manufacturers:
1. Reznor.
2. Sterling.
3. Modine.

B. Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner or heater, controls.

C. Performance Ratings: Seasonal efficiency to ANSI/ASHRAE 103.

D. Venting System
1. Provide aluminized or type 409 stainless steel draft diverter assembly.
2. Provide vertical vent connection.

E. Refer to Schedule. Gas heating capacities are sea level ratings.

F. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation and reflective liner.

G. Heat Exchanger: 20 gauge Aluminized or 18 gauge Stainless Steel type 409, type 321 welded construction.

H. Combustion Chamber: ANSI/UL 727; ANSI/UL 729; welded stainless steel.

I. Supply Fan: Propeller or Centrifugal forward curved type with direct or belt drive, variable pitch motor pulley.

J. Burner:

1. Gas Burner: Atmospheric type with adjustable combustion air supply, combination gas valve and pressure regulator incorporating manual shut-off, pilot valve, automatic 100 percent shut-off and thermo-couple pilot safety device, electronic pilot ignition, automatic vent damper,] and draft diverter.
2. Gas Burner Safety Controls: Thermo-couple sensor prevents opening of solenoid gas valve until pilot flame is proven and stops gas flow on ignition failure.

K. Burner Operating Controls:
1. Room thermostat: Cycles burner to maintain room temperature setting.
2. High Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on high bonnet temperature and re-energizes when temperature drops to lower value.
3. Fan Control: Bonnet thermostat independent of burner controls, cycles supply fan, with manual switch for continuous fan operation.

L. Operating Controls:
   1. Room Thermostat: Low voltage, to control burner operation, heater stages, to maintain temperature setting. Include fan control switch (auto-on).

M. Accessories:
   1. Discharge Louvers: Individually adjustable horizontal [and vertical] louvers to match cabinet finish.
   2. Downturn Nozzle: [30] [60] degree nozzle to match outlet and cabinet finish.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that space is ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available.

C. Verify that proper fuel supply is available for connection.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install to NFPA 90A and ANSI/NFPA 90B.

C. Install gas fired units to ANSI Z223.1 (NFPA 54).

D. Provide vent connections to ANSI/NFPA 211.

E. Install unit heaters with vibration isolation. Refer to Section 15240.

END OF SECTION

SECTION 15671

AIR COOLED CONDENSING UNITS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 15050, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

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.

PART 2 - PRODUCTS

2.01 AIR-COOLED CONDENSING UNITS

A. Air-cooled condensing unit shall be designed for use with split system having a remote direct-expansion (DX) cooling coil mounted in evaporator fan unit. Capacity shall be as called for on the drawings when matched to the appropriate evaporator coil.

B. Condensing unit shall consist of high-efficiency hermetic compressor, air-cooled condenser with quiet fan, factory wired controls, R-401a, R-407c or R-410a (HCFC not acceptable) refrigerant and refrigeration circuit and valves.

C. Cabinet shall be heavy-gauge galvanized steel with bonding primer and baked-enamel finish coat. The entire cabinet shall be protected from rust.

D. Compressor shall be protected from excessive current and temperatures and shall be provided with a thermostatically controlled crankcase heater to operate only when needed for protection of the compressor. Compressor shall be spring-mounted on rubber isolators. Compressor shall be located in compartment isolated from condenser fan and coil. Provide a high-capacity dryer in the system to remove moisture and dirt.

E. Condenser fan shall be directly connected to a weather-protected, quiet, high-efficiency motor. Fan guard shall be provided and shall be protected from rust by PVC finish. Condenser coil shall be aluminum fin with copper tube.

F. Connections for refrigerant suction and liquid lines shall be extended outside the cabinet and provided with service valves with gauge connections.

G. Power connections shall be made to the connectors located inside the electrical connection box.

H. Standard operating and safety controls shall include high-pressure switch, low pressure switch, compressor overload service, and solid-state timed-off control.

I. All components (parts and labor) of the sealed refrigeration circuit shall be warranted by the manufacturer for five years.

2.02 AUXILIARY EQUIPMENT

A. Auxiliary equipment shall consist of refrigerant lines prepared for the unit involved. These lines shall be cleaned, dried, and pressurized at the factory.

B. Low ambient kit to allow operation at outside temperature below 35 deg. F (2

deg. C) shall be provided.

C. Expansion valve shall be provided with the evaporator coil.

D. Provide thermostat to match the requirements of the job. Thermostat shall provide subbase with Heat-Cool-Off and Fan On-Auto switch. See section on controls for other related requirements.

E. Provide polyethylene structural base designed for that service and intended to support the unit and eliminate vibration transmission.

F. Provide hard-start kit with unit.

G. Provide guards for condenser coils.

2.03 ACCEPTABLE MANUFACTURERS

A. Condensing unit shall be the make and model number shown on the drawings or acceptable equivalents by Lennox, York, or Trane.

PART 3 - EXECUTION

3.01 All HVAC equipment shall be installed as per manufacturers printed installation instructions.

3.02 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.

3.03 INSTALLATION

A. Install the condensing unit on proper foundation as shown on the drawings, and in location that will not restrict the air entry or discharge from the unit.

B. Install refrigerant lines as recommended by the manufacturer, taking care not to lose the refrigerant charge contained in the lines, or allow air to enter the lines or equipment. Locate the lines in such a way as to not obstruct access to the condensing unit or other equipment. Lines located under ground or under concrete shall be installed in a PVC pipe conduit for protection.

C. Provide electrical connections as required by the applicable codes. Provide control wiring required. All power wiring and control wiring shall be in conduit and located so as not to obstruct access to the unit or other equipment.

3.04 TESTING

A. Operate the condensing unit and the system to assure that unit is operating properly and without excessive noise and vibration.

B. Read and record the power draw and the refrigeration suction and liquid pressures as required Testing, Adjusting, and Balancing, Section 15990.

END OF SECTION

SECTION 15854

DX FAN COIL UNIT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 15050, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

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.

PART 2 - PRODUCTS

2.01 FAN COIL UNITS

Fan coil units shall be factory built, manufactured as scheduled on drawings. York, Trane or Lennox shall be considered as equal, if they comply with the specification and schedule. Special Note: Contractor shall field verify exact clearances required for air handling units. Units shall be field located as required and shop drawings shall indicate final location for approval by Architect/Engineer.

A. Furnish and install fan coil units of the type, capacities, ratings and drive motor horsepower shown on the drawings.

B. Units shall be factory fabricated, draw-thru type, and shall have fan section, cooling coil section, condensate drain pan, adjustable blower drive with motor on resilient mounted base, vee-belts with guard, filter section, and mixing box (if scheduled) assembled as integrated air handling units.

C. REQUIREMENTS:
1. Mill-galvanized steel, rigidly framed, braced, and reinforced; access panels each side of unit; minimum panel ga. - 18; minimum weight formed framing member 14 ga.
2. Fan section, cooling coil section, and outlet frame throats shall be internally insulated at the factory with 1" thick, 3/4 PCF density, Neoprene coated fiberglass cemented in place with water-proof adhesive, having fire-retardant characteristics in accordance with NFPA 90A.
3. Drain pan shall be not lighter than 14 ga.; extend completely under the coil section and be all-galvanized, foam insulated pan with drain connections.
4. When the fan coil unit is installed above an accessible ceiling, the

unit shall incorporate a secondary drain pan. The secondary pan shall be fabricated from galvanized sheet metal, 16 gauge minimum with cross breaking sloped towards a drain. The sides shall be a minimum 2" tall and the corners shall be soldered watertight. The top edge shall have a 1/4" hem to provide additional rigidity and the secondary pan shall be supported at a minimum of six points. The pan shall extend on all sides a minimum of 3" beyond the sides of the unit casing. Route the secondary drain piping to a conspicuous location or install a float switch at the low point in the secondary pan. The secondary pan should be sloped a minimum of 1/8" per foot and supported so that the unit is not in contact with the bottom of the secondary pan.

5. The fan section, including wheels, shafts, bearings, drive, etc., shall be statically and dynamically balanced as an assembly, and the shaft shall not pass through the first critical speed, while accelerating from rest to operating speed. Submittal data shall state the first critical shaft speed. Shaft bearings shall be of vacuum de-gassed steel, and shall be selected for 200,000 hours average life.
6. Coil shall be as hereinafter specified.

2.02 COILS

A. Cooling coils shall be cartridge type and, when mounted in air handling units, shall be removable from either end. Coils shall be constructed of copper tubes with aluminum fins and shall be designed for even distribution of air across the face of the coils; air shall not pass around coil frames.

B. DX refrigerant coils shall be counter-flow refrigerant to air, shall have inlet and outlet connections permanently marked shall have thermostatic expansion valves with adjustable super heat.

C. Maximum face velocity across cooling coils shall be 500 FPM, unless noted otherwise on schedule.

PART 3 - EXECUTION

3.01 All HVAC equipment shall be installed as per manufacturers printed installation instructions.

3.02 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.

END OF SECTION

SECTION 15860

POWER VENTILATORS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Centrifugal roof ventilators.

B. Ceiling and inline ventilators.

C. Roof supply fans.

D. Utility fans.

1.02 RELATED SECTIONS

A. Section 15050 – Basic Materials and Methods

B. Section 15170 – Motors and Motor Controllers

C. Section 15240 – Sound and Vibration Control

D. Section 15951 – Controls

E. Section 15990 – Testing, Adjusting and Balancing

1.03 QUALITY ASSURANCE

A. UL Compliance: Fans shall be designed, manufactured, and tested in accordance with UL 705 "Power Ventilators."

1.04 SUBMITTALS

1. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

2. Product data for selected models, including specialties, accessories, and the following:
   a. Motor ratings and electrical characteristics plus motor and fan accessories.
   b. Materials gages and finishes, include color charts.
   c. Dampers, including housings, linkages, and operators.
   d. Full color paint samples.

3. Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.
4. Coordination drawings, in accordance with Division 15 Section "Basic Materials and Methods", for roof penetration requirements and for reflected ceiling plans drawn accurately to scale and coordinating penetrations and units mounted above ceiling. Show the following:
   a. Roof framing and support members relative to duct penetrations.
   b. Ceiling suspension members.
   c. Method of attaching hangers to building structure.
   d. Size and location of initial access modules for acoustical tile.

e. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.

6. iring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer-installed wiring and field- installed wiring.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Fans shall be stored and handled in accordance with the unit manufacturer’s instructions.

B. Lift and support units with the manufacturer's designated lifting or supporting points.

C. Disassemble and reassemble units as required for movement into the final location following manufacturer's written instructions.

D. Deliver fan units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. PennBarry

B. Loren Cook Company

C. Greenheck Fan Corporation

D. Thermador

E. Substitutions under provisions of Division One.

2.02 GENERAL DESCRIPTION

A. Provide fans that are factory fabricated and assembled, factory tested, and factory finished with indicated capacities and characteristics.

B. Fans and Shafts shall be statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower.

C. Provide factory baked-enamel finish coat after assembly. Color shall be verified during the submittal process.

2.03 CENTRIFUGAL ROOF VENTILATORS

A. Fan shall be a spun aluminum, centrifugal, roof mounted, direct driven or belt driven as indicated.

B. Fan shall be listed by Underwriters Laboratories (UL 705). Fan shall bear the AMCA certified ratings seal for sound and air performance.

C. The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure. The aluminum base shall have continuously welded curb cap corners for maximum leak protection. The discharge baffle conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring connections. The motor, bearings and drives shall be mounted on a minimum 14 gauge steel power assembly, isolated from the unit structure with rubber vibration isolators. The motor, bearings and drives shall be mounted on a minimum 14 gauge steel power assembly, isolated from the unit structure with rubber vibration isolators. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Unit shall bear an engraved aluminum nameplate and shall be shipped in transit tested packaging.

D. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA standard 204-96, balance quality and vibration levels for fans.

E. Motor shall be heavy duty type with permanently lubricated sealed ball bearings.

F. Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball type in a cast iron housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

G. Accessories: The following accessories are required.

1. Disconnect Switch: Nonfusible type, with thermal overload protection mounted inside fan housing, factory-wired through an internal aluminum conduit.
2. Bird Screens: Removable ½ inch mesh, 16 gauge, aluminum or brass wire.
3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base, factory set to close when fan stops.
4. Dampers: Motor-operated, parallel-blade, volume control dampers mounted in curb base.
5. Roof Curbs: Prefabricated, 12 inch high, heavy-gauge, galvanized steel; mitered and welded corners; 2 inch thick, rigid, fiberglass insulation adhered to inside walls; built-in cant and mounting flange for flat roof decks; and 2 inch wood nailer. Size as required to suit roof opening and fan base.

2.04 CEILING AND INLINE VENTILATORS

A. Ceiling and inline ventilators shall be direct drive or belt drive as indicated, centrifugal blower type. Fan wheel shall be constructed of galvanized steel and shall be dynamically balanced. The housing shall be constructed of minimum 20 gauge corrosion resistant galvanized steel and acoustically insulated for quiet operation. Blower and motor assembly shall be easily removable from the housing without disturbing the ductwork. The motor shall be permanently lubricated with built-in thermal overload protection and shall be factory tested prior to shipment. The ceiling ventilators shall be furnished standard with a powder-painted white steel grille.

B. Ventilators shall be certified and licensed to bear the AMCA Seal for Air and Sound Performance. Ventilator performance shall be based on tests and procedures performed in accordance with AMCA publication 211 and comply with the requirements of the AMCA Certified Ratings Program. Fan sound power level ratings shall be based on tests and procedures performed in accordance with AMCA publication 311 and comply with the requirements of the AMCA Certified Ratings Program. Ventilators shall be UL listed and CSA certified.

2.05 Accessories: The following accessories are required.

1. Dampers:
   a. Aluminum backdraft damper.
   b. Motor-operated volume control damper.
   c. U.L. listed ceiling radiation damper for ceiling fans comply with NFPA Standard 90A rated for 3 hours.
2. Disconnect Switch: Nonfusible type with thermal overload protection.
3. Speed Controls: Fan **[wall]** mounted, solid state speed controller.

2.06 ROOF SUPPLY FANS

A. Roof-mounted, filtered air supply units are of the belt-driven, double width, double inlet (DWDI), forward curved centrifugal blower type. The unit's blower assembly shall be mounted on vibration isolators. Motor drives shall be machine cast iron and variable pitch and shall be factory set to the specified RPM. Belts shall be non-static and oil resistant. Both motor and blower bearings shall be permanently lubricated with sealed ball bearings. The blower housing shall be fabricated of heavy gauge painted steel.

B. Fan shall be listed by Underwriters Laboratories (UL 705) and shall bear the AMCA certified rating seal for sound and air performance.

C. Units housing shall be minimum 18 gauge extruded aluminum with a removable aluminum cover. The insulated cover shall be held in place with bolts for easy access to fan components.

D. Filters shall be permanent, one inch, washable, aluminum type and shall be easily removed for cleaning. Units carry the AMCA Certified Ratings Seal for air performance with filters in place.

E. Accessories: The following items are required.

1. Disconnect Switch: Nonfusible type, with thermal overload protection mounted inside fan housing, factory-wired through an internal aluminum conduit**.**
2. Bird Screens: Removable ½ inch mesh, 16 gauge, aluminum or brass wire.
3. Dampers: Motor-operated, parallel-blade, volume control dampers mounted in curb base.
4. Roof Curb: Prefabricated, 12 inch high, heavy gauge, galvanized steel; mitered and welded corners; 2 inch thick, rigid, fiberglass insulation adhered to inside walls; built-in cant and mounting flange for flat roof decks; and 2 inch wood nailer. Size as required to suit roof opening and fan base.

2.07 UTILITY FANS

A. Fans shall be of the direct driven or belt driven utility fan type as indicated with a single width, single inlet housing in AMCA arrangement 10.

B. The housing shall be constructed of minimum 14 gauge steel with continuously welded or lock formed seams permitting no air leakage. The housing shall be field rotatable to any of the eight standard discharge positions. Housing and bearing supports shall be constructed of minimum 10 gauge welded steel members to prevent vibration and rigidly support the shaft and bearings. Side access inspection port shall be provided for access to the motor compartments.

C. The fan wheel shall be of the forward curved type C, centrifugal fan type and constructed of heavy gauge steel. Wheels shall be statically and dynamically balanced. The wheel cone and fan inlet cone shall be carefully matched for maximum performance and operating efficiency.

D. Motors shall be permanently lubricated, heavy duty, ball bearing type carefully matched to the fan load and furnished at the specified voltage, phase and enclosure. The fan shaft shall be ground and polished solid steel mounted in heavy duty, permanently sealed, pillow block ball bearings. Bearings shall be selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts. The motor pulley shall be adjustable for final system balancing.

E. Fan performance shall be based on tests conducted in accordance with AMCA Standard 210 test code for air moving devices. Fans shall be licensed to bear the AMCA Certified Ratings Seal for air performance.

2.08 PROPELLER WALL AXIAL VENTILATORS AND ASSEMBLIES LOCATED IN POOL ROOMS

A. Unless noted otherwise, all materials shall be of noncorrosive aluminum or stainless steel.

B. Ventilator and assembly shall consist of propeller wall axial ventilator section, motorized damper section and accessories as scheduled.

C. Motorized Damper Section:
1. Blades and frame shall be of aluminum construction with Air Dry Phenolic (Heresite VR-500) coating.
2. Blade edge seals shall be Ruskiprene type or equivalent, mechanically locked in extruded blade slots.
3. Linkage shall be stainless steel, mounted in frame.
4. Axles shall be square or hexagonal, stainless steel construction.
5. Bearings shall be non-corrosive molded synthetic.
6. Shaft shall be stainless steel.
7. Damper actuator shall be mounted inside NEMA 4 type enclosure, factory wired through an internal aluminum conduit.

D. Gravity Damper Section:
1. Blades and frame shall be of aluminum construction with Air Dry Phenolic (Heresite VR-500) coating.

E. Propeller Wall Axial Ventilator Section:
1. Fan motor shall be in TEFC type enclosure.
2. All steel fan components shall be coated with Air Dry Phenolic (Heresite VR-500) coating.

F. Wall collar shall be of aluminum construction.

G. Accessories: The following items are required:
1. Disconnect Switch: Nonfusible type, with thermal overload protection mounted inside NEMA 4 enclosure, factory-wired through an internal aluminum conduit.
2. Bird Screens: Removable ½ inch mesh, 16 gauge, aluminum or brass wire.

PART 3 – EXECUTION

3.01 Install in accordance with manufacturer's instructions.

3.02 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

END OF SECTION

SECTION 15881

AIR DISTRIBUTION DEVICES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Ceiling air diffusers.

B. Wall registers and grilles.

C. Louvers.

D. Other air devices indicated on drawings and schedules.

1.02 RELATED SECTIONS

A. Section 15050 – Basic Materials and Methods

B. Section 15890 – Metal Ductwork

C. Section 15891 – Fibrous Glass Ductwork

D. Section 15910 – Ductwork Accessories

E. Section 15990 – Testing, Adjusting and Balancing

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air distribution devices of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. ARI Compliance: Test and rate air distribution devices in accordance with ARI 650 "Standard for Air Outlets and Inlets".
2. ASHRAE Compliance: Test and rate air distribution devices in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".
3. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters".
4. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
5. NFPA Compliance: Install air distribution devices in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for air distribution devices including the following:

1. Schedule of air distribution devices indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
2. Data sheet for each type of air distribution devices, and accessory furnished; indicating construction, finish, and mounting details.
3. Performance data for each type of air distribution devices furnished, including aspiration ability, temperature and velocity traverses; throw and drop; and noise criteria ratings. Indicate selections on data.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air distribution devices, indicating materials and methods of assembly of components.

C. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 1.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver air distribution devices wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B. Store air distribution devices in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

1.06 WARRANTY

A. Warrant the installation of the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from defective or nonconforming workmanship.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Titus Company

B. Metalaire Industries, Inc.

C. Nailor Industries

D. Krueger

E. Substitutions under provisions of Division One.

2.02 GENERAL DESCRIPTION

A. Unless otherwise indicated, provide manufacturer’s standard air devices when shown of size, shape, capacity, type and accessories indicated on drawings and schedules, constructed of materials and components as indicated and as required for complete installation and proper air distribution.

B. Provide air devices that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer’s current data.

C. Unless noted otherwise on drawings, the finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100 hour ASTM D117 Corrosive Environments Salt Spray Test without creepage, blistering, or deterioration of film. The paint must pass a 250 hour ASTM-870 Water Immersion Test. The paint must also pass the ASTM D-2794 Reverse Impact Cracking Test with a 50 inch pound force applied.

D. Provide air device with border styles that are compatible with adjacent ceiling or wall system, and that are specially manufactured to fit into the wall construction or ceiling module with accurate fit and adequate support. Refer to architectural construction drawings and specifications for types of wall construction and ceiling systems.

E. Provide integral volume damper with roll formed steel blades where indicated on drawings or schedules. Dampers shall be opposed blade design with a screw driver slot or a concealed lever operator for adjustment through the face of the air device.

F. Air devices designated for fire rated systems shall be pre-assembled with UL classified radiation damper and thermal blanket. Fire rated air devices shall be shipped completely assembled; one assembly per carton, Each assembly shall be enclosed in plastic shrink wrap with installation instructions.

2.03 LOUVERS

A. Except as otherwise indicated, provide manufacturer's standard louvers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

A. Provide louvers that have minimum free area, and maximum pressure drop of each type as listed in manufacturer's current data, complying with louver schedule.

B. Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to architectural construction drawings and specifications for types of substrate.

C. Louvers shall be constructed of aluminum extrusions, ASTM B 221, Alloy 6063-T5. Weld units or use stainless steel fasteners.

D. Louver Screens: On inside face of exterior louvers, provide 1/2" square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.

E. Acceptable Manufacturers:

1. Ruskin Manufacturing Company
2. Greenheck Company

3. Louvers and Dampers, Inc.
4. Substitutions under provisions of Division One.

PART 3 – EXECUTION

3.01 All interior surfaces of all air devices shall be painted flat black.

3.02 See floor plans for type, neck size and CFM of air for all air distribution devices.

3.03 Install all air distribution devices as detailed on plans and in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 15885

AIR FILTERS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 15050, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

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.

PART 2 - PRODUCTS

2.01 FILTERS

Occupied Spaces

A. During construction when air handling units used, filtration media shall be provided with a Minimum Efficiency Reporting Value (MERV) of 8 at each return air grille, as determined by ASHRAE 52.2-2003.

B. Replace all filtration media immediately prior to occupancy. Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 13, as determined by ASHRAE 52.2-2003 for media installed at the end of construction.

C. Filtration requirement for building flush-out. After construction ends and prior to occupancy conduct a minimum two week building flush-out with new Minimum Efficiency Reporting Value (MERV) 13 filtration media at 100% outside air. After the flush-out, replace the filtration media with new MERV

13 filtration media, except the filters solely processing outside air.

Unoccupied Spaces

A. Air Handling Units: The contractor shall provide and install a filter section with two-inch flat face construction throwaway fiberglass filters on units without a factory installed filter section. Units shall have filters installed with removable protective covers to protect filter surfaces during installation. Filters shall be removable from the rear or side of the unit. An extra set of filters shall be provided by the contractor for field installation after unit start-up.

B. Fan Coil Units: Provide 1” thick pleated Farr 30/30 disposable non-woven cotton media filters

APPROVED MANUFACTURERS: The following manufacturers are approved subject to specification compliance;

1. American Air Filter.
2. Airguard Industries, Inc.
3. Cambridge.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install differential pressure switch to activate "Filter Dirty" light when pressure difference across filters reaches 0.5 inch W.G. (adjustable). Locate "filter dirty" lights in mechanical rooms with identifying label

B. Install and relocate filters in the mechanical or the storage room in accordance with manufacturer's recommendations.

C. Refer to Section 15050 for additional filter information.

END OF SECTION

SECTION 15890

METAL DUCTWORK

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Low pressure ductwork.

B. Kitchen hood ductwork.

C. Commercial dryer vent

D. Duct cleaning

1.02 RELATED SECTIONS

Section 09900 - Painting: Weld priming, weather resistant, paint or coating.

A. Section 15050 - Basic Material and Methods.

B. Section 15140 - Supports and Anchors.

C. Section 15290 - Duct Insulation.

D. Section 15910 - Ductwork Accessories.

E. Section 15881 - Air Distribution Devices.

F. Section 15990 - Testing, Adjusting and Balancing.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of metal ductwork products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firms with least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.

C. Codes and Standards:

1. SMACNA Standards: Comply with latest SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.
2. ASHRAE Standards: Comply with ASHRAE Handbook, Equipment Volume, Chapter 1 "Duct Construction", for fabrication and installation of metal ductwork.
3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems", NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems", and NFPA 96 Standard.
4. IECC 2003: Comply with 2003 International Energy Conservation Code.

1.04 GENERAL DESCRIPTION

A. Extent of metal ductwork is indicated on drawings and in schedules, and by requirements of this section.

1.05 SUBMITTALS

A. Submit shop drawings, duct fabrication standards and product data under provisions of Division One.

B. Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work.

C. The contract documents are schematic in nature and are to be used only for design intent. The contractor shall prepare sheet metal shop drawings, fully detailed and drawn to scale, indicating all structural conditions, all plumbing pipe and light fixture coordination, and all offsets and transitions as required to permit the duct to fit in the space allocated and built. All duct revisions required as a result of the contractor not preparing fully detailed shop drawings will be performed at no additional cost.

1.06 DEFINITIONS

A. Duct Sizes: Inside clear dimensions. For lined ducts, maintain indicated clear size inside lining. Where offsets or transitions are required, the duct shall be the equivalent size based on constant friction rate.

B. Low Pressure: Low pressure ductwork shall be rated for an operating pressure of 2”. Low pressure ductwork shall be defined as all return, exhaust, and outside air ducts, all supply ductwork associated with constant volume air handling units with a scheduled external static pressure of less than 2”, and all supply ductwork downstream of terminal units in variable volume systems.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protection: Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings, use sheet metal end caps on any lined duct exposed to the weather.

B. Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.01 DUCTWORK MATERIALS

A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.

B. Sheet Metal.: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 924, lock forming quality, with G 90 zinc coating in accordance with ASTM A 563; and mill phosphatized for exposed locations.

C. Stainless Steel Sheet: Where indicated, provide stainless steel complying with ASTM A167; Type 316; with No. 4 finish where exposed to view in

occupied spaces, No. 1 finish elsewhere. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.

D. Aluminum Sheet: Where indicated, provide aluminum sheet complying with ASTM B 209, Alloy 3003, Temper H14.

2.02 MISCELLANEOUS DUCTWORK MATERIALS

A. General: Non combustible and conforming to UL 181, Class 1 air duct materials.

B. Flexible Ducts: Flexmaster U.S.A., Inc. Type 3M or approved equal, corrosive resistant galvanized steel formed and mechanically locked to inner fabric with 1" thick insulation when flexible ducts are located in conditioned spaces and with R-5 insulation when located in unconditioned spaces. Flexible duct shall have reinforced metalized outer jacket comply with UL 181, Class 1 air duct.

C. Sealants: Hard-Cast "iron grip" or approved equal, non-hardening, water resistant, fire resistive and shall not be a solvent curing product. Sealants shall be compatible with mating materials, liquid used alone or with tape or heavy mastic.

D. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

1. For exposed stainless steel ductwork, provide matching stainless steel support materials.
2. For aluminum ductwork, provide aluminum support materials.

2.03 LOW PRESSURE DUCTWORK

A. Fabricate and support in accordance with latest SMACNA Duct Construction Standards and ASHRAE handbooks, except as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

B. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by approved shop drawings. Obtain engineer's approval prior to using round duct in lieu of rectangular duct.

C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide airfoil-turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

E. Use crimp joints with bead for joining round duct sizes 6 inch smaller with crimp in direction of airflow.

F. Use double nuts and lock washers on threaded rod supports.

2.04 KITCHEN HOOD EXHAUST DUCTWORK

A. Fabricate in accordance with SMACNA Duct Construction Standards, and NFPA 96.

B. Construct of 16 gauge carbon steel or 18 gauge stainless steel, using continuous external welded joints.

2.05 SHOWER/LOCKER ROOM EXHAUST DUCTWORK

A. All ductwork shall be stainless steel, one gauge heavier than that required for galvanized steel duct.

B. Slope all duct to drain out grilles or provide drain line to floor drain.

2.06 CHLORINE STORAGE AREA

A. 18 gauge minimum galvanized steel.
B. Three coat minimum, acid resistance, epoxy paint, minimum 6 mil dry film thickness total, inside of duct and outside of duct.

C. Paint after fabrication including all taps and grilles.

2.07 COMMERCIAL DRYER VENT

A. Construct of 18 gauge, Type 316 stainless steel.

B. All welded construction.

C. Provide hard duct connection to dryer.

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Obtain manufacturer's inspection and acceptance of fabrication and installation of ductwork at beginning of installation.

B. 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.

C. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

D. Connect diffusers to low pressure ducts with 6 feet maximum, 4 feet minimum, length of flexible duct. Hold in place with strap or clamp.

E. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

F. The interior surface of all ductwork shall be smooth. No sheet metal parts, tabs, angles, or anything else may project into the ducts for any reason, except as specified to be so. All seams and joints shall be external.

G. All angles shall be carried around all four sides of the duct or group of ducts. Angles shall overlap corners and be welded or riveted.

H. All ductwork shall be fabricated in a manner to prevent the seams or joints being cut for the installation of grilles, registers, or ceiling outlets.

3.02 INSTALLATION OF FLEXIBLE DUCTS

A. Maximum Length: For any duct run using flexible ductwork, do not exceed 6'-0" extended length.

B. Installation: Install in accordance with Section III of SMACNA's, "HVAC Duct Construction Standards, Metal and Flexible".

3.03 REQUIREMENTS FOR KITCHEN HOOD EXHAUST DUCT

A. Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for cleanout.

B. Provide access openings in each change in direction, located on sides of duct 1½" minimum from bottom, and fitted with grease-tight covers of same material as duct

C. Use stainless steel for ductwork exposed to view.

3.04 DUCTWORK APPLICATION SCHEDULE

AIR SYSTEM	MATERIAL
Low Pressure Supply	Steel, Aluminum
Return and Relief	Steel, Aluminum
General Exhaust	Steel, Aluminum
Kitchen Hood Exhaust	Galvanized Steel, Stainless Steel
Shower/Locker Room/ Dryer Vent	Stainless Steel

Fume Hood Exhaust	Stainless Steel, Glass Fiber Reinforced Plastic if not in air plenum.
Outside Air Intake	Steel
Combustion Air	Steel
Emergency Generator Ventilation	Steel

3.05 DUCTWORK HANGERS AND SUPPORTS

A. All ductwork shall be properly suspended or supported from the building structure. Hangers shall be galvanized steel straps or hot-dipped galvanized rod with threads pointed after installation. Strap hanger shall be attached to the bottom of the ductwork, provide a minimum of two screws one at the bottom and one in the side of each strap on metal ductwork. The spacing, size and installation of hangers shall be in accordance with the recommendations of the latest SMACNA edition.

B. All duct risers shall be supported by angles or channels secured to the sides of the ducts at each floor with sheet metal screws or rivets. The floor supports may also be secured to ducts by rods, angles or flat bar to the duct joint or reinforcing. Structural steel supports for duct risers shall be provided under this Division.

3.06 AIR DUCT LEAKAGE: (From SMACNA Duct Standards Latest Edition) Test all ductwork (designed to handle over 1000 CFM) as follows:

A. Test apparatus

The test apparatus shall consist of:

1. A source of high pressure air--a portable rotary blower or a tank type vacuum cleaner.
2. A flow measuring device consisting of straightening vanes and an orifice plate mounted in a straight tube with properly located pressure taps. Each orifice assembly shall be accurately calibrated with its own calibration curve. Pressure and flow readings shall be taken with U-tube manometers.

B. Test Procedures

1. Test for audible leaks as follows:
2. Close off and seal all openings in the duct section to be tested. Connect the test apparatus to the duct by means of a section of flexible duct.
   a. Start the blower with its control damper closed.
   b. Gradually open the inlet damper until the duct pressure reaches 1.5 times the standard designed duct operating pressure.

c. Survey all joint for audible leaks. Mark each leak and repair after shutting down blower. Do not apply a retest until sealants have set.

3. After all audible leaks have been sealed, the remaining leakage should be measured with the orifice section of the test apparatus as follows:
   a. Start blower and open damper until pressure in duct reaches 50% in excess of designed duct operating pressure.
   b. Read the pressure differential across the orifice on manometer No. 2. If there is no leakage, the pressure differential will be zero.
   c. Total allowable leakage shall not exceed one (1) percent of the total system design air flow rate. When partial sections of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.
   d. Even though a system may pass the measured leakage test, a concentration of leakage at one point may result in a noisy leak which, must be corrected.
4. Test Witness
   a. Air duct leakage test shall be witnessed by Owner/Engineer.
   b. The Architect or duly authorized construction inspector shall be notified in writing at least 2 working days prior to each test.

3.07 DUCT SYSTEM CLEANING

A. Duct system cleaning shall be performed in accordance with the current published standards of ASHRAE and NADCA.

B. Duct system cleaning method used shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device must be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment is assured.

C. All vacuum devices exhausting air inside the building shall be equipped with HEPA filters (minimum efficiency), including hand-held vacuums and wet-vacuums.

D. All vacuum devices exhausting air outside the facility shall be equipped with Particulate Collection including adequate filtration to contain debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any outdoor environmental standards, codes or regulations.

D. Fibrous glass thermal or acoustical insulation elements present in any equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment, while the HVAC system is under constant negative pressure, and not permitted to get wet in accordance with applicable NADCA and NAIMA standards and recommendations.

E. Duct cleaning method used shall not damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.

F. Replace the fiberglass material if there is any evidence of damage, deterioration, delamination, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating.

G. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

H. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

I. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

J. Cleaning Report: Contractor shall provide a report to the Owner indicating the completion of duct cleaning per specification and areas of the duct system found to be damaged and/or in need of repair.

3.08 DUCT JOINTS AND SEAMS

A. Seal all non-welded duct joints with duct sealant as indicated.

END OF SECTION

SECTION 15910

DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Volume control dampers.

B. Round Duct Taps.

C. Fire dampers.

D. Combination fire and smoke dampers.

E. Back draft dampers.

F. Air turning devices.

G. Flexible duct connections.

H. Duct access doors.

I. Duct test holes.

1.02 RELATED WORK

A. Section 15240 - Vibration Isolation.

B. Section 15890 - Ductwork.

1.03 REFERENCES

A. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

B. SMACNA - Low Pressure Duct Construction Standards.

C. UL 33 - Heat Responsive Links for Fire-Protection Service.

D. UL 555 - Fire Dampers and Ceiling Dampers.

1.04 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Provide shop drawings for shop fabricated assemblies indicated, including volume control dampers duct access doors duct test holes. Provide product data for hardware used.

C. Submit manufacturer's installation instructions under provisions of Section 01300, for fire dampers and combination fire and smoke dampers.

PART 2 PRODUCTS

2.01 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards, and as indicated.

B. Fabricate splitter dampers of material same gauge as duct to 24 inches size in either direction, and two gauges heavier for sizes over 24 inches.

C. Fabricate splitter dampers of double thickness sheet metal to streamline shape. Secure blade with continuous hinge or rod. Operate with minimum 1/2 inch diameter rod in self aligning, universal joint, action flanged bushing, with set screw.

D. Fabricate single blade dampers for duct sizes to 9-1/2 x 24 inch.

E. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12 x 72 inches.

1. Assemble center and edge crimped blades in prime coated or

galvanized channel frame with suitable hardware.

2. On outside air, return air, and all other dampers required to be low leakage type, provide galvanized blades and frames, seven inches wide maximum, with replaceable vinyl, EPDM, silicone rubber seals on blade edges and stainless steel side seals. Provide blades in a double sheet corrugated type construction for extra strength. Provide hat 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.

F. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

G. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Where rod lengths exceed 30 inches provide regulator at both ends.

H. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

2.02 ROUND DUCT TAPS

A. Taps to trunk duct for round flexible duct shall be spin-in fitting with locking quadrant butterfly damper, model no. FLD-B03 by Flexmaster or approved equal.

2.03 ACCEPTABLE MANUFACTURERS - FIRE DAMPERS AND COMBINATION FIRE AND SMOKE DAMPERS

A. Greenheck

B. Louvers and Dampers Inc.

C. Ruskin.

D. Nailor Industries.

2.04 FIRE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

B. 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.

C. Fabricate multiple blade fire dampers per U.L. with 16 gauge minimum 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.

D. Fusible links, UL 33, shall separate at 160 degrees F. Provide adjustable link straps for combination fire/balancing dampers.

2.05 COMBINATION FIRE AND SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

B. Provide factory sleeve for each damper. Install damper operator on exterior of sleeve and link to damper operating shaft.

C. Fabricate with multiple blades with 16 gauge galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.

1. Operators shall be spring return electric type suitable to operate on 120 V AC, 60 cycle.
2. Operators shall be UL listed and labeled.

2.06 SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

B. Motorized Smoke Dampers: multi-blade type, normally open with power on, close automatically when power is interrupted, UL-listed and labeled damper and damper operator.

2.07 ACCEPTABLE MANUFACTURERS - BACKDRAFT DAMPERS

A. Greenheck

B. American Warming and Vent.

C. Louvers and Dampers Inc.

D. Ruskin.

E. Substitutions: Under provisions of Division One.

2.08 BACKDRAFT DAMPERS.

A. Gravity back draft dampers, size 18 x 18 inches or smaller, furnished with air moving equipment, may be air moving equipment manufacturers standard construction.

B. Fabricate multi-blade, parallel action gravity balanced back draft dampers of 16 gauge 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.

2.09 ACCEPTABLE MANUFACTURERS - AIR TURNING DEVICES

A. Young Regulator.

B. Titus.

C. Tuttle and Bailey.

D. Substitutions: Under provisions of Division One.

2.10 AIR TURNING DEVICES

A. 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.

B. 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.

2.11 ACCEPTABLE MANUFACTURERS - FLEXIBLE DUCT CONNECTIONS

A. Metaledge.

B. Ventglass.

C. Substitutions: Under provisions of Division One.

2.12 FLEXIBLE DUCT CONNECTIONS TO AIR MOVING EQUIPMENT

A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards, and as indicated.

B. 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.

2.13 ACCEPTABLE MANUFACTURERS - DUCT ACCESS DOORS

A. Greenheck

B. American Warming and Vent.

C. Ruskin.

D. Titus.

E. Substitutions: Under provisions of Division One.

2.14 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards and as indicated.

B. Review locations prior to fabrication.

C. Fabricate rigid and close-fitting doors of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover. Insulation shall be replaceable without field cutting or patching.

D. Access doors smaller than 12 inches square may be secured with sash locks.

E. 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.

F. Access doors with sheet metal screw fasteners are not acceptable.

2.15 DUCT TEST HOLES

A. 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.

B. Permanent test holes shall be factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions.

B. Balancing Dampers

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.
2. All regulators mounted on externally insulated ductwork 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 ductwork 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. All dampers in lined ductwork shall have bushing to prevent damper damage to liner.

C. 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.

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

E. Provide back draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

F. 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.

G. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, every 70 linear feet, at each change of direction, both sides of turning vanes and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Locate doors so that minimum number possible is used.

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

END OF SECTION

SECTION 15951

CONTROLS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

These general requirements apply to all work covered in the various sections of Division 15 – Mechanical.

A. Furnish and install a complete an Automatic Temperature Control System. The system shall be complete in all respects including labor, materials, equipment, and services necessary, and shall be installed by personnel regularly employed by the manufacturer. The system shall consist of stand-alone controls.

1.02 CONTRACTOR QUALIFICATIONS

A. ACCEPTABLE SYSTEM MANUFACTURERS
1. Unit manufacturer or approved equal.

1.03 WORK BY OTHERS

A. Sheet Metal Subcontractor:

1. Setting of automatic control dampers, smoke control dampers, and necessary blank off plates.

2. Access doors where and as required.

B. Heating Contractor:

1. Installation of immersion wells and pressure tappings.

2. Installation of flow switches.

3. Setting of automatic control valves.

4. Installation of pressure tappings and associated shut-off cocks.

C. Electrical Subcontractor:

1. All power wiring and line voltage interlock wiring shown on the electric plans. This includes all interlock wiring associated with smoke detectors.

1.04 ELECTRICAL WORK FOR CONTROLS:

A. Complying with the principle of "unit responsibility" all electrical work for automatic controls, except as otherwise specified, or shown on the Electrical Drawings shall be included in Division 15.

B. Electrical work shall, in general, comply with the following:

1. All low voltage wiring in finished rooms shall be concealed below working heights and exposed above.

2. Electrical work may include both line voltage and low voltage wiring, as required.

3. Conduit network for power systems may be used for running control high voltage wiring.

4. All electrical work shall comply with the N.E.C. and local electrical codes.

5. All safety devices shall be wired through both hand and auto positions of motor starting device to insure 100% safety shut-off.

6. All magnetic starters furnished by Electrical Contractor for mechanical equipment shall be furnished with integral 120 volt control transformers, sized to handle the additional VA needed for the controls - pilots, EP valves, etc.

7. The motor starter supplier shall provide auxiliary contacts as required for interlock by FMS Contractor; the supplier shall estimate an allowance of at least 1 auxiliary contract per starter. All interlock and control wiring shown on the electrical prints is by the Electrical Subcontractor.

8. Low voltage plenum rated wiring can be run exposed above working heights in equipment rooms and above accessible ceiling. Wiring shall be neatly tied to pipes, EMT or other devices and not laid on ceiling tile.

1.05 CONTROL EQUIPMENT AND DEVICES

A. The Control System shall include all necessary and specified control equipment properly installed in accordance with Specifications and Drawings, and shall include the automatic control of the following:

1. Control Dampers: Dampers required in the temperature control functions of the automatic Control System shall be provided with the Fan-Coil Units. All dampers shall be sized as shown on Drawings or as specified. All damper frames shall be constructed of 13-gauge galvanized sheet metal or extruded aluminum of 12-gauge thickness, and shall have a flange or duct mounting. The blades shall be parallel or opposed, as required, and suitable for the air velocities to be encountered in the system. Replaceable Butyl rubber seals are to be provided on damper blades and installed along with the top and bottom of the frame. Stainless steel damper blades and seals shall be installed inside the frame sides. Seals and bearings shall be able to withstand temperatures ranging from minus 40° F to plus 200° F. Dampers shall be leak rated for 3 CFM/foot squared at 1" WG and 20 CFM/foot squared at 4" WG or less in full closed position at 4" WG pressure differential across damper. All smoke control dampers must conform to UL5555 and be Ruskin SD-60 or Johnson Control SD-1300. Damper blades shall not exceed 6" in width. All blades shall not exceed 6" in width. All blades are to be corrugated type construction, fabricated from 2 sheets of #22-gauge galvanized sheet steel, spot welded together. Blades are to be suitable for high velocity performance. Damper blades shall be a maximum of 48" long. Longer units shall be fabricated in sections. Dampers shall be Ruskin CD-60 or Johnson Controls D-1300.

2. Operators: A damper or valve operator shall be electric and be provided for each automatic damper or valve and shall be of sufficient capacity to operate the damper or valve under all conditions and to guarantee tight close-off of valves, as specified, against system pressure encountered. Each shall be provided with spring-return for normally closed or normally open position for fail safe operation to account for fire, low temperatures, or power interruption as indicated. Damper and valve operators are to be made out of diecast metal; no plastic or sheet metal bodies will be allowed.

3. Sensors and Controllers:

a. Low Limit Thermostats shall be of manual reset type, with setpoint adjustment. The sensing element shall be 20' minimum and shall be

installed completely across the coil. When any 1' of the element senses a temperature as low as the setpoint, the thermostat contacts shall open. These shall contain double pole switches for simultaneous remote alarms or as desired. Thermostat shall be Johnson Controls A70 or equal.

b. Space Temperature Transmitter shall contain an RTD sensing element to monitor room air temperatures in the range of 30° F to 90° F, unless indicated otherwise. The transmitter shall be factory calibrated to an accuracy of $\pm$ 1%. The assembly shall be installed within a metal ventilated enclosure suitable for wall mounting. The output shall be and compatible with the panel it serves. Transmitter shall be factory calibrated to an accuracy of $\pm$ 1% over the full range. Include a warmer/cooler slider on each room thermostat.

PART 2 – PRODUCTS

2.01 GENERAL PRODUCT DESCRIPTION

A. The fan coil units shall be controlled by standalone programmable thermostats

2.02 PROGRAMMABLE THERMOSTAT FOR FAN COIL UNITS

A. The heating and cooling setpoints shall be individually adjustable for both the occupied and unoccupied periods. The thermostat shall have a minimum deadband of 2°F (no mechanical heating or cooling shall operate within this deadband). Space temperature deviation above the cooling setpoint or below the heating setpoint shall generate a demand signal to control the system as follows.

B. The thermostat shall control the heating output based on the demand signal communicated from the thermostat program, taking into account both space temperature deviation (proportional error) and the duration of that temperature deviation (integral error).

C. The thermostat shall energize the gas fired duct heater when space temperature falls below heating setpoint.

D. The thermostat shall have the capability to set back or shut down the system based on day of the week and time of day, and provide a readily accessible manual override that will return to the preset back or shutdown schedule without reprogramming.

E. Heating Setback and Cooling Setup: Initiation of heating setback or cooling setup for each of 7 days shall be provided by a programmed time schedule

manually entered into the thermostat. When all or a portion of a manually programmed schedule is unavailable, the thermostat shall control to the default program as follows:

F. No calibration and no adjustment shall be required for mixed air temperature, throttling range, reset ratio, band width, or discharge air temperature.

G. Temperature setting displayed on thermostat shall be adjustable within +/- 3°F of measured room temperature (optional).

H. Overrides: Temperature setpoints can be overridden in three ways:

a. Thermostat shall allow for a 1, 3, 8 or 12 hour timed override from unoccupied setpoint to occupied setpoint from the thermostat keypad. In addition the thermostat shall allow for the adjustment of the occupied setpoint during the timed override from the keypad.

b. Thermostat shall allow for a 1, 3, 8 or 12 hour timed override from unoccupied setpoint to occupied setpoint from a remote sensor with a temporary occupied key (optional). In addition the thermostat shall allow for the adjustment of the occupied setpoint during the timed override from a remote sensor with warmer/cooler keys (optional).

c. Thermostat shall allow for a continuous override to the unoccupied setpoint from the thermostat keypad.

2.03 THERMOSTAT GUARDS

Heavy duty, cast metal type. Provide for all thermostats in public areas.

2.04 All blowers rated at 2000 CFM or more shall be automatically de-energized by a smoke detector. Ref: Division 16 for specification.

2.05 GAS UNIT HEATERS

Provide electric thermostat to cycle unit and fan motor.

2.06 HUMIDITY CONTROL

Provide humidistat to cycle unit and electric reheat on as required to dehumidify. Direct or reverse acting type with differential not exceeding 5 percent relative humidity and minimum 60 percent set point adjustment.

2.07 CO SENSOR

Provide carbon monoxide sensor to monitor carbon monoxide levels in apparatus bay and activate circulation fan when levels exceed the setpoint..

PART 3 - SEQUENCE OF OPERATIONS

3.01 Sequences

DX Fan Coil Unit (FCU-1 to 3)

1. The unit may be started and stopped automatically through an operator-determined time schedule. When the unit is enabled, the outdoor air damper (where shown on the plans) will open and the fan will start. Interlock any related exhaust fans as shown on the schedule.

2. A controller shall stage the heating and cooling to maintain space temperature set point.

3. A humidistat in the space shall maintain the space humidity set point. With a rise in humidity above the desired set point of 60%, the humidistat shall stage the heating until humidity set point is satisfied and below 60% humidity.

4. Thermostat shall be similar to Johnson Controls SZ1009, SZ1022, SZ1031, SZ1035. Controller shall be similar to Johnson Controls SZ1143B. Humidity Sensor shall be similar TH1021. Other approved equal components are acceptable.

A. Exhaust Fans (EF-1 to 5)

1. Interlock exhaust fan EF-4 with FCU-1. Fan shall be on when FCU is energized.
2. Interlock exhaust fan EF-13 with FCU-2. Fan shall be on when FCU is energized
3. Exhaust fans EF- 1, 3, 5, 6, 7, 8, 10, 11 and 12 shall be controlled by ON/OFF switch.
4. Exhaust fans EF-5 and 6 in apparatus bay shall be interlocked to motorized damper in the intake louver as indicated in Note 7 on drawing M201. The constant speed exhaust fan will be started based on carbon monoxide levels. When exhaust fan is enabled, all (2) intake louver dampers will be opened to supply fresh air. When the exhaust fan status indicates the fan started, the control sequence will be enabled. Upon a loss of airflow, the system will automatically restart. The fans may also be started with a manual wall mounted on/off switch.
5. Exhaust fans EF-2, 9, 14 shall be controlled by thermostat. Fans shall be on when thermostat reaches 80°F.

END OF SECTION

SECTION 15990

TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 15050, are included as a part of this Section as though written in full in this document.

1.02 RELATED DOCUMENTS

Approved submittal date on equipment installed, to accomplish the test procedures, outlined under Services of the Contractor of this Section, will be provided by the Contractor.

1.03 DESCRIPTION

A. The TAB of the air conditioning systems will be performed by an impartial technical firm whose operations are limited only to the field of professional TAB. The TAB work will be done under the direct supervision of a qualified engineer employed by the TAB firm.

B. The TAB firm will be responsible for inspecting, adjusting, balancing, and logging the date on the performance of fans, dampers in the duct system, and air distribution devices. The Contractor and the various subcontractors of the equipment installed, shall cooperate with the TAB firm to furnish necessary data on the design and proper applications of the system components and provide labor and material required to eliminate deficiencies or malperformance.

1.04 QUALITY ASSURANCE

A. QUALIFICATIONS OF CONTRACTOR PERSONNEL: Submit evidence to show that the personnel who shall be in charge of correcting deficiencies for balancing the systems are qualified. The Owner and Engineer reserve the right to require that the originally approved personnel be replaced with other qualified personnel if, in the Owner and Engineer's opinion, the original personnel are not qualified to properly place the system in condition for balancing.

B. QUALIFICATIONS OF TAB FIRM PERSONNEL:

1. A minimum of one registered Professional Engineer licensed in the State, is required to be in permanent employment of the firm.
2. Personnel used on the jobsite shall be either Professional Engineers or technicians, who shall have been permanent, full time employees of the firm for a minimum of six months prior to the start of Work for that specified project.
3. Evidence shall be submitted to show that the personnel who

actually balance the systems are qualified. Evidence showing that the personnel have passed the tests required by the Associated Air Balance Council (AABC) shall be required.

C. CALIBRATION LIST: Submit to the Engineer for approval, a list of the gauges, thermometers, velometer, and other balancing devices to be used in balancing the system. Submit evidence to show that the balancing devices are properly calibrated before proceeding with system balancing.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 SERVICES OF THE CONTRACTOR

A. The Drawings and specifications have indicated valves, dampers, and miscellaneous adjustment devices for the purpose of adjustment to obtain optimum operating conditions, install these devices in a manner that leaves them accessible, provide access as requested by the TAB firm.

B. Have systems complete and in operational readiness prior to notifying the TAB firm that the project is ready for their services, and certify in writing to the Construction Manager that such a condition exists.

C. As a part of the Work of this Section, make changes in the sheaves, belts, and dampers or the addition of dampers required for correct balance of the new work as required by the TAB firm, at no additional cost to the Owner.

D. Fully examine the existing system to be balanced, to determine whether or not sufficient volume dampers, balancing valves, thermometers, gauges, pressure and temperature taps, means of reading static pressure and total pressure in duct systems, means of determining water flow, and other means of taking data needed for proper water and air balancing are existing. Submit to the Engineer in writing a listing of omitted items considered necessary to balance existing systems. Submit the list and proposal as a cost add item.

E. Verify that fresh air louvers are free of blockage, coils are clean and fresh air ducts to each air handling unit has individually adjustable volume regulating dampers.

F. Provide, correct, repair, or replace deficient items or conditions found during the testing, adjusting, and balancing period.

G. In order that systems may be properly tested, balanced, and adjusted as specified, operate the systems at no expense to the Owner for the length of time necessary to properly verify their completion and readiness for TAB period.

H. Project Contract completion schedules shall provide time for allowances to permit the successful completion of TAB services to Owner's final inspection and acceptance. Complete, operational readiness, prior to commencement of TAB services, shall include the following services of the Contractor:

1. Construction status of building shall permit the closing of doors, window, ceilings installed and penetrations complete, to obtain project operating conditions.
2. AIR DISTRIBUTION SYSTEMS:
   a. Verify installation for conformity to design. Supply, return, and exhaust ducts terminated and pressure tested for leakage as specified.
   b. Volume and fire dampers properly located and functional. Dampers serving requirements of minimum and maximum outside air, return and relief shall provide tight closure and full opening, smooth and free operation.
   c. Supply, return, exhaust and transfer grilles, registers and diffusers.
   d. Air handling systems, units and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc., shall be blanked and sealed to eliminate excessive bypass or leakage of air.
   e. Fans (supply and exhaust) operating and verified for freedom from vibrations, proper fan rotation and belt tension; overload heater elements shall be of proper size and rating; record motor amperage and voltage and verify that these functions do not exceed nameplate ratings.
   f. Furnish or revise fan drives or motors as necessary to attain the specified air volumes.
3. AUTOMATIC CONTROLS:
   a. Verify that control components are installed in accordance with project documents and functional, electrical interlocks, damper sequences, air and water resets, fire and freeze stats.
   b. Controlling instruments shall be functional and set for design operating conditions. Factory precalibration of room thermostats and pneumatic equipment will not be acceptable.
   c. The temperature regulation shall be adjusted for proper relationship between the controlling instruments and calibrated by the TAB Contractor. Advise Owner of deficiencies or malfunctions.

3.02 SERVICES OF THE TAB FIRM

A. The TAB firm will act as liaison between the Owner, Engineer, and the Contractor and inspect the installation of mechanical piping system, sheet metal work, temperature controls and other component parts of the heating, air conditioning and ventilating systems being retrofitted, repaired, or added under this Contract. The re-inspection of the Work will cover that part related to proper arrangement and adequate provision for the testing and balancing and will be done when the Work is 80 percent complete.

B. Upon completion of the installation and start-up of the mechanical equipment, to check, adjust, and balance system components to obtain optimum conditions in each conditioned space in the building. Prepare and submit to the Owner complete reports on the balance and operations of the systems.

C. Measurements and recorded readings of air, water, and electricity that appear in the reports will be done by the permanently employed technicians or engineers of the TAB firm.

D. Make an inspection in the building during the opposite season from that in which the initial adjustments were made. At the time, make necessary modifications to the initial adjustments required to produce optimum operation of system components to affect the proper conditions as indicated on the Drawings. At time of opposite season check-out, the Owner's representative will be notified before readings or adjustments are made.

E. In fan systems, the air quantities indicated on the Drawings may be varied as required to secure a maximum temperature variation of two degrees within each separately controlled space, but the total air quantity indicated for each zone must be obtained. It shall be the obligation of the Contractor to furnish or revise fan drive and motors if necessary, without cost to the Owner, to attain the specified air volumes.

F. The various existing water circulating systems shall be cleaned, filled, purged of air, and put into operation before hydronic balancing.

3.03 PROFESSIONAL REPORT

A. Before the final acceptance of the report is made, the TAB firm will furnish the Owner the following data to be approved by the Owner and Engineer:

1. Summary of main supply, return and exhaust duct pitot tube traverses and fan settings indicating minimum value required to achieve specified air volumes.
2. A listing of the measured air quantities at each outlet corresponding to the temperature tabulation as developed by the Engineer and TAB firm.
3. Air quantities at each return and exhaust air handling device.
4. Static pressure readings entering and leaving each supply fan, exhaust fan, filter, coil, balancing dampers and other components of the systems included in the retrofit Work. These readings will be related to performance curves in terms of the CFM handled if available.
5. Motor current readings at each equipment motor on load side of capacitors. The voltages at the time of the reading shall be listed.
6. The final report shall certify test methods and instrumentation used, final velocity reading obtained, temperatures, pressure drops, RPM of equipment, amperage of motors, air balancing problems encountered, recommendations and uncompleted punch list items. The test results will be recorded on standard forms.
7. A summary of actual operating conditions shall be included with each system outlining normal and ventilation cycles of operation. the final report will act as a reference of actual operating conditions for the Owner's operating personnel.

3.04 BALANCING AIR CONDITIONING SYSTEM

A. GENERAL:

1. Place all equipment into full operation, and shall continue the operating during each working day of balancing and testing. If the air conditioning system is balanced during Off-Peak cooling season Balancing Contractor shall return to rebalance air side system as required to put system in proper balance at that time.
2. The Contractor shall submit detailed balancing and recording forms for approval. After the approval by the Architect, prepare complete set of forms for recording test data on each system. All Work shall be done under the supervision of a Registered Professional Engineer. All instruments used shall be accurately calibrated to within 1% of scale and maintained in good working order.
3. Upon completion of the balancing and testing, the Balancing Contractor shall compile the test data in report forms, and forward five copies to the Architect for evaluation.
4. The final report shall contain logged results of all tests, including such data as:
   a. Tabulation of air volume at each outlet.
   b. Outside dry bulb and wet bulb temperature.
   c. Inside dry bulb and wet bulb temperatures in each conditioned space room or area.
   d. Actual fan capacities and static pressures. Motor current and voltage readings at each fan.

B. AIR SYSTEMS: Perform the following operations as applicable to system balance and test:

1. Check fan rotation.
2. Check filters (balancing shall be done with clean filters).
3. Test and adjust blower rpm to design requirements.
4. Test and record motor full load amperes.
5. Test and record system static pressures, suction and discharge.
6. Test and adjust system for design cfm, return air and outside air (+2%). Change-out fan sheaves as required to balance system.
7. Test and record entering air temperatures, db and wb.
8. Test and record leaving air temperatures, db and wb.
9. Adjust all zones to design cfm (+2%).
10. Test and adjust each diffuser, grille, and register to within 5% of design.

C. AIR DUCT LEAKAGE: (From SMACNA Duct Standards 3rd Edition) Test all ductwork (designed to handle over 1000 CFM) as follows:

1. Test apparatus
   The test apparatus shall consist of:
   a. A source of high pressure air--a portable rotary blower or a tank type vacuum cleaner.
   b. A flow measuring device consisting of straightening vanes and an orifice plate mounted in a straight tube with properly located pressure taps. Each orifice assembly shall be accurately calibrated with its own calibration curve. Pressure and flow readings shall be taken with U-tube manometers.

2. Test Procedures

a. Test for audible leaks as follows:

1) Close off and seal all openings in the duct section to be tested. Connect the test apparatus to the duct by means of a section of flexible duct.

2) Start the blower with its control damper closed.

3) Gradually open the inlet damper until the duct pressure reaches 1.2 times the standard designed duct operating pressure.

4) Survey all joint for audible leaks. Mark each leak and repair after shutting down blower. Do not apply a retest until sealants have set.

b. After all audible leaks have been sealed, the remaining leakage should be measured with the orifice section of the test apparatus as follows:

1) Start blower and open damper until pressure in duct reaches 25% in excess of designed duct operating pressure.

2) Read the pressure differential across the orifice on manometer No. 2. If there is no leakage, the pressure differential will be zero.

3) Total allowable leakage shall not exceed one (1) percent of the total system design air flow rate. When partial sections of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.

4) Even though a system may pass the measured leakage test, a concentration of leakage at one point may result in a noisy leak which, must be corrected.

D. DX SYSTEMS:

1. Test and record suction and discharge pressures at each compressor and record ambient air temperature entering the condensing coils.
2. Test and record unit full load amps and voltage.
3. Test and record staging and unloading of unit required by sequence of operation or drawing schedule.

E. Automatic temperature controls shall be calibrated and all thermostats and dampers, adjusted so that the control system is in proper operating condition, subject to the approval of the Architect.

F. The Air Balance Contractor shall report to Engineer all air distribution devices or other equipment that operate noisily so that corrective measures may be implemented by the Contractor at no additional cost to the Owner or Architect/Engineer.

END OF SECTION

SECTION 16050

BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Tests

B. Inspections

C. Submittals

D. Project Coordination

1.02 RELATED SECTIONS

A. General Conditions

B. Supplementary Conditions

C. Division One

1.03 COOPERATION WITH TRADES:

A. Cooperation with trades of adjacent, related, or affected materials or operations shall be considered a part of this work in order to affect timely and accurate placing of work and bring together in proper and correct sequence, the work of such trades.

B. Participate in commissioning as described in 01800 and 16995.

1.04 REFERENCES

A. National Electrical Code (NEC)

B. American Society for Testing and Materials (ASTM)

C. Underwriter's Laboratories, Inc. (UL)

D. Insulated Cable Engineer's Association (ICEA).

E. National Electrical Manufacturer's Association (NEMA).

F. Institute of Electrical and Electronics' Engineers (IEEE).\

G. American National Standards Institute (ANSI).

H. National Fire Protection Association (NFPA).

I. International Energy Conservation Code (IECC).

1.05 COMPLETE FUNCTIONING OF WORK:

A. All work fairly implied as essential to the complete functioning of the

electrical systems shown on the Drawings and Specifications shall be completed as part of the work of this Division unless specifically stated otherwise. It is the intention of the Drawings and Specifications to establish the types of the systems, but not set forth each item essential to the functioning of the system. In case of doubt as to the work intended, or in the event of amplification or clarification thereof, the Contractor shall call upon the Architect for supplementary instructions, Drawings, etc.

B. Contractor shall review all pertinent Drawings and adjust his work to all conditions shown there on. Discrepancies between Plans, Specifications, and actual field conditions shall be brought to the prompt attention of the Architect.

1. Approximate location of transformers, feeders, branch circuits, outlets, lighting and power panels, outlets for special systems, etc., are indicated on the Drawings. However, the Drawings, do not give complete and accurate detailed locations of such outlets, conduit runs, etc., and exact locations must be determined by actual field measurement. Such locations will, at all times, be subject to the approval of the Architect.
2. Communicate with the Architect and secure his approval of any outlet (light fixture, receptacle, switch, etc.) location about which there may be the least question. Outlets obviously placed in a location not suitable to the finished room or without specific approval, shall be removed and relocated when so directed by the Architect. Location of light fixtures shall be coordinated with reflected ceiling plans.

C. Additional coordination with mechanical contractor may be required to allow adequate clearances of mechanical equipment, fixtures and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts or equipment locations.

1.06 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the approved shop drawings.

1.07 CONTRACTOR’S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:
1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.
2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.
3. Perform work by persons qualified to produce workmanship of specified quality. Persons performing electrical work shall be required to be licensed. Onsite supervision, journeyman shall have minimum of journeyman license. Helpers, apprentices shall have minimum of apprentice license.

1.08 DATE OF FINAL ACCEPTANCE

A. The date of final acceptance shall be the date of owner occupancy, or the date all punch list items have been completed or final payment has been received. Refer to Division One for additional requirements.

B. The date of final acceptance shall be documented in writing and signed by the architect, owner and contractor.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Deliver products to the project at such time as the project is ready to receive the equipment, pipe or duct properly protected from incidental damage and weather damage.

C. Damaged equipment shall be promptly removed from the site and new, undamaged equipment shall be installed in its place promptly with no additional charge to the Owner.

1.10 SUBMITTALS

A. Coordinate with Division 1 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded the Contractor shall submit a minimum of eight (8) complete bound sets of shop drawings and complete data covering each item of equipment or material. The first submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive shop drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain one (1) copy each of all shop drawings for their files. Where full size drawings are involved, submit one (1) print and one (1) reproducible sepia or vellum in lieu of eight (8) sets. All literature pertaining to an item subject to Shop Drawing submittal shall be submitted at one time. A submittal shall not contain information from more than one Specification section, but may have a section subdivided into items or equipment as listed in each section. The Contractor may elect to submit each item or type of equipment separately. Each submittal shall include the following items enclosed in a suitable binder:

1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
2. An index page with a listing of all data included in the Submittal.
3. A list of variations page with a listing all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO

VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.

4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
6. Identification of each item of material or equipment matching that indicated on the Drawings.
7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
8. Additional information as required in other Sections of this Division.
9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

B. Refer to Division 1 for additional information on shop drawings and submittals.

C. Equipment and materials submittals and shop drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of shop drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D. Where shop drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E. Shop drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:

1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.
2. REVIEWED AS NOTED**:** Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the

O&M manual. The contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.

3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.
4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous shop drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.
5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all shop drawings.
6. MANUFACTURER NOT AS SPECIFIED**:** Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F. Materials and equipment which are purchased or installed without shop drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

H. Furnish detailed shop drawings, descriptive literature, physical data and a specification critique for each section indicating "compliance" and/or "variations" for the following items:

Electrical Meters
Distribution Panel boards
Lighting and Appliance Panel boards
Wiring Gutters
Heavy Duty Disconnect Switches

Lighting Fixtures
Lighting Contactors
Time Clocks
Lighting Control System
Photocells
Wiring Devices and Plates
Security System
Conduit and Fittings
Wire
Lightning Protection
Emergency Generator
Automatic Transfer Switches
Fire Alarm System
Technology Wiring
Television Distribution System
Integrated Telecommunications/Telemedia System
Transient Voltage Surge Suppressors (TVSS)

A. Refer to each specification section for additional requirements.

1.11 OPERATION AND MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1 and in addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.12 RECORD DRAWINGS

A. Maintain a continuous record during the course of construction of all changes and deviations in the work from the contract drawings. Upon completion of the work, purchase a set of "Auto Positive Tracings" on vellum and make corrections as required to reflect the electrical systems as installed. Location and size of all conduit shall be accurately shown to dimension. Submit three prints of the tracings for approval. Make corrections to tracings as directed and deliver "Auto Positive Tracings" to the Architect. Record drawings shall be furnished in addition to shop drawings. Symbols on the Record drawings shall correspond to the identification symbols on the contract drawings and equipment identification plates and tags.

B. The Contractor shall maintain a set of clearly marked black line record "AS-BUILT" prints on the job site on which he shall mark all work details, alterations to meet site conditions and changes made by "Change Order" notices. These shall be kept available for inspection by the Owner, Architect or Engineer at all times.

C. Refer to Division 1 for additional requirements concerning record drawings. If the Contractor does not keep an accurate set of as-built drawings, the pay request may be altered or delayed at the request of the Architect. Mark the drawings with a colored pencil. Delivery of as-built prints and reproducibles is a condition of final acceptance.

D. The record prints shall be updated on a daily basis and shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed pipe or duct, locations of all concealed valves, controls and devices and any deviations from the work shown on the Construction Documents which are required for coordination. All dimensions shall include at least two dimensions to permanent structure points.

E. Submit three prints of the tracings for approval. Make corrections to tracings as directed and delivered "Auto Positive Tracings" to the architect. "As-Built" drawings shall be furnished in addition to shop drawings.

F. When the option described in paragraph F., above is not exercised then upon completion of the work, the Contractor shall transfer all marks from the submit a set of clear concise set of reproducible record "AS-BUILT" drawings and shall submit the reproducible drawings with corrections made by a competent draftsman and three (3) sets of black line prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The reproducible record "AS-BUILT" drawings shall have the Engineers Name and Seal removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

(NAME OF GENERAL CONTRACTOR)

BY:_____
(SIGNATURE)

(NAME OF SUBCONTRACTOR)

BY:_____
(SIGNATURE)

1.13 CERTIFICATIONS AND TEST REPORTS

A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and schedule date for each test. This detailed completion and test schedule shall be submittal at least 90 days before the

projected Project completion date.

B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.

C. Submit 4 copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D. Certifications and test reports to be submitted shall include, but not be limited to those items outlined in Section of Division 16.

1.14 MAINTENANCE MANUALS

A. Coordinate with Division 1 for maintenance manual requirements, unless noted otherwise bind together in “D ring type” binders by National model no. 79-883 or equal, binders shall be large enough to allow ¼” of spare capacity. Three (3) sets of all approved shop drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections and labeled for easy reference and shall utilize the individual specification section numbers shown in the Electrical Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 16 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

B. Prepare maintenance manuals in accordance with Special Project Conditions, in addition to the requirements specified in Division 16, include the following information for equipment items:

1. Identifying names, name tags designations and locations for all equipment.
2. Fault Current calculations and Coordination Study.
3. Reviewed shop drawing submittals with exceptions noted compliance letter.
4. Fabrication drawings.
5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
6. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and

adjusting instructions, servicing instructions and lubrication charts and schedules.

8. Equipment name plate data.
9. Wiring diagrams.
10. Exploded parts views and parts lists for all equipment and devices.
11. Color coding charts for all painted equipment and conduit.
12. Location and listing of all spare parts and special keys and tools furnished to the Owner.
13. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

E. Refer to Division 1 for additional information on Operating and Maintenance Manuals.

F. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer a minimum of 14 working days prior to the beginning of the operator training period.

1.15 OPERATOR TRAINING

D. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include 12 hours of on site training in three 4 hour shifts.

E. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

F. Refer to other Division 16 Sections for additional Operator Training requirements.

1.16 SITE VISITATION

A. Visit the site of the proposed construction in order to fully understand the facilities, difficulties and restriction attending the execution of the work.

B. Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

C. Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

D. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.17 WARRANTY

A. The undertaking of the work described in this Division shall be considered equivalent to the issuance, as part of this work, of a specific guarantee extending one year beyond the date of completion of work and acceptance by Owner, against defects in materials and workmanship. Materials, appliances and labor necessary to effect repairs and replacement so as to maintain said work in good functioning order shall be provided as required. Replacements necessitated by normal wear in use or by Owner's abuse are not included under this guarantee.

1.18 TRANSFER OF ELECTRONIC FILES

A. Project documents are not intended or represented to be suitable for reuse by Architect/Owner or others on extensions of this project or on any other project. Any such reuse or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner's risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney's fees arising out of or resulting thereof.

B. Because data stored in electric media format can deteriorate or be modified inadvertently, or otherwise without authorization of the data's creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

C. When transferring documents in electronic media format, Engineer makes no representations as to the long term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.

D. Any reuse or modifications will be Contractor's sole risk and without liability or legal exposure to Architect, Engineer or any consultant.

E. The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect's written consent.

It is agreed that "MEP" hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The contract documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement between Architect and Owner.

If the client, Architect/Owner, or developer of the project requires electronic

media for “record purposes”, then an AutoCAD based compact disc (“CD”) will be prepared. The “CD” will be submitted with all title block references intact and will be formatted in a “plot” format to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.

F. At the Architect/Owner’s request, Engineer will prepare one “CD” of electronic media to assist the contractor in the preparation of submittals. The Engineer will prepare and submit the “CD” to the Architect/Owner for distribution to the contractor. All copies of the “CD” will be reproduced for a cost of reproduction fee of Five Hundred Dollars ($500.00) per “CD”.

The “CD” will be prepared and all title blocks, names and dates will be removed. The “CD” will be prepared in a “.dwg” format to permit the end user to revise the drawings.

G. This Five Hundred Dollars ($500.00) per “CD” cost of reproduction will be paid directly from the Contractor to the Engineer. The “CD” will be prepared only after receipt of the Five Hundred Dollars ($500.00). The Five Hundred Dollars ($500.00) per “CD” cost of reproduction is to only recover the cost of the man-hours necessary to reproduce the documents. It is not a contractual agreement between the Contractor and Engineer to provide any engineering services, nor any other service.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. The names and manufacturers and model numbers have been used in the Contract documents to establish types of equipment and standards of quality. Where more than one manufacturer is named for a specific item of equipment, only one of the specified manufacturers will be considered for approval. Where only one manufacturer is mentioned with the phrase "or approved equal", Contractor may submit an alternate manufacturer for consideration, provided the following conditions are met:

1. Submit alternate equipment with complete descriptive data in shop drawing form. Provide sample of equipment upon request for review by Architect. Samples will be returned if requested in writing.
2. Alternate equipment must be equal from the standpoint of materials, construction and performance.
3. Alternate submittal must be presented to the Engineer/Architect ten (10) days prior to bid date for approval.

B. The Architect and Engineer shall be the sole judge of quality and equivalence of equipment, materials and methods.

2.02 All materials and products used on this project shall be listed by Underwriters' Laboratories.

2.03 ACCESS DOORS

A. Wherever access is required in walls or ceilings to concealed junction boxes,

pull boxes, equipment, etc., installed under this Division, furnish a hinged access door and frame with flush latch handle to another Division for installation. Doors shall be as follows:

1. Plaster Surfaces: Milcor Style K.
2. Ceramic Tile Surfaces: Milcor Style M.
3. Drywall Surfaces: Milcor Style DW.
4. Install panels only in locations approved by the Architect.

2.04 EQUIPMENT PADS

A. Unless noted otherwise 4" high concrete pads for floor mounted equipment shall be installed under Division 3. Pads shall conform to the shape of the equipment with a minimum of 3" margin at equipment supports. Top and sides of pads shall be troweled to a smooth finish, equal to floor. External corners shall be bull nosed to a 3/4" radius, unless shown otherwise.

2.05 ESCUTCHEONS

A. Provide heavy chrome or nickel plated plates, of approved pattern, on conduit passing through walls, floors and ceilings in finished areas. Where conduit passes through a sleeve, no point of the conduit shall touch the building construction. Caulk around such conduit with sufficient layers of two hour rated firesafing by Thermafiber 4.0 P.C.F. density, U.S.G. fire test 4/11/78 and seal off openings between conduit and sleeves with non-hardening mastic prior to application of escutcheon plate. Escutcheons shall be Gravler Sure-Lock, or approved equal.

2.06 SPACE LIMITATIONS

A. Equipment shall be chosen which shall properly fit into the physical space provided and shown on the drawings, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearances in accordance with Code requirements. Physical dimensions and arrangement of equipment shall be subject to the approval of the Architect.

2.07 PAINTING

A. All factory assembled equipment for electrical work, except light fixtures, that normally is delivered with a factory applied finish shall be delivered with a hard surface factory applied finish such as baked-on machinery enamel which will not require additional field painting. The finish shall consist of not less than 2 coats of medium gray color paint USA No. 61 Munsell Notation 8-3G, 6. 10/0.54 enamel. This Contractor shall protect this finish from damage due to construction operations until acceptance of the building. He shall be responsible for satisfactorily restoring any such finishes or replacing equipment that becomes stained or damaged.

2.08 ELECTRICAL SYSTEM IDENTIFICATION

A. Conduit Systems: Provide adequate marking of major conduit which is

exposed or concealed in accessible spaces to distinguish each run as either a power or signal/communication conduit. Except as otherwise indicated, use orange banding with black lettering. Provide self-adhesive or snap-on type plastic markers. Indicate voltage for that raceway. Locate markers at ends of conduit runs, on pull boxes, on junction boxes, near switches and other control devices, near items of equipment served by the conductors, at points where conduit passes through walls or floors, or enters non-accessible construction and at spacing's of not more than 50 feet along each run of conduit. Switch-leg conduit and short branches for power connections do not have to be marked, except where conduit is larger than ¾ inch. Branch circuit conduits, junction boxes and pull boxes shall be marked with a permanent marker indicating panel name and branch circuit numbers.

B. Underground Cable Identification: Bury a continuous, preprinted, bright colored plastic ribbon cable marker with each underground cable (or group of cables), regardless of whether conductors are in conduit, duct bank, or direct buried. Locate each directly over cables, 6 to 8 inches below finished grade.

C. Identification of Equipment:

1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Care shall be taken not to obliterate this nameplate in any way.
2. A black-white-black laminated plastic engraved identifying nameplate shall be secured by stainless steel screws to each automatic transfer switch, distribution panel, motor starter panels and panelboards.
   a. Identifying nameplates shall have ¼ inch high engraved letters and shall contain the following information:
      1) Name
      2) Voltage
      3) Phase
      4) "3" or "4" wire, and
      5) Where it is fed from.
   b. An example of a panelboard nameplate is:
      Center Panel – 1HB
      480/277 volt, 3 phase, 4 wire
      Center Fed from DP2
   c. An example of an automatic transfer switch nameplate is:
      Center ATS #2
      480/277 volt, 3 phase, 4 wire, 4 pole
      Center Fed from MSB and DPE
3. Each feeder device in a switchboard, distribution panel, and motor control center device shall have a nameplate showing the load served in ½ inch high engraved letters.
4. A black-white-black laminated plastic engraved identifying nameplate shall be secured by screws to each safety switch, disconnect switch, individual motor starter, enclosed circuit breaker, wireway, and terminal cabinet.
   a. Identifying nameplates shall have ¼ inch high engraved letters and shall indicate the equipment served.
   b. An example if a disconnect switch is: AHU-1.

5. Cardholders and directory cards shall be furnished for circuit identification in panel boards. Cardholder shall be located on inside of panel door and shall be in a metal frame with clear plastic front. Circuit lists shall be typewritten. Circuit descriptions shall include location and name of each item of equipment served. Spares and spaces shall be written in erasable pencil for future use. Circuit directory shall show the room served by each circuit. The final graphs/signage room numbers shall be used. Do not use Architectural numbering on plans.
6. Prohibited Markings: Markings which are intended to identify the manufacturer, vendor, or other source from which the material has been obtained are prohibited for installation within public, tenant, or common areas within the project. Also, prohibited are materials or devices which bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters' Laboratories, Inc.), and approval labels are exceptions to this requirement.
7. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of electrical facilities. Provide text of sufficient clarity and lettering of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with recognized industry standards for color and design.
8. Operational Tags: Where needed for proper and adequate information on operation and maintenance of electrical system, provide tags of plasticized card stock, either preprinted or hand printed. Tags shall convey the message, example: "DO NOT OPEN THIS SWITCH WHEN BURNER IS OPERATING."

PART 3 - EXECUTION

3.01 EXCAVATING AND BACKFILLING

A. Trenching and backfilling and other earthwork operations required to install the facilities specified herein shall conform to the applicable requirements of Division 2 (95% of maximum standard density). Where trenching or excavation is required in improved areas, the backfill shall be compacted to a condition equal to that of adjacent undisturbed earth and the surface of the area restored to the condition existing prior to trenching or excavating operations. Provide a minimum of 3" of sand underneath all conduits. The plans indicate information pertaining to surface and sub-surface obstructions; however, this information is not guaranteed. Should obstructions be encountered whether or not shown, the Contractor shall alter routing of new work, reroute existing lines, remove obstructions where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of new work and leave existing surfaces and structures in a satisfactory and serviceable condition. All work shall comply with OSHA Standards.

3.02 WORKMANSHIP AND CONCEALMENT

A. The work of this Section shall be performed by workman skilled in their trade. Installation shall be consistent in completeness whether concealed or exposed. Each item of electrical work shall be concealed in walls, chases,

under floors and above ceilings except:

1. Where shown to be exposed.
2. Where exposure is necessary to the proper function.

3.03 SLEEVES, CUTTING AND PATCHING

A. This section shall be responsible for placing sleeves for all conduit passing through walls, partitions, sound walls, beams, floors, roof, etc. Sleeves through below-grade walls shall use water-tight fitting manufactured by O.Z. Gendey.

B. All cutting and patching will be done under another Division, but this Section will be responsible for timely performance of this work and layout of holes and setting sleeves.

C. All un-used sleeves shall be sealed with 2 hour UL approved fire sealant manufactured by “3M” or approved equal.

D. Refer to 16110 for additional requirements.

3.04 ELECTRICAL GEAR

A. Install all electrical equipment in accordance with the National Electrical Code and as shown on the drawings.

B. Lighting contractors, time clocks, disconnect switches, etc. mounted in mechanical/electrical rooms shall be mounted at a working height not requiring a ladder, when wall space is available. Installation of these devices at greater elevations shall be approved by the Engineer. Contractor shall provide a coordination sketch of each mechanical/electrical room noting locations and mounting heights of all electrical devices(note bottom and top elevations) shown to be installed. Sketches shall be provided to the Engineer for review and the general contractor for coordination with other trades working in these rooms.

3.05 CLEANING

A. Clean lighting fixtures and equipment.

B. Touch-up and refinish scratches and marred surfaces on panels, switches, starters, and transformers.

3.06 TESTS AND INSPECTIONS

A. Tests and inspection requirements shall be coordinated with Division I.

B. Date for final acceptance test shall be sufficiently in advance of completion date of contract to permit alterations or adjustments necessary to achieve proper functioning of equipment prior to contract completion date.

C. Conduct re-tests as directed by Architect on portions of work or equipment altered or adjusted as determined to be necessary by final acceptance test.

No resultant delay or consumption of time as a result of such necessary re-test beyond contract completion date shall relieve Contractor of his responsibility under contract.

D. Put circuits and equipment into service under normal conditions, collectively and separately, as may be required to determine satisfactory operation. Demonstrate equipment to operate in accordance with requirements of these specifications. Perform tests in the presence of Architect. Furnish instruments and personnel required for tests.

E. Final Inspection:

1. At the time designated by the Architect, the entire system shall be inspected by the Architect and Engineer. The contractor or his representative shall be present at this inspection.
2. Panel boards, switches, fixtures, etc., shall be cleaned and in operating condition.
3. Certificates and documents required hereinbefore shall be in order and presented to the Architect prior to inspection.
4. Panel covers, junction box covers, etc., shall be removed for visual inspection of the wire, bus bars, etc.
5. After the inspection, any items which are noted as needing to be changed or corrected in order to comply with these specifications and the drawings shall be accomplished without delay.

F. The contractor shall provide a thermographic test using an independent testing laboratory using an infrared scanning device. This test shall include but not limited to all switchboards, distribution panel boards, panel boards, automatic transfer switches and other electrical distribution devices. This test shall be conducted to locate high temperature levels. This test shall be conducted between 3 to 8 months after occupancy, but not beyond the one year warranty period. Submit test to the architect and engineer using test reporting forms. All unacceptable conditions shall be corrected prior to the end of the warranty period.

END OF SECTION

SECTION 16110

RACEWAYS

PART 1 - GENERAL

1.01 SCOPE

A. Provide electrical raceways and fittings as shown, scheduled and specified.

B. The types of raceways and fittings required are as follows:

1. Rigid hot-dipped galvanized steel conduit (RGS)
2. Intermediate hot-dipped galvanized steel conduit (IMC)

3. Electrical metallic tubing (EMT)
4. PVC
5. Flexible metal conduit
6. Liquid-tight flexible metal conduit (non-metallic is not acceptable)
7. PVC coated rigid galvanized steel conduit
8. Aluminum Rigid Conduit (ARC)

1.02 STANDARDS

A. ANSI, C80.1 & C80.3

B. NEMA FB-1

C. NEMA TC3

D. UL, 6, 797 & 1242

1.03 ACCEPTABLE MANUFACTURERS

A. Raceways

1. Allied
2. Triangle
3. Republic
3. Carlon
4. Wheatland Tube
5. Cantex
6. Western Tube
7. Robroy Industries

B. Fittings
1. Appleton
2. Crouse Hinds
3. Steel City
4. O.Z. Gedney
5. Carlon
6. Raco, Inc.

1.04 SUBMITTALS

A. Shop drawing shall include but not be limited to:

1. Cut sheets for raceways and fitting.

1.05 REQUIREMENTS OF REGULATORY AGENCIES WORK IN ACCORDANCE WITH:

A. National Electrical Code.

B. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.01 PROVIDE CONDUIT AS FOLLOWS:

A. Except as noted or otherwise specified, all wiring shall be installed in galvanized rigid steel, rigid aluminum conduit or electrical steel tube (EMT) of the proper size to contain the number of conductors required in accordance with the latest edition of the N.E.C. Where conduit sizes are shown on the drawings, these shall take preference. Contractor shall epoxy coat galvanized rigid steel conduit for use in natatoriums.

B. EMT in sizes up to 4 inches when concealed or not exposed to damage.

C. PVC coated rigid galvanized steel shall be used for all penetrations of slab on grade.

D. Rigid galvanized steel where embedded in concrete or masonry construction, exposed to damage or in exterior applications.

E. Rigid aluminum shall be used in exterior applications.

F. Carlon Schedule 40 PVC may be utilized underground, in or below slab where shown on the construction documents.

G. MINIMUM SIZE: 3/4 inch.

H. PVC coated rigid galvanized steel conduit shall be coated inside and outside.

I. PVC coated rigid galvanized steel conduit shall be used at cooling towers, corrosive areas and pool pump rooms.

J. Fixture whips: 1/2 inch greenfield or MC cable not exceeding 8 feet. Provide grounding conductor in all whips.

K. Flexible metal shall be used for connecting rotating equipment installed in conditioned spaces.

L. Sealtite shall be used for connecting rotating equipment installed in non-conditioned spaces and outside.

M. Bear the stamped approval of the UL and be approved by the Architect and Engineer.

2.02 Branch circuits run underground shall be run in Carlon Schedule 40 PVC conduit. Install ground wire in accordance with NEC table 250-122.

2.03 FITTINGS

A. Couplings for rigid steel or intermediate conduit shall be hot dipped galvanized steel. Set screw type is not acceptable.

B. Steel or malleable iron fittings shall be used on all other raceway types except for PVC.

C. Couplings for aluminum raceways shall be threaded aluminum.

D. EMT systems shall utilize steel insulated throat, threadless, water tight compression type connectors and threadless steel water tight compression type couplings.

E. Coupling and connectors accessories and fittings for PVC coated rigid galvanized steel shall be PVC coated.

F. Metal sealtite fittings shall be steel. Plastic is not acceptable.

G. Provide nylon bushing on end of all low voltage cabling system conduits (sleeves, rough-ins, etc.).

PART 3 - EXECUTION

3.01 CONDUIT

A. GENERAL

The Drawings are diagrammatic, and are intended to show the general location of outlets, devices, fixtures, and arrangement and control of circuits. The Contractor shall determine exact locations by actual measurement of the building or by reference to the Architectural Drawings.

B. Of such size, and so installed that conductors may be drawn in without injury or excessive strain.

C. Where entering panels, pull boxes, junction boxes, or outlet boxes, shall be secured in place with lock nuts inside and outside, and insulated bushings inside.

D. Have Red seal type VCC or approved equal cable supports in risers, as required by N.E.C.

E. Have ends reamed after cutting and application of die.

F. Keep conduit corked and dry during construction, and swab out before conductors are pulled.

G. Have bends and offsets made with approved tools. Bends or offsets in which the pipe is crushed or deformed shall not be installed.

H. Where not embedded in concrete or masonry, be firmly secured by approved clamps, half-straps or hangers.

I. Have O.Z. Gedney or approved equal expansion fittings where crossing building expansion joints.

J. EXPANSION JOINTS: Make provision for expansion and shifting of metal or PVC conduits where risers occur from underground.

K. Except in the mechanical equipment rooms, run conduit concealed, and by the shortest practicable route between outlets. Install risers, drops, and offsets necessary to avoid conflict with ductwork, piping, structural members, and similar items.

L. Install exposed conduit in mechanical rooms, and elsewhere as indicated, parallel to horizontal and vertical lines of walls, ceilings, and floors.

M. In general, fluorescent fixtures in finished areas having suspended acoustical ceilings shall be connected to outlet boxes of lighting grid by flexible metal conduit; length not to exceed ten feet.

N. Outlet boxes in partitions shall never be set back to back. They shall be offset to prevent undue noise transmission from room to room.

O. Concealed conduit shall run in as direct manner as possible using long bends. Exposed conduit shall be run parallel with or at right angles to the lines of the building; and all bends shall be made with standard conduit elbows or conduit benders. Not more than equivalent of four quarter bends shall be used in any run between terminals and cabinet, of between outlet or junction boxes. Approved condulets shall be used in lieu of conduit elbows where ease of installation and appearance warrants their use and approved by the engineer. Conduit joints shall be made with approved couplings and unions.

P. Conduits shall be continuous from outlet to outlet and from outlets to cabinets, junction or pull boxes and shall be electrically continuous throughout. Terminals of all conduits shall be provided with double lock nuts and bushing or terminated on conduit hubs. Use of running threads is prohibited.

Q. Each entire conduit system shall be installed complete before any conductors are drawn in. Every run of conduit shall be finished before covering up to guard against obstructions and omissions.

R. Sleeves shall be placed in the forms of concrete, masonry and fire rated walls, floor slabs and beams, for the passage of conduits. Sleeves should be set in place a sufficient time ahead of the concrete work so as not to delay the work. Sleeves shall be rigid galvanized steel and set to extend 4” above slab.

S. All pipe penetrations through walls and concrete floors shall be fire rated by applying USG Thermafiber in the space between the concrete and the pipe. The fire rating shall be additionally sealed by using 3M brand model CP 25 or 303 fire barrier caulk and putty. All fire rating material shall be installed in accordance with manufacturer's printed instructions.

T. All conduit shall be cleaned and swabbed to remove all foreign matter and moisture prior to pulling wire and cable. All boxes in which conduits terminate shall be cleaned of all concrete mortar and other foreign matter.

U. Provide #30 nylon pulling line in all conduits in which permanent wiring is not installed.

V. All conduit shall be securely fastened and supported using hot galvanized malleable iron one-hole pipe straps, clamps, hanger or other means approved by the engineer. Supports shall be as required by NEC Table 344-3 (B)(2). Tie wire shall not be used as support or securing means. Support conduit independently of ceiling hanger wire. Use all thread rods to support outlet boxes and conduit.

W. When PVC conduit is routed underground, all stub-up's and 90° elbows shall be PVC coated rigid galvanized steel. Use PVC coated rigid galvanized steel when penetrating concrete on grade.

X. Route all conduit above grade unless otherwise noted on the construction documents.

Y. Contact the Architect and Engineer for an installation review before covering any below grade or above grade conduit.

Z. All new outlets shall be flush mounted. In remodeled areas where wall construction prohibits flush mounting, provide wiremold 2400 series. Verify exact location and routing with architect before installation.

AA. Contractor shall not penetrate water proof barriers without using proper fitting to maintain barriers. This shall include exterior walls and slabs. Coordinate with Architect for proper methods.

3.02 FITTINGS

A. Install approved expansion fitting in all conduit runs in excess of 150 feet or when crossing building expansion joints.

3.03 CONDUIT CORROSION PROTECTION

A. Branch circuit conduits installed in concrete slabs on fill or grade shall be positioned in a manner to ensure complete concrete cover. In no case shall such conduits be exposed below or above the slab surfaces, or penetrate the waterproof membrane.

B. At locations where metallic conduits pass through slabs on grade or transitions below grade, PVC coated rigid galvanized conduit shall be used.

3.04 OUTLET AND JUNCTION BOXES

A. Provide an approved galvanized outlet box with adequate volume for number of conductors installed.

B. Provide standard galvanized switch boxes of the required number of gangs. Switch boxes where conduit is exposed shall be handy boxes or approved equal.

C. Outlet boxes for receptacles shall be similar to Universal 52151 with suitable raised cover. Receptacle boxes where conduit is exposed shall be handy boxes or approved equal.

D. Weatherproof boxes shall be FS or FD. Provide these boxes in all non-conditioned areas, exterior areas and natatoriums.

E. Outdoor boxes shall be NEMA 3R, with conduit connections made by Myers Hubs.

F. See notes and details on Drawings for special box requirements.

G. Provide junction boxes required to facilitate installation of the various conduit systems. Provide support boxes required for risers, each complete with approved cable supports as described elsewhere in this Division.

H. Outlet boxes for drywall shall be standard galvanized 4" square boxes with the appropriate device cover.

I. Provide floor outlet fittings for telephone to match fittings for duplex floor receptacles.

J. Provide 3-1/2” deep gangable masonry boxes in all masonry wall (CMU). Steel City GW-135-G or approved equal.

K. Provide shallow 4”x4” boxes in all demountable partitions.

L. Metallic boxes located in fire rated walls or partitions shall be separated by a minimum horizontal distance of 24 in. This minimum separation distance between metallic boxes may be reduced when “Wall Opening Protective Materials” (CLIV) are installed according to the requirements of their Classification. Metallic boxes shall not be installed on opposite side of walls or partitions of staggered stud construction unless “Wall Opening Protective Materials” are installed with the metallic boxes in accordance with Classification requirements for the protective materials.

3.05 THRU-WALL SEALS

A. Provide O.Z. Gedney “Thru-wall” seals for all conduits passing through concrete structure below grade, above grade, and floor penetrations below grade. These prevent moisture from entering the building.

B. Straight sleeves are not acceptable.

3.06 PULL BOXES

A. Pull boxes shall be provided for conduit systems as required and shall be constructed of galvanized steel of not less than gauge and size specified by National Electrical Code.

B. Where two or more feeders pass through a common pull box, they shall be tagged to indicate clearly their electrical characteristics, circuit number, and panel designation.

3.07 WIREWAYS

A. Wireways shall be installed as indicated or required and locations shall be coordinated with architect.

B. Wireways shall be made of not less than 16-gauge sheet steel for 4 inch and 6 inch square sizes and 14 gauge steel for 8 inch and 12 inch square sizes. Couplings end plates, and knockouts shall be furnished as required. Each section of wireways shall be rigidly supported.

C. Wiring in wireways shall be neatly bundled, tied and suitably tagged.

D. The finish shall be ANSI-49 gray epoxy paint applied by a cathodic electrodeposition paint process over a corrosion resistant phosphate preparation for NEMA 1 wireways. Provide galvanized steel for NEMA 3R wireways. NEMA 3R wireways and auxiliary gutters are for horizontal mounting only.

3.08 UNDERGROUND DUCTBANK SYSTEM

A. DUCT SYSTEM

1. The duct system shall consist of Schedule 40 PVC or type 1-EB PVC conduits encased in red concrete as detailed on the drawings. Use rigid conduit for stub-ups and the last ten feet at the end of each ductbank. Duct lines shall be laid to a minimum grade of 4 inches per 100 feet and shall be free from either horizontal or vertical waves. Duct lines shall be straight unless otherwise noted on the drawings. Duct lines shall be installed so that the top of concrete in encased duct lines is not less than 24 inches below finished grade or finished paving at any point. Changes in direction or runs exceeding a total of 10 degrees, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature of 25 feet. The long sweep bends may be made up of one or more curved or straight sections and/or combinations thereof using five degree angle couplings. Conduit shall be thoroughly cleaned before using or laying. During construction and after the duct line is completed, the ends of the conduit shall be plugged to prevent water washing mud into the conduits. Particular care shall be taken to keep the conduits clean of concrete, dirt, and any other substance during the course of construction.
2. Each single conduit of the duct bank shall be completely encased in steel reinforced concrete as indicated. The thickness of concrete encasement indicated is the minimum thickness, and may be increased to fit the actual shape of trench.
3. Concrete for duct bank envelopes shall be standard 2000 psi concrete mix as described in Division 03100, and be colored deep red for permanent marking of underground electrical work. The concrete red pigment shall be pure inorganic natural metallic base pigment, approved by the Engineer before use. Organic pigments will not be permitted. The approved pigments shall be mixed four pounds per yard of cement.
   a. Envelopes may be poured directly against sides of trenches if the "cut" is clean, even and free of loose material. All loose dirt and extraneous material shall be removed from the

trenches before and during the pouring of concrete to ensure sound envelopes. Concrete shall be carefully spaded during pouring to eliminate all voids under and between the conduit and honeycombing of the exterior surfaces. Power driven tampers of agitators shall not be used, unless specifically designed for the application, in order to ensure that the water-tightness of the conduits is not destroyed.

b. Generally, each run of envelopes shall be poured in one continuous operation. Where more than one pour is necessary, each pour shall terminate in a vertical plane. Partial pours shall not terminate in horizontal or angular planes.

B. For normal underground installation see Section 16050-3.01 for Excavating and Backfilling.

END OF SECTION

SECTION 16120

WIRE, CABLE AND RELATED MATERIALS

PART 1 - GENERAL

1.01 SCOPE

A. Provide 600 volt building wire, cable and connectors and 300 volt wire, cable and connectors.

B. WORK INCLUDED: Include the following Work in addition to items normally part of this Section.

1. Wiring for lighting and power.
2. Automatic Control Wiring.
3. Connection of equipment shown.
4. Fire Alarm System.

C. WORK SPECIFIED ELSEWHERE:

1. Heating, ventilating, and air conditioning equipment.
2. Structured cabling system.
3. Coaxial cables

1.02 STANDARDS

A. UL83

B. ASTM B-3

C. All wire cable and connectors shall be UL approved.

1.03 ACCEPTABLE MANUFACTURERS

A. 600 VOLT WIRE AND CABLE

1. Southwire
2. General Cable
3. Essex
4. Cerro
5. American Insulated Wire Corporation

B. 300 VOLT WIRE AND CABLE
1. Westpenn
2. Beldon
3. Alpha

C. FLEXIBLE CABLE SYSTEMS
1. AFC Modular Cable Systems

D. CONNECTORS

1. AMP
2. Burndy
3. Ideal
4. 3M
5. O.Z. Gedney
6. Thomas & Betts

1.04 SUBMITTALS

A. Shop drawings shall include, but not limited to:

1. Cutsheets of wire, cable and connectors to indicate the performance, fabrication procedures, product variations, and accessories.

1.05 REQUIREMENTS OF REGULATORY AGENCIES WORK IN ACCORDANCE WITH:

A. National Electrical Code.

B. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.01 WIRING

A. All wire shall be new and continuous without weld, splice, or joints throughout its length. It must be uniform in cross-section, free from flaws, scales and other imperfections.

B. WIRE MATERIAL: Soft drawn, annealed, 98% pure copper, with tin coating. Aluminum wiring is not acceptable.

C. TYPES:

1. Provide type “THHN/THWN” insulation for all buried feeders and service entrance conductors.
2. Provide type “THHN/THWN” insulation for all branch circuits and above grade feeders.
3. All wire No. 8 and larger shall be stranded. All wire No. 10 and smaller shall be stranded or solid.
4. Provide type "XHHW" or other 90 degrees insulation wiring for branch circuit wiring installed through continuous rows of fluorescent fixture bodies.
5. All 300-volt cable including but not limited to telephone, fire alarm, data, CATV and security shall be UL listed for use in return air plenums.

D. CONDUCTOR SIZES

1. Feeder conductors shall be sized for a maximum of 2% drop in rated voltage at scheduled load.
2. Branch circuit conductors shall be sized for a maximum 3% drop in the rated voltage to the longest outlet on the circuit.
3. Minimum wire shall be No. 12, unless otherwise shown on Drawings or required by Code.

E. COLOR CODING: No. 6 or larger shall use tape for color coding. No. 8 and smaller wire shall be color coded in accordance with the governing authority requirements or as follows:

120/208 VOLT	277/480 VOLT	120/240 VOLT
NEUTRAL: White	Neutral: Gray	Neutral: White
PHASE A: Black	Phase A: Brown	Phase A: Black
PHASE B: Red	Phase B: Purple	Phase B: Orange
PHASE C: Blue	Phase C: Yellow	Phase C: Blue
GROUND: Green	Ground: Green	Ground: Green

2.02 GROUNDING

Permanently connect all conduit work, motors, starters, and other electrical equipment to grounding system in accordance with the National Electrical Code.

PART 3 - EXECUTION

3.01 WIRE

A. Do not pull wire into conduit until Work of an injurious nature is completed. Where two or more circuits run to a single outlet box, each circuit shall be properly tagged. Wyreze or approved equal may be used as a lubricant where necessary.

B. Splices shall be fully made up in outlet boxes with compression crimp-on type splice connectors.

C. Joints and splices will not be permitted in service entrance or in feeders. Joints in branch circuits will be permitted where branch circuits divide, and

then shall consist of one through-circuit to which the branch shall be spliced. Joints shall not be left for the fixture hanger to make. Connect joints and splices with Buchanan Series "2000" solderless connectors complete with insulating caps or properly sized wire nuts.

D. All stranded conductors shall be furnished with lugs or connectors.

E. Connectors furnished with circuit breakers or switches shall be suitable for copper wire termination.

F. “Sta-Cons” shall be used to terminate stranded conductors on all switches and receptacles.

G. All stranded #10 and small conductors shall be terminated with an approved solderless terminal if the device or light fixture does not have provisions for clamp type securing of the conductor.

H. The jacket for all travelers used on 3-way and 4-way switches shall be pink.

3.02 BALANCING SYSTEM

A. The load on each distribution and lighting panel shall be balanced to within 10% by proper arrangement of branch circuits on the different phase legs. Provide written documentation showing results. Submit with O & M manuals.

3.03 LOW VOLTAGE WIRING

A. Low voltage wiring shall be plenum rated. All wiring in mechanical rooms, electrical rooms, drywall ceiling, inaccessible areas, underground, plaster ceiling, inside concealed walls areas exposed to occupant view, and other areas subject to physical damage shall be run in conduit.

B. Low voltage wiring shall be routed in separate raceways from power wiring systems.

C. Sleeves shall be placed in the forms of concrete, masonry and fire rated walls, floor slabs and beams, for the passage of wiring. Sleeves should be set in place a sufficient time ahead of the concrete work so as not to delay the work. Sleeves shall be rigid galvanized steel.

3.04 CABLE SUPPORTS

A. Provide cable supports in all vertical raceways in accordance with Article 300-19 of the NEC.

3.05 DEFECTS

A. Defects shall include, but are not to limited to, the following:

1. Tripping circuit breakers under normal operation.
2. Improperly connected equipment.
3. Damaged, torn, or skinned insulation.

END OF SECTION

SECTION 16140

WIRING DEVICES

PART 1 - GENERAL

1.01 SCOPE

A. Provide wiring devices as shown; scheduled, required and as specified.

B. The types of wiring devices required include:

1. Receptacles
2. Switches
3. Coverplates

1.02 STANDARDS

A. NEMA WD-1

B. NEMA WD-5

C. UL

D. Federal Spec WC-596-F and WS-896

1.03 ACCEPTABLE MANUFACTURERS

A. Leviton Manufacturing

B. Hubbell

C. Pass & Seymour

1.04 SUBMITTALS

A. Shop drawings shall include but not limited to:

1. Cut sheets of all devices indicating NEMA configuration, rating, materials, color, and all accessories.
2. Cut sheets of all coverplates indicating materials, color and any engraving specified on drawing or in the specifications.

1.05 REQUIREMENTS OF REGULATORY AGENCIES WORK IN ACCORDANCE WITH:

A. National Electrical Code.

B. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.01 MATERIALS AND COMPONENTS

A. GENERAL

1. Provide factory assemble wiring devices with the rating type and color as required and specified for the service indicated.
2. Provide matching one-piece multiple gang plates where switches are ganged. Provide wall plates for each receptacle furnished.
3. Architect reserves the right to select wiring device styles and colors to match wall finish.
4. Wall plates shall be of same manufacturer as devices.

2.02 SWITCHES

A. Provide specification grade Gray, toggle switches where indicated on the Drawings. Provide "Red" switches for switching emergency lighting circuits where switching is indicated. Coordinate exact locations with architect.

B. Wall switches shall be 20 amp, 120-277 volt and shall be Leviton, Hubbell or P&S as follows:

1. SINGLE POLE SWITCHES:
   Leviton 1221-2, Hubbell HBL 1221, P&S PS20AC1
2. DOUBLE POLE SWITCHES:
   Leviton 1222-2, Hubbell HBL 1222, P&S PS20AC2
3. THREE WAY SWITCHES:
   Leviton 1223-2, Hubbell HBL 1223, P&S PS20AC3
4. FOUR WAY SWITCHES:
   Leviton 1224-2, Hubbell HBL 1224, P&S PS20AC4
5. MOMENTARY CONTACT SWITCHES:
   Leviton 1257, Hubbell HBL 1557, P&S 1251
6. THREE POSITION, TWO CIRCUIT MAINTAINED CONTACT SWITCHES:
   Leviton 1285, Hubbell HBL 1385, P&S 1225
7. KEY TYPE LOCKABLE CORBIN STYLE:
   Leviton 1221-2KL with 2KL key or P&S PS20AC1-KL with 4609 key for each switch, Hubbel #HBL 1221-RKL.

C. Dimmers: Provide Lutron Nova "T" series or Leviton or as shown on drawings. Wall box dimmers shall be sized to handle the load. Where fluorescent dimming ballasts are to be used, coordinate wall box dimmer with ballast manufacturer.

D. Light Handle Switches: Provide Leviton 1221-7L-LHC, Hubbell HBL1221-IL, P&S PS20AC1-ISL lighted handles to switch emergency lights were noted on the drawings.

2.03 RECEPTACLES

A. Provide specification grade Gray receptacles where indicated on the Drawings. Provide "Red" receptacles for receptacles on emergency power.

Coordinate exact location with architect.

B. Receptacles shall be Leviton, Hubbell or Pass & Seymour as follows:

1. Duplex 20A-125V-self grounding: (Nema configuration 5-20R):
   Leviton 5362, Hubbell HBL5362, P&S 5362A
2. Simplex 20A-125V-Self Grounding: (Nema configuration 5-20R):
   Leviton 5361, Hubbell HBL5361, P&S 5361
3. Isolated ground duplex, 20A-125V: (Orange, Nema configuration 5-20R)
   Leviton 5362IG, Hubbell IG5362, P&S IG6300.
4. Clock hanger receptacle 15A-125V: (Brown with stainless steel plate with hanger, Nema configuration 5-15R).
   Leviton 5361-CH, Hubbell 5235, P&S S3733-SS
5. Ground fault circuit interrupter (GFCI) receptacle 20A-125V; (Nema Configuration 5-20R, shall incorporate features which will lock-out or render the device incapable of being reset if ground fault protection is compromised, with "Feed through" connectors capable of protecting connected downstream receptacles on a single circuit, and of being installed in a 2-3/4" deep outlet box without adapter, Leviton 8899, P & S 2094.
6. Tamper resistant receptacles 20A-125V (Nema configuration 5-20R):
   Leviton 8300-SG, Hubbell HBL8300SG, P&S TR63-H.
7. Surge Protection Duplex Receptacles 20A-125V, (Nema 5-20R) Hospital grade to include LED light and audible alarm:
   Leviton 8380, Hubbell HBL 8362SA, P&S 8300SP
8. Equipment receptacles shall be coordinated with owner/manufacturer requirements and the correct and appropriate receptacle and cover plate shall be installed.

2.04 Floor boxes shall be cast iron as manufactured by Hubbell or equal by Wiremold and as indicated below:

A. Slab at grade (dual level, fully adjustable type 1).
   1. Single gang: #B-2436 w/#SB-3083 carpet flange.
   2. Two gang: #B-4233 w/#SB-3084 carpet flange.
   3. Three gang: #B-4333 w/#SB-3085 carpet flange.

B. Slab above grade (shallow, semi-adjustable, type II)
   1. Single gang: #B-2414 w/#SB-3083 carpet flange.
   2. Two gang: #B-4214 w/#SB-3084 carpet flange.
   3. Three gang: #B-4314 w/#SB-3085 carpet flange.

C. Cover plates shall have brass finish as follows:
   1. #S-3825 for duplex flap for duplex receptacles.
   2. #S-2425 for data/communications.

2.05 PVC floor boxes manufactured by Wiremold shall be as follows:

A. Provide #881 dual service PVC floor box with divider and 897CTC cover.

2.06 PLATES

A. Furnish and install plates on all outlet boxes. Oversize (Jumbo) plates are not acceptable.

B. Plates shall be 302/304 smooth stainless steel.

C. Provide Taymac Bell, Carlon or Leviton NEMA 3R weatherproof coverplates on all exterior wiring devices. Enclosure shall be suitable for wet locations when in use.

D. Plates shall be Leviton, Pass & Seymour or Hubbell 302/304 smooth stainless steel on all receptacles 30 amps and larger.

2.07 Fire rated poke through devices shall be as follows:

A. Flush fire rated poke through devices shall be Wiremold RC2001 Series (black) with pre-wired 20A, 125V duplex receptacle and (4) individual openings for telephone, signal or Category 5 data cables.

B. Poke through devices with above floor service fittings shall be Wiremold RC700 Series with (1) 20A, 125V duplex receptacle and telephone data cover plate.

PART 3 - EXECUTION

3.01 WIRING DEVICE MOUNTING HEIGHTS

A. Unless noted to the contrary on plans, or directed otherwise during the progress of the Work, wiring devices shall be set as follows:
1. Switches 42" above finished floor.
2. Wall mounted receptacles shall be installed vertically at 15 inches to the bottom outlet above finished floor unless otherwise noted or as required by local codes.
3. Wall telephone outlets shall be mounted 15 inches to the bottom above finished floor unless otherwise noted. Mount even with wall mounted receptacles.
4. At locations above counters, set devices at 6 inches above to the centerline counter tops, verify exact mounting height with the architect.

3.02 INSTALLATION (Refer to 16110/3.04 for outlet box specifications.)

A. Wall switches shall be set in a suitable steel box and shall be installed on the strike side of the door as finally hung, whether so indicated on the Drawings or not.

B. Receptacles shall be installed in a suitable steel box.

C. The Architect reserves the right to relocate wiring device up to a distance of 5 feet from the location shown, before rough-in, without additional cost.

D. Provide multi-gang device covers at locations where devices gang together.

E. Device locations are indicated schematically on the drawings along with the

type and mounting height. Final locations and mounting heights shall be coordinated with the Architect on the jobsite, and with shop drawings of equipment; including equipment to be furnished and installed by the Owner. Devices installed in walls covered with vinyl, fabric wallpaper or other special finishes shall be coordinated and verified with the Architect on the job-site.

F. Stranded wire termination to switches, receptacles, devices and miscellaneous control devices shall be with an approved solderless terminal if clamp type securing is not possible (i.e. Sta-Con crimp on fork tongue connectors; Burndy Type TP-F).

G. Provide keyed switches in all common areas not monitored by the faculty (i.e. gym, corridors, cafeteria, commons natatoriums).

END OF SECTION

SECTION 16412

SURGE PROTECTIVE DEVICE – HIGH INTERRUPTING (TVSS)

PART 1 GENERAL

1.01 SCOPE

A. Provide electrical and mechanical requirements for a modular high-energy surge protective device system (SPD). The system shall provide effective high energy surge current diversion and be suitable for application in ANSI/IEEE C62.41 Category A, B and C3 environments, as tested by ANSI/IEEE C62.11, C62.45.

B. The system shall be constructed using multiple surge current diversion modules utilizing metal oxide varistors (MOV) computer matched to +/- 1 volt variance and tested for manufacturer's defects. The modules shall be designed and constructed in a manner that ensures surge current sharing. Use of gas tubes, silicon avalanche diodes or selenium cells are unacceptable.

1.02 STANDARDS

A. The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:

Canadian Standards Association (CSA)
American National Standards Institute and
Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.11, C62.41, C62.45)
Federal Information Processing Standards Publication 94 (FIBS PUB 94)
National Electrical Manufacturer Association (NEMA LS-1 1992)
National Fire Protection Association (NFPA 20, 70, 75 and 780)
National Electric Code
Underwriters Laboratories (UL 1449 and UL 1283) (Second Edition)
International Electrotechnical Commission (IEC 801)
International Standards Organization (ISO) Company certified ISO 9001

for manufacturing, design and service
EMC Directive 89/336/EEC - CE compliant

B. The systems individual units shall be UL Listed and labeled under UL 1449 (Second Edition) Standard for Transient Voltage Surge Suppression and the surge ratings shall be permanently affixed to the SPD. The units shall also be listed and labeled to UL1283 Standard for Electromagnetic Interference Filters, and CSA Listed.

1.03 ACCEPTABLE MANUFACTURERS

A. Liebert Corporation

1.04 QUALITY ASSURANCE

A. The manufacturer shall be ISO 9001 certified. The specified system shall be tested at the component and fully assembled level, under surge conditions with AC power applied for a minimum of 1 hour. Testing shall include but not be limited to quality control checks, dielectric voltage withstand test per UL and CSA requirements, UL ground continuity tests and operational and calibration tests.

B. The unit shall be designed and manufactured in the USA by a qualified manufacturer of line conditioning equipment and Active Tracking Filters. The manufacturer shall have been engaged in the design and manufacture of such products for a minimum of 10 years.

PART 2 PRODUCTS

2.01 ENCLOSURE

A. The specified system shall be provided in a heavy duty NEMA 4 dust-tight, drip-tight enclosure with no ventilation openings. The cover of the enclosure shall be hinged on the left side and require a tool for access to internal components. A drawing pocket shall be provided inside the door for storage of unit drawings and installation/operation manual. All monitoring indication must be visible without opening the door. The enclosure maximum dimensions shall be (20) inches/(508) millimeters high, (16) inches/(406) millimeters wide and (8) inches/(203) millimeters deep.

2.02 OVERCURRENT PROTECTION (FUSING)

A. All suppression components shall be individually fused and rated to allow maximum specified surge current capacity. For every 100 k Amps of Surge Current Capacity, 120 amps RMS of internal, integral fusing shall be required. Devices that utilize a single fuse to protect two or more suppression paths are not accepted.

Individual surge components shall be sand packed and fused at a maximum of 17.2 amps to prevent violent failure. The fusing shall be UL listed to be capable of interrupting up to 200kA symmetrical fault current with 480VAC applied. Replaceable fusing is unacceptable. Over current protection that

limits specified surge currents is not acceptable.

2.03 DESIGN REQUIREMENTS

A. ProtectionModes
The SPD shall provide protection as follows: All modes, L-N or L-L, L-G and N-G (where applicable) Note: L = Line, G = Ground, N = Neutral

B. UL 1449 Ratings
The maximum UL 1449 listed surge ratings for each and/or all of the specified protection modes shall not exceed the following:

System voltage	Surge Voltage Rating			
L-N	L-G	N-G	L-L	
120/240 volts	330 volts	400 volts	400 volts	600
120/208 volts	330 volts	400 volts	400 volts	600
240	800 volts		800 volts	
277/480 volts	700 volts	800 volts	600 volts	1200
480	1200 volts		1500 volts	

C. Noise Attenuation
The unit shall be UL 1283 Listed as an electromagnetic interference filter. The filter shall provide 41dB at 100kHz, 31dB at 1MHz, 35dB at 10MHz, 53dB at 100MHz, per 50 Ohm Insertion Loss Methodology from MIL 220A. The system shall provide up to 120-dB insertion loss from 100 kHz to 100 MHz when used in a coordinated facility system.

D. Lifecycle Testing
The SPD system shall be duty life cycle tested to survive, 10kA (8x20µs), 20kV (1.2x50µs), IEEE C62.41 Category C surge current with less than 5% degradation of clamping voltage. The minimum numbers of surges the unit shall be able to protect against are:

Model Surge Rating	Number of Life Cycle Surges			
	Per Mode			*Per Phase*
	L-N	L-G	N-G	(L-N + L-G)
160kA per phase	12000	12000	12000	24000
320kA per phase	24000	24000	24000	48000

2.04 CONNECTIONS

A. The terminals shall be provided to accommodate wire sizes up to #1/0 AWG.

2.05 INTERNAL CONNECTIONS AND SERVICEABILITY

A. All surge current diversion module intra-unit connections shall be by way of low impedance copper plates. Surge current diversion modules shall use bolted connections to the plates for reliable, low impedance connections. The system shall be designed for simple change out of any or all SPD component modules by a qualified electrician. Designs that require factory service are not acceptable. All connections, conductors and terminals must be appropriately sized for specified surge current capacity.

2.06 STANDARD FEATURES

A. Component Testing and Monitoring
The monitoring circuitry must continually verify the protection status during operation, and display this information on the front cover status panel. The SPD must also contain a built-in-test circuit that will verify the integrity of all fuse links and each associated MOV. The built-in-test circuit must cycle through all phase banks and the neutral-ground bank sending test signals to all modules. The integrity of all fuses in test must be indicted on the status panel. All testing must be able to be performed without disconnecting power to the SPD. Units that require external test sets or equipment are unacceptable.

B. Unit Status Indicators:
Red and green solid state indicators with printed labels shall be provided on the hinged front cover to redundantly indicate on-line unit status. The absence of the green light and the presence of the red light shall reliably indicate that surge protection is reduced and service is needed to restore full operation.

C. Dry Contacts for remote monitoring:
Electrically isolated Form C dry contacts, one normally open and one normally closed set standard on all units for remote monitoring.

D. Under voltage detection:
Unit shall be equipped with 70% under voltage detection capability.

E. Phase Loss Monitoring:
Unit shall be equipped with phase loss monitoring.

F. Power Loss Monitoring:
Unit shall be equipped with power loss monitoring.

2.07 ENVIRONMENTAL REQUIREMENTS

A.	Storage Temperature:	-55 to +85 C (-67 to +187 F)
B.	Operating Temperature:	-40 to +60 C (-40 to 140 F)
C.	Relative Humidity:	0% to 95%
D.	Audible Noise:	less than 45 dBa at 5 feet (1.5 m).
E.	Operating Altitude:	0 to 18,000 feet above sea level.

2.08 WARRANTY

A. The manufacturer shall provide a full five year parts and labor warranty from date of shipment against any part failure when installed in compliance with manufacturer's written instructions, UL Listing requirements and any applicable national, state or local electrical codes. Direct, factory trained, ISO 9001 certified employees must be available for 48 hour assessment. A 24 hour 800 number must be available to support warranty.

PART 3 EXECUTION

3.01 INSTALLATION

A. The contractor shall install the parallel SPD with short and straight conductors as practically possible. Locate adjacent to the switchboard or panel it is serving. The contractor shall twist the SPD input conductors together to reduce input conductor inductance. The contractor shall follow the SPD manufacturer's recommended installation practices as found in the installation, operation and maintenance manual and comply with all applicable codes.

END OF SECTION

SECTION 16413

SURGE PROTECTIVE DEVICE – STANDARD INTERUPTING (TVSS)

PART 1 GENERAL

1.01 SCOPE

A. Specify the electrical and mechanical requirements for a modular high-energy surge protective device system (SPD). The specified system shall provide effective high energy surge current diversion and be suitable for application in ANSI/IEEE C62.41 Category A, B and C3 environments, as tested by ANSI/IEEE C62.11, C62.45.

B. The system shall be constructed using multiple surge current diversion modules utilizing metal oxide varistors (MOV) computer matched to +/- 1 volt variance and tested for manufacturer's defects. The modules shall be designed and constructed in a manner that ensures surge current sharing. Use of gas tubes, silicon avalanche diodes or selenium cells are unacceptable.

1.02 STANDARDS

A. The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:

Canadian Standards Association (CSA)
American National Standards Institute and
Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.11,

C62.41, C62.45)
Federal Information Processing Standards Publication 94 (FIBS PUB 94)
National Electrical Manufacturer Association (NEMA LS-1 1992)
National Fire Protection Association (NFPA 20, 70, 75 and 780)
National Electric Code
Underwriters Laboratories (UL 1449 and UL 1283) (Second Edition)
International Electrotechnical Commission (IEC 801)
International Standards Organization (ISO) Company certified ISO 9001 for manufacturing, design and service
EMC Directive 89/336/EEC - CE compliant

B. The systems individual units shall be UL Listed and labeled under UL 1449 (Second Edition) Standard for Transient Voltage Surge Suppression and the surge ratings shall be permanently affixed to the SPD. The units shall also be listed and labeled to UL1283 Standard for Electromagnetic Interference Filters, and CSA Listed.

1.03 ACCEPTABLE MANUFACTURERS

A. Liebert Corporation

1.04 QUALITY ASSURANCE

A. The manufacturer shall be ISO 9001 certified. The specified system shall be tested at the component and fully assembled level, under surge conditions with AC power applied for a minimum of 1 hour. Testing shall include but not be limited to quality control checks, dielectric voltage withstand test per UL and CSA requirements, UL ground continuity tests and operational and calibration tests.

B. The unit shall be designed and manufactured in the USA by a qualified manufacturer of line conditioning equipment and Active Tracking Filters. The manufacturer shall have been engaged in the design and manufacture of such products for a minimum of 10 years.

PART 2 PRODUCTS

2.01 ENCLOSURE

A. The specified system shall be provided in a heavy duty NEMA 4 dust-tight, drip-tight enclosure with no ventilation openings.

2.02 OVERCURRENT PROTECTION (FUSING)

A. All components, including suppression, filtering, and monitoring components, shall be individually fused and rated to allow maximum specified surge current capacity. For every 100 K amps of Surge Current Capacity, 120 amps RMS of internal, integral fusing shall be required.

B. Individual surge components shall be sand packed and fused at a maximum of 7 1/2 amps to prevent violent failure. The fusing shall be UL listed to be capable of interrupting up to 300 kA symmetrical fault current with 600VAC

applied. Replaceable fusing is unacceptable. Overcurrent protection that limits specified surge currents is not acceptable.

2.03 DESIGN REQUIREMENTS

A. Protection Modes
The SPD shall provide protection as follows: All modes, L-N or L-L, L-G and N-G (where applicable) Note: L = Line, G = Ground, N = Neutral

B. UL 1449 Ratings

The maximum UL 1449 listed surge ratings for each and/or all of the specified protection modes shall not exceed the following in any mode of protection:

System voltage	Surge Voltage Rating
120/208 or 120/240 volt	400 volts
208, 240, 277, 230/400, or 277/480 volt	800 volts
347, or 347/600 volt	1200 volts
480 volt	1500 volts
600 volt	2000 volts

C. Noise Attenuation
The unit shall be UL 1283 Listed as an electromagnetic interference filter. The filter shall provide insertion loss with a maximum of 60 dB from 100 KHz to 100 MHz per 50 Ohm Insertion Loss Methodology from MIL 220A. The system shall provide up to 120 dB insertion loss from 100 KHz to 100 MHz when used in a coordinated facility system.

D. Life Cycle Testing
The SPD system shall be duty life cycle tested to survive 3,000 20kV, 10kA Surges, per IEEE C62.41 Category C3 surge current with less than 5% degradation of clamping voltage.

2.04 CONNECTIONS

A. The terminals shall be provided to accommodate wire sizes up to #10 AWG.

2.05 ACCESSORIES

A. Unit Status Indicators:
Red and green solid state indicators with printed labels shall be provided on the front cover to redundantly indicate on-line unit status. The absence of the green light and the presence of the red light shall reliably indicate that surge protection is reduced and service is needed to restore full operation.

B. Dry Contacts for remote monitoring:
Electrically isolated Form C dry contacts, one normally open and one normally closed set standard on all units for remote monitoring.

C. Under voltage detection:
Unit shall be equipped with 70% under voltage detection capability.

D. Phase Loss Monitoring:
Unit shall be equipped with phase loss monitoring.

E. Power Loss Monitoring:
Unit shall be equipped with power loss monitoring.

2.06 TESTING

A. Component Testing and Monitoring
Unit shall include an on-line circuit which tests and redundantly monitors individual components in all protection modes including neutral to ground (where applicable). Units that require external test sets or equipment are unacceptable.

2.07 ENVIRONMENTAL REQUIREMENTS

A. Storage Temperature: -55 to +85 C (-67 to +187 F)
B. Operating Temperature: -40 to +60 C (-40 to 140 F)
C. Relative Humidity: 0% to 95%
D. Audible Noise: less than 45 dBa at 5 feet (1.5 m).
E. Operating Altitude: 0 to 18,000 feet above sea level.

2.08 WARRANTY

A. The manufacturer shall provide a full five year parts and labor warranty from date of shipment against any part failure when installed in compliance with manufacturer's written instructions, UL Listing requirements and any applicable national, state or local electrical codes. Direct, factory trained, ISO 9001 certified employees must be available for 48 hour assessment. A 24 hour 800 number must be available to support warranty.

PART 3 EXECUTION

3.01 INSTALLATION

A. Specify the installing contractor shall install the parallel SPD with short and straight conductors as practically possible. Locate adjacent to the switchboard or panel it is serving. The contractor shall twist the SPD input conductors together to reduce input conductor inductance. The contractor shall follow the SPD manufacturer's recommended installation practices as found in the installation, operation and maintenance manual and comply with all applicable codes.

END OF SECTION

SECTION 16420

ELECTRICAL SERVICE ENTRANCE

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.02 SCOPE

A. INCLUDED: Power Supply through main disconnect.

B. RELATED WORK:
1. Basic Electrical Materials and Methods.
2. Earthwork Section.

1.03 PERMITS, CODES, LAWS AND ORDINANCES

A. NFPA-70, NESC, State and local.

1.04 MINIMUM COMPLIANCE STANDARDS

PART 2 - PRODUCTS

2.01 ELECTRICAL SERVICE

A. POWER SOURCE: Center Point Energy.

B. SOURCE VOLTAGE: 208Y/120 volt, three phase, four wire system.

2.02 CABLE TERMINAL BOX

A. Size as necessary.

2.03 METER PROVISIONS

A. As required.

PART 3 - EXECUTION

3.01 SYSTEM ARRANGEMENT

A. Underground service to main switchgear.

3.02 COORDINATION

A. Confirm with CenterPoint Energy exact locations of service entry.

3.03 INSTALLATION

A. Provide conduit and wire as required.

END OF SECTION

SECTION 16450

GROUNDING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.02 SCOPE

A. WORK COMBINED WITH OTHER SECTIONS: Combine the work specified herein with the following Sections to form a single responsibility for the Work:

1. Electrical.
2. Basic materials and methods.

B. Provide electrical service, equipment and wiring device grounding as shown, scheduled and as specified.

C. The types of grounding include, but not limited to, the grounding bonding of all equipment devices, building steel piping, and as required by the National Electrical Code, Local Inspection Department and Power Company.

1.03 STANDARDS

A. NATIONAL ELECTRICAL CODE (NFPA-70)

B. Local municipal and State codes that have jurisdiction.

C. NECA

1.04 ACCEPTABLE MANUFACTURES

A. Provide grounding products manufactured by Copperweld and Cadweld.

1.05 SUBMITTALS

A. Shop drawings shall include, but not limited to the following:

1. Cut sheets of ground rods, clamps and connectors.
2. Grounding system diagram.

PART 2 - PRODUCTS

A. GENERAL: Provide all materials required to construct a complete grounded electrical system.

B. GROUND RODS: Ground rods shall be 3/4" inch diameter by 10 feet long

construction with copper jacket and a steel core.

C. CLAMPS: Ground clamps shall be copper except for steel or iron pipes in which the clamps shall be galvanized iron.

D. CONDUCTORS: Conductors shall be connected by means of an approved pressure connector or clamp.

PART 3 - EXECUTION

3.01 INSTALLATION

A. GENERAL: Install grounding system as shown and specified to ensure a properly grounded system.

B. SERVICE ENTRANCE GROUNDING SYSTEM: Provide a main bonding jumper between the neutral and ground bus of each switchboard. Route a separate grounding electrode conductor in conduit from each main distribution panel to the ground rod grid, incoming cold water piping system, and to the "lightning protection system" (250 - 106 of NEC) under ground bonding loop. Provide a bonding jumper around water meter. The grounding electrode conductor shall be stranded copper, 98% conductivity and shall be run continuous without splices or joints and installed at least 12" below grade.

C. BUILDING STEEL AND PIPING SYSTEM: Install a bonding jumper between building steel and metallic piping systems to bond them to the electrical grounding system.

D. NEUTRAL: The neutral shall be grounded only at the service entrance and other separately derived systems. The neutral shall be kept separate from the grounding system and shall not be used as a ground.

E. GROUNDING SEPARATELY DERIVED ALTERNATING CURRENT SYSTEM

1. STANDBY EMERGENCY GENERATOR: The generator neutral shall be bonded to the generator when a 4 pole switched neutral automatic transfer switch is specified.

F. GROUNDING CONDUCTOR: A grounding conductor and metallic conduit system shall bond all equipment served by the electrical system. Provide a flexible bonding jumper for isolated metallic piping and ductwork and around expansion fittings and joints.

G. CONDUIT GROUNDING BUSHING:

Conduit terminating in equipment that has a ground bus such as switchboards, panelboards, etc., shall have grounding bushings installed. Ground each conduit by means of a grounding bushing and to the ground bus in the equipment.

H. MOTORS: The frame of all motors shall be grounded.

I. SPECIAL GROUNDING: Provide a #6 AWG copper grounding conductor for each telephone board, television system, etc. Terminate the grounding conductor on ground bus and to the building electrical grounding system. Refer to 800-40(d) and 820-40(d) of the NEC.

J. REMOTE PANELBOARDS: Provide a grounding electrode conductor all remote panels as required by the NEC.

K. LIGHTING FIXTURES: Flexible fixture whips containing a green grounding conductor shall be used to connect light fixtures. Flexible fixture whips shall not exceed ten feet.

L. RECEPTACLES: All receptacles shall be grounded using the branch circuit grounding conductor. Receptacles shall use an approved grounding yoke.

3.02 TESTING: Perform a ground resistance test using a biddle analog or digital portable earth/ground resistance tester. The system resistance shall not exceed 5 OHMS. Provide additional electrodes as required (refer to 250-84 of the NEC or the most current edition 250-56). Test shall not be conducted following wet weather. Provide personal instruments to conduct these tests and submit certified test for review. Test shall be verified by Engineer.

END OF SECTION

SECTION 16470

PANELBOARDS

PART 1 - GENERAL

1.01 SCOPE

A. Provide panel boards as shown, scheduled and as specified herein.

B. The types of panelboards include:

1. Lighting and appliance panelboards.
2. Power distribution panelboards.

1.02 STANDARDS

A. Products shall be designed, manufactured, tested and installed in compliance with applicable standards.

B. Products shall conform to all applicable UL standards and shall be UL-labeled.

1.03 ACCEPTABLE MANUFACTURERS

A. Provide one of the following manufacturers:

1. General Electric Company
2. Square D Company
3. Siemens

1.04 SUBMITTALS

A. Shop drawings shall include, but not be limited to:

1. Cutsheets of all enclosures, circuit breakers, fusible switches, bussing, rating, schedules and all accessories clearly labeled.

1.05 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:

1. National Electrical Code.
2. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.01 MATERIALS AND COMPONENTS

A. General

Furnish and install power distribution, lighting and appliance panelboards as indicated in the panelboard schedule and as shown on the plans. Power distribution panelboards shall be equipped with fusible switches or circuit breakers as shown on the schedule. Panelboards shall be equipped with thermal-magnetic, molded case circuit breakers of frame and trip ratings as shown on the schedule.

B. Busing Assembly and Temperature Rise

Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed 50ºC. rise above 40ºC ambient. Heat rise test shall be conducted in accordance with Underwriters Laboratories Standard UL 67. The use of conductor dimensions will not be accepted in lieu of actual heat tests. All current carrying parts of the bus shall be tin or silver plated copper.

1. Bus structure shall be insulated. Bus bar connections to the branch circuit breakers shall be distributed phase or phase sequence type and shall accept bolt-on circuit breakers for lighting and appliance panelboards.

Provide a bare uninsulated and/or insulated ground bus and full size neutral bus as required and indicated in each panelboard enclosure.

C. Distribution Panelboards

1. Circuit breakers shall be equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers

shall be flush with each other. Large, permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking a position between “ON” and “OFF”. Provisions for additional breakers shall be such that no additional connectors will be required to add breakers. Circuit breakers shall be of the frame size, trip setting and interrupting capacity as indicated on the drawings.

Current limiting circuit breakers shall be equal to Square D Company “I-Limiter” Series.

Circuit breakers shall be conventional interrupting capacity but in no case be less than the following symmetrical amperes RMS.

FRAME SIZE/ VOLTAGE	CONVENTIONAL INTERRUPTING CAPACITY	HIGH INTERRUPTING CAPACITY	CURRENT LIMITING
100AF/240V	10,000 AIC	65,000 AIC	200,000 AIC
225AF/240V	10,000 AIC	65,000 AIC	200,000 AIC
400AF/240V	42,000 AIC	65,000 AIC	200,000 AIC
600AF/240V	42,000 AIC	65,000 AIC	200,000 AIC
800AF/240V	42,000 AIC	65,000 AIC	200,000 AIC
1000AF/240V	42,000 AIC	65,000 AIC	200,000 AIC
1200AF/240V	42,000 AIC	65,000 AIC	200,000 AIC
100AF/480V	14,000 AIC	25,000 AIC	200,000 AIC
225AF/480V	22,000 AIC	65,000 AIC	200,000 AIC
400AF/480V	30,000 AIC	35,000 AIC	200,000 AIC
600AF/480V	30,000 AIC	65,000 AIC	200,000 AIC
800AF/480V	30,000 AIC	65,000 AIC	200,000 AIC
1000AF/480V	30,000 AIC	65,000 AIC	200,000 AIC
1200AF/480V	50,000 AIC	65,000 AIC	200,000 AIC

D. 240 Volt Lighting and Appliance Panelboard

Main breakers shall be vertically mounted. Horizontally mounted main breakers are not acceptable.

Circuit breakers shall be bolt-on thermal-magnetic, molded case circuit breakers. Breakers shall be 1, 2, or 3 pole with an integral crossbar to assure simultaneous opening of all poles in multiple circuit breakers. Breakers shall have an overcenter, trip-free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication. Handles shall have "ON", "OFF" and "TRIPPED" positions.

Circuit breakers shall be UL listed in accordance with UL standard 489 and shall be rated 240 volts ac maximum with continuous current rating as noted on the plans.

Branch circuit breakers feeding convenience outlets shall have sensitive instantaneous trip settings of not more than 10 times the trip settings of the

breaker to prevent repeated arcing short resulting from frayed appliance cords. Single pole 15 and 20 ampere circuit breakers shall be UL listed as "Switching Breakers" at 120V ac and carry the SWD marking.

UL Class A ground fault circuit protection shall be provided on all receptacle circuits serving wet areas and on all 120V ac branch circuits as specified on the plans or panelboard schedule. This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for branch circuit wiring. Tripping of a branch circuit breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. A single pole circuit breaker with integral ground fault circuit interruption shall require no more panelboard branch circuit space than a conventional circuit breaker. Circuit breakers shall be rated 10,000 AIC at 240V unless otherwise noted on plans.

Provide double sized neutral bus with panels served from a non-linear transformer or when indicated on drawings. This shall be a UL approved assembly.

E. Cabinets and Fronts

The panelboard bus assembly shall be enclosed in a steel cabinet with multiple knockouts. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. Wiring gutter space shall be in accordance with UL Standard 67 for panelboards. The box shall be fabricated from galvanized steel or equivalent rust resistant steel. Provide stainless steel front cover for all panels located in all Pool Equipment rooms, Food Labs, Snack Bars, Culinary Arts, Kitchens and Life Skills rooms. All NEMA-1 lighting and receptacle panels shall have hinged front covers. The front cover shall have a door with hinges, latch and a lock. The hinged front covers shall allow full access to the circuit breaker gutter area without having to remove the entire front cover. All panelboard lock shall be keyed alike. Circuit breaker and fusible distribution panels shall have four-piece trims. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. Provide NEMA 1 enclosure where installed indoors unless otherwise noted. Provide NEMA 3R enclosure where installed outside or in a sprinkled area.

F. Safety Barrier

The distribution panelboard interior assembly shall be dead front with panelboard front removed. Main lugs or main breakers shall have barriers on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall have barriers.

G. Integrated Equipment Short Circuit Rating

Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. This rating shall be established by testing with the over-current devices mounted in the panelboard. The short circuit tests on the over-current devices and on the panelboard structure

shall be made simultaneously by connecting the fault to each over-current device with the panelboard connected to its rated voltage source. Method of testing shall be per Underwriters Laboratories Standard UL 67. The source shall be capable of supplying the specified panelboard short circuit current or greater. Testing of panelboard over-current devices for short circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure alone is not acceptable. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install panelboards, including electrical connections, in accordance with manufacturers' written instructions, NEC and recognized industry practices.

B. Housekeeping Pads: Mount floor mounted panelboards on 4 inch high concrete housekeeping pads.

C. Fuses: Install fuses of the rating and class as shown in each fusible distribution panel scheduled on drawings.

D. Conduits: Stub up three one inch conduits to an accessible location above the ceiling for each recessed panelboard.

3.02 IDENTIFICATION

A. Nameplate: Each panelboard shall have an engraved bakelite nameplate. Nameplates shall be white with black letters and show panel designation. Nameplates shall be attached with stainless steel screws.

B. Directory Card: Place a neat, carefully typewritten directory card identifying the load served by each branch circuit in the frame on the panel door, under a clear plastic cover. Spares and spaces shall be written with erasable pencil for future use.

C. Replacement Components: Where circuit breakers or fuses are applied in compliance with the series combination ratings marked on the equipment by the manufacturers, the equipment enclosure(s) shall be legibly marked in the field to indicate the equipment has been applied with a series combination rating. The marking shall be readily visible and state "caution - Series Rated System." (NEC 110-22). Nameplate shall also identify replacement components.

END OF SECTION

SECTION 16475A

CLASS J FUSES

PART 1 - GENERAL

1.01 SCOPE

A. Provide fuses as shown and scheduled and indicate by this specification section and other specifications sections.

B. The type of fuses include:

1. 250 volt current limiting.

1.02 STANDARDS

A. ANSI

B. UL

1.03 ACCEPTABLE MANUFACTURERS

Provide fuses manufactured by Bussman manufacturing.

1.04 SUBMITTALS

A. Shop drawings shall include, but not be limited to:

1. Cut sheets of all fuses showing ratings and fuse curves.

1.05 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:

1. National Electrical Code.
2. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.01 CURRENT - LIMITING FUSES

A. General: Provide 200,000 amp interrupting capacity current limiting fuses of the ampacity and voltage indicated and scheduled.

B. Mains, Feeders and Branch Circuits

1. Circuits 601 to 6000 ampere shall be protected by current limiting BUSSMAN HI-CAP Time Delay Fuses KRP-C. Fuses shall employ "O" ring as positive seals between the end bells and the glass melamine fuse barrel. The terminals shall be peened. Fuses shall be time-delay and must hold 500% of rated current for a minimum of 4 seconds, clear 20 times rated current in .1 seconds or less and be listed by Underwriters' Laboratories Inc., with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class L.
2. Circuits 0 to 600 ampere shall be protected by current limiting BUSSMAN LOW-PEAK Dual Element Fuses LPJ. All dual-element fuses shall have separate overload and short-circuit elements. Fuse

shall incorporate a spring activated thermal overload element having a 284 degree Fahrenheit melting point alloy and shall be independent of the short-circuited clearing chamber. The fuse must hold 500% of rated current for a minimum of 10 seconds and listed by Underwriters' Laboratories Inc., with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class J.

3. Motor Circuits - All individual motor circuits rated 600 amperes or less shall be protected by BUSSMAN LOW-PEAK LPJ. The fuses for 1.15 service factor motors shall be installed in ratings approximately 125% of motor full current except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to full speed quickly, such as large fans. Under such conditions the fuse should be 150% to 200% of the motor full load current. Larger H.P. Motor shall be protected by BUSSMAN Type KRP-C HI-CAP Time-Delay Fuses of the rating shown on the drawings. 1.0 service factor motors shall be protected by BUSSMAN LOW-PEAK Dual-Element Fuses LPJ installed in ratings approximately 115% of the motor full load current except as noted above. The fuses shall be UL Class LPJ or L. Circuit breaker panels shall be protected by BUSSMAN LOW-PEAK Dual-Element LPJ as shown on the drawings. The fuses shall be UL Class J.

2.02 SPARES

Upon completion of the building the contractor shall provide the owner with spare fuses as shown below.

A. 10% (minimum of 3) of each type and rating of installed fuses shall be supplied as spares.

B. BUSSMAN spare fuse cabinets - Catalog No. SFC - shall be provided to store the above spares.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Fuses: Fuses shall not be installed until equipment is ready to be energized. This measure prevents fuse damage during shipment of the equipment from the manufacturer to the job-site or from installation. All fuses shall be furnished and installed by the electrical contractor. All fuses shall be of the same manufacturer.

B. All fuses shall be installed in fuse holders.

END OF SECTION

SECTION 16482

MOTOR STARTERS

PART 1 - GENERAL

1.01 SCOPE

A. Provide motor starters as shown, scheduled and as specified herein.

B. The types of motor starters include:
   1. Individual motor starters.
   2. Combination motor starters.
   3. Manual motor starters.

C. All integral motor starters for equipment furnished under Division 15 shall be installed under Division 16 requirements unless noted otherwise on the plans.

1.02 STANDARDS

A. Products shall be designed, manufactured, tested and installed in compliance with applicable standards.

B. Products shall conform to all applicable UL standards and shall be UL-labeled.

1.03 ACCEPTABLE MANUFACTURERS

A. Provide one of the following manufacturers:
   1. General Electric Company
   2. Square D Company
   3. Siemens

1.04 SUBMITTALS

A. Shop drawings shall include, but not be limited to:
   1. Cutsheets of all enclosures, circuit breakers, fusible and non-fusible switches, overloads, ratings, schedules and all accessories clearly labeled.

1.05 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:
   1. National Electrical Code.
   2. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.01 MOTOR STARTERS

A. GENERAL: Motor starters shall be Square D Company Class 8536 across-the-line magnetic type, full-voltage, non-reversing (FVNR) starter. Provide FVNR speed, single winding starter where indicated. Provide FVNR two speed, single winding or two speed, two winding starters where indicated. Provide Square D Class 8736 "FVR" with selector switch for motors being served by a variable speed drive. All starters shall be constructed and tested in accordance with the latest NEMA standards, sizes and horsepower. IEC sizes are not acceptable. Starters shall be mounted in a

general purpose dead front, painted steel enclosure and surface-mounted. Provide size and number of poles as shown and required by equipment served.

B. CONTACTS: Magnetic starters contacts shall be double break solid silver alloy.

All contacts shall be replaceable without removing power wiring or removing starter from panel. The starter shall have straight-through wiring.

C. OPERATING COILS: Operating coils shall be 120 volts and shall be of molded construction. When the coil fails, the starter shall open and shall not lock in the closed position.

D. OVERLOAD RELAYS: Provide manual reset, trip-free Class 20 overload relays in each phase conductor in of all starters. Overload relays shall be melting alloy type with visual trip indication. All 3 phase and single phase starters shall have one overload relay in each underground conductor. Relay shall not be field adjustable from manual to automatic reset.

E. PILOT LIGHTS: Provide a red “on” running pilot light and green “off” pilot light for all motor starters. Provide fast and slow pilot lights for two speed starters. Pilot lights shall be mounted in the starter enclosure cover and shall be “L.E.D.”. Pilot lights shall be operated from an interlock on the motor starter and shall not be wired across the operating coil.

F. CONTROLS: Provide starters with HAND-OFF-AUTOMATIC switches. Coordinate additional motor starter controls with the requirements of Division 15. Motor starter controls shall be mounted in the starter enclosure cover.

G. CONTROL POWER TRANSFORMER: Provide a single-phase 480 volt control power transformer with each starter for 120 volt control power. Connect the primary side to the line side of the motor starter. The primary side shall be protected by a fuse for each conductor. The secondary side shall have one leg fused and one leg grounded. Arrange transformer terminals so that wiring to terminals will not be located above the transformer.

H. AUXILIARY CONTACTS: Each starter shall have one normally open and one normally closed convertible auxiliary contact in addition to the number of contacts required for the "holding interlock", remote monitoring, and control wiring. In addition, it shall be possible to field-install three more additional auxiliary contacts without removing existing wiring or removing the starter from its enclosure.

I. UNIT WIRING: Unit shall be completely pre-wired to terminals to eliminate any interior field wiring except for line and load power wiring and HVAC control wiring.

J. ENCLOSURES: All motor starter enclosures shall be NEMA 1, general purpose enclosures or NEMA-3R if mounted outside. Provide NEMA 4X stainless steel or in mounted next to cooling towers.

K. Power Monitor: Provide a Square "D" RM3TAR114TS7 or approved equal phase failure and under-voltage relay, base and wiring required for starters serving motors 5 horse power and larger. Set the under-voltage setting according to minimum voltage required for the motor to operate within its range.

2.02 COMBINATION MOTOR STARTERS

A. GENERAL: Combination motor starters shall consist of a magnetic starter and a fusible or non-fusible disconnect switch in a dead front, painted steel NEMA 1 enclosure unless otherwise noted and shall be surface-mounted. Size and number of poles shall as shown and required by equipment served. Combination motor starters shall be as specified for motor starters in Paragraph 2.01/A, except as modified herein.

B. DISCONNECT SWITCH: Disconnect switches shall be as specified in Section 16490.

2.03 MANUAL MOTOR STARTERS

A. GENERAL: Manual starters shall consist of a manually operated toggle switch equipped with melting alloy type thermal overload relay. Thermal unit shall be of one-piece construction and interchangeable. Starter shall be inoperative if thermal unit is removed. Contacts shall be double break, silver alloy, visible from both sides of starter. Manual starters shall be Square D class 2510 or 2512 or approved equal. Provide the size and number of poles shall be as shown and required by equipment served. Furnish red pilot light as indicated.

B. ENCLOSURES: All manual motor starter enclosures shall be NEMA 1, general purpose enclosures, or NEMA-3R if mounted exposed to high moisture conditions. Provide NEMA-4X when mounted next to cooling tower.

PART 3 - EXECUTION

3.01 INSTALLATION OF MOTORS

A. GENERAL: Mount electric motors which are not factory installed.

B. MOTOR CONNECTIONS: Provide electrical and grounding connections to motors as indicated. Connections as follows:

1. Not less than 18 inch length of Sealtite, extending from motor connection box to motor branch circuit conduit on outdoor and wet locations. Provide Greenfield for inside dry locations.
2. Install connections mechanically secure, assuring electrical continuity, proper and effective grounding.

3.02 INSTALLATION OF MOTOR STARTERS

A. GENERAL: Install motor starters in accordance with the manufacturer's written instructions, the applicable requirements of the NEC and the NECA's "Standard of Installation", and recognized industry practices to ensure that products serve the intended function.

B. OVERLOADS: Install overload heaters in each motor starter. Heater ratings shall be based on actual motor nameplate full load amps.

C. COORDINATION: Motor starters shall be provided to properly coordinate with motors as furnished by Division 15. Motor starter controls shall be provided to properly coordinate with controls specified in Division 15.

D. SUPPORTS: Motor starter enclosures shall be installed on galvanized unistrut or other supports where mounting on wall and shall not be supported by conduit alone. When enclosures are unit mounted on equipment served, the switch shall not inhibit the removal of any service panels or interfere with any required access areas.

3.03 TESTING

A. GENERAL: Check motor starters for continuity of circuits, for short circuits and demonstrate that it is functioning properly with HVAC controls.

B. MOTOR-STARTER COORDINATION DOCUMENTATIONS: Provide motor-starter coordination documents including, but not limited to, the following information in the operation and maintenance manuals.
1. Motor size in horsepower
2. Motor full load amp
3. Motor efficiency
4. Service factor
5. Size and manufacturer catalog number of starter and thermal overloads.

END OF SECTION

SECTION 16490

SAFETY AND DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 SCOPE

A. Provide safety and disconnect switches as shown, scheduled and as specified herein.

1.02 STANDARDS

A. Products shall be designed, manufactured, tested and installed in compliance with applicable standards.
1. NEMA KS1 - Enclosed switches
2. Federal specification W-S-865C-Heavy duty switches

B. Products shall conform all applicable UL standards, including UL98 (standard for safety, enclosed and dead front switches) and shall be UL-labeled.

1.03 ACCEPTABLE MANUFACTURERS

A. Provide one of the following manufacturers:
   1. General Electric Company
   2. Square D Company
   3. Siemens

1.04 SUBMITTALS

A. Shop drawings shall include, but not be limited to:
   1. Cutsheets of switches with ratings, physical dimensions and all accessories clearly labeled.

1.05 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:
   1. National Electrical Code.
   2. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.01 GENERAL

A. Furnish and install heavy duty type safety switches with the number of switched poles as indicated on the plans and specifications. All safety switches shall be NEMA Heavy Duty Type HD, and Underwriters Laboratories listed.

2.02 MATERIALS AND COMPONENTS

A. Switch Interior

All switches shall have switch blades that are fully visible in the "OFF" position when the door is open. Switches shall have removable arc suppressor where necessary, to permit easy access to line side lugs. Lugs shall be front removable and UL listed for 60ºC and 75ºC copper or aluminum cables. All switches blades and contacts shall be plated copper. Adjust fuse block to accept Class J fuses.

B. Switch Mechanism

Switches shall have a quick-make and quick-break operating handle and mechanism, which shall be an integral part of the box, not the cover. Padlocking provisions shall be provided for locking in the "OFF" position with at least three padlocks. Switches shall have a dual cover interlock to prevent unauthorized opening of the switch door when the handle is in the "ON" position, and to prevent closing of the switch mechanism with the door open. A means shall be provided to permit authorized personnel to release the interlock for inspection purposes. Handle position shall indicate if switch is "ON" or "OFF".

C. Neutral

Provide a solid neutral with the safety switch where a neutral is present in the circuit.

D. Ratings

Switches shall be horsepower rated for ac and/or dc as indicated by the plans. The fused switches shall have Class R rejection fuse clips. UL listed short circuit ratings of the switches, when equipped with Class R fuses, shall be 200,000 symmetrical amperes.

E. Enclosures

1. Indoor switches shall be furnished in NEMA 1 enclosures.
2. Outdoor switches, switches located in wet areas or sprinkled areas shall be furnished in NEMA 3R enclosures.
3. Switches installed in wet areas such as cooling tower areas shall be NEMA 4X stainless steel or fiberglass reinforced polyester.
4. Switches installed in kitchens shall be stainless steel.
5. Switches installed in areas of a corrosive nature and subjected to salt air shall be NEMA 4X stainless steel or fiberglass reinforced polyester.

F. Service Entrance

Switch shall be suitable for use as service entrance equipment when installed in accordance with the National Electrical Code.

PART 3 - EXECUTION

3.01 GENERAL

A. Install safety and disconnect switches, including electrical connections, and fuses in accordance with manufacturer's written instructions, NEC and recognized industry practices.

B. Location: Install switches within sight of controllers.

C. Hubs: Provide bolt-on hubs for rainproof or wet area applications.

3.02 IDENTIFICATION

A. Nameplate: Each disconnect switch shall have an engraved bakelite nameplate. Nameplates shall be white with black letters and show equipment served. Nameplates shall be attached with stainless steel screws.

END OF SECTION

SECTION 16510

LIGHTING FIXTURES

PART 1 - GENERAL

1.01 SCOPE

A. Furnish and install general and emergency lighting fixtures as noted on the drawings. Fixtures shall be completely wired with lamps installed and shall be in perfect operating condition at the time of substantial completion.

B. The types of lighting fixtures required for this project include:
   1. Fluorescent
   2. Incandescent and
   3. High-Intensity-Discharge (HID)

1.02 STANDARDS

A. All fixtures shall conform to all applicable UL standards and shall be UL label including damp and wet location ratings.

B. All fluorescent ballast shall comply with certified ballast manufacture (CBM) standard and CBM labeled.

C. NFPA 101

D. ANSI C82.1

E. NEMA-LE

F. IEEE Publication 587 Category "A" (Electronic Ballast)

1.03 ACCEPTABLE MANUFACTURERS

A. Provide lighting fixtures produced by manufacturers as shown and scheduled.

B. BALLAST:
   1. Provide one of the following manufacturers
      a. Advance Transformer Company
      b. Universal Lighting Technologies
      c. Osram Sylvania

C. LAMPS:
   1. Provide one of the following manufacturers
      a. General Electric Company
      b. Osram Sylvania
      c. North American Philips

1.04 SUBMITTALS

A. Shop drawings shall include a brochure with a separate cut sheet for each fixture type arranged in alphabetical order with fixture and all accessories/options clearly labeled. Provide performance data for each fixture. Provide an independent test lab report for each fixture if requested by the Architect/Engineer.

B. Provide ballast and lamp data brochures indicating which lamp and ballast (if required) will be used in each fixture type.

C. Furnish air handling and heat removal data for light fixtures specified with these requirements.

1.05 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:
1. National Electrical Code.
2. Local, municipal, or state codes that have jurisdiction.
3. UL fire resistance directory.

PART 2 - PRODUCTS

2.01 MATERIALS AND COMPONENTS

A. General:

Provide the size, type and rating of each light fixture shown and scheduled. All light fixtures shall complete with reflectors, lens, trim rings, flanges, lamps, lamp holders, ballast, starters, fuses, wiring, earthquake clips, etc. to provide a complete functioning light fixture.

B. Lighting Fixture Types:
1. Fluorescent Fixtures
a. Fixture ballast and lamp holders shall be pre-wired and installed. Fixture shall be equipped with a top access plate with knockouts for conduit entry. Fixture shall also include knockouts at each end plate for conduit entry.
b. Provide disconnect switch as required by the 2008 National Electrical Code.
c. Fixtures shall be cold roll steel finished using a multistage iron phosphate pretreatment to ensure maximum bonding and rust inhibitor. Finish shall be a lighting grade, baked white enamel finish with a minimum reflectance of 85%.
d. Door frame shall be heavy gauge flush white steel or aluminum and hinged from one side and use a positive spring action latch on the other side for latching.
e. Any lamp shall be easily replaced without removing another lamp.
f. Fixtures installed in continuous rows shall utilize nipples or other accessories such as snap together plug in connectors supplied by the fixture manufacturer.
g. Provide battery ballast for emergency light fixtures.
2. Incandescent Fixtures
a. Fixtures shall be pre-wired equipped with frame in kit and an integral thermal protection required by UL for recessed fixtures.
b. Provide appropriate trim rings for recessed mounted fixtures compatible with the ceiling in which the fixture is installed.
c. All lamps shall be inside frosted unless otherwise noted or

scheduled.

3. High Intensity Discharge Fixtures (HID)
   a. Fixtures shall be pre-wired with frame-in kit and integral thermal protection required by UL for recessed fixtures. Ballast shall be encased and potted and mounted on the frame-in kit.
   b. Provide remote ballast mounted on a separate mounting plate where indicated or scheduled. Ballast shall include a splice box.
   c. Provide a heat resistant glass shield below the lamp to contain lamp glass envelope and ARC tube to prevent them from falling to the floor and causing damage to life and property. Lamp rated for open fixtures may be used in lieu of glass shield if approved by the engineer.
   d. Provide a fuse and fuse holder installed on the line side of each ballast to prevent branch circuit from tripping due to faulty ballast. The fuse and fuse holder shall be mounted in a junction box for recessed fixtures and in the base of all poles. The fuse holder shall be waterproof when installed in damp or wet locations. Fuse size and type shall be as recommended by ballast manufacturer.
4. Exit signs
   a. Exit signs shall meet all federal, state and local codes.
   b. Provide fire alarm interface relay when required to flash exit signs.
   c. Provide battery packs for emergency operation when specified.

2.02 BALLASTS - COORDINATE WITH LIGHT FIXTURE SCHEDULE

A. Fluorescent
   1. Program start electronic ballast shall be high power factor 98% minimum), operate lamp at 40 KHz, less than 10% total harmonic content, normal ballast factor 50,000 switching cycles, universal voltage, crest factor less than 1.7, multi-lamp, class “P” thermally protected, sound “A” rating, encased and potted and 0°F minimum starting temperature. Provide 5 year warranty parts and labor. Ballast shall be Osram Sylvania PSN Series or approved equal by Universal Lighting Technologies or Advance Transformer Company.
   2. All outdoor ballast unless otherwise noted shall be high power factor, rapid start, class P thermally protected, encased and potted, sound rating B and a 0ºF temperature rating. Ballast shall be CBM certified by an ETL and UL approved.
   3. Provide suitable dimming ballast where indicated.
   4. Compact fluorescent ballast shall be electronic, shall have circuitry designed to shut down the system reliably and safely when lamps have reached their end of life, high power factor, sound rating “A” and UL approved. Provide 5-year warranty, parts and labor.

B. HID
   1. Provide high power factor, constant wattage auto-transformer with a -20 degree F temperature rating. Ballast shall have a sound rating of “B” for lamps less than 400 watts. Ballast for recessed downlights or

located remotely shall be encased and potted and shall be provided with a splice box. Provide 120 volt tap for auxiliary lamp when specified.

2.03 LAMPS – COORDINATE WITH LIGHT FIXTURE SCHEDULE

A. General
1. Provide the lamp type, wattage, color, beam spread, as indicated and scheduled.

B. F40T12 fluorescent lamps shall be Cool White 34 watt energy saving.

C. Extended life F032 T8 Fluorescent lamps shall be 36,000 hours @ 3 hours per start, 3,500°K, 32 watt and low mercury.

D. All incandescent lamps shall be inside frosted, extended life rated for 2500 hours unless otherwise noted. 130 volt lamps may be used to provide extended life.

E. All HID lamps shall be base up, base down, horizontal, or universal burn as indicated or specified.

F. All compact fluorescent (T5 and smaller diameter) lamps shall be 3500ºK and 4-pin

2.04 SPARE LAMPS

A. Provide 5% spare lamps, minimum of 3 of each type.

B. Ship lamps to the Owner in original cartons (loose lamps are not acceptable).

PART 3 - EXECUTION

3.01 INSTALLATIONS

A. General
1. Install the type of light fixture where shown and indicated in accordance with manufacturer's written instructions.
2. Provide earthquake clips on all recessed lay-in light fixtures as required by building code.
3. Adjust all adjustable light fixtures, as directed by the Architect.
4. Provide safety chains and wire guards for light fixtures located in gymnasium, multi-purpose rooms, play areas, etc.

B. Coordination
1. The contractor shall verify the type of fixtures with the ceiling types as indicated on the drawings. Any discrepancies shall immediately be brought to the architect's attention before the contractor places his order and accepts delivery. Fixtures shall fit exact in the type of ceiling scheduled. Provide plaster frames, trim rings and other accessories required for a correct fit.

2. Provide supports attached to structural member to support fixtures when the ceiling system cannot maintain support. Provide separate supports for all recessed ceiling mounted HID fixtures.
3. Refer to architectural reflected ceiling plan for the exact location of all light fixtures. Notify the architect for any discrepancies or conflicts with structural, architectural, mechanical piping or ductwork before installation.

C. Mounting
1. Provide support channels to support outlet boxes used support surface mounted light fixtures such as exit signs or downlights.
2. Pendant or surface mounted fixture shall be provided with required mounting devices and accessories, including hickeys and stud-extensions, ball-aligners, canopies and stems. Locations of fixtures in mechanical areas shall be coordinated with mechanical contractor. Mounting stems of pendant fixtures shall be of the correct length to uniformly maintain the fixture heights shown on the drawings or established in the field. The allowable variation tolerance in mounting individual fixtures shall not exceed 1/4 inch and shall not vary more than 1/2 inch from the floor mounting height shown on the Drawings. Fixtures hung in continuous runs shall be installed absolutely level and in line with each other. Hanging devices shall comply with Code requirements. Fixtures shall employ single - not twin - stem hangers unless otherwise noted.
3. All structure mounted fixtures (i.e. bracket mounted, pipe mounted and surface mounted) shall be provided with cables of suitable size and weight to support the weight of the fixture. Cables shall be fastened around or fastened to the housing of the fixture. On pendant fixtures, one safety cable of suitable size and weight to support the weight of the fixture assembly shall connect the top of the pendant to the supporting structure by means of welding or bolting, and one safety cable shall connect the housing of the fixture to the bottom of the pendant. Where more than one pendant per fixture occurs, only one pendant must be cabled. Track fixtures for pendant mounted track shall also be supplied with clip-on safety cables of suitable size and weight to support the weight of the fixture.

D. Electrical Connection
1. All light fixtures installed in an accessible suspended ceiling shall be connected from a branch circuit junction box using 1/2" flexible metal conduit fixture pigtails not exceeding 6'- 0". All fixtures must be grounded by using a grounding conductor. Fixture to fixture wiring of fixtures installed in an accessible ceiling is not permitted. Fixture whips shall not lay-on ceiling tile or grid. Provide caddy clips to provide additional support.

E. Fire Rated Ceiling
1. Provide fire rated canopy or enclosure for all fixtures recessed in a fire rated ceiling. The fire rated canopy or enclosure shall be as required by the UL design number listed in the UL fire resistance directory. Refer to architectural drawing for the UL design number. Coordinate with ceiling installer and manufacturer.

F. Air Handling Fixtures

1. Install all air handling light fixtures with return air slot in the open position, if it is to be as an air handling fixture. Coordinate with mechanical contractor.

3.02 FINAL INSPECTION

A. Remove all plastic and protective coating from all fixtures. Fixtures shall be thoroughly cleaned. Replace any damaged fixture or fixture parts including reflectors, louvers, lens and metal parts that show signs of corrosion.

B. All final incandescent lamps used during construction shall be replaced with new lamps. Replace all other defective ballast, lamps or discolored lamps, showing signs of excessive usage.

C. Demonstrate proper operation of all fixtures and controls.

END OF SECTION

SECTION 16721A

FIRE ALARM AND SMOKE DETECTION SYSTEM
(SMALL AND MEDIUM ANALOG SYSTEM)

NOTE* No Fire Alarm System is required, only Smoke Detection System

PART 1 - GENERAL

1.01 SCOPE

A. The contractor shall furnish and install a complete microprocessor based 24VDC, electrically supervised, analog intelligent fire alarm system as specified herein and indicated on the drawings. The system shall include, but not be limited to, all control equipment, power supplies, signal initiating and signaling devices, conduit, wire, fittings, and all other accessories required to provide a complete and operable system.

B. The system shall operate as a non-coded, continuous ringing system, which will sound alarm devices until manually silenced, as herein specified.

C. The system shall be wired as a style B and style 4 supervised system for all circuits.

1.02 CODES AND STANDARDS

A. The system shall comply with the applicable Codes and Standards as follows:

1. National Electrical Code - Article 760.
2. National Fire Protection Association Standards:
   NFPA 70 NEC
   NFPA 72 Protective Signaling Systems (current State adopted version)
   NFPA 90A Air Conditioning
   NFPA 101 Life Safety Code

UL 1971 Visual Devices
ANSI 117.1 Visual Devices

3. Local & State Building Codes
4. Requirements of Local Authorities having Jurisdiction. If local authorities design requirements differ substantially from contract drawings, the design engineer shall be notified no less than 10 days prior to bid date, to allow time for addendum to be provided to all contractors. Contractor to provide additional devices as required by local authorities in bid pricing.
5. Underwriters Laboratory Requirements and Listings for use in Fire Protective Signaling Systems as follows:
   UL 864 Control Panels
   UL 268 Smoke Detectors - Systems
   UL 268A Duct Smoke Detectors
   UL 521 Heat Detectors
   UL 228 Door Holder-Closers
   UL 464 Audible Signaling Appliances
   UL 1971 Visual Signaling Appliances
   UL 38 Manual Alarm Stations

1.03 ACCEPTABLE MANUFACTURERS

A. To establish the type, quality, and features of system required, the equipment specified is that of the Notifier Company.

B. All equipment, materials, accessories, devices, etc. covered by the specifications and/or noted on the contract drawings shall be new and unused and be U.L. listed for their intended use.

C. All references to manufacturer or supplier's model numbers and other pertinent information herein is intended to establish a minimum standard of quality, performance and features required. All equipment proposed as an EQUAL to that specified shall COMPLETELY conform to the specifications herein.

D. Equipment of other manufacturer's or supplier's may be considered as an equal to that specified provided that completely marked and identified catalog sheets of all proposed equipment is provided to the architect/ engineer for review ten (10) days prior to the date of bid for evaluation. In addition, a list of the contractor's qualifications and any exceptions to the specifications must be provided for review. Approval for any such substitution of equipment must be obtained in writing from the architect/engineer five (5) days prior to bid.

E. Provide one of the following manufacturers:

1. Notifier
2. FCI
3. Siemens/Cerberus
4. Edwards System Technology (EST)

1.04 GENERAL REQUIREMENTS

A. Contractor Qualifications:

1. The equipment supplier shall be an authorized and designated representative of the Fire Alarm Manufacturer to sell, install, and service the proposed manufacturer's equipment.
2. The equipment supplier and installing contractor shall be licensed by the State Fire Marshall to sell, install, and service fire alarm systems as required by Article 5.43-2 of the Texas Insurance Code.

3. The installing contractor and/or equipment supplier shall have on his staff a minimum of three (3) installation superintendents who are licensed by the State Fire Marshall's office for such purpose and under whose supervision installation, final connections, and check out will take place as required by the Texas Insurance Code.
4. The installing contractor or equipment supplier shall have on staff a minimum of one (1) certified NICET Level III state licensed fire alarm planner under whose supervision system design shall take place.
5. The installing contractor shall provide 24 hour, 365 days per year emergency service with qualified and state licensed service technicians.
6. The installing contractor shall have been actively engaged in the business of selling, installing, and servicing fire alarm systems for at least seven (7) years.

1.05 SUBMITTALS

A. The installing contractor and/or equipment manufacturer shall provide complete and detailed shop drawings and include:

1. Control panel configuration including wiring and interconnection schematics.
2. Complete point to point wiring diagram showing terminal connections to all system devices.
3. Riser wiring diagram and associated zoning/addressing configurations with associated conduit sizes.
4. Complete floor plan drawings locating all devices associated with the fire alarm system. Floor plan drawings shall include conduit and wiring routing complete with conduit sizing and number of conductors by type.
5. Factory data sheets on each piece of equipment to be used and so marked as to model, dimensions, size, voltage, and configuration.
6. Detailed system description in this specification format describing system functions and operation. All specification variations and deviations shall be clearly noted and marked.
7. Complete Bill of Material for reference.
8. Programming matrix defining all input/output functions and zoning.
9. Power supply and battery calculations.

B. All submittal data will be in bound form with contractor's name, supplier's name, project name, and state fire alarm license number adequately identified.

C. Only basic equipment devices have been shown on the contract drawings.

Specific wiring between equipment/devices has not been shown. It is the contractor's responsibility to submit for approval the COMPLETE ENGINEERED system configuration and layout showing all devices, wiring, conduit, and locations along with other required information as specified herein.

1.06 COORDINATION

A. It shall be the responsibility of the installing contractor to coordinate all requirements surrounding installation of the fire alarm system with all trades including, but, not exclusive of: electrical contractor, sprinkler contractor, and HVAC/controls contractor and intercom system. Adequate coordination shall be provided to insure proper installation and interface to all peripheral items required to interact with the fire alarm and communication system to provide a complete and functional life safety system.

PART 2 - PRODUCTS

2.01 SYSTEM FUNCTIONAL OPERATION

A. Alarm Detection

1. When a fire alarm condition is detected by any of the system alarm initiating devices, the following functions shall occur:
   a. The system common alarm LED on the CPU Module shall flash. The internal audible trouble device shall sound. Acknowledgement or silencing the alarm condition shall silence the alarm signals and cause flashing alarm LED's to illuminate steady.
   b. An 80 character back-lit LCD display shall indicate all applicable information associated with the alarm condition including: zone, device type, divide location, and time of alarm. Location and zoning messages shall be custom field programmed to respective premises.
   c. Any remote or local annunciator LED's associated with the alarm zone shall be illuminated as herein specified.
   d. A three channel digital alarm communicator shall be integrally provided and transmit trouble and alarm signals to an approved remote station (remote station connection and service provided by Owner).
   e. All automatic events programmed to the alarm point shall be executed and the associated indicating devices and/or outputs activated. As each indicating circuit or control relay is activated, its associated "ON" LED shall be illuminated.
   f. Activate all audible/visual alarm devices.
   g. De-activate HVAC systems over 2000 CFM.
   h. Display system status changes on the remote annunciator(s).
   i. Release all smoke doors, fire doors, fire coiling doors, fire smoke dampers and fire shutters.

B. Alarm Verification

Alarm verification shall be field programmed for each respective detector.

Global verification will not be acceptable. The verification sequence is activated after a "check" procedure and the panel will wait a field programmable delay period (0-50 seconds) then proceed to re-sample the detector for continued presence of smoke. If the alarm condition still exists or a non-verified device is actuated during the verification period, the alarm will then initiate all alarm sequences specified herein. The system shall incorporate the ability to log in memory the number of verification events that have occurred for each selected device.

C. System Trouble Detection

1. When a trouble condition is detected by the CPU, one of the system initiating, alarm or SLC circuits, the following functions shall immediately occur:
   a. The system trouble LED on the CPU module shall flash and the internal audible trouble device shall sound. Acknowledgement of the trouble condition shall silence the audible trouble device and cause all trouble LED's to illuminate steady.
   b. The 80 character alphanumeric LCD annunciator shall display all applicable information via the alphanumeric display associated with the respective trouble condition and its location.
   c. The system common trouble indicator on associated remote annunciators shall be illuminated as specified herein.

D. Auxiliary Control

1. All designated "non-silenceable" auxiliary control functions shall remain in operation (even upon silencing of audible alarms) until such time as the control panel is cleared and reset manually (i.e. fan control outputs, central station interface, elevator recall interface, etc.).
2. Activation of duct smoke detectors associated fans shall shutdown their respective units immediately in addition to identifying the condition as herein specified.

E. System Supervisory Detection

1. When a supervisory condition is detected by the fire alarm control panel, the following functions shall occur:
   a. The fire alarm control panel supervisory indicator shall flash and the internal audible device shall sound. Acknowledgment of the supervisory condition shall silence the audible device and cause the supervisory indicator to illuminate steady.
   b. The 80 character liquid crystal display shall display all applicable information associated with the respective supervisory condition.
   c. Activate a supervisory contact closure to interface with the owner provided central station monitoring service.
   d. Display the system status change on the remote annunciator(s).

F. Fire Drill Control

Provide a fire drill switch located on the Fire Alarm Control Panel. When activated, this switch will activate all horn/strobes and speakers for a fire drill. It shall not release fire shutter, shut down air handling equipment or recall elevators. If a fire alarm condition is detected, the system shall operate as defined in part 2.01A of this section.

2.02 ZONING

A. The system shall have the inherent capability to employ "Intelligent' smoke detectors and addressable interface devices capable of being recognized and annunciated at the main control panel on an individual basis. All zoning/device location information shall be totally field programmable to exact job requirements as approved by the Architect/Engineer.

2.03 FIRE ALARM CONTROL PANEL

A. The fire alarm control panel shall be Notifier series NFS-640. The control panel shall utilize DISTRIBUTED solid state MICROPROCESSORS. The microprocessor based CPU shall be completely FIELD PROGRAMMABLE. CPU module shall provide for programmable non-volatile EEPROM memory. All circuitry shall be U.L. listed for power-limited application. System shall be sized to accommodate the capacity of the system specified and shown on the drawings, and be expandable to over 200 points. <u>System shall be capable of being networked for future expansion</u>.

B. Central Processing Unit Module (CPU)

1. The CPU shall contain and execute all custom time control functions or control-by-event programs for specified events including 'Holiday' exceptions. Time control event/programs shall be automatically overridden by priority fire alarm events. All programs shall be held in non-volatile programmable EEPROM memory, and shall be lost if both system primary and secondary power failure occurs
2. System CPU shall also provide for non-alarm points for non-fire, low priority building functions. The CPU shall provide capability of multi-stage signaling, tornado warning, positive alarm sequencing as well as remote control system operation.

C. Display

1. The DIA shall provide an 80-character backlit, supertwist Liquid Crystal Display (LCD). It shall provide Light-Emitting Diodes (LED's) for AC POWER; SYSTEM ALARM; SYSTEM TROUBLE; SUPERVISORY; CPU FAIL; and ALARM SILENCED.
2. The DIA shall provide power to a 21-key membrane keypad with control capability to command all system functions, status readouts, manual control action, and entry of any alphanumeric or numeric information. The keypad shall include means to enter multiple five digit passwords to prevent unauthorized manual control programming.

D. Control Switches

1. Acknowledge/Step Switch
2. Signal Silence Switch
3. Evacuate
4. Lamp Test/Reset

E. System Outputs

1. The system shall provide the following outputs:
   a. One port for CRT, modem, and/or printer (RS-232c)
   b. One port for supervised remote LED annunciators (RS-485)
   c. Four Style Y supervised alarm signaling circuits

F. Loop Interface (SLC)

The CPU shall communicate and provide power to all devices on its loop over a single pair of wires. The CPU shall receive digital/ANALOG information from all "intelligent" detectors and shall process this information to determine normal, alarm, trouble, and sensitivity conditions. The analog information may be used for automatic test and determination of maintenance requirements, and be U.L. listed for such use. The CPU module shall individually monitor all "intelligent" detectors for sensitivity variation initiating a trouble condition should detector sensitivity "drift" become excessive. The system control unit shall have the capability to remotely read each detector's sensitivity in % obscuration, and if need be, electronically adjust the detector sensitivity as required for existing conditions within U.L. recommended limits. In addition, the system shall incorporate a "day/night" sensitivity feature. The system shall provide capability to program each individual detector for multiple 'pre-alarm' conditions. Each 'pre-alarm' level shall be field programmable as a function of the programmed alarm level. The system shall allow designated control-by-event actions to occur as may be required prior to any sensor reaching the designated alarm point.

G. Non-Lock Walk Test

The system shall include a special non-lock "walk test" mode. The walk test mode shall incorporate a one hour time-out feature to return system to normal. Test results shall be capable of being generated and displayed on LCD annunciator or printed out on system printer.

H. Automatic Detector Test

The system shall include a special automatic detector test feature, which permits reading and adjustment of the sensitivity of all intelligent detectors from the main control panel. In addition, the automatic test feature shall also permit the functional testing of any "intelligent" detector or addressable interface device individually from the main control panel. An automatic detector test shall occur automatically a minimum of every two hour period or be initiated manually from the FACP as desired. Automatic detector test sequencing shall be terminated upon receipt of a true alarm condition.

I. Special System Reports

The system shall have the ability to generate and print, upon command, system and point status reports. Selection of 'system' read status provides the operator with global system programming information as well as providing the operator with all individual point programming data. The system shall also provide the capability to print out a detailed 'history' report from system history file upon command.

J. Field Programming

The system shall be 100% field programmable without the need for external computers or, PROM programmers, and shall NOT require replacement of memory IC's. SYSTEMS REQUIRING FACTORY PROGRAMMING/RE-PROGRAMMING OR REPLACEMENT OF MEMORY I.C. CHIPS SHALL NOT BE ACCEPTABLE. All programs shall be stored in non-volatile EEPROM memory. Programming shall be accomplished only after entering an appropriate and pre-selected five digit password security code. System programming mode shall NOT require the system to be taken off-line nor prohibit the system from performing its normal operations and routines. The system shall be capable of revising/changing programmed functions or system expansion at any time subsequent to initialization as described herein without factory modifications or factory programming. Field programming via the use of external computers may be considered provided programming can be accomplished on-site and the owner is permanently furnished with the required programming apparatus and software as part of this contract.

K. Event History

The main fire alarm panel shall have the resident ability to store a minimum of 400 system events in chronological order of occurrence. Event history shall include all system alarms, troubles, operator actions, unverified alarms, circuit/point alterations, and component failures. Events shall be time and date stamped. Events shall be stored in non-volatile buffer memory. Access to history buffer shall be secured via five digit password security code. Systems not employing event history memory storage shall be required to furnish a printer/recorder for recording system events.

L. Remote Diagnostics

The system shall be provided with system compatible, asynchronous, 2,400 baud modem registered to Part 60 of F.C.C. as well as Sub-part J of Part 15 of F.C.C. Modem shall interfere to system control panel via RS-232c port and tie to spare commercial telephone line. Modern shall facilitate the system with remote diagnostic and programming capability without affecting normal system operation and routines while the system remains 'on-line'. Remote diagnostic routines and programming shall be accomplished from manufacturers and/or local authorized representative's facility to aid in trouble diagnostics, repairs, and programming.

The manufacturer and local authorized manufacturer's representative shall both be fully equipped (and operational) to perform specified remote

diagnostics, maintenance, and programming in order to promote full system support and maintenance.

M. Power Supply

The power supply shall provide all control panel and peripheral power needs with filtered power as well as rectified 24VDC power for external audio-visual devices. All power supplies shall be designated to meet UL and NFPA requirements for POWER-LIMITED operation on all external signaling lines, including initiating circuits and indicating circuits.

Input power shall be 120VAC 60Hz. The power supply shall provide internal supervised batteries and automatic charger. The power supply shall provide both positive and negative ground fault supervision, battery/charger fail condition, A.C. power fail indicators. The power supply shall also provide supervision of modular expansion power supplies as may be required.

2.04 FIELD DEVICES

A. Multisensor Detector (Smoke and Heat)

1. Provide intelligent multisensory smoke detectors. The multisensor analog detector shall use a light scattering type photoelectric smoke sensor, a unipolar ionization smoke sensor and an ambient temperature sensor to sense changes in air samples from its surroundings. The integral microprocessor shall employ time based algorithms to dynamically examine data. The Muiltisensor shall be capable of adapting to ambient environmental conditions. The temperature sensor shall self-adjust to the ambient temperature of the surrounding air and input an alarm when there is a change of 65° F in ambient temperature. Systems using central intelligence for alarm decisions shall not be acceptable. The detector shall continually monitor any changes in sensitivity due to the environmental affects of dirt, smoke, temperature, age and humidity. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using a laptop PC.
   <u>Separately mounted photoelectric detectors, ionization detectors and heat detectors in the same location are not acceptable alternatives.</u>
2. The Multisensor smoke detector shall be rated for ceiling installation at minimum of 30 ft. (9.1m) centers and suitable for wall mount applications. The Multisensor shall be suitable for direct insertion into air ducts up to 3 ft. (0.91m) high and 3 ft. (0.91m) wide and air velocities up to 500 ft/min. (0-2.54m/sec) without requiring specific duct detector housings or supply tubes. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The integral heat sensor shall cause an alarm when it senses a change in ambient temperature of 65° F or reaches it fixed temperature alarm set point of 135° F nominal. The Multisensor detector shall be suitable for operation in the following environment:
   a. Temperature: 32° F to 100° F (0° C to 38° C)
   b. Humidity 0-93% RH, non condensing

c. Elevation: Up to 6,000 ft (1828m)

A. Intelligent Duct Detector

Notifier/BRK model FSD-P series duct mounted “intelligent” smoke detectors shall be provided where shown on the drawings. Detectors shall operate on the same principles and exhibit the same basic characteristics as area type “intelligent” smoke sensors. The unit shall be capable of interchanging/accepting either photo-electronic or ionization type sensors. The detector shall operate in air velocities of 300 FPM to 4,000 FPM. Each detector shall interface directly to the system SLC loop without the requirement of interface zone modules.

The unit shall consist of a clear noryl molded plastic enclosure with integral conduit knockouts. The unit shall be provided with clear faceplate cover to provide visual viewing of detector/sensor for monitoring sensor operation and chamber condition. The duct housing shall be provided with gasket seals to insure proper seating of the housing to the associated ductwork. Each unit’s sampling tubes shall extend the width of the duct and be provided with porosity filters to reduce sensor/chamber contamination. Detectors shall be installed per NFPA 90A, and be listed with the fire alarm control panel. A remote LED shall be located on the corridor ceiling adjacent to the respective detector where detectors are not plainly visible or concealed from view.

B. Intelligent Thermal Detectors

1. Notifier Model FST-751R analog, fixed temperature and rate of rise thermal detectors shall be provided where indicated on the drawings. The detectors shall use dual electronic thermostats to measure temperature levels in the chamber and shall, on command from the control panel, send data to the panel representing the analog temperature level.
2. The detectors shall provide address-setting means on the detector heat using rotary decimal switches. No binary coding shall be required. Systems requiring separate detector programming apparatus will be unacceptable.
3. The detectors shall provide dual alarm and power/status LED's. Status LED's shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel. Both LED's may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED.
4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base.

C. Addressable Manual Stations

1. Notifier Model NBG-12LX manual stations shall be provided where indicated on the drawings. The manual station shall provide address-setting means using rotary decimal switches. No binary coding shall be required.

2. Manual stations shall be designed for semi-flush mounting on standard electrical box. The station shall be constructed of hi-impact red molded Lexan with instructions for station operation in raised white letters. Stations shall be of the dual action type.

D. Monitor Module

1. Notifier model FMM-1 addressable monitor modules shall be provided where required to interface to contact alarm devices. The monitor module shall be used to connect a supervised zone of conventional initiating devices to an intelligent SLC loop. Each zone may be wired either class A or class B - field selectable.
2. The monitor module shall provide address-setting means using rotary
decimal switches. No binary coding shall be required. A status/power LED shall be provided which shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel. The status LED shall illuminate steady upon detection of an alarm condition.
3. Each monitor module shall include a magnetic test feature to field test the unit for functional operation. In addition, an automatic test feature shall also permit functional testing of the device from the main control panel.

E. Control Module

1. Notifier model FCM-1 or FRM-1 control and relay modules shall be provided where required to provide audible alarm interface and/or relay control interface. The control module shall be used to connect a supervised zone of conventional indicating devices to an intelligent loop. The zone may be wired class A or class B - field selected. The control module may be optionally wired as dry contact (form C) relay.
2. The control module shall provide address-setting means using rotary decimal switches. No binary coding shall be required. A status LED shall be provided which shall flash under normal conditions, indicating that the control module is operational and in regular communication with the control panel. The LED shall illuminate steady when the device is actuated via the fire alarm control panel.

F. Electronic Audio Visual Devices

Audible/Visual alarm devices shall be Gentex “GEC3-24” Series electronic horn/strobe units, to be located where indicated on the drawings. Electronic device shall not contain any vibrating electro-mechanical solenoids or contacts for reliability and performance. Electro-mechanical devices shall not be considered as equal. Units shall operate at 24VDC and be polarized supervised. Each unit shall provide a choice of three difference audible tones capable of being field selected. Preferred alarm signals shall be a pulsing tone producing a sound pressure level of 91 dBA. The visual device shall use Xenon strobe type producing a minimum of 75 candela on a 24 VDC limited energy supervised circuit and meet the requirements of ADA. Strobe unit shall automatically flash upon operation of the horn. Horn/strobe unit shall be provided in textured white finish and be flush mounted. Refer to

floor plans for candela intensity required.

Synchronize visual devices when two or more visual devices are located within a room or within 55 feet. Provide modules and additional wiring as required.

G. Electronic Alarm Signal

Provide Gentex “GEH-24” solid state electronic alarm device where indicated on the contract drawings. Electronic device shall not contain any vibrating electro-mechanical solenoids or contacts for reliability and performance. Electro-mechanical devices shall not be considered as equal. Units shall operate at 24 VDC and be polarized supervised. Each unit shall provide a choice of two different audible tones capable of being field selected. Preferred alarm signals shall be a pulsing tone producing a sound pressure level of 91 dBA.

Units shall be flush mounted and molded of high-impact white plastic.

H. Exterior Audio Visual Devices

All audio visual devices located outside or labeled weatherproof shall be weatherproof. Provide the following devices:

1. Gentex #WGMS-24-75-WR for audio/visual devices.
2. Gentex #WGM-24 for visual devices

All devices shall use Gentex #WGBB-R outlet boxes.

I. High Intensity Visual Signals

Provide a Gentex “GES3-24” Series visual signal device. High intensity visual signals shall be installed where shown on the drawings and as may be required by the Americans with Disabilities Act (Public Law 101-336).

High intensity visual alarms shall be Xenon strobe type producing a minimum of 75 candela on a 24 VDC limited energy supervised circuit. Alarm devices shall be designated to be flush wall mounted. Signals shall operate in unison with audible alarm appliances. High intensity visual signals shall be of solid state low current design and listed to U.L. Standard 464. Refer to floor plans for candela intensity required.

Units shall be flush mounted and shall be provided in textured white.

Synchronize visual devices when two or more visual devices are located within a room or within 55 feet. Provide modules and additional wiring as required.

J. Auxiliary AHU Relays

Notifier/Air Products model MR-101C relays or approved equal shall be provided for HVAC and AHU control and interface. Relays shall be heavy duty type and rated up to 10 amps at 24 VDC, 60 HZ. Relays shall be

provided with NEMA I dust cover assembly and be provided with SPDT contacts as well as (fail safe) so that if the cable is broken, disconnected etc., the AHU will automatically shutdown.

K. Field Charging Power Supplies

Provide Notifier #FCPS24 power supplies with battery backup as required. Provide 120 volts dedicated circuit to each power supply.

L. Remote LCD Alpha-Numeric Annunciators

Provide where indicated on the drawings, a Notifier LCD-80 remote LCD alpha-numeric annunciator to annunciate all system events and duplicate the displayed status at the main FACP. The annunciator shall be a backlit eighty-character LCD display and operate via the system RS485 and RS232 serial output terminal from main FACP. The LCD display shall automatically illuminate upon receipt of an alarm or trouble condition. The illuminary source shall extinguish during normal/standby model to conserve power. The unit shall operate from FACP 24VDC power and function during system power failure while the system resides on standby batteries. The remote LCD annunciator shall include:

- Integral time-date clock
- Time-date select clock
- Time-date/contrast adjust
- Display/step switch
- System reset
- System silence
- System acknowledge
- Integral trouble buzzer

Annunciator shall upon command display the first system alarm, last alarm, and system alarm count. The unit shall be equipped with an integral lamp test feature. The unit shall be flush mounted where shown.

M. Protective Covers

Provide protective covers on all fire alarm devices pull stations. These protective covers shall be manufactured by Safety Technology International, Inc. (STI). These covers shall be provided on all devices including but not limited to smoke detectors, heat detectors, audible and visual devices, pull stations, etc. The mounting of a device shall be reinforced to enable the protective covers to protect the fire alarm devices.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Wiring:

1. All wiring shall be in accordance with NFPA 72 and the National Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.
2. All wire shall be U.L. Listed, limited energy (300 volt) FPLP or MPP wire and shall be run open in return air ceiling plenums. The wire shall be listed to U.L. TEST 910 for such applications and is of the

low smoke producing fluorocarbon type and complies with NEC Article 760 if so approved by the local authority having jurisdiction. Provide conduit in all inaccessible locations, inside concealed wall, all mechanical/electrical rooms, or other areas where wiring might be exposed and subject to damage.

3. Support wire clear of knock out panels, access panels, and maintenance spaces for equipment. Wire and cable shall be run using wire management techniques supporting cable as close as possible to within one foot of the floor or roof rafters. Wire supports shall be directly fastened to the structure on a maximum of five foot centers. Wire routing shall be parallel and perpendicular to building lines. The wire and cable shall be secured with tie wraps or carrier wire. Sagging in excess of three inches will not be allowed nor will bending of the supporting ring structure.
4. All wiring for SLC signaling circuits shall be of the twisted/shielded, low capacitance type to guard against outside RF and EMF interference and induced noise.
5. All wiring shall be run in a supervised fashion (i.e. no branch wiring or dog-legged wiring) per NFPA requirements such that any wiring disarrangement will initiate the appropriate trouble signals via the main control panel per NFPA and U.L. requirements.
6. Wiring splices shall be kept to a minimum with required splices to be made in designated terminal boxes or at field device junction boxes. Transposing or color code changes of wiring will not be permitted. End-of-line supervisory devices shall be installed with the last device on the respective circuit. Said device shall be appropriately marked designating it as the terminating device on the respective circuit.
7. No A.C. wiring or any other wiring shall be run in the same conduit as fire alarm wiring.

B. Conduit/Raceway

1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
2. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per NEC.
3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.

C. Minimum Wire Sizes Shall Be As Follows:

1. Initiating Zones: 18 AWG
2. Indicating Zones: 14 AWG
3. Relay Control Circuits: 18 AWG

D. Sprinkler Valves

1. Contractor shall connect all tamper switches and post indicator valves to the supervisory circuit. Connect all water flow switches to the alarm circuit. Coordinate exact locations of water vaults valves and flow switches with sprinkler contractor.

3.02 NOTIFICATION APPLIANCE CIRCUITS SYNCHRONIZATION

A. All visual and audible devices shall be synchronized per the current state adopted version of NFPA 72. Provide all components required.

3.03 TEST AND REPORTS

A. A state licensed factory trained technical representative of the manufacturer shall perform the final control panel connections and supervise testing of the system and it shall be subject to the approval of the responsible engineer and owner. Upon completion of the acceptance tests, the owner and/or his representatives shall be instructed in the proper operation of the system.

B. The installing contractor shall functionally test each and every device in the entire system for proper operation and response. In addition, each circuit in the system shall be fully tested for wiring supervision to insure proper wiring installation. Any items found not properly installed or non-functioning shall be replaced or repaired and re-tested. All testing shall be supervised by a licensed fire alarm superintendent.

C. The installing contractor shall provide a complete written report on the functional test of the entire system. The test and report shall verify the function of each device in the system, operation of all auxiliary control functions, and the proper operation of the main fire alarm control panel. A copy of the test report shall be provided with maintenance manuals. The test report shall be signed and dated by the licensed fire alarm superintendent responsible for supervising the final system test and checkout.

D. The installing contractor's fire alarm superintendent shall test the entire system in the presence of the local authorities having jurisdiction.

3.04 WARRANTY

A. The fire alarm system shall be free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of acceptance or beneficial occupancy, whichever shall occur first. Any equipment shown to be defective shall be repaired, replaced or adjusted during normal working hours at no cost to the owner.

B. The equipment manufacturer shall be represented by a local service organization and the name of such shall be furnished to the Owner, Architect, and Engineer.

3.05 GRAPHIC FLOOR PLANS

A. Provide 1/16” = 1’-0” floor plan showing all devices and zoning. Zoning shall correspond to the zone on the fire alarm control panel. The floor plans shall be framed with a glass cover and located by the fire alarm control panel. This graphic floor plan shall use the actual room numbers based on the architectural graphics package. Verify specific requirements with Owner. Provide a sample for approval.

END OF SECTION

SECTION 16930

MISCELLANEOUS ELECTRICAL CONTROLS AND WIRING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.02 SCOPE

A. Provide the various miscellaneous control devices, wiring and additional branch circuits as required, shown and specified.

B. The types of miscellaneous control devices and wiring include but not limited to the following.

1. Contactors
2. Relays
3. Photocells
4. Time switches
5. Additional control wiring and safety devices as shown and specified.

C. WORK SPECIFIED ELSEWHERE:

1. Various control devices, of an electrical nature, for the safe operation and temperature control of the heating, ventilating, air conditioning and plumbing systems provided under Division 15.
2. All control wiring and conduit shall be furnished under Division 15. All power wiring 120 volt or larger shall be provided by Division 16.

1.03 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:

1. National Electrical Code.
2. Local municipal or state codes that have jurisdiction.

1.04 ACCEPTABLE MANUFACTURERS

A. Provide one of the following manufacturers:

1. LIGHTING CONTACTORS AND RELAYS
   a. General Electric
   b. Square D Company
   c. Automatic Switch Company

2. PHOTOCELLS AND TIME SWITCHES

a. Tork, Inc.
b. Intermatic time controls
c. AMF paragon

PART 2 - PRODUCTS

2.01 MATERIAL

A. GENERAL: This Section shall outline the basic installation of electric devices, conduit, boxes, fittings, and wiring required for complete interconnection of several systems, this may not reflect every required appurtenance. It does not cover integral parts of mechanical equipment.

B. CONTACTORS AND RELAYS: Provide control wiring, contactors, and relays with the ampere-rating and number of poles as shown, specified, and required for a complete and functioning system.:

1. Rated at 600 volts, 60 hertz.
2. Continuously rated contacts for all types of ballast and tungsten lighting, resistance and motor loads. Contacts shall be sized as scheduled or noted.
3. Shall have totally enclosed, double-break silver-cadmium-oxide power contacts. Auxiliary arcing contacts are not acceptable. Contact inspection and replacement shall be possible without disturbing line or load wiring.
4. The contactor shall have straight-through wiring with all terminals clearly marked.
5. The contactor shall be approved per UL508 and/or CSA, and be designed in accordance with NEMA ICS2-21 1B.
6. They shall be industrial-duty rated for applications to 600 volts maximum.
7. The contactor shall have provisions for factory or field addition of:
   a. Four (4) N.O. or N.C. auxiliary contacts rated 6 amperes continuous at 600 volts.
   b. Single or double circuit, N.O. or N.C., 30 or 60 ampere 600 volt power-pole adder.
8. The contactor shall have a NEMA type 1 enclosure unless otherwise noted.
9. Control power to the contactor 120V control circuit shall be provided from the nearest panelboard 120V circuit. If the 120V control power circuit is not shown, provide a control power transformer for 120 volt control power and a 120 volt coil when required for control. Provide primary and secondary fuses on the control power transformer.
10. Electrically Held Lighting - Contactor coils shall be continuously rated and encapsulated. Electrically held contactors are not to be used unless specifically shown on the plans.
11. Mechanically Held Lighting Contactors - Coil-clearing contacts shall be supplied so that the contactor coils shall be energized only during the instance of operation. Both latch and unlatch coils shall be encapsulated. All contactors shall be mechanically held unless noted otherwise on the plans.
12. Provide 2-wire or 3-wire control modules as required to operate lighting contactors.

13. Provide hand-off-automatic controls (H-O-A) for each lighting contractor.

C. Photocells: Provide a specification grade self contained, weatherproof, photoelectric control that shall be mounted on an FS type weatherproof junction box. The photocell shall:

1. Switch "ON" at dusk and "OFF" at dawn.
2. Adjustable from 2 to 50 foot candles.
3. Rated at 2000 watts.
4. Use 1" diameter cadmium sulphide cell.
5. Have a 2 minute delay to prevent false switching.

D. TIME SWITCHES: Provide a 7-day digital time clock with battery back-up feature installed in a NEMA 3R enclosure.

E. Control wiring shall be not less than #14 AWG type TW, and shall be color coded and labeled with Brady markers throughout. Bundle multiple conductors with Ty-Raps.

PART 3 - EXECUTION

3.01 Install miscellaneous electrical controls and wiring to provide a functioning system.

3.02 H.V.A.C. AND PLUMBING CONTROL

A. Install electrical devices not an integral part of mechanical equipment providing conduit, boxes, fittings, wiring, and other devices.

B. Electrical contractor is responsible for providing all line voltage power to devices indicated by controls contractor that require electrical power to operate. Electrical contractor shall terminate line voltage power to termination points indicated by control contractor. Electrical contractor shall coordinate with controls contractor to determine sizing and quantities of line voltage circuits to adequately power control devices. Electrician is to obtain circuits from nearest low voltage panel using spare circuits provided, if device requires power not already available.

3.03 Install contactor and relays in electrical/mechanical rooms unless otherwise noted.

3.04 Install photocells on the roof unless otherwise directed by the architect. Coordinate any roof penetrations with all other trades and shield from other light sources.

3.05 Provide miscellaneous connections for signs and other furnished equipment as shown on the Drawings.

END OF SECTION

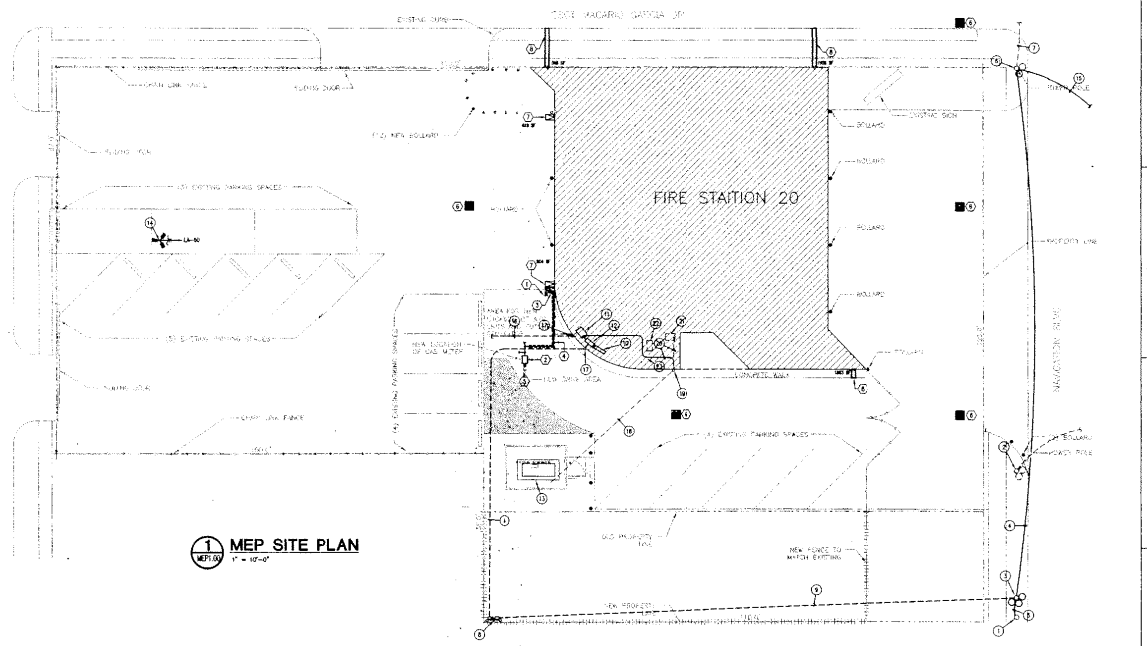
Drawings:

1.01 Structural drawings seen below beginning on page 212 of 226

A PDF version of the Structural Drawings and Graphics can also be viewed on the following web Link
https://purchasing.houstontx.gov/buyer/BidDocumentManager.aspx?id=C23357

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_2009.pdf



1 MEP1.00 **MEP SITE PLAN**
1" = 10'-0"

ELECTRICAL KEYED NOTES.

1. APPROXIMATE LOCATION OF EXISTING CENTER POINT ENERGY POWER POLE.
2. APPROXIMATE LOCATION OF EXISTING CENTER POINT ENERGY 120/240V DELTA HIGH LEG UTILITY TRANSFORMER POLE. EXISTING TRANSFORMERS SHALL BE RELOCATED BY CENTER POINT ENERGY TO EXISTING POLE ON CORNER OF 590' MACARIO GARCIA DR. AND NAVIGATION BLVD. TO RE-FEED ADJACENT PROPERTY ACROSS NAVIGATION BLVD. CENTER POINT ENERGY SHALL COORDINATE OUTAGES TO ADJACENT PROPERTY AS REQUIRED. EXISTING POLE SHALL BE DEMOLISHED FOLLOWING RELOCATION OF TRANSFORMERS.
3. PROPOSED LOCATION OF NEW CENTER POINT ENERGY 208Y/120V, 3Ø UTILITY TRANSFORMER POLE.
4. EXISTING CENTER POINT ENERGY TENSION SPAN SHALL BE EXTENDED TO NEW TRANSFORMER POLE LOCATION.
5. PROPOSED NEW CENTER POINT ENERGY TENSION SPAN.
6. APPROXIMATE LOCATION OF RELOCATED 120/240V DELTA HIGH LEG UTILITY TRANSFORMERS BY CENTER POINT ENERGY ON EXISTING CENTER POINT ENERGY POWER POLE.
7. EXISTING CENTER POINT ENERGY OVER HEAD POWER LINES SHALL REMAIN.
8. PROPOSED LOCATION OF NEW RACK MOUNTED C/T CAN AND UTILITY METER.
9. PROPOSED ROUTING OF NEW UNDERGROUND SECONDARY.
10. APPROXIMATE LOCATION OF NEW MAIN DISTRIBUTION PANEL.
11. APPROXIMATE LOCATION OF NEW AUTOMATIC TRANSFER SWITCH "ATS".
12. APPROXIMATE LOCATION OF NEW MAIN SERVICE DISCONNECT.
13. EXISTING GENERATOR SHALL REMAIN.
14. EXISTING LIGHTING POLE SHALL REMAIN. PROVIDE NEW CIRCUITING AS INDICATED. PROVIDE NEW LAMPS AND NEW 2HID BALLASTS.
15. NEW OVERHEAD BLACK SPAN BY CENTER POINT ENERGY SHALL RE-FEED ADJACENT PROPERTY ACROSS NAVIGATION BLVD.
16. ROUTE (2) 3" AND (1) 1" UNDER GROUND PVC CONDUITS AS INDICATED. CAP OFF IN PARKING LOT AND PROVIDE A MARKER. REFER TO CAP AND STAKE DETAIL FOR ADDITIONAL INFORMATION.
17. ROUTE CONDUIT FROM BELOW GROUND AND UP EXTERIOR WALL. PENETRATE EXTERIOR WALL AND ROUTE DIRECTLY INTO MAIN FIRED DISCONNECT INSIDE ELECTRICAL ROOM. KEEP CONDUIT TIGHT TO EXTERIOR WALL AND PROVIDE SUPPORTS AS REQUIRED PER NEC.
18. EXISTING UNDERGROUND GENERATOR CONDUITS SHALL REMAIN. PULL NEW FEEDERS AS INDICATED ON ONE LINE DIAGRAM.
19. EXISTING GENERATOR FEEDERS ROUTED UP THE EXTERIOR WALL AND INTO THE EMERGENCY ELECTRICAL ROOM SHALL BE REMOVED.
20. EXISTING FEEDERS FROM EXISTING GENERATOR SHALL BE REMOVED. ABANDON EXISTING 4" UNDERGROUND CONDUIT. ROUTE (2) NEW 2" PVC CONDUITS FROM INE BACK OF THE EXISTING GENERATOR TO THE NEW TRANSFER SWITCH. PROVIDE ADDRGUAL.
21. EXISTING AUTOMATIC TRANSFER SWITCH SHALL BE REMOVED AND RETURNED TO OWNER.
22. EXISTING DISCONNECT SWITCH SHALL BE REMOVED AND RETURNED TO OWNER.
23. UTILIZE EXISTING WALL PENETRATIONS FOR RE-ROUTED GENERATOR FEEDERS THROUGH BUILDING.

PLUMBING KEYED NOTES.

1. 2-1/2" DOMESTIC WATER SERVICE ENTRY. PROVIDE SCHEDULE 40 PVC SLEEVE FOR LINES BELOW DRIVE AND SERVICE YARD AREAS. REFER TO CIVIL UTILITY DRAWINGS FOR CONTINUATION BEYOND 5' OF BUILDING.
2. GAS METER ASSEMBLY INSTALLED BY GAS UTILITY COMPANY FOR A TOTAL CONNECTED DEMAND OF APPROX. 1004 CFH TO BE SUPPLIED AS THE BUILDING SERVICE. REFER TO PLUMBING RISER.
3. GAS PRESSURE REGULATOR SET TO 4oz PRESSURE FOR A DEMAND OF 1114 CFH
4. 2-1/2" GAS LINE BELOW GRADE TO BUILDING. PROVIDE SCHEDULE 40 PVC SLEEVE FOR GAS LINES BELOW DRIVE AND SERVICE YARD AREAS.
5. GAS METER ASSEMBLY AND UTILITY GAS LINE TO BE INSTALLED AND PROVIDED BY UTILITY COMPANY.
6. EXISTING AREA DRAIN CATCH BASIN; FIELD VERIFY FOR EXACT SIZE AND LOCATION.
7. PROVIDE SPLASH BLOCK FOR DOWNSPOUT; COORDINATE WITH ARCHITECT.
8. CONTRACTOR SHALL FIELD FABRICATE STORM DRAINAGE THOUGH; REFER TO DETAIL 1/P301.

THIS PLAN WAS APPROVED IN THE CONSTRUCTION OFFICE FOR BUILDING CODE COMPLIANCE ONLY. THE BUILDING CODE COMPLIANCE AND HVAC WAS NOT REVIEWED FOR CODE COMPLIANCE AND IS SUBJECT SOLELY TO FIELD INSPECTION.

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FAX 713.780.7824
DBR Project Number 09065.000
KP | SS | JT | KR

ISSUE LOG		
NO.	DATE	DESCRIPTION
1	05/21/09	90% CD'S
2	06/22/09	ISSUE FOR PERMIT
3		
4		
5		
6		

CONSULTANT(S):
NATEX CORPORATION ARCHITECTS
2500 WILCREST, SUITE 300
HOUSTON, TEXAS 77042
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FAX: 713-780-7824

SEAL(S):
C.S. GALBRAIT #
06/22/09

PROJECT NAME:
FIRE STATION 20
INTERIOR RENOVATION PACKAGE
HOUSTON, TEXAS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:
PROGRAM MANAGER | CONSTRUCTION SUPERVISOR
PROJECT MANAGER

OTHER APPROVALS:
WATER ENGINEERING | TRAFFIC AND TRANSPORTATION
WASTEWATER ENGINEERING | SAFETY, HEALTH & RISK MANAGEMENT
STORMWATER ENGINEERING | PLANNING & DEVELOPMENT
CITY ENGINEER | DATE
DIRECTOR, DEPT. OF PUBLIC WORKS & ENGINEERING | DATE

DATE: 05/21/09
W.B.S. No.: O-000000-0000-0
SCALE: AS SHOWN
DRAWN BY:
CHECKED BY:

SHEET TITLE:
MEP SITE PLAN

SHEET NO.:
12 OF 31 SHEETS

CITY DWG. NO.:
MEP1.00

DESIGN FILE:
CAD FILE:

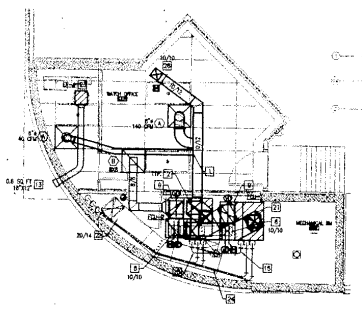
GENERAL NOTES

1. THERMOSTAT SHALL HAVE CAPABILITY TO SET BACK OR SHUT DOWN THE SYSTEM BASED ON DAY OF THE WEEK AND THE TIME OF THE DAY, AND PROVIDE A READILY ACCESSIBLE MANUAL OVERRIDE THAT WILL RETURN TO THE PRECEDEACE OF SHUTDOWN SCHEDULE WITHOUT REPROGRAMMING.
2. ZONE THERMOSTAT CONTROL SHALL PROVIDE A TEMPERATURE RANGE OR DEADBAND OF AT LEAST 3°F WITHIN WHICH THE SUPPLY OF HEATING AND COOLING ENERGY TO THE ZONE IS CAPABLE OF BEING SHUT OFF OR REDUCED TO A MINIMUM.
3. PROVIDE INSULATION FOR PIPING AND DUCTWORK THAT MEETS THE CITY OF HOUSTON MECHANICAL CODE AMENDMENTS AS SPECIFIED IN SECTION 15290.
4. PROVIDE RETURN AIR BOOTS WHERE WALLS ARE TO DECK. SIZE BASED ON 500 FPM MAXIMUM AIR VELOCITY.
5. CONTRACTOR SHALL TRANSITION DUCTWORK AS REQUIRED TO COORDINATE WITH BEAM LOCATIONS. PROVIDE EQUIVALENT FREE AREA AT TRANSITIONS. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.
6. FASTEN AND SEAL ALL DUCTWORK JOINTS, LONGITUDINAL AND TRANSVERSE SEAMS AND CONNECTIONS PER CITY OF HOUSTON MECHANICAL CODE AMENDMENTS. DUCT SEALANT SHALL BE INSPECTED PRIOR TO DUCTWORK BEING INSULATED.
7. OUTSIDE AIR QUANTITIES ARE BASED ON THE LATEST EDITION OF ASHRAE STANDARD 62 WITH CITY OF HOUSTON AMENDMENTS.
8. ALL ROOF PENETRATIONS SHALL BE PAINTED TO MATCH THE ROOF COORDINATE COLOR WITH ARCHITECT.

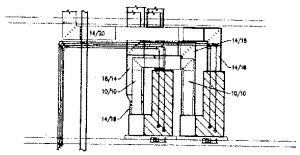
REFER TO SPECIFICATION SECTION 01800 FOR COMMISSIONING REQUIREMENTS.

MECHANICAL KEYED NOTES

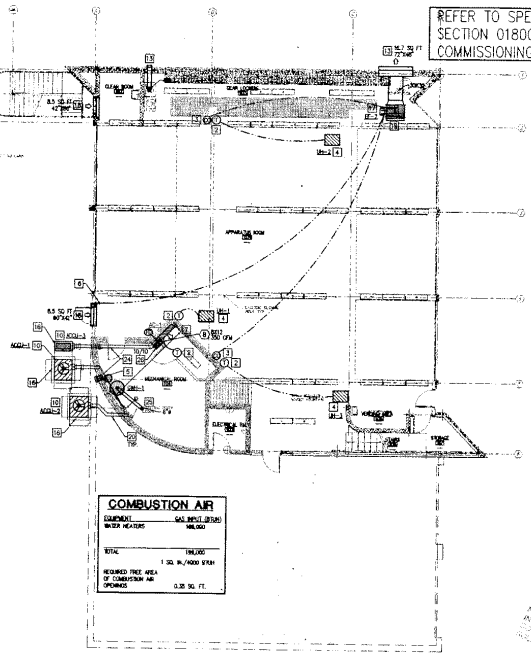
1. PROVIDE SPIN-IN FITTING WITH LOCKING QUADRANT BUTTERFLY DAMPER FOR ALL ROUND FLEXIBLE DUCT CONNECTIONS TO RECTANGULAR DUCT. RE: 3/M3.01.
2. LOCATE THERMOSTAT AS SHOWN. MOUNT AT SAME ELEVATION AS LIGHT SWITCHES. COORDINATE EXACT LOCATION WITH ARCHITECT, TYPICAL.
3. MOUNT CARBON MONOXIDE DETECTOR AT SAME ELEVATION AS LIGHT SWITCH. COORDINATE WITH ARCHITECT PRIOR TO CONSTRUCTION TO AVOID CONFLICT WITH FURNITURE. FAN TO SWITCH ON WHEN THE CARBON MONOXIDE DETECTS 50 PARTS PER MILLION OF CO.
4. PROVIDE GAS UNIT HEATER MOUNTED HORIZONTALLY AT THIS LOCATION. MOUNT HEATER AT A MINIMUM 42" CLEARANCE FROM STRUCTURE. PROVIDE WITH 2 STAGE THERMOSTAT. COORDINATE FINAL LOCATION WITH STRUCTURAL TO AVOID CONFLICTS. RE: 15/M3.01.
5. PROVIDE 14" X 12" INTAKE ELEVATION INTAKE AND EXHAUST COMBUSTION LOUVERS WITH A MINIMUM FREE AREA OF 0.25 SQ FT. MOUNTED 12" ABOVE FINISHED FLOOR AND 12" BELOW FINISHED CEILING.
6. MOUNT EXHAUST FAN ON OFF SWITCH AT SAME ELEVATION AS LIGHT SWITCHES. COORDINATE WITH ARCHITECT PRIOR TO CONSTRUCTION TO AVOID CONFLICT WITH FURNITURE.
7. ROUTE 3/4" PRIMARY CONDENSATE PIPE TO FLOOR DRAIN. REFER TO PLUMBING DRAWINGS FOR EXACT LOCATION. COORDINATE WITH PLUMBING CONTRACTOR. RE: 7/M3.01.
8. CONNECT THE OUTDOOR AIR DUCTWORK TO THE MIXING BOX PLENUM ON THE FCU. ROUTE THE OUTDOOR AIR DUCT THROUGH THE WALL TO THE EXTERIOR AIR INTAKE LOUVER. SUPPORTED DUCTWORK AS REQUIRED. PROVIDE A MOTORIZED DAMPER WITH FLOW CHARTER AND BALANCE OUTDOOR AIR TO THE CFM SCHEDULED FOR EACH FAN COIL UNIT. MOTORIZED DAMPER SHALL START WHEN UNIT IS NOT ENERGIZED. RE: 11/M3.01.
9. PROVIDE 18" DEEP MIXING BOX PLENUM ON FCU WITH RETURN AIR AND OUTDOOR AIR DUCTWORK CONNECTIONS SIZED AS SHOWN. PLENUM BOX SHALL BE THE SAME HEIGHT AND WIDTH AS THE AIR HANDLING UNIT. PROVIDE A RETURN AIR VOLUME DAMPER IN THE RETURN AIR DUCTWORK TO HELP PROPERLY BALANCE THE OUTSIDE AIR.
10. AIR COOLED CONDENSING UNIT. RE: 4/M3.01. ROUTE REFRIGERANT PIPING FROM CONDENSING UNIT TO THE FAN COIL UNIT THAT IT SERVES. CONTRACTOR SHALL FIELD VERIFY THE EXACT ROUTING OF THE REFRIGERANT PIPING AND ADJUST THE MECHANICAL LAYOUT.
11. ROUTE REFRIGERANT PIPING UP ADJACENT TO THE BUILDING TO A POINT NOT GREATER THAN 18" ABOVE GRADE AND THEN ROUTE INTO THE EXTERIOR WALL AND UP WITHIN WALL WITH PLENUM SPACE.
12. ROUTE CONDENSATE PIPING TO FLOOR DRAIN IN APPROPRIATE LOCATION SHOWN.
13. ROUTE 4" DRYER VENT TO WALL CAP. REFER TO 14/M3.01.
14. SIZE REFRIGERANT LINES PER MANUFACTURERS RECOMMENDATIONS. TYPICAL TO ALL. ROUTE PIPING UP THROUGH CHASE TO MEZZANINE.
15. ROUTE 1" PRIMARY CONDENSATE PIPE TO FLOOR DRAIN. REFER TO PLUMBING DRAWINGS FOR EXACT LOCATION. COORDINATE WITH PLUMBING CONTRACTOR. RE: 7/M3.01.
16. INSTALL CONDENSING UNIT AT GROUND ON 4" HOUSEKEEPING PAD. PROVIDE ALL CLEARANCE AS RECOMMENDED BY THE MANUFACTURER. RE: 4/M3.01.
17. INSTALL INLINE EXHAUST FAN AT THIS LOCATION PER MANUFACTURER SPECIFICATION. MOUNT AS HIGH AS POSSIBLE BELOW STRUCTURE. COORDINATE EXACT LOCATION WITH ARCHITECT TO AVOID CONFLICT WITH ROLL-UP DOORS. PROVIDE TRANSITIONS AS REQUIRED. RE: 9/M3.01.
18. PROVIDE MAKE UP AIR LOUVER AT THIS LOCATION. LOUVER SHALL BE INTAKE INSIGHT TYPE EL2270DL WITH MINIMUM FREE AREA OF 8.5 SQUARE FEET. COORDINATE EXACT LOCATION AND DIMENSIONS WITH ARCHITECT. PROVIDE BACKDRAFT DAMPER.
19. CONDI INLET OF FAN WITH 42" X 42" HARDWARE CLOTH.
20. PROVIDE PIPING SUPPORTS AS REQUIRED. (TYP)
21. COORDINATE ROUTING OF DUCTWORK IN FIELD TO AVOID CONFLICT WITH STRUCTURE. PROVIDE TRANSITION AS REQUIRED.
22. ROUTE DUCTWORK SIZED AS SHOWN UP TO SECOND FLOOR. PROVIDE TRANSITION AS REQUIRED. RE: 6/M3.01 FOR CONTINUATION.
23. PROVIDE CEILING MOUNTED EXHAUST FAN AS SCHEDULED. ROUTE EXHAUST DUCT SIZED AS SHOWN IN CLOSED WALL. PROVIDE FLEXIBLE CONNECTION TO FAN AND TRANSITION AS REQUIRED.
24. ROUTE REFRIGERANT PIPING OVERHEAD TIGHT TO WALL.
25. ROUTE FLUE PIPE SIZED AS SHOWN THROUGH CHASE TO CAP ON ROOF. PROVIDE TRANSITION AS REQUIRED TO AVOID CONFLICTS WITH OUTSIDE AIR DUCTWORK AND DOORS. RE: 16/M3.01.
26. ROUTE DUCTWORK SIZED AS SHOWN THROUGH CHASE TO COMMUNICATIONS ROOM. PROVIDE MOTORIZED DAMPER INTERLOCKED WITH ASSOCIATED FAN COIL UNIT TO CLOSE UPON ACTIVATION OF HEATING CYCLE. PROVIDE 2 HOUR FIRE DAMPER AT FLOOR PENETRATION.



2 M2.01 MECHANICAL MEZZANINE PLAN
1/8"=1'-0"



3 M2.01 MECHANICAL MEZZANINE ELEVATION
1/8"=1'-0"



1 M2.01 1ST FLOOR MECHANICAL PLAN
1/8"=1'-0"

COMBUSTION AIR

EQUIPMENT	GAS INPUT (BTUH)
WATER HEATERS	186,000
TOTAL	186,000
	1 SQ. IN./4000 BTUH
REQUIRED FREE AREA OF COMBUSTION AIR OPENINGS	0.35 SQ. FT.

THIS PLAN WAS APPROVED IN THE CITY OF HOUSTON OFFICE OF BUILDING CODE ENFORCEMENT. ANY CHANGES, ADDITIONS OR ALTERATIONS TO THE PLAN SHALL BE SUBMITTED FOR REVIEW AND APPROVAL.

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DBR ENGINEERING CONSULTANTS
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Houston, Texas 77092
713.914.9888
713.914.9886

DBR Project Number	09065.000
KP	SS

ISSUE LOG

NO.	DATE	DESCRIPTION
1	05/21/09	90% CD'S
2	06/22/09	ISSUE FOR PERMIT
3		
4		
5		
6		

CONSULTANT(S):

NATEX CORPORATION ARCHITECTS
2500 WILCREST, SUITE 300
HOUSTON, TEXAS 77042
TELEPHONE: 713-975-9525
FAX: 713-780-7824

SEAL(S):

STATE OF TEXAS
KEVIN A. PFEIFFER
90810
REGISTERED PROFESSIONAL ENGINEER
6/18/09

PROJECT NAME:
FIRE STATION 20
INTERIOR RENOVATION PACKAGE
HOUSTON, TEXAS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:
PROGRAM MANAGER — SPONSORING DEPARTMENT
PROJECT MANAGER

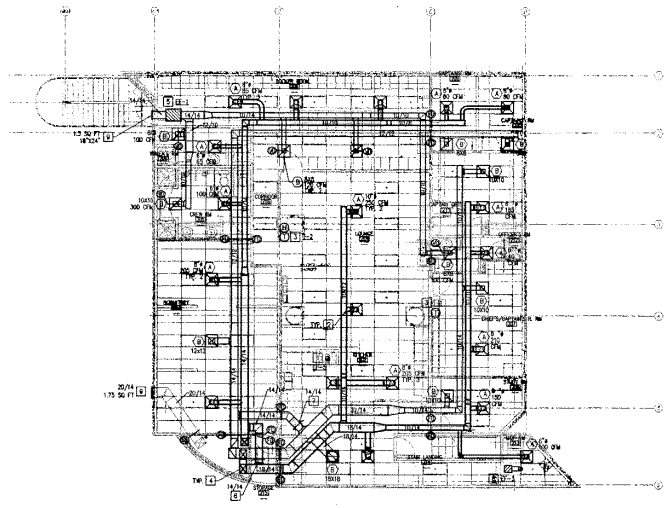
OTHER APPROVALS:
BUILDING ENGINEERING — DIRECTOR AND CHIEF ENGINEER
MECHANICAL ENGINEERING — CHIEF, HVAC & ROOF ENGINEERING
STRUCTURAL ENGINEERING — PLANNING & DEVELOPMENT
CITY ENGINEER — DATE
DIRECTOR, DEPT. OF PUBLIC WORKS & ENGINEERING — DATE

DATE: 05/21/09
W.B.S. No.: D-000000-0000-0
SCALE: AS SHOWN
DRAWN BY:
CHECKED BY:

SHEET TITLE:
1ST FLOOR MECHANICAL PLAN

SHEET NO.:
13 OF 31 SHEETS

CITY DWG. NO.:
M2.01



REFER TO SPECIFICATION SECTION 01800 FOR COMMISSIONING REQUIREMENTS.

1 / M2.02 2ND FLOOR MECHANICAL PLAN

1/8"=1'-0"

THIS PLAN WAS APPROVED IN THE ONE-STOP OFFICE FOR BUILDING CODE COMPLIANCE ONLY. THIS ELECTRICAL, PLUMBING AND HVAC WAS NOT REVIEWED FOR CODE COMPLIANCE AND IS SUBJECT SOLELY TO FIELD INSPECTION.

GENERAL NOTES

1. THERMOSTAT SHALL HAVE CAPABILITY TO SET BACK OR SHUT DOWN THE SYSTEM BASED ON DAY OF THE WEEK AND THE TIME OF THE DAY, AND PROVIDE A READILY ACCESSIBLE MANUAL OVERRIDE THAT WILL RETURN TO THE PRESETBACK OR SHUTDOWN SCHEDULE WITHOUT REPROGRAMMING.
2. ZONE THERMOSTAT CONTROL SHALL PROVIDE A TEMPERATURE RANGE OR DEADBAND OF AT LEAST 5°F WITHIN WHICH THE SUPPLY OF HEATING AND COOLING ENERGY TO THE ZONE IS CAPABLE OF BEING SHUT OFF OR REDUCED TO A MINIMUM.
3. PROVIDE INSULATION FOR PIPING AND DUCTWORK THAT MEETS THE CITY OF HOUSTON MECHANICAL CODE AMENDMENTS AS SPECIFIED IN SECTION 15250.
4. PROVIDE RETURN AIR BOOTS WHERE WALLS ARE TO DECK. SIZE BASED ON 600 FPM MAXIMUM AIR VELOCITY.
5. CONTRACTOR SHALL TRANSITION DUCTWORK AS REQUIRED TO COORDINATE WITH BEAM LOCATIONS. PROVIDE EQUIVALENT FREE AREA AT TRANSITIONS. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.
6. FASTEN AND SEAL ALL DUCTWORK JOINTS, LONGITUDINAL AND TRANSVERSE SEAMS AND CONNECTIONS PER CITY OF HOUSTON MECHANICAL CODE AMENDMENTS. DUCT SEALANT SHALL BE INSPECTED PRIOR TO DUCTWORK BEING INSULATED.
7. OUTSIDE AIR QUANTITIES ARE BASED ON THE LATEST EDITION OF ASHRAE STANDARD 62 WITH CITY OF HOUSTON AMENDMENTS.
8. ALL ROOF PENETRATIONS SHALL BE PAINTED TO MATCH THE ROOF. COORDINATE COLOR WITH ARCHITECT.

MECHANICAL KEYED NOTES

1. PROVIDE 6"ø FOR ROUND ROUND DUCT FROM KITCHEN HOOD TO CAP ON ROOF. PROVIDE TRANSITION AS REQUIRED.
2. PROVIDE SPIN-IN FITTING WITH LOCKING QUADRANT BUTTERFLY DAMPER FOR ALL ROUND FLEXIBLE DUCT CONNECTIONS TO RECTANGULAR DUCT. RE: 2/M3.01.
3. PROVIDE PROGRAMMABLE THERMOSTAT/HUMIDISTAT FOR CONTROL OF THE FAN COIL UNITS. COORDINATE FINAL MOUNTING HEIGHT AND LOCATION OF HUMIDISTAT AND THERMOSTAT WITH THE ARCHITECT/OWNER. (TSP) TEMPERATURE CONTROL FOR FCU-1 AND FCU-2 SHALL TAKE READING FROM BOTH THERMOSTAT T-1 AND T-2 AND MODULATE COMPRESSOR AND ELECTRIC HEAT AT EVAPORATOR BASED ON AVERAGE TEMPERATURE READING OF BOTH THERMOSTATS.
4. ROUTE DUCTWORK SIZED AS SHOWN DOWN TO MECHANICAL ROOM IN MEZZANINE. PROVIDE TRANSITION AS REQUIRED. RE: 2/M3.01 FOR CONTINUATION.
5. PROVIDE INLINE EXHAUST FAN. ROUTE DUCTWORK TO RUSKIN ELF375DX TYPE LOUVER OR APPROVED EQUAL IN WALL SIZED FOR 1.5 SQ FT OF FREE AREA.
6. PROVIDE SUPPLY AIR BYPASS DUCT CONNECTION SIZED AS SHOWN. PROVIDE OPPOSED BLADE VOLUME DAMPER, GREENHECK VCD-23 MGA, LOW LEAKAGE EXTRUDED VINYL BLADE SEALS WITH MANUAL HAND QUADRANT LOCKED IN CLOSED POSITION. LABEL CEILING TILE AS "SUPPLY AIR BYPASS DAMPER".
7. PROVIDE RETURN AIR BYPASS DUCT CONNECTION SIZED AS SHOWN. PROVIDE OPPOSED BLADE VOLUME DAMPER, GREENHECK VCD-23 MGA, LOW LEAKAGE EXTRUDED VINYL BLADE SEALS WITH MANUAL HAND QUADRANT LOCKED IN CLOSED POSITION. LABEL CEILING TILE AS "RETURN AIR BYPASS DAMPER".
8. PROVIDE CEILING MOUNTED EXHAUST FAN AS SCHEDULED. ROUTE EXHAUST DUCT SIZED AS SHOWN UP TO CAP ON ROOF. PROVIDE FLEXIBLE CONNECTION TO FAN AND TRANSITION AS REQUIRED.
9. PROVIDE RUSKIN ELF375DX TYPE LOUVER OR APPROVED EQUAL WITH A FREE AREA INDICATED. COORDINATE EXACT LOUVER DIMENSIONS WITH ARCHITECT. EXHAUST LOUVER SHALL BE INSTALLED A MINIMUM OF 10'-0" FROM INTAKES INTO BUILDING.

DBR ENGINEERING CONSULTANTS
TBPE FIRM REGISTRATION NO. 2224

DBR Project Number: 09065.000

KP	SS	JT	KR

ISSUE LOG

NO.	DATE	DESCRIPTION
1	05/21/09	90% CD'S
2	06/22/09	ISSUE FOR PERMIT
3		
4		
5		
6		

CONSULTANT(S):

NATEX CORPORATION ARCHITECTS
2500 WILCREST, SUITE 300
HOUSTON, TEXAS 77042
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FAX: 713-780-7824

SEAL(S):

STATE OF TEXAS
REYNA A. PROFFER
68819
REGISTERED ARCHITECT
06/19/09

PROJECT NAME:

FIRE STATION 20
INTERIOR RENOVATION PACKAGE
HOUSTON, TEXAS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:

PROGRAM MANAGER — SPONSORING DEPARTMENT
PROJECT MANAGER

OTHER APPROVALS:

WATER ENGINEERING — TRAFFIC AND TRANSPORTATION
WASTEWATER ENGINEERING — STREET, BRIDGE & ROW OPERATIONS
DRAINAGE ENGINEERING — PLANNING & DEVELOPMENT
CITY ENGINEER — DATE
DIRECTOR, DEPT. OF PUBLIC WORKS & ENGINEERING — DATE

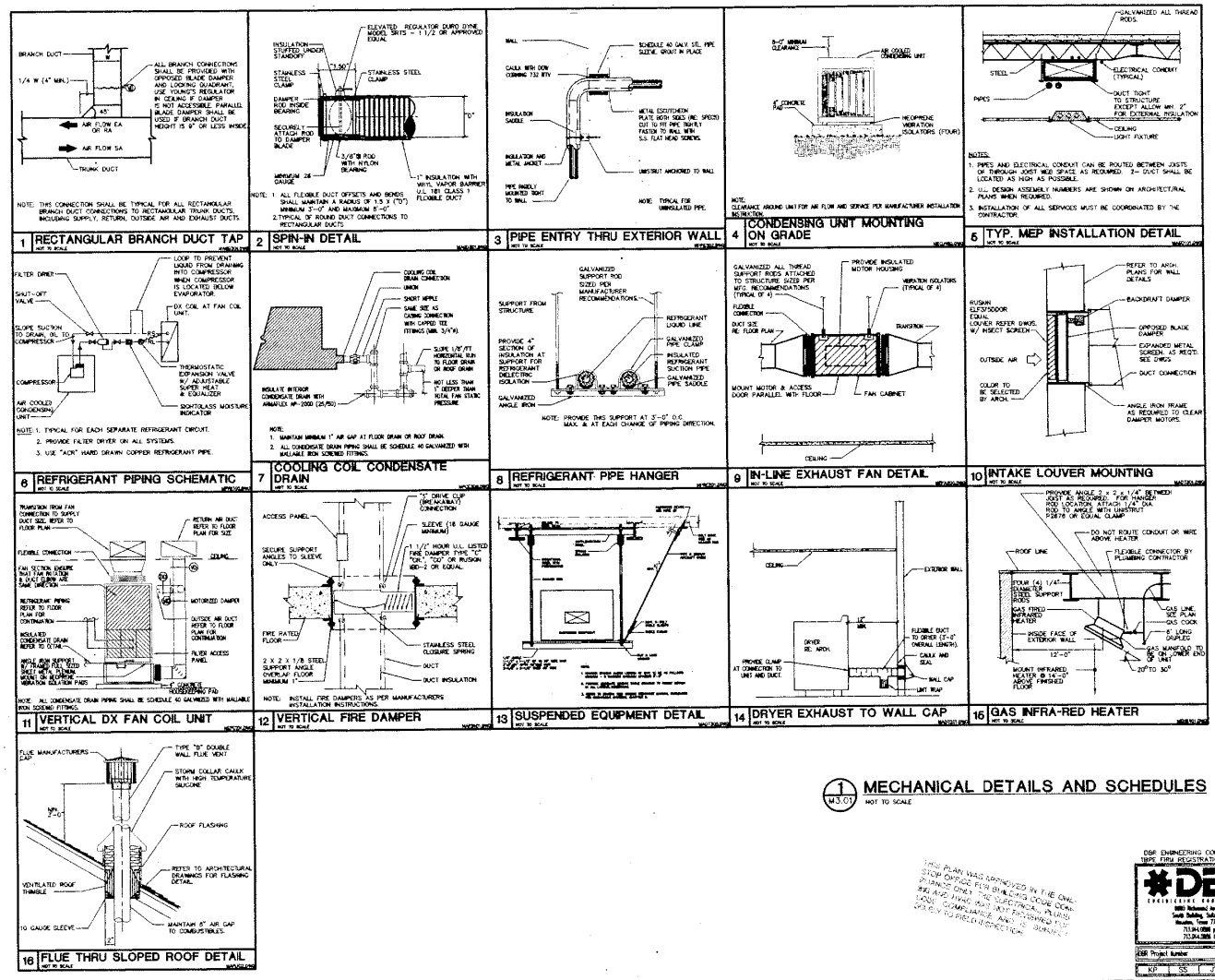
DATE: 05/21/09
W.B.S. No.: D-090000-0000-0
SCALE: AS SHOWN
DRAWN BY:
CHECKED BY:

SHEET TITLE:
2ND FLOOR MECHANICAL PLAN

SHEET NO.:
14 OF 31 SHEETS

CITY DWG. NO.:
M2.02

DESIGN FILE:



1 M3.01 MECHANICAL DETAILS AND SCHEDULES
NOT TO SCALE

THIS PLAN WAS APPROVED IN THE ONE STOP OFFICE FOR BUILDING CODE COMPLIANCE ONLY. THE STRUCTURAL, PLUMBING, MECHANICAL AND ELECTRICAL PLANS ARE ONLY TO FIELD INSPECTION.

DBR ENGINEERING CONSULTANTS
TBPE FIRM REGISTRATION NO. 2234
DBR Project Number 09065.005

KP	CS	JT	KR

ISSUE LOG

NO.	DATE	DESCRIPTION
1	05/21/09	90% CD'S
2	06/22/09	ISSUE FOR PERMIT
3		
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5		
6		

CONSULTANT(S):

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SEAL(S):
STATE OF TEXAS
KEVIN A. PFEIFFER
95819
REGISTERED PROFESSIONAL ENGINEER
6/18/09

PROJECT NAME:
FIRE STATION 20
INTERIOR RENOVATION PACKAGE
HOUSTON, TEXAS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:
PROGRAM MANAGER — SPONSORING SUPERVISOR
PROJECT MANAGER

OTHER APPROVALS:
WATER ENGINEERING — TRAFFIC AND TRANSPORTATION
WASTEWATER ENGINEERING — STREET, BRIDGE & ROW ENGINEERING
STORMWATER ENGINEERING — PLANNING & DEVELOPMENT
CITY ENGINEER — DATE
DIRECTOR, DEPT. OF PUBLIC WORKS & ENGINEERING — DATE

DATE: 05/21/09
W.B.S. No.: D-000000-0000-0
SCALE: AS SHOWN
DRAWN BY:
CHECKED BY:

SHEET TITLE:
MECHANICAL DETAILS

SHEET NO.:
15 OF 31 SHEETS

CITY DWG. NO.:
M3.01

DX SPLIT SYSTEM SCHEDULE

		MARK	FCU-1	FCU-2
INDOOR UNIT	GENERAL	SERVES	PLAN	PLAN
		SUPPLY AIR (CFM)	1,690	1,300
		OUTSIDE AIR (CFM)	125	250
		EXT. SP. (IN W.G.)	1.5	1.5
		FAN MOTOR HORSEPOWER	2	2
		BELT/DIRECT DRIVE	BELT	BELT
	COOLING	TOTAL COOLING (MBH)	66.3	67.3
		SENSIBLE COOLING (MBH)	51.5	50.1
		ENTERING AIR TEMP. DB/WB (F)	77.9/64.9	79.4/66.6
		LEAVING AIR TEMP. DB/WB (F)	58	58
	HEATING	TOTAL HEATING kW	15	15
		ENTERING AIR TEMP. DB (F)	66.2	64.0
		LEAVING AIR TEMP. DB (F)	95	96
	BASIS	VOLTS/PHASE/HERTZ	208/3/60	208/3/60
		MANUFACTURER	TRANE	TRANE
		MODEL	BCVC064	BCVC064
		WEIGHT (LBS)	260	260
CONDENSING UNIT	GENERAL	MARK	ACCU-1	ACCU-2
		STEPS OF CAPACITY	1	1
		EER	10	10
		AMBIENT AIR	100	100
	ELECTRICAL	VOLTS/PHASE/HERTZ	208/3/60	208/3/60
		MCA	26	26
		MOCP	45	45
	BASIS	MANUFACTURER	TRANE	TRANE
		MODEL	2TTA0072A3	2TTA0072A3
		NOMINAL TONS	6	6
		REFRIGERANT	R-410A	R-410A
		NOTES	1, 2, 3,4,5,7,8	1,2,3,4,5,6,7,8

NOTES:
1. PROVIDE CONDENSER COIL HAIL GUARDS.
2. PROVIDE LOW AMBIENT CONTROL.
3. PROVIDE REFRIGERANT PIPING IN STRICT ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
4. PROVIDE SINGLE POINT ELECTRICAL CONNECTION.
5. PROVIDE PROGRAMMABLE THERMOSTAT.
6. UNITS SHALL BE PROVIDED WITH HOT GAS BYPASS.
7. PROVIDE UNIT WITH ELECTRIC HEATING.
8. PROVIDE UNITS WITH A SINGLE POINT ELECTRICAL CONNECTION.

MINI SPLIT A/C UNIT SCHEDULE

MARK	AC-1
SERVES	TECHNOLOGY ROOM
SUPPLY AIR (CFM)	425
OUTDOOR AIR (CFM)	NONE
TOTAL COOLING CAPACITY (BTUH)	12,000
TOTAL HEATING CAPACITY (KW)	NONE
VOLTS / PHASE / HERTZ	208/1/60
MANUFACTURER	MITSUBISHI
MODEL NO.	PKA-A12GA
NOTES	1,2,3

NOTES:
1. INSTALL PER MANUFACTURERS SPECIFICATIONS.
2. REFRIGERANT LINES TO BE SIZED BY MANUFACTURER.
3. UNIT SHALL BE PROVIDED WITH CONDENSATE PUMP.

MINI SPLIT CONDENSING UNIT

MARK	ACCU-1
SERVES	AC-1
TOTAL COOLING CAPACITY (MBH)	12,000
AMBIENT TEMP. (F)	100
S.E.E.R.	10.8
VOLTS / PHASE / HERTZ	208/1/60
MANUFACTURER	MITSUBISHI
MODEL NUMBER	PUY-A12NHA
NOTES	

GAS UNIT HEATER SCHEDULE

MARK	UH-1,2,3
SERVES	APARATUS BAY
GAS CONNECTION (IN)	1/2
GAS INPUT (BTUH)	90,000
WEIGHT (LBS)	46
STAGES	2
GAS TYPE	NATURAL GAS
ELECTRICAL	120/1/60
MANUFACTURER	DAYTON
MODEL	3E134
NOTES	1,2

NOTES:
1. INSTALL PER MANUFACTURER'S SPECIFICATIONS.
2. PROVIDE WITH UNIT MOUNTED TEMPERATURE SENSOR. HEATERS SHALL BE ENERGIZED WHEN TEMPERATURE DROPS BELOW 50°F

AIR DEVICE SCHEDULE

MARK	MFR. & MODEL	TYPE	REMARKS
A	TITUS - PSS AA	24"x24" PERFORATED FACE SUPPLY AIR GRILLE	ALUMINUM CONSTRUCTION WITH FRAME FOR LAY-IN CEILING OR HARD CEILING, DEPENDING ON CEILING TYPE. REFER TO ARCHITECTURAL PLANS FOR CEILING TYPE. SIZE NECK ACCORDING TO DRAWING.
B	TITUS - PAR AA	24"x24" PERFORATED FACE RETURN / EXHAUST AIR GRILLE	ALUMINUM CONSTRUCTION WITH FRAME FOR LAY-IN CEILING OR HARD CEILING, DEPENDING ON CEILING TYPE. REFER TO ARCHITECTURAL PLANS FOR CEILING TYPE. PROVIDE NECK SIZED AS NOTED ON DRAWINGS. PROVIDE VOLUME DAMPER WHEN USED FOR DUCTED EXHAUST/RETURN.
C	TITUS 300FL	SIDEWALL SUPPLY AIR GRILLE	ALUMINUM CONSTRUCTION WITH FRAME FOR SURFACE MOUNT. 3/4" BLADE SPACING. DOUBLE DEFLECTION WITH FRONT BLADES PARALLEL TO LONG DIMENSION. PROVIDE O.B.D.

NOTES:
1. PAINT FACE OF ALL AIR DEVICES TO MATCH CEILING FINISH. REFER TO ARCHITECTURAL DRAWINGS FOR SPECIFICATIONS.
2. INSULATE BACK-PAN OF ALL DEVICES.
3. PROVIDE FRAME TO MATCH CEILING TYPE INDICATED ON ARCHITECTS REFLECTED CEILING PLAN.
4. PAINT INTERIOR SURFACE(S) OF DUCTWORK VISIBLE FROM FACE OF RETURN AIR GRILLES FLAT BLACK.

FAN SCHEDULE

MARK	EF-1	EF-2	EF-3	EF-4	EF-5
SERVES	LIVING QTRS	APPARATUS BAY	MOP ROOM	MOP ROOM	KITCHEN
TYPE/DRIVE	CENT/BELT	CENT/BELT	CENT/DIRECT	CENT/DIRECT	CENT/BELT
CFM	300	10,000	125	100	800
EXT. S.P. (IN. W.G.)	0.400	0.300	0.300	0.300	0.300
HORSEPOWER (WATTS)	1/4	3	(120)	(120)	(515)
RPM (MAX.)	1,020	840	1,050	950	1,500
SONES (MAX.)	8.5	18.3	3.4	1.3	--
VOLTS/PHASE/HERTZ	120/1/60	208/3/60	120/1/60	120/1/60	120/1/60
MANUFACTURER	GREENHECK	GREENHECK	GREENHECK	GREENHECK	THERMADOR
MODEL NUMBER	BSQ-130	BSQ-300	CSP-B150	CSP-B150	VTM630D
NOTES	1,3,4	1,3	1,4	1,4	1,2,5

NOTES:
1. PROVIDE WITH BACKDRAFT DAMPER AND FAN MOUNTED SPEED CONTROL.
2. FAN TO OPERATE BY SWITCH MOUNTED AT SAME LEVEL AS LIGHT SWITCHES. COORDINATE WITH ARCHITECT FOR EXACT LOCATION.
3. PROVIDE CARBON MONOXIDE DETECTOR TO TURN ON FAN WHEN CARBON MONOXIDE REACHES A LEVEL OF 30 PARTS PER MILLION.
4. INTERLOCK FAN WITH ASSOCIATED AIR HANDLING UNIT.
5. COORDINATE WITH GENERAL CONTRACTOR TO CONFIRM WHO IS RESPONSIBLE FOR PROVIDING HOOD.

THIS PLAN WAS APPROVED IN THE CONCEPTUAL STAGE FOR BUILDING CODE COMPLIANCE ONLY. THE ELECTRICAL, PLUMBING AND MECHANICAL NOT REVIEWED FOR CODE COMPLIANCE AND IS SUBJECT SOLELY TO FIELD INSPECTION.

DBR ENGINEERING CONSULTANTS
TBPE FIRM REGISTRATION NO. 2234

DBR Project Number 09065.000

KP	SS	JT	KR

ISSUE LOG

NO.	DATE	DESCRIPTION
1	05/21/09	90% CD'S
2	06/22/09	ISSUE FOR PERMIT
3		
4		
5		
6		

CONSULTANT(S)

NATEX CORPORATION ARCHITECTS
2500 WILCREST, SUITE 300
HOUSTON, TEXAS 77042
TELEPHONE: 713-975-0525
FAX: 713-790-7824

SEAL(S):

PROJECT NAME:
FIRE STATION 20
INTERIOR RENOVATION PACKAGE
HOUSTON, TEXAS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:

OTHER APPROVALS:

DATE: 09/21/09
W.B.S. No.: D-000000-0000-0
SCALE: AS SHOWN
DRAWN BY:
CHECKED BY:

SHEET TITLE:
MECHANICAL SCHEDULES

SHEET NO.:
16 OF 31 SHEETS

CITY DWG. NO.:
M3.02

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 9.12.1payable 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-C23357

HVAC Installation at Fire Station No. 20

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