September 1, 2023

Project Name: Pearl Fire Stations
Project Number: 22-099 & 22-108

ADDENDUM NO. 02

NOTICE TO ALL DOCUMENT HOLDERS:
The following additions, deletions, changes and clarifications to the drawings and specifications are to be included as part of the Contract Documents.

GENERAL

ITEM NO. 01 **Pre-Bid Conference**
A Pre-Bid Conference will not be held for this Project.
A final Addendum, if necessary, shall be issued on Monday, September 11, 2023.
Questions regarding the Project must be received by no later than Thursday, August 7, 2023 in order to receive answers or clarifications.

ITEM NO. 02 **Testing / Special Inspections**
All testing and/or special inspections to be performed by an independent testing agency will be contracted by and through the Owner. Contractor does not need to include pricing for testing services.

SPECIFICATIONS

ITEM NO. 03 **00.0003 Table of Contents**
DELETE references to the following Sections:
14.2100 – Electric Traction Elevators
14.9100 – Facility Trash Chutes
Clarification: The Project does not include Elevators or Trash Chutes.

ITEM NO. 04 **Divisions 20, 21, 22, and 23**
REPLACE Divisions 20, 21, 22, and 23 in their entirety with the attached Divisions.
Clarification: Originally published Fire Protection, Plumbing, and HVAC specifications were illegible due to a file malfunction.

DRAWINGS

ITEM NO. 05 **Sheet A010 Site Plan & Ext Details - Central Fire Station**
REPLACE the attached drawing in its entirety with the attached **Sheet A010.**
Clarification: Revised sheet includes detail information about trash and utility enclosures.

ITEM NO. 06 **Sheet A020 Site Plan & Ext. Details - Station 5**
REPLACE the attached drawing in its entirety with the attached **Sheet A020.**
Clarification: Revised sheet includes detail information about trash and utility enclosures.

Encl: **RFIs**: n/a
Specifications (8.5x11): Divisions 21, 22, 23, and 24 (124 pages)
Drawings (24x36): A010, A020
Cc: All document holders
File : 22-099/C/C2

Mechanical General Provisions

PART 1 GENERAL

1.1 SCOPE

Provide all material, equipment and labor, etc., required to complete installation specified herein and/or shown or scheduled on Contract Drawings.

1.2 MECHANICAL SPECIFICATION SECTION INDEX

Division 20 – Fire Protection, Plumbing and HVAC General Provisions
Section 200010 – Mechanical General Provisions
Section 200020 – Basic Mechanical Requirements
Section 200030 – Mechanical Submittals and Shop Drawings
Section 200035 – Mechanical Systems and Equipment Warranties
Section 200040 – Mechanical Close-out Requirements
Section 200050 – Basic Mechanical Materials and Methods
Section 200060 – Pipes and Pipe Fittings
Section 200100 – Valves
Section 200120 – Piping Specialties
Section 200140 – Supports and Anchors
Section 200170 – Electrical Requirements
Section 200190 – Mechanical Identification
Section 200240 – Mechanical Sound and Vibration Control
Section 200250 – Mechanical Insulation

Division 21 – Fire Suppression
Section 210330 – Fire Sprinkler System

Division 22 – Plumbing
Section 220430 – Plumbing Specialties
Section 220440 – Plumbing Fixtures, Trim and Accessories
Section 220450 – Domestic Water Heaters and Accessories

Division 23 – Heating, Ventilating and Air Conditioning (HVAC)
Section 230670 – Packaged Air Conditioners
Section 230830 – Heating/Cooling Terminal Units
Section 230860 – Fans
Section 230885 – Air Cleaning/Treatment
Section 230890 – Ductwork
Section 230910 – Ductwork Accessories
Section 230980 – Controls and Instrumentation
Section 230990 – Testing, Adjusting and Balancing

1.3 DEFINITIONS

A. ARCHITECT: Architectural Design firm or ARCHITECT OF RECORD, meaning general building designer whose professional seal appears on the majority of general construction Contract Documents, or their authorized representative.

B. ENGINEER (ENGINEER-OF-RECORD): ENGINEER whose professional stamp appears on Contract Drawings, etc. In general, unless specifically denoted otherwise, ENGINEER-OF-RECORD in Division 20, 21, 22 and 23 Specification Sections denotes MECHANICAL ENGINEER-OF-RECORD.

C. Exposed, or exposed to view: Those installations which can be seen, in whole or part.

D. Finished Spaces: Inside the building extents.

E. Inspect and/or Inspection: Utilized for the PROFESSIONAL'S construction period services and defines as "visits by the PROFESSIONAL to the Project at appropriate intervals during construction to become generally familiar with the progress and quality of the CONTRACTOR'S work and to determine if the work is proceeding in accordance with the Contract Documents."

F. Outside: Synonymous with outdoors, outside of building, exposed to weather, etc.

G. Plans: Denotes general Construction Drawings prepared by the A/E.

H. PROFESSIONAL: Authorized representative of ENGINEER-OF-RECORD'S firm.

I. Provide: Unless specifically denoted otherwise, the CONTRACTOR referred to shall be responsible for furnishing, providing, installing, connecting, and making item or system fully functional in a safe manner as recommended by the manufacturer and by Industry Standards.

1.4 APPLICABLE STANDARDS

A. The intent is that the complete installation shall comply with applicable laws and ordinances, utility company regulations, and applicable requirements from the latest edition of the following:

ANSI	American National Standard Institute
ASHRAE	ASHRAE guides, Latest Editions
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing Materials
ICC	International Code Congress
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UL	Underwriters Laboratories

City of Pearl, Mississippi, Fire, Building, Gas, Plumbing and Mechanical Codes and Regulations, and governing authority having jurisdiction.

B. Other applicable building, safety or fire codes having jurisdiction over equipment, materials or methods. The decision of the ENGINEER will be final in event of dispute over Code to use or its interpretation.

1.5 GENERAL CONDITIONS

A. The General Conditions, Information to Bidders, Special Conditions, and other pertinent documents issued by the ARCHITECT are a part of these Specifications and shall be complied with in every respect.

B. By the act of submitting a bid, this CONTRACTOR agrees that all of the Contract Documents and each of the divisions of the complete Specifications have been reviewed and studied, and all requirements and coordination resulting there from are

included.

C. This CONTRACTOR shall conform to standards prescribed by City, County, and State regulations or ordinances having jurisdiction. Any changes that may be necessary to conform to such regulations or ordinances shall be made by this CONTRACTOR without extra costs to the OWNER. Where code requirements are less than those shown on the Plans or in the Specifications, the Plans and Specifications shall be followed. Where applicable, NFPA requirements shall be met.

D. The CONTRACTOR shall comply with all applicable provisions of the William-Steiger Occupational Safety and Health Act (O.S.H.A.).

E. Permits required for the installation of the work, as well as all authorized code inspections, including all fees and assessments, shall be borne by and arranged for by the CONTRACTOR. The CONTRACTOR shall verify specific mechanical related provisions for permitting in advance, especially where additional design/installation documentation may be required, and include provisions and/or cost of same in this bid.

F. This CONTRACTOR shall provide all items, articles, materials, operations or methods listed, mentioned, or scheduled on the Drawings and/or herein including all labor, materials, equipment and incidentals necessary, required or implied, for the completion of the various systems.

1.6 EXPLANATION AND PRECEDENCE OF DRAWINGS

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

B. Do not scale drawings having 1/4" or smaller scale. The Drawings indicate required size and points of termination of pipes and ducts, and suggest proper routes of pipe to conform to structure, avoid obstructions and preserve clearances. Because of small scale, it is not intended that Drawings indicate all necessary offsets, and it shall be the work of this Section to install work in such a manner as to conform to structure, avoid obstructions, preserve headroom and keep openings and passageways clear without further instruction or cost to the OWNER.

C. It is intended that all apparatus be located symmetrically with architectural elements, and shall be installed at exact height and locations as shown on the Architectural Drawings.

D. The CONTRACTOR shall be solely responsible for taking his own measurements and installing his work to suit conditions encountered.

1.7 SPECIAL CONDITIONS, MECHANICAL

A. The right is reserved to move any element as much as ten (10') feet at no increase in cost provided CONTRACTOR is notified before work in question is fabricated or installed.

B. The CONTRACTOR shall fully inform himself regarding any and all peculiarities and limitations of spaces available for the installation of all work and materials furnished and installed under the contract. He shall exercise due and particular caution to determine that all parts of his work are made quickly and easily accessible. The

CONTRACTOR shall be guided by the architectural details and conditions existing at the job, correlating this work with that of the other trades, and report to the OWNER any discrepancies or interferences that are discovered. Failure to report such discrepancies and interferences shall result in the correcting of these errors or omissions by the CONTRACTOR at his own expense. All work which deviates from the Drawings and Specifications without prior approval of the OWNER, shall be altered by the CONTRACTOR at his own expense to comply with the Drawings and Specifications as directed.

C. If equipment or fixtures to be furnished by OWNER and/or OWNER'S vendor are not delivered prior to final acceptance, services shall be capped or plugged at walls or floor as directed by ARCHITECT, ready for future connection.

D. The CONTRACTOR shall coordinate his work with that of the OWNER, in order that there will be no delay in the proper installation and completion of the work. If, in the opinion of the OWNER, any piping, equipment, etc., has been improperly placed or installed due to lack of coordination with the other trades, such piping and equipment shall be relocated as directed by the OWNER at the CONTRACTOR'S expense.

1.8 SITE SAFETY

CONSULTANT'S site responsibilities are limited solely to the activities of CONSULTANT and CONSULTANT'S employees on site. These responsibilities shall not be inferred by any party to mean that CONSULTANT has responsibility for site safety. Safety in, on, or about the site is the sole and exclusive responsibility of the CONTRACTOR alone. The CONTRACTOR'S methods of work performance, superintendence of the CONTRACTOR'S employees and sequencing of construction are also the sole and exclusive responsibilities of the CONTRACTOR alone. The CONTRACTOR shall, to the fullest extent permitted by law, waive any claim against CONSULTANT and his employees and indemnify, defend, and hold CONSULTANT harmless from any claim or liability for injury or loss arising from CONSULTANT'S alleged failure to exercise site safety responsibility. The CONTRACTOR also shall compensate CONSULTANT for any time spent or expenses incurred by CONSULTANT in defense of any such claim. Such compensation shall be based upon CONSULTANT'S prevailing fee schedule and expense reimbursement policy. The term "any claim" used in this provision means "any claim in contract, tort or statute alleging negligence, errors, omissions, strict liability, statutory liability, breach of contract, breach of warranty, negligent misrepresentation, or other acts giving rise to liability.

PART 2 – PRODUCTS – NOT APPLICABLE

PART 3 – EXECUTION

3.1 WORKMANSHIP, MATERIALS AND EQUIPMENT

A. All work shall be performed in a workmanlike manner and shall present a neat and mechanical appearance when completed. All materials shall be of type, quality and minimum rating prescribed herein or indicated on the Contract Drawings.

B. If equipment or fixtures to be furnished by OWNER and/or OWNER'S vendor are not delivered prior to final acceptance, services shall be capped or plugged at walls or floor as directed by ARCHITECT, ready for future connection.

3.2 CLEAN-UP

A. Do not allow mechanical related waste material or rubbish to accumulate in or about job site.

B. At completion of work, remove all rubbish, tools, scaffolding and surplus materials from and about building, leaving work clean and ready for use without further cleaning required. Clean all equipment, piping, valves, fixtures, and fittings of grease, metal cuttings, insulation cement, dust, dirt, paper labels, etc.

C. Any discoloration or other damage to parts of building, its finish or furnishings due to failure to properly clean or keep clean mechanical systems shall be repaired without additional cost to OWNER.

D. All equipment, fixtures and installations, especially where installations are exposed to view, shall be thoroughly cleaned, polished, seams smoothed and/or sealed for a neat appearance.

3.3 INSPECTION OF PROPOSED CONSTRUCTION

Prior to submitting his bid, the CONTRACTOR shall visit the site of the proposed construction and shall thoroughly acquaint himself with existing utilities, working conditions to be encountered, etc. No additional compensation shall be allowed for conditions increasing the CONTRACTOR'S cost which were not known or appreciated by him when submitting his proposal if the condition was obvious and could have been discovered by him if he had visited the project site and thoroughly informed himself of all existing conditions which would affect his work, including requirements of local authorities to meet their procedures, special requirements, codes, etc.

3.4 TEMPORARY ENVIRONMENTAL CONDITIONING

Temporary heating, cooling and dehumidification capability shall be provided for this project beginning a minimum of 90 days prior to the original contract scheduled substantial completion date and maintained until the OWNER'S final acceptance of the project, or any phase thereof. The beginning of this temporary HVAC period is intended to align with general industry standard construction practice of providing a minimum suitable indoor environment for the installation and curing of adhesives, finishes, wall covering(s), tile ceiling/floors, etc. It is highly dependent upon the CONTRACTOR's comprehensive project coordination and scheduling efforts and shall be lengthened (begun earlier) should the CONTRACTOR install such systems and/or finishes which are recommended by the system and/or finish manufacturer to be installed and/or maintained in a minimum environmental condition. This interior space conditioning, known hereafter as "temporary HVAC", includes all areas of the project where the space will be similarly conditioned with heating, cooling and/or dehumidification capability after the project or any portion/phase thereof is completed.

During this minimal temporary HVAC period, the interior space shall be continuously monitored and controlled to provide the following:

1. maximum 85 degrees Fahrenheit dry bulb temperature.
2. minimum 60 degrees Fahrenheit dry bulb temperature.
3. maximum 60% relative humidity.

In effect, automatic controls for refrigeration, dehumidification, and heating shall be provided such that the indoor building environment, as described above, can be continually maintained. If a system and/or finish manufacturer recommends a more stringent requirement for conditioning, same shall be provided.

The CONTRACTOR shall coordinate such temporary provisions with the all trades and utility companies to accomplish this requirement including adequate temporary power to

equipment, etc. All cost and coordination for these temporary HVAC provisions shall be the responsibility of the CONTRACTOR and included in his base bid.

While operating the systems, the intent is to protect the installations from dirt, dust, debris, etc. such that at substantial completion the systems are new, clean and ready for the OWNER's beneficial use. The CONTRACTOR is responsible for protection of the WORK to meet the design intent identified herein. The following minimum requirements shall be met:

1. Completed manufacturer equipment start-up forms must be filled out completely for each and every piece of equipment. Copy of same shall be maintained on file at the project site for verification. Failure to complete the form entirely or maintain copy at project site will result in equipment operation being discontinued without exception.
2. The exterior building envelope is complete including installation of all permanent doors, windows, walls, louvers, roof openings, etc.
3. ALL interior and exterior dust generating activities and subsequent cleanup is complete and approved by the ARCHITECT. Examples of this are exterior sitework around the building, interior sheet rock installation/finishing, floor grinding, spray application of paints/sealers, etc.
4. HVAC Systems shall have pleated air filters of types indicated in Section Air Cleaning/Treatment installed, monitored and periodically replaced when loaded.
5. All R/A grilles and/or openings into ductwork/plenums are fully covered, and protected with filter material of types indicated in Section Air Cleaning/Treatment. These filters shall be continually monitored and periodically replaced when loaded.
6. There is no reduction in specified equipment warranty, capacity, performance, or life of the equipment.
7. HVAC equipment manufacturer's recommendations don't indicate construction practices and installations are harmful to systems, equipment, etc.
8. HVAC equipment manufacturer start-up tests have been performed and accompanying forms have been transmitted to Professional for review. See HVAC equipment specification sections for more information. A copy of same shall be included in Close-out Documents. See Section *MECHANICAL CLOSE-OUT REQUIREMENTS*.

If new HVAC equipment cannot be utilized for providing indoor environmental control during construction for finishes, etc., the CONTRACTOR shall arrange for other temporary HVAC capacity as required.

If the CONTRACTOR fails to adhere to these guidelines for operation of the permanent building mechanical systems, corrective action by the CONTRACTOR will be required. Corrective action will be determined by the ENGINEER but may include any combination of the following:

1. Cleaning or Replacing Ductwork should it be found with visible dust/debris. A third-party testing/inspection representative may be required depending upon the extent of contamination.
2. Replacement or Cleaning of Equipment should it be found with visible

dust/debris/damage. The respective equipment manufacturer's representative will be required to inspect and make written recommendations as to the corrective actions necessary to return the equipment to like new conditions.

The CONTRACTOR will be solely responsible for and include all cost associated with any required corrective actions.

However, permanent HVAC equipment, as described above, shall be fully operational during the last 30 days of the temporary HVAC period such that system performance and controls can be tested, adjusted and balanced per Section Testing, Adjusting and Balancing.

3.5 EXISTING UTILITIES AND SERVICES

A. When encountered in work, protect existing active sewer, water, gas, electric, other utility services, structures; where required for proper execution of work, relocate them as directed. If existing active services are not indicated, contact PROFESSIONAL for instructions.

B. When encountered in work area, whether or not indicated, cap or plug or otherwise discontinue existing inactive sewer, water, gas, electric, other utility service structures, of which action should be taken. If removal is required, request instructions from PROFESSIONAL.

C. While work is in progress, except for designated short intervals during which connections are to be made, continuity of service shall be maintained to all existing utilities and systems. Interruptions shall be scheduled and coordinated with ARCHITECT and OWNER and approved in advance with the OWNER and serving utilities. If requested, downtime shall be limited to weekends and/or night periods to least disrupt normal use of these utilities. The CONTRACTOR shall be responsible for any interruptions to service and shall promptly repair any damages to existing systems caused by his operations.

D. The accuracy of the location of existing underground, and otherwise concealed, HVAC, domestic, fire protection, sanitary and storm drainage utilities is not guaranteed. The CONTRACTOR shall, early in the project, prior to demolition of existing work and layout of new work, verify all underground and concealed work in the proximity of connections to existing services and routings.

E. Immediately upon commencing construction, and prior to construction of any part of the facility involved in any way with utilities, the CONTRACTOR shall investigate thoroughly the size, capacity, arrangement and location of all mechanically related utilities. The CONTRACTOR shall immediately report any discrepancies or apparent problem involving the project that pertains to utilities. This applies to private as well as public utilities. This CONTRACTOR shall coordinate and utilize the services of public and private "locators" to ascertain the whereabouts of all underground utilities in the area where work is to be performed.

END OF SECTION

Basic Mechanical Requirements

PART 1 – GENERAL

1.1 SCOPE

Furnish all labor, materials, services, and equipment required to complete the installation of complete and acceptable mechanical systems in accordance with these specifications and the contract drawings.

1.2 TESTS

A. This CONTRACTOR shall conduct such tests as required to determine that systems and equipment, which he installs, conform to Specifications. CONTRACTOR shall supply all labor, materials, instruments, operations, etc., required to facilitate testing.

B. Gauges, thermostats, and instruments used in testing shall be accurate, recently calibrated and approved by the PROFESSIONAL prior to test. Instruments installed permanently in systems as specified herein may be used in testing when approved by the ENGINEER.

PART 2 – PRODUCTS – NOT APPLICABLE

PART 3 – EXECUTION

3.1 MISCELLANEOUS WORK REQUIRED

A. The CONTRACTOR shall provide foundations for equipment, chases, furring, framed openings in walk, partitions, etc., installation of wall louvers and grilles in doors, finish painting and all other similar work of a general construction nature. All roof flashing by CONTRACTOR.

B. The CONTRACTOR shall bring adequate power to and make final connections to all equipment furnished under this Contract.

C. All items of labor, materials and equipment not specifically stated herein or on Contract Drawings to be by others are required to make the systems complete and operative, shall be by this CONTRACTOR.

3.2 PROTECTION OF EQUIPMENT AND MATERIALS

A. Responsibility for care and protection of equipment and materials under this Contract rests with this CONTRACTOR until equipment or materials have been tested and accepted.

B. All pipe ends, valves, ductwork and parts of equipment left unconnected, permanently or temporary, shall be capped, plugged or properly protected at the end of each working day to prevent entry of foreign matter. During the construction process, cover ductwork exposed to weather and/or when not yet installed, with sheet metal caps screwed in place and sealed.

C. Store equipment, ductwork including pipe and valves, off the ground and under cover. For storage outdoors, minimum 6-mil thick plastic shall be fitted to withstand splattering, ground water, precipitation and wind.

D. Protect air handling unit coils by use of protective sheet metal panels or plywood.

E. Damaged equipment shall be repaired or replaced at the option of the PROFESSIONAL. Finishes and/or scratched paint on equipment, etc., shall be repaired and repainted to match new condition(s).

F. Do not bring insulated equipment or ductwork to job site until same can be adequately protected from wind, rain and damage, etc. In general, store ductwork in building(s) not yet fully enclosed, off the ground and under minimum 6-mil plastic sheeting, etc. This includes dual wall spiral and interior lined rectangular ductwork, and other similar equipment with liners, controls, etc., not recommended to be exposed to wind and water, etc. Such ductwork and equipment found damaged and/or damp shall be immediately replaced and shall not be utilized for this project.

G. This CONTRACTOR shall protect his work at all times from danger by freezing, breakage, dirt, foreign materials, etc., and shall replace all work so damaged. The CONTRACTOR shall use every precaution to protect the work of others, and he will be held responsible for all damage to other work caused by his work or through the neglect of his workmen.

3.3 INSTALLATION COORDINATION

A. The mechanical plans do not give exact elevations or locations of lines, nor do they show all the offsets, control lines, or other installation details. The CONTRACTOR shall carefully lay out his work at the site to conform to the structural conditions, to provide proper grading of lines, to avoid all obstructions, to conform to details of installation supplied by the manufacturers of the equipment to be installed, and to thereby provide an integrated, coordinated and satisfactory operating installation. In general ductwork has the right-of-way.

B. If the CONTRACTOR proposes to install equipment, including piping and ductwork requiring space conditions other than those shown, or to rearrange the equipment, he shall assume full responsibility for the rearrangement of the space and shall have the ARCHITECT review the change before proceeding with the work. The request for such changes shall be accomplished by Shop Drawings of the space in question.

C. The CONTRACTOR shall so coordinate the work of the several various trades that it may be installed in the most direct and workmanlike manner without hindering the other trades. Piping interferences shall be handled by giving precedence to pipe lines, which require a stated grade for proper operation. For example, sewer lines and condensate piping shall take precedence over water lines in determination of elevations. Where there is interference between sewer lines and condensate lines, the sewer lines shall have precedence and provisions shall be made in the condensate lines for looping them around the sewer lines. In all cases, lines requiring a stated grade for their proper operation shall have precedence over electrical conduit and ductwork.

D. Piping, equipment, or ductwork shall not be installed in electrical equipment rooms or elevator machine rooms except as serving only those rooms. Outside of electrical equipment rooms, do not run piping or ductwork, or locate equipment, with respect to switchboards, panel boards, power panels, motor control centers or dry type transformers:

1. Within 42” in front (and rear if free standing) of equipment; or
2. Within 36” of sides of equipment.
3. Clearances apply vertically from floor to structure/ceiling.

3.4 INSTALLATION DIRECTIONS

Obtain manufacturer's printed installation directions to aid in properly executing work on equipment requiring such directions. Submit such directions and installation details to

PROFESSIONAL for approval prior to time of installation for use in supervising work. If the manufacturer's installation instructions or details conflict with the Contract Document requirements, CONTRACTOR shall promptly make PROFESSIONAL aware in writing and request clarification.

3.5 MECHANICAL VERIFICATION AND INSPECTIONS

A. The CONTRACTOR shall coordinate, with the A/E with a minimum ten (10) days advance notice, the inspection of mechanical sub-systems for the following:

1. in-wall piping/ductwork

2. above ceiling piping/ductwork

B. These inspections shall be coordinated prior to wall and/or ceiling/attic insulation installation, (concealment) etc., such that these mechanical installations can be easily visually inspected by A/E for general conformance with Contract requirements. These installations shall not be concealed until such time the A/E indicates these mechanical installations are acceptable. If a re-inspection is required, an A/E revisit and a follow-up inspection shall be similarly coordinated with sufficient advance notice as approved by the A/E. Therefore, it is pertinent for the CONTRACTOR to inspect these type installations himself and verify that these installations are complete and in conformance with specified standards to minimize any time delays and/or coordination of construction sequencing, etc.

C. The CONTRACTOR should note the following requirement for administering the punch list(s) and mechanical closeout documents associated with a substantial completion and/or final, etc.

D. In general, the punch list(s) will be furnished with blanks for the CONTRACTOR and/or his Sub-Contractor(s) to initial and date, adjacent to each item, for coordination and verification efforts. The completed punch list shall be transmitted to A/E to allow them to thereafter schedule a follow-up visit for re-inspection and verification. It is, therefore, prudent for the CONTRACTOR, to administer the overall process, and verify that all punch list items are complete and in compliance with Contract requirements, prior to requesting a follow-up A/E inspection effort.

E. The CONTRACTOR shall be liable for inspections and further administrative involvement required of the A/E after 30 days of the original scheduled completion date, and for re-inspections and involvement by the A/E caused by the CONTRACTOR'S negligence and failure to fully complete punch lists and Closeout Documents when required and/or requested.

END OF SECTION

Mechanical Submittals and Shop Drawings

PART 1 – GENERAL

1.1 SUBMITTALS AND SHOP DRAWINGS

A. The submittal data to be furnished for this project shall comply with the Specifications and Contract Documents in their entirety. See *Division 01* for more information.

B. Reproduction of design documents in any portion for use in a submittal is not acceptable.

C. Provide all additional documentation required to obtain permanent permit for this project as may be required by Authorities Having Jurisdiction. All such additional documentation shall be considered a normal part of the shop drawing with the cost of same included.

D. Selection of Materials and Equipment:

1. Where a definite material or brand name is specified, it is not the intent to discriminate against any product of another manufacturer. Reference to a specific manufacturer's product by name, make or catalog number is intended to establish standards of quality, design, dimensions and appearance.

2. Open competition is expected, but in all cases, complete data must be submitted for comparison and test when requested by the PROFESSIONAL. Burden of "proof of equality" lies solely with the CONTRACTOR.

3. The products of various manufacturers have been used as the basis of design in preparation of these documents. It shall be the responsibility of the CONTRACTOR to ensure the submitted materials and equipment will fit into the space allotted. Furthermore, verify and maintain adequate access to equipment, valves, filters, lubrication outlets, etc. Any changes to the building or system design necessary shall be arranged for in writing before the materials and equipment is ordered. All costs involved in making such changes shall be borne by the CONTRACTOR.

4. When submitting materials and equipment other than the basis of design, note the following minimum considerations:

   a. Capacities shown are absolute minimum and must be equaled

   b. Physical size, weight, etc. limitations

   c. Noise and vibration levels

   d. Interchangeability

   e. Accessibility for maintenance and replacement

   f. Compatibility with other materials, assemblies

   g. Similar items shall be furnished by the same manufacturer and style whenever possible.

5. The availability of service is of prime importance to the OWNER and was a major consideration in selecting the materials and equipment that are listed as the basis for design. Competent service must not only be available, but must, in the case of specialty HVAC equipment and control systems, be a

direct arm of the manufacturer. Further, the service agency, as a representative of this manufacturer, must have been in continuous operation in this area sufficient time to indicate a degree of permanence.

1.2 SAMPLES AND MOCK-UPS OF PROPOSED INSTALLATION

A. Samples:

1. Provide samples of equipment, components, control devices, etc. as requested by the PROFESSIONAL.

2. These samples are intended to demonstrate quality of construction of proposed installation materials and/or equipment.

3. In general, each substitution request made by the CONTRACTOR will likely require a sample be furnished for review. However, in some cases, samples will be requested of specified equipment, components, control devices, etc. to demonstrate to the Owner the proposed installations.

B. Mock-ups:

1. Provide mock-ups of the proposed installations as requested by the PROFESSIONAL.

2. These mock-ups shall be either in-place or separately constructed at the direction of the PROFESSIONAL.

3. In general, mock-ups shall be of completed proposed installations as coordinated between CONTRACTOR and PROFESSIONAL. In some cases, this will require different levels of completion or staged mock-up construction (i.e. ductwork with taps installed and sealant applied in one section without insulation and insulation applied in another). Some examples of these mock-ups are as follows:

a. Furnace Evaporator

b. Dehumidifier

c. Ductwork including rectangular interior lined and exterior wrapped with round taps and run-outs

d. Plumbing fixture(s)

e. Trapeze piping installation including valves, fittings, insulation and saddles

PART 2 – PRODUCTS – NOT APPLICABLE

PART 3 – EXECUTION

3.1 SUBMITTALS AND SHOP DRAWINGS

A. The following product data submittals for materials and equipment shall be submitted to PROFESSIONAL for approval:

1. SECTION *PIPE AND PIPE FITTINGS*

a. Sanitary Waste and Vent Piping Fittings and Connections

b. Condensate Drain Piping Fittings and Connections

c. Domestic Water Piping Fittings and Connections

d. Natural Gas Piping Fittings and Connections

e. Refrigerant Piping Fittings and Connections

f. Equipment Utility and Relief Drain Piping Fittings and Connections

g. Oil Waste Piping Fittings and Connections

h. Fire Protection Piping Fittings and Connections

2. SECTION *VALVES*

a. Manual "Circuit-Setter" Balancing Valves

b. Ball Valves

c. Gas Valves

d. Check Valves

3. SECTION *PIPING SPECIALTIES*

a. Pressure Gauges

b. Thermometers

4. SECTION *MECHANICAL IDENTIFICATION*

a. List and Size/Color(s) of all Starter, Switch, Disconnect Switch, Time clock and Equipment and Warning Phenolic Labels

b. Piping Markers

c. Underground Tracer Identification Tape

5. SECTION *MECHANICAL SOUND AND VIBRATION CONTROL*

a. Pipe, Duct and Equipment Vibration Isolation

6. SECTION *MECHANICAL INSULATION*

a. Insulation for all piping applications

b. Insulation for all ductwork applications

c. Piping fitting insulation and cover

d. Vinyl cover

7. SECTION *FIRE SPRINKLER SYSTEM*

a. Sprinkler Hydraulic Calculations

b. Sprinkler Shop Drawing(s)

c. Copy of State Rating Board of Certification (Letter)

d. OS&Y Valves

e. Electric Alarm Bells

f. Tamper Switches

g. Flow Switches

h. Sprinkler Heads

i. Spare Sprinkler Head Cabinet

j. Pipe Labels

k. Backflow Preventer

l. Hangers

m. Copy of Local Fire Marshall Approval Letter

n. Seismic Restraint Drawings and Calculations

o. Installation and Material Certificate. Note: Submittal must be transmitted to the Professional 5 days prior to request for substantial completion inspection.

8. SECTION *PLUMBING SPECIALTIES*

a. Cleanouts

b. Floor Drains

9. SECTION *PLUMBING FIXTURES, TRIM & ACCESSORIES*

a. Plumbing Fixtures and Trim

b. Carriers

c. Handicapped Drain/Water Supply Insulation Protectors

d. Hose Bibbs

e. Water Hammer Arrestors

f. Oil Interceptor

g. Washer Boxes

h. Icemaker Boxes

10. SECTION *DOMESTIC WATER HEATERS AND ACCESSORIES*

a. Water Heaters and Installation Accessories

b. Potable Water Expansion Tanks

c. Mixing Valves

d. Re-circulating Pumps

11. SECTION *PACKAGED AIR CONDITIONERS*

a. Split Systems (Equipment)

b. Thermostats, Humidistats and Protective Covers

c. Ductless Mini-Splits

12. SECTION *HEATING/COOLING TERMINAL UNITS*

a. Unit Heaters

13. SECTION *FANS*

a. All Fans, Construction, Accessories, and Finishes

b. Submit Fan and Curb Housing Color Chart for ARCHITECT Color Selection

14. SECTION *AIR CLEANING/TREATMENT*
    a. Air Filters for Construction Period and Spares for Permanent use.
15. SECTION *DUCTWORK*
    a. Round to Rectangular Duct Adapters (Bell mouth)
    b. Joint Sealant
    c. Flexible Duct
16. SECTION *DUCTWORK ACCESSORIES*
    a. Duct Access Doors
    b. Volume Dampers
    c. Backdraft Dampers
    d. Wall Louvers with Color/Finish Selection Chart and Screen Data
    e. Air Distribution Devices
    f. Life Safety Dampers with each application identified (i.e. – MPSA, LPSA, LPRA, etc.)
    g. Brick Vents with Screen Data
    h. Dryer Vent Outlet
    i. Spun Aluminum Roof Mounted Intake/Relief Hoods
17. SECTION *CONTROLS AND INSTRUMENTATION*
    a. Control Devices
    b. Relays
    c. Sequence of Operation
    d. Thermostat and Humidistat and Covers
18. SECTION *TESTING, ADJUSTING AND BALANCING*
    a. Testing, Adjusting and Balancing Agency, Certification Credentials, Sample Forms, Instrument List with Calibration History.
    b. TAB Report – Preliminary with certification of mechanical systems safety and operating controls. Note: Submittal must be transmitted to the Professional 5 days prior to request for substantial completion inspection.

END OF SECTION

Mechanical Systems and Equipment Warranties

PART 1 – GENERAL

1.1 SCOPE

Furnish all labor, materials, services, and equipment warranties as outlined herein for mechanical systems and equipment.

1.2 GUARANTEE AND WARRANTY

A. See Division 01 for warranty start date.

B. INDUSTRY STANDARD GUARANTEE:

See Architectural Specifications.

C. Test Period:

Each piece of equipment shall meet performance specifications after three months' actual operation to OWNER'S satisfaction.

D. CONTRACTOR shall replace, or make good, any defect due to faulty workmanship or material, which shall develop within one year from the beginning of the warranty period. This guaranty shall cover both material and labor. Leaking pipe work is considered faulty workmanship. This warranty shall include repair, removal of defective parts and installation of replacements. The CONTRACTOR shall also be responsible for property damage that results from defects in materials, improper controls or setup, and/or installation during the warranty period.

E. For first year after the warranty begins, CONTRACTOR shall provide, at no cost to the OWNER, any required maintenance and service necessary to assure the proper operation of the installations and systems. Latent defects arising during this period shall, upon notification by the OWNER, be promptly corrected at no additional cost to the OWNER. This shall include:

1. Refrigerant and Oil Replacement in Refrigeration Systems: Leaking refrigerant systems shall be repaired, proved tight, and charged with manufacturer’s recommended refrigerant and lubricant, within any standard warranty period.

2. Any adjustments and service required, excluding filter monitoring and replacement.

3. Any necessary adjustments in system control set points when required, excluding filter monitoring.

F. The CONTRACTOR shall make inspections at end of 6th and 11th months after beginning of warranty related to the HVAC control system. During these inspections, the CONTRACTOR shall verify all control settings and recalibrate controls and sensors to match requirements as can be coordinated with PROFESSIONAL based on historical trend by data and to optimize system performance. Temperature and safety controls shall be adjusted as necessary to insure continuous, trouble free, safe, and automatic operation of systems including gas burner, refrigerating equipment, etc.

G. Extended Equipment Warranties

1. Definitions and General Requirements

a. Extended warranties, defined as a warranty after the standard one (1) year warranty.

b. “Comprehensive” is defined as a complete warranty except for acts of God and negligent maintenance or operation of the specified equipment as required of the OWNER.

c. All comprehensive equipment warranties shall include all parts, labor, shipping, postage, freight, handling fees, etc., to accomplish any repair and/or replacement at no additional cost to OWNER. These warranty provisions will be binding on any CONTRACTOR and/or supplier/manufacturer unless specifically approved otherwise in writing by OWNER.

d. Lack of specific action on any manufacturer’s, supplier, and/or CONTRACTOR submitted alternate warranty shall not be construed as approval of same and shall not void the manufacturer and/or CONTRACTOR’S contractual obligation to provide specified warranty.

e. Third party insurance and/or split CONTRACTOR labor/manufacturer’s equipment/material warranties shall not be acceptable. Only manufacturer’s comprehensive warranties shall be acceptable.

2. Extended Warranties Required

a. Section *Packaged Air Conditioners* – 4 years compressor parts only non-prorated.

PART 2 – PRODUCTS – NOT APPLICABLE

PART 3 – EXECUTION

3.1 GUARANTEE AND WARRANTY

All certificates shall first be presented to the ARCHITECT for approval. After approval, copies of the certification(s) shall be forwarded to the OWNER by the CONTRACTOR.

END OF SECTION

Mechanical Close-Out Requirements

PART 1 – GENERAL – NOT APPLICABLE

PART 2 – PRODUCTS – NOT APPLICABLE

PART 3 – EXECUTION

3.1 AS BUILT DRAWINGS

Project Record Documents and As Built Drawings:

A. Maintain at job site a set of contract record documents kept current by indicating thereon all changes, substitutions, etc., between work as specified and as installed.

B. Show on record documents actual air quantities, water flow rates, valve or damper positions after balancing, etc.; also show, by actual dimension, location of all new and known existing underground work.

C. At the completion of the project, furnish the OWNER three (3) set(s) of bluelines and three (3) complete, clean sets of specifications showing installed location, size, etc., of all work and material as taken from record documents. All as-built (on record) drawings shall be labeled “As-Built Drawings,” dated and certified accurate by CONTRACTOR with his signature, on front page of all Drawing Blueline sets and Specifications.

3.2 OPERATION AND MAINTENANCE MANUALS

A. Submit three (3) complete sets of bound brochures in 8-1/2” x 11” spring post binders, indexed and tabled by equipment type (Air Handler, Plumbing Fixtures, etc.).

B. Include in these brochures written submittal data, manufacturers operating and maintenance procedures and recommendations, spare parts lists and suppliers and any interlocking control or wiring diagrams for all equipment. The information listed herein is to be bound in the following order:

1. First sheet to list ARCHITECT, ENGINEER, CONTRACTOR and Sub-Contractors with addresses for each.

2. Second sheet to list type of equipment with sequential number, the manufacturer, make, model and serial number of the actual equipment nameplate data rated horsepower, full load rated amps, voltage and phase.

3. Next, actual copy of approved submittal data including all manufacturers published information on capacities, capacity curves or tables, accessory and control item lists, and other pertinent information as requested by ENGINEER. Cross-reference all equipment to Contract Documents.

4. Next, copy of all spare parts list and suppliers’ contact information.

5. Next, include the manufacturer's published operating and maintenance procedures.

a. Include instructions to stop and start each piece of equipment including reference to controls and interlocks and an itemized maintenance schedule detailing procedure and interval of periodic maintenance items. Start this log of the maintenance list(s) by accomplishing the initial required maintenance procedure(s) for each and every maintenance item.

b. Operating instructions shall also include recommended periodic maintenance and seasonal changeover procedures, and suggested procedures in operation of all systems in this particular building to promote energy conservation. These instructions must be written expressly for this project and shall refer to equipment, valves, etc., by mark number from project schedules. Operating instructions and procedures shall be submitted in draft form, for approval prior to final issue of complete brochures. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions. Bulletins shall be clearly marked for the equipment furnished. Where a bulletin contains more information than that for the installed equipment, such extended information shall be deleted by crossing it out or by stripping it from the bulletin.

6. All system operating instructions that were earlier approved by PROFESSIONAL and utilized for OWNER personnel education shall also be inserted herein.

C. This bound information will require the PROFESSIONAL'S signed approval before this contract is complete. No exceptions will be granted.

D. A copy of HVAC and Plumbing equipment, and sprinkler system operation and maintenance (O & M) Manufacturer's recommended brochures shall be transmitted to the TAB Agent within ninety (90) days after Notice to Proceed such that TAB Agent shall utilize same in preparation of Owner's Personnel Education/Agenda.

E. The manuals shall be previously approved by the PROFESSIONAL and transmitted to the OWNER at least one week prior to the final inspection.

3.3 OWNER EDUCATION

A. OWNER Representative Education and Operating and Maintenance instructions

1. During the last phase of the project, the CONTRACTOR, in conjunction with the applicable SUB-CONTRACTORS shall coordinate and facilitate the start-up, Testing, Adjusting and Balancing, and subsequent OWNER'S representatives' education and instruction.

2. The OWNER education shall be administered by the CONTRACTOR, with special instructions from equipment technical representatives, CONTRACTOR qualified representatives, etc.

a. The instructions for the OWNER will include a complete walk-through of the facility, review of all mechanically related systems, and comprehensive education of the pertinent operating and maintenance requirements.

b. This shall include an overview of system components and descriptions, seasonal provisions/changes required, major valve location/function, safety provisions and concerns, normal operating and energy conservation techniques, actions to be taken with system failure or malfunction, start-up and shut-down instructions, reaction to fire and safety alarm annunciation, normal operating parameters, etc.

c. The education shall include all pertinent data from industry

standards, minimal recommendations indicated herein and further as recommended by each manufacturer's O&M manuals.

d. All equipment and material suppliers will also be expected to participate. The CONTRACTOR shall schedule with the A/E and designated OWNER'S Representative(s).

e. Additional instruction and education sessions shall be provided subsequent to the initial session to provide additional instruction as required to fully educate the OWNER'S operators.

3. The CONTRACTOR shall submit to the PROFESSIONAL in draft form, an outline of the contents of this education, with agenda and list of pertinent personnel, a minimum of thirty (30) days prior to project completion date and scheduling said instruction with the OWNER and PROFESSIONAL.

4. When the seminar and subsequent instruction periods are completed, CONTRACTOR shall furnish ARCHITECT a letter signed by the OWNER certifying that his representative(s) has received adequate instruction in operation of installed equipment and systems. <u>This letter shall be furnished prior to final acceptance of this project.</u>

B. Some suggestions for pertinent subject matter to include in the administration of the education of OWNER'S operation and maintenance personnel, is as follows:

1. Nominal Split and Packaged Direct Expansion Cooling and Heating Systems:

a. Air filter size, monitoring and changeout (note that CONTRACTOR is to provide a schedule to OWNER, indicating all systems, filter grilles, etc., and matched sizes) and number of air filters.

b. Periodic bearing lubrication

c. Periodic belt monitoring and adjustment

d. Periodic evaporator and condenser coil inspection and cleaning

e. Periodic monitoring of refrigerant charge by (1) visual observation of site glass, and (2) discharge air temperature monitoring

f. Normal temperature and fan controls setpoints for occupied and unoccupied periods.

g. Normal indoor humidity setpoints for all periods

h. Condensate drain periodic inspection and maintenance; including algaecide

i. Smoke detection and fire alarm interaction

2. Potable Water Heaters and Accessories:

a. Normal setpoint and adjustment for water temperature from heater

b. Normal setpoint and seasonal adjustment for water temperature from mixing valve, along with safety/use instructions

c. Periodic maintenance for mixing valve

d. Periodic maintenance for recirculating pumps

e. Routine inspection of flue piping and discharge cap for soot build-up on gas fired hoods.

f. Function and periodic maintenance of T&P relief valve.

g. Function and periodic maintenance of anode rods.

3. Dehumidifiers

a. Air filter size, monitoring and changeout (note that CONTRACTOR is to provide a schedule to OWNER, indicating all systems, and matched sizes) and number of air filters.

b. Periodic coil inspection and cleaning

c. Periodic monitoring of refrigerant charge

d. Normal indoor humidity setpoints for all periods

e. Condensate drain periodic inspection and maintenance; including algaecide

4. Exhaust Fans:

a. Periodic bearing lubrication

b. Periodic belt monitoring and adjustment

c. Periodic fan blade & grille inspection for excessive dust build-up, etc.

5. Unit Heaters:

a. Describe purpose, temperature adjustment location & seasonal setpoint recommendation(s)

b. Periodic maintenance and cleaning, etc.

6. Fire Protection Sprinkler:

a. Replacement heads and tools

b. Alarm and annunciation with fire alarm panel

c. Periodic maintenance

d. Go thru procedures for alarm and false alarm, water turn-off in case of problem, etc.

e. Annual certification of system

f. Backflow prevention and annual inspection

7. Controls:

a. Describe setup and operation (including override functions) of programmable thermostats.

b. Calibration of sensors (temperature, humidity, etc.)

c. Describe purpose of duct smoke detection, HVAC unit shut-down, and remote smoke detector alarm panels and reset procedures.

8. General:

a. Warranties: Explain the various warranties. Explain to OWNER his

role during the warranty period(s), his limitations who he is to call when a problem tied to a warranty issue occurs, for both the one-ear standard warranty and extended warranties, etc.

b. Special tools and spare parts

c. Air filter spares

d. Purpose of O & M Manuals (spare parts, O & M manufacturer's recommendations, trouble-shooting, etc.)

e. Purpose of roof mounted hydrant.

9. Oil Interceptor:

Instruct Owner of design concept for oil interceptor and periodic maintenance, cleanout, etc.

3.4 CLOSEOUT DOCUMENTATION

A. Seven (7) days prior to requesting a final inspection, the CONTRACTOR shall submit all O&M and closeout documentation to the ARCHITECT, to be turned over to the OWNER at the end of the project.

B. The following checklist shall be utilized for compiling documentation and shall be included behind front cover of O&M manuals.

C. CONTRACTOR shall initial and date each line item once completed and shall fax or email copy of the completed checklist to the PROFESSIONAL prior to final inspection request.

CLOSEOUT DOCUMENTATION CHECKLIST FIRE SPRINKLER		
PROJECT NAME:		
INITIALS OF PERSON COMPLETING TASK	**DATE TASK COMPLETED**	**DESCRIPTION OF CONTRACTOR'S SUBMITTAL**
		Signed Letter Record of Owners Personnel O & M Education
		Provide copy of Installation and Material Certificate per NFPA 13.

CLOSEOUT DOCUMENTATION CHECKLIST PLUMBING		
PROJECT NAME:		
INITIALS OF PERSON COMPLETING TASK	**DATE TASK COMPLETED**	**DESCRIPTION OF CONTRACTOR'S SUBMITTAL**
		Final TAB Report (3 each required)
		Signed Letter Record of Owners Personnel O & M Education
		Plumbing Operation & Maintenance Manuals (3 each)
		As-Built Drawings with Contractor's Stamp (3 each)
		Extended Warranties: (See Section *Mechanical Systems and Equipment Warranties*)
		Potable Water Sanitation Report and Certification
		Pipe Test Log - Form in Section *Pipe and Pipe Fittings* to be comprehensively filled out.
		Valve tag and floor plan location charts. See Section *Mechanical Identification*.
		Keys to access doors per Section *Basic Mechanical Materials and Methods* (provide written receipts with Owner's acceptance).
		Keys to plumbing stops and hose bibb boxes per Section *Basic Mechanical Materials and Methods* and Section *Plumbing Fixtures, Trim and Accessories* (provide written receipts with Owner's acceptance).

CLOSEOUT DOCUMENTATION CHECKLIST **MECHANICAL**		
PROJECT NAME:		
INITIALS OF PERSON COMPLETING TASK	**DATE TASK COMPLETED**	**DESCRIPTION OF CONTRACTOR'S SUBMITTAL**
		Final TAB Report (3 each required)
		Signed Letter Record of Owners Personnel O & M Education
		Mechanical HVAC Operation & Maintenance Manuals (3 ea)
		As-Built Drawings with Contractor's Stamp (3 each)
		Completed HVAC equipment factory start-up forms for each individual unit.
		Extended Warranties: (See Section *Mechanical Systems and Equipment Warranties*)
		Provide list of all spare air filter sets per Section *Air Cleaning/Treatment*. List number, size, type and location/equipment match-up.
		Pipe Test Log - Form in Section *Pipe and Pipe Fittings* to be comprehensively filled out.
		Duct Test Log - Form in Section *Ductwork* to be comprehensively filled out.
		Keys to access doors per Section *Basic Mechanical Materials and Methods* (provide written receipts with Owner's acceptance).
		Keys to control panels and sensor/controller covers per Section *Basic Mechanical Materials and Methods* and Section *Controls and Instrumentation* (provide written receipts with Owner's acceptance).

END OF SECTION

Basic Mechanical Materials and Methods

PART 1 – GENERAL

1.1 SCOPE

A. Provide all material, equipment and labor, etc., required to complete installation specified herein and/or shown or scheduled on Contract Drawings.

B. The requirements of this section apply to all sections of Division 20, 21, 22 and 23.

C. Definitions:

1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms, including mechanical and/or equipment rooms.

2. Option or Optional: CONTRACTOR'S choice of an alternate material or method.

1.2 PRODUCTS CRITERIA

A. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.

B. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.

C. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or otherwise permanently marked on each item of equipment.

1.3 FLAME SPREAD AND SMOKE DEVELOPED PROPERTIES OF MATERIALS

A. Materials and adhesives used throughout the mechanical and electrical systems for insulation, and jackets or coverings of any kind, or for piping or conduit system components, shall have a flame spread rating not over 25 without evidence of continued combustion and with a smoke developed rating not higher than 50. If such materials are to be applied with adhesives, they shall be tested as applied with such adhesives, or the adhesives used shall have a flame spread rating not over 25 and a smoke developed rating not higher than 50. (Note: Materials need not meet these requirements where they are entirely located outside of a building and do not penetrate a wall or roof, and do not create an exposure hazard.)

B. “Flame-Spread Rating” and “Smoke Developed Rating” shall be as determined by the “Method of Test of Surface Burning Characteristics of Building materials,” NFPA No. 255, ASTM E84, Underwriter’s Laboratories, Inc., Standard”. Such materials are listed in the Underwriters’ Laboratories, Inc., “Building Materials List” under the heading “Hazard Classification (Fire)”.

1.4 HAZARDOUS MATERIALS

A. No products shall be used that contain any known hazardous or carcinogenic materials. Products with asbestos or radioactive content shall not be used.

B. Handling of any hazardous material is not covered in this specification Division.

1.5 EQUIPMENT FURNISHED BY OWNER

A. The CONTRACTOR shall unload, uncrate, assemble, and connect any and all equipment shown on the Drawings or called out in the Specifications to be furnished by the OWNER for installation by the CONTRACTOR.

B. The CONTRACTOR shall protect and take full charge of such equipment from the time the items are delivered to the job, set in place, connected, tested, adjusted, and placed into operation.

PART 2 – PRODUCTS

2.1 EQUIPMENT ACCESSORIES

A. Provide removable guards to enclose all rotating or moving elements. Construct of galvanized steel to withstand 250 lbs. static load.

B. Wall/Ceiling Access Doors

1. Panels in non-rated applications shall be galvanized steel, 18-gauge frame, 16-gauge door with mounting accessories, piano hinges, screwdriver operated lock, and prime coat paint.

a. Acudor Model UF-5000 for acoustic tile or exposed masonry

b. Acudor Model PS-5030 for plaster finishes

c. Acudor Model UF-5000 (stainless steel) for ceramic or glazed structural tile.

2. Panels in fire rated applications shall be painted steel type, 1 hour rated, piano hinged, exterior key lock, nominal size 24" x 36" at equipment installations as approved, Air Balance, Inc. - Model "F".

2.2 ROOF CURBS

A. Curbs shall be constructed as required to hold top level. See detail on Drawings for more information on curb construction requirements.

B. **All exposed roof mounted curbs and flashing shall be field and/or factory painted to match roof color.** (Color selection by ARCHITECT).

C. Auxiliary supports under curbs shall be constructed as approved by ARCHITECT.

2.3 FIRE, SMOKE AND SOUND STOPPING

A. UL listed penetration sleeve assembly and/or firestop that meets ASTM E-814 E119, and E84, as "3M" systems for the intended applications.

B. All fire, smoke and sound stopping to be done by a separate licensed and certified Subcontractor as approved by Professional.

2.4 PIPE SLEEVES

A. Galvanized sheet metal sleeves shall have lock seam joints and comply with the following minimum thickness:

1. 24 Gauge for 3 inches and smaller.

2. 22 Gauge for 4 inches to 6 inches inclusive.

3. 20 Gauge for sizes over 6 inches.

B. Galvanized steel sleeves shall be constructed from schedule 40 grade A53 pipe.

C. PVC sleeves shall be constructed from solid core Schedule 40 PVC pipe.

D. Water tight sleeves/seals shall be equal to “Link-Seal”.

2.5 WALL, FLOOR, AND CEILING PLATES

A. Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve.

B. The thickness shall conform to the following requirements:

1. Not less than 3/32 inch for floor plates.

2. For wall and ceiling plates, not less than 0.025” for up to 3 inch pipe and 0.035” for larger pipe.

C. All escutcheons shall be equal to Beacon, Caldwell or approved equal.

2.6 PROTECTIVE DRIP PANS

A. Fabricate pans of 20-gauge galvanized sheet metal, stainless steel (if shown) or PVC, minimum two inches deep with rolled top edges.

B. Solder all seams watertight, and cross brace pans to prevent sagging and warping.

C. Provide dielectric union at copper pipe/galvanized pan connection point. Water heater drain pans shall have minimum one inch (1”) drain outlet.

2.7 PAINTING OF MECHANICAL WORK

A. See Division 09 for more information.

B. See Section *Mechanical Identification* for color-coding of piping, etc. All other metal structure and hangers to be color of adjacent finish.

PART 3 – EXECUTION

3.1 EQUIPMENT ACCESSORIES

A. Provide access panels, or doors, at concealed dampers, valves, vents, equipment, inspection points, etc., and where noted. Where ceiling is "lift out" construction, ceiling access panels are not required. Panels shall be 15" square, or larger as approved for service intended.

B. CONTRACTOR shall provide substantial metal angle frame and support at all ceiling access doors.

3.2 ROOF CURBS

A. All roof mounted equipment shall be furnished with a roof curb compatible with both the equipment configuration and roofing system. Curbs shall be installed level by either shimming or sloped curb construction. See detail on Drawings for more information on curb construction requirements.

B. Provide auxiliary support under all roof mounted equipment under curb base and at all penetrations as approved by ARCHITECT.

3.3 FIRE, SMOKE AND SOUND STOPPING

A. Fire and smoke stopping shall be provided and installed at all locations where mechanical Work passes thru rated assemblies. This includes all ductwork, piping and controls related conduit.

B. Penetrations in “sound” walls shall be similarly acoustically sealed, both sides of wall with caulk or other approved material. New and existing walls extending to the roof/floor structure above are considered sound walls.

3.4 PIPE SLEEVES

A. Pipe sleeves shall be constructed of galvanized sheet steel except where noted below or in individual work sections.

B. Pipe sleeves shall be constructed of galvanized steel or schedule 40 PVC pipe when pipes are located within or passing through the following:

1. concrete beams
2. outside walls
3. foundations
4. footings
5. waterproofed floors
6. In locations where sleeve is extended above finished floor

C. Where pipe motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of pipe.

D. Where pipes are insulated, make sleeves of sufficient diameter to pass pipe insulations.

E. Check floor and wall construction and finish to determine proper length of sleeves for various locations, make actual length to suit following:

1. Terminate sleeve flush with walls, partitions, and ceilings.
2. In areas where pipes are concealed as in chases, terminate sleeves flush with floor.
3. In finished areas where pipes are exposed, extend sleeves 1/4" above finished floor except in kitchen, toilets, equipment rooms, and other areas where water may accumulate on floor, extend 1 1/2".

F. Interior openings shall be caulked tight with fire, smoke or sound stopping material and sealant to prevent the spread of fire, smoke, and sound. Contractor shall coordinate specific requirements to ensure fire, smoke or sound ratings are maintained.

G. For drilled penetrations in existing floors provide one-inch angle rings set in silicone sealant and bolted to the floor in lieu of pipe sleeves with one inch extension above floor.

H. Below grade exterior wall penetrations into habitable spaces, including crawlspaces shall include sleeves with water tight seals as “Link-Seal”.

3.5 WALL, FLOOR, AND CEILING PLATES

A. Exposed piping passing through walls, floors and ceilings, shall be fitted with escutcheons.

B. Inside diameter shall fit around insulation or around pipe when not insulated; outside diameter shall cover sleeve.

C. Use plates that fit tight around insulation or pipes when not insulated.

D. Plates shall cover openings around pipes/insulation and cover the entire pipe sleeve projection.

3.6 PROTECTIVE DRIP PANS

A. Provide pitched drip pans where shown under all fluid conducting piping that is over electric switchgear, elevator controllers, busways or electric motor starters or as indicated. Pans shall extend minimum two inches beyond each side of the mechanical equipment, pipe or group of pipes being contained. Pans shall extend six inches beyond electrical equipment below.

B. Pitch pans shall be routed to a drain connection with discharge piped utilizing ¾" or larger of copper tube to the nearest available open drain or outside as directed by PROFESSIONAL. Open-end slices discharging to intercepting pans are not acceptable.

C. Provide drip/overflow pans under water heaters, air conditioning equipment, pumps, etc., and where shown.

3.7 PAINTING OF MECHANICAL WORK

A. All equipment shall present a clean painted appearance; touch up or repair as required.

B. All surfaces shall be properly prepared prior to painting. CONTRACTOR must contact PROFESSIONAL, such that all tests, installations etc., are approved prior to painting.

C. The CONTRACTOR shall prime (where applicable) and paint the following mechanical related Work:

1. Piping of the following types which are outdoors and indoors when exposed to view, including mechanical rooms:

   a. New Natural Gas Piping.

   b. Domestic Water Piping.

   c. Sanitary and Oil Waste/Vent Piping.

   d. Fire Sprinkler Piping.

2. All exposed ferrous metal non-galvanized hangers, auxiliary supports, braces, etc., in all locations.

3. All exposed and exterior galvanized ductwork, plenums, access doors, and control conduit, fitting, boxes, etc.

4. All insulated refrigerant piping, pumps, valve bodies, etc., where exposed to view outdoors.

5. All new or modified fire hydrants, metal valve and metal box covers, post indicator valves, gas meter/regulators, and the like. This includes items provided and installed by others, and existing on-site installations.

D. Refer to Section *Mechanical Identification* for color-coding of piping, etc. All other metal structure and hangers to be color of adjacent finish.

3.8 WELDING

Before any welding is performed submit a copy of the Welding Procedure Specification (WPS) together with the Procedure Qualification Record as required by Section IX of the ASME Boiler and Pressure Vessel Code for each and every welder intended for use on this

project and with qualifications and certifications suitable for work classification intended.

A. Before any welder performs any welding, submit a copy of the Manufacturer's Record of Welder Operator Qualification Tests as required by Section IX of the ASME Boiler and Pressure Code. The letter or symbol (as shown on the qualification test form) shall be used to identify the work of that welder and shall be affixed, in accordance with appropriate construction code, to each completed weld. Submit certification according to Section *Mechanical Submittals and Shop Drawings* for each and every welder and welding associated with the project.

B. The types and extent of non-destructive examinations required for pipe welds are shown in Table 146.4 of the Code of Pressure Piping ANSI/ASME B31.1.

3.9 TOOLS AND KEYS

A. Furnish, and turn over to the OWNER, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Provide OWNER, at end of project with spare keys to stops, hose bibbs, control cabinets, tamper-proof controls covers, etc. Provide the following spares, and label with function/locations:

1. Plumbing Stops – 8 keys
2. Hose Bibbs – 8 keys
3. Control Panels – 4 keys each panel
4. Tamper-proof Controls Cover – 2 keys per cover
5. Wall and Ceiling Access Doors – 2 keys per door

3.10 LUBRICATION

A. During construction, all bearings and shafts shall be kept thoroughly greased and protected.

B. After equipment has been operated seven days and before final acceptance, all bearings shall be inspected and filled to operating level with lubricant recommended by manufacturer. Tag each piece of equipment with cloth tag showing: proper type of lubricant, and period between lubrications, date of lubrication, and worker's initials. Have space for ten (10) lubrication notations.

3.11 WORK IN AND AT EXISTING BUILDING AND/OR BUILDING SITES

A. Perform as described or shown on Contract Drawings, for relocation of existing equipment, alterations and restoration of existing building(s).

B. As specified on Contract Drawings, make alterations to existing service piping at times that will least interfere with normal operation of the facility.

C. It is important that CONTRACTOR thoroughly investigate existing conditions, utilities, services, finishes, sized, connections, etc., prior to bidding this project. The Designer's responsibility included only a cursory review of existing conditions and/or installations. It is the CONTRACTOR'S responsibility to coordinate a more thorough investigation and ascertain and confirm pertinent installation connections, etc., prior to his bid. This investigation shall be coordinated in a minimum seven (7) days advance of any published bid date such that the CONTRACTOR immediately thereafter can advise Designer in writing of any design discrepancies and/or

changes required; otherwise, the CONTRACTOR shall be required to remedy any such peculiarities at his own expense and at no additional cost to the OWNER. It is the CONTRACTOR'S responsibility to verify existing size and/or location, etc., any time replacement and/or modifications to existing are included as a part of this project.

D. Prior to excavation, investigation shall be made to the extent necessary to determine the location of existing underground services, structures and conflicts. Care should be exercised by the CONTRACTOR during excavation to avoid damage to existing structures.

E. The CONTRACTOR shall be responsible for obtaining the services of an "Independent Locator" whose function shall include location and identification of all underground service wiring, piping, coax, fiber optics, etc. The CONTRACTOR shall make every effort to protect and avoid conflicts with existing installations. Damage caused to existing installation by CONTRACTOR, or his Sub-contractor, etc., shall be promptly remedied and put back into service, per serving utility requirements.

F. When obstructions that are not shown on the Contract Drawings are encountered during the progress of work and interfere so that an alteration of the Drawings is required, the ENGINEER will alter the Drawings or order a deviation in line and grade or arrange for removal, relocation, or reconstruction of the obstructions.

G. When crossing existing pipelines or other structures, alignment and grade shall be adjusted as necessary, with the approval of the PROFESSIONAL, to provide clearance as required by federal, state or local regulations or as deemed necessary by the ENGINEER to prevent future damage or contamination of either structure.

3.12 PROTECTION AND CLEANING

A. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the PROFESSIONAL. Damaged or defective items, in the opinion of the PROFESSIONAL, shall be replaced.

B. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

C. Do not store insulation materials in building until it is enclosed and dry. Wet insulation shall not be installed.

D. Fixtures, piping, ducts, equipment, etc., shall be cleaned per manufacturer's printed instructions and PROFESSIONAL'S instructions.

E. Piping shall be: (1) flushed with clean water, (2) "blown out" with steam or compressed air, or (3) "swabbed out" as required, except where specified otherwise. All temporary connections required for flushing shall be provided and subsequently removed by the CONTRACTOR. See Section *Pipe and Pipe Fittings* for further instructions.

F. Before final building interior finish is applied:

1. Interior of air handling equipment shall be thoroughly cleaned.

2. Drain pans shall be cleaned and then flushed with water after which all fans will run with air filters in place, etc., for 24 hours.

3.13 CUTTING AND PATCHING

A. Do not cut into any major structural element without written approval of the ARCHITECT.

B. Cut required openings through existing masonry or reinforced concrete with diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the ARCHITECT. Locate openings that will least affect structural slabs, columns, ribs or beams. Refer to the ARCHITECT for determination of proper design for openings through structural sections and opening layouts for approval prior to cutting or drilling into structure. After ARCHITECT'S approval, carefully cut openings through construction no larger than absolutely necessary for the required installation.

C. Patching shall be (1) of quality equal to, and of appearance matching existing construction, and (2) shall restore all services and construction that remains in use, to its condition prior to this contract, unless otherwise noted.

3.14 FLASHING

A. Where pipes, ducts, etc., pass through roof or walls, flash and caulk.

B. Provide flashing or caulking as required at each opening through outside walls or roof. Flashing through roof of same materials and methods as under Moisture Protection Division; through walls shall be aluminum unless noted otherwise.

END OF SECTION

Pipes and Pipe Fittings

PART 1 – GENERAL

1.1 SCOPE

A. Provide all material, equipment and labor, etc., required to complete installation specified and/or shown or scheduled on Contract Drawings.

B. Work included: Pipes, fittings, unions, couplings, flanges, gaskets, and other materials and instructions.

1.2 PIPING SCHEDULE

Piping systems for this project shall include the following:

A. Sanitary and Oil Waste and Vent Piping.

B. Condensate Drain Piping.

C. Domestic Water Piping.

D. Natural Gas Piping.

E. Refrigerant Piping.

F. Equipment Utility and Relief Drain Piping.

G. Fire Sprinkler Piping

1.3 MANUFACTURER'S ASSISTANCE

Manufacturer shall provide, if required, to the CONTRACTOR a factory trained service man to properly train CONTRACTOR'S personnel in all phases of installation.

PART 2 – PRODUCTS

2.1 PIPING MATERIALS

All piping installed on this project shall be new and of full weight and size indicated and of proper specification for service intended. Only domestic pipe may be used. Pipe and pipe fittings for the various systems shall be as follows:

A. Sanitary and Oil Waste and Vent Piping.

1. Piping above and below slab on grade extending to five (5) feet outside building perimeter, shall be solid core Schedule 40 PVC with solvent weld joints and DWV fittings.

2. Sanitary waste piping below grade outside building shall be as specified in *Civil Division*.

B. Condensate Drain Piping.

1. Condensate drain piping routed indoors shall be solid core Schedule 40 PVC with solvent weld joints and DWV fittings.

C. Domestic Water Piping.

1. Piping above slab on grade inside building shall be Type "L" copper with 95/5 soldered joints or specialty piping systems such as “ProPress” by Viega. “T-drill” or “pulled” taps/outlets shall NOT be utilized; only full body fittings will be allowed.

2. Piping below slab on grade and to a point ten (10) feet from building

perimeter shall be Type "K" copper pipe with brazed joints. Note: There shall be no joints below slab on grade except at building entrance service on piping 2" and larger.

3. Underground service entrance at building shall be single extended 90 degree fitting of fabricated 304 stainless steel, maximum working pressure of 200psi.

   a. Sizes 2”-3” equal to Watts Series TR2. Provide with grooved or MNPT connections on inside of building. Provide with grooved, MNPT or flanged connections outside of building.

4. Piping routed outside building below grade, shall be as specified in Section *Civil Division*.

D. Natural Gas Piping

1. Piping above slab on grade and extending from meter or regulator shall be Schedule 40 black steel pipe complying with ANSI B36.10, ASTM A53 or ASTM A106 with class 150# Malleable iron or steel fittings. Joints in piping sizes 2" and smaller shall be screwed type. Joints in piping sizes 2 ½" and larger shall be welded with flanges at valves.

2. Connections to gas-fired equipment, such as furnaces, shall include gas cock, drip leg and union and be rigid as detailed above. Other gas fired equipment may be connected similarly with flexible stainless-steel connections where allowed by governing code and authority.

3. Flexible connections to equipment with input less than 75 MBH may be corrugates stainless steel tested, listed and installed in accordance with ANSI/AGA LL-1. Flexible connections shall not extend through unit cabinet

4. Piping outside of building and routed below grade shall be Schedule 40 (API SL) polyethylene and shall conform to the requirements of thermoplastic pipe as outlined in ANSI 31.8 for gas transmission. Riser to regulator and extending five feet horizontally below grade shall be black steel pipe with asphalt based coating and plastic jacket as Extru-coat. All gas service piping into any structure shall be electrically grounded per code.

E. Refrigerant Piping

1. Piping shall be Type "L" ACR copper with brazed joints. All joints, fittings and piping shall be brazed connection type. No flared or compression piping accessories allowed except at equipment connections.

F. Equipment Utility and Relief Drain Piping

1. Indoor water heater T & P, backflow preventer and miscellaneous equipment relief and drain piping shall be full size connection Type 'L' copper with solder joints.

2. Piping exposed outside of building shall be Schedule 40 galvanized steel with threaded joints and fittings.

G. Fire Sprinkler Piping

1. Wet Pipe: Piping from fire protection riser to new wet pipe sprinkler distribution system shall be black steel, with joints and connections either welded, screwed, or by mechanical gasketed grooved couplings, as per

NFPA 13.

Sprinkler piping shall have antibacterial coating on inside of piping to resist microbial colonization of pipe/fitting wall(s) preventing the onset of microbiological influenced corrosion (MIC), as “Dynathread” by Allied Tube and Conduit.

2. All screwed piping shall be minimum schedule 40 and all rolled groove piping shall be a minimum of schedule 10 piping. No piping less than schedule 10 shall be allowed anywhere in the project.

3. Underground service entrance at building shall be single extended 90 degree fitting of fabricated 304 stainless steel, maximum working pressure of 200psi.Sizes The assembly shall be UL/FM approved and meet AWWA C900 Inlet/DIP coupler fitting on outside end and a grooved end connection on the indoor end and shall include tie-rod restraining brackets. Assembly equal to Ames Series IBR.

2.2 PIPE FITTINGS, UNIONS, FLANGES, AND GASKETS

A. All fittings shall conform to pipe as to black steel, galvanized steel, copper, PVC or cast iron, etc. or as indicated. Fittings and accessories shall have equal or greater pressure rating than piping specified for particular application.

B. Malleable steel fittings shall be minimum 150 psi class.

C. Steel pipe unions shall be malleable iron having bronze to iron ground joints.

D. Steel nipples shall be extra heavy type. All thread nipples prohibited. Provide a minimum of 1” of bare pipe between threaded ends of nipples.

E. Flange bolts: Galvanized Alloy steel, ASTM #A 196, Galvanized GR. B 7; nuts' ASTM #S 194, GR. 2 H; both hex head style.

F. Flange gaskets serving piping below 250 degrees F shall be synthetic composition type; serving above 250 degrees F gaskets shall be corrugated metallic type. Utilize gasket suitable for service intended.

G. Couplings, steel pipe malleable iron, Grade II.

H. Provide factory made reducers and increasers, and nipples of comparable materials as the piping. The use of bushings is not acceptable to obtain reduction or increase in sizes.

I. Galvanized steel pipe shall be assembled with galvanized screw fittings unless specifically indicated otherwise.

2.3 DIELECTRIC FITTINGS

Provide where copper and ferrous metal are joined.

A. 2-inch and less: Threaded dielectric union.

B. 2 ½-inch and larger: Flange union with dielectric gasket and bolt sleeves.

C. Temperature Rating, degree F: 210 for water systems.

2.4 BEDDING AND BACKFILL MATERIALS

A. Type S1 – Select Fill

1. Material shall consist of select, non-organic, debris-free silty clays or sandy clays with no more than 55 percent fines passing a No. 200 sieve.

2. The plasticity index shall be within the range of 8 to 20.

3. The liquid limit shall be less than 40.

B. Type S2 – Course Aggregate

1. Material shall consist of washed stone free of shale, clay, friable material, sand and debris.

2. The aggregate shall be graded in accordance with ANSI/ASTM C33, size number 467.

C. Type S3 – Pea Gravel

1. Material shall consist of natural stone free of shale, clay, friable material, sand and debris.

2. The material shall be graded to be between a minimum of 1/4” and a maximum of 5/8” in size.

D. Type S4 – Sand

1. Material shall consist of natural river or bank sand, washed free of silt, clay, or organic matter, loam friable or soluble materials.

2. The material shall be graded in accordance with ANSI/ASTM C33.

E. Type S5 – Crushed Stone

1. Crushed limestone, No. 610 gradation.

2.5 BEDDING AND BACKFILLING MATERIAL QUALITY CONTROL

A. Tests and analysis of soil material shall be performed in accordance with ASTM D4318 or ASTM C136.

B. Materials tested which do not meet the specified requirements shall be removed and replaced with acceptable material at no cost to Owner.

C. Maximum dry density of the soil materials shall be determined by ASTM D698 and field density of in-place materials by ASTM D2922.

PART 3 – EXECUTION

3.1 PIPING INSTALLATION

A. General

1. Arrange and install piping approximately as indicated, straight, plumb and as direct as possible; form right angles or parallel lines with building walls. Keep pipes close to walls, partitions, ceilings, offset only where necessary to follow walls as directed. Locate groups of pipes parallel to each other; space them at distance to permit applying full insulation and to permit access for servicing valves. The PROFESSIONAL reserves the right to require this CONTRACTOR to make minor changes in pipe locations where conflicts occur with other trades or equipment. Such changes shall be made without extra cost to OWNER.

2. Install horizontal piping as high as possible without sags or humps. Grade

drainage piping at uniform slope of 1/8” per foot minimum and maximum 1/4” per foot, or as noted. Where this is impossible, maintain slope as directed, but in no case less than 1/16” per foot. Pitch piping in direction of flow.

3. When piping is cut, it shall be reamed with pipe reamer and all burrs, scale, trash and foreign matter removed. If any piping is found installed without being reamed, cleaned, deburred, etc., or in any way contrary to above, it shall be sufficient reason for related erected piping to be removed, inspected by the PROFESSIONAL, corrected and reinstalled, all at CONTRACTOR'S expense.

4. Where size changes on horizontal lines, use reducing fittings; bushings are prohibited. On liquid lines have eccentricity down, hold the top level. On gas or vapor lines have eccentricity up, hold the bottom level.

5. Sufficient space shall be allowed in erecting piping for proper application of thermal installations including fittings. In no case shall any insulation be cut or reduced thickness because of inadequate space.

6. Offset equipment connections to allow valving off for maintenance and repair with minimal removal of piping.

7. Locate valves for easy access and operation. Concealed valves shall be provided access doors. Do not locate any valves with stems below horizontal.

8. Install gauges, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gauges to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

9. Furnish and install unions or mating flanges at all connections to each piece of equipment conveniently located to facilitate quick and easy disconnecting of equipment. Flanges or union connections shall be used on both sides of traps, control valves, pressure reducing valves and meters and the like.

B. Steel Piping

1. Where piping is threaded, dies shall be clean and sharp. Threads shall conform to ANSIU B2.1; joint compound shall be applied to male threads only and joints made up so no more than three threads show. Coat exposed threads or steel pipe with joint compound and red lead paint for corrosion protection. The caulking of these joints will not be tolerated. Pipe joint compound must be approved by the PROFESSIONAL.

2. Where welding is specified or done, it shall be by electric arc by mechanics skilled in operation and holding a test certificate acceptable to the ENGINEER. All scale and flux shall be removed from piping after welding. Welding, beveling, spacing and other details shall conform to ANSI B31.1.

C. Plastic Piping

1. Install all fittings and joints as per manufacturer's recommendation.

2. Utilize purple pipe cleaning compound on all solvent weld joints.

3. Utilize manufacturer’s recommended colored (non-purple) solvent glue on all

solvent weld joints, unless manufacturer's installation instructions do not allow or if solvent glue is not rated for specific application.

4. Install all underground plastic and fiberglass glass piping outside building perimeter with tracer identification tape (per Section Mechanical Identification) and minimum 12-gauge bare copper wire for future location reference.

D. Copper Piping

1. Copper tubing shall be thoroughly reamed, cleaned with steel wool or emery cloth and a non-corrosive flux used before soldering or bracing.

2. Copper tubing shall be thoroughly reamed and de-burred before joining with specialty piping systems such as Viega "Pro-Press".

3. Where solder joints are specified, use solder having 95% tin and 5% antimony. Each roll of solder shall be clearly stamped as to grade and content.

4. Where brazing joints are specified, use a brazing filler metals having a melting point above 1100 degrees F and containing at least 5% silver.

5. Where copper tubing extends through concrete slab on grade, tubing shall have an "Armaflex" or "Rubatex" type.

6. Provide PVC isolation wrap where copper pipe extends through masonry walls to connect plumbing fixtures or valves, etc.

E. Refrigerant Piping

1. Braze joints in the presence of an inert gas.

2. Verify pipe size and configuration and provide same based on HVAC equipment manufacturer's recommendation to provide scheduled capacity, performance and maximize equipment life.

3. Refrigerant piping systems shall be installed in accordance with applicable chapters of the ASHRAE "Applications" handbook. Particular attention shall be given to suction gas, velocities and requirements for liquid sub cooling.

3.2 PIPE EXPANSION

A. In the installation of all pipe runs where shown or where necessary, install swing joints, flexible couplings, turns, expansion loop or long offsets to allow for expansion. Broken pipe or fittings due to rigid connections must be removed and replaced at no additional cost to the OWNER.

B. All lines shall be securely anchored where required. Where such anchors occur, they shall be securely fastened to the steel or concrete structure of the building in a manner approved by the PROFESSIONAL. Drawings shall be submitted before installation.

3.3 ANCHORS

Plastic pipe shall be jointed to steel systems with flanges. Steel system shall be anchored within five (5') feet of connection point to eliminate any thrust, stress, or torque from steel system to fiberglass and/or plastic system.

3.4 THRUST BLOCKS

All changes in direction of fiberglass or plastic pressure systems for 2" and larger systems shall be encased in concrete (3000 psi) thrust blocks to provide anchor points for direct expansion and contraction.

3.5 TESTS

A. Cooperation/Scheduling:

The ARCHITECT shall be notified no less than ninety-six (96) hours prior to any pipe test. The ARCHITECT shall also be notified in adequate time for an inspection of the test before the test is completed. The PRIME CONTRACTOR'S Superintendent shall be responsible for administering and witnessing all tests, log it for permanent record and transmit to ARCHITECT at completion of project. CONTRACTOR shall refer to and make additional copies of the “Pipe Test Log Form” at the end of this section to use as standard test log forms. The PRIME CONTRACTOR’S Superintendent shall keep this on-going log on jobsite and shall include the following:

1. Date of Test
2. Duct/Piping Description (EX: “Sanitary Sewer”)
3. Location (EX: “Northwest Quadrant First Level”)
4. Results (EX: “Held 10 ft. of head for eight hours without leakage”, etc.)

B. Tests shall be as follows: (New and Existing Modified Piping shall be tested and all leaks repaired)

1. Gravity Flow Sanitary and Oil Waste and Vent piping above and below slab: Minimum 10 feet static head and as required by ASA A40.8 or local code, for a minimum period of four (4) hours, without discernable loss. All below grade piping and joints shall be clearly visible during test.
2. Gravity Flow Condensate Drain piping above and below slab: Minimum 10 feet static head and as required by ASA A40.8 or local code, for a minimum period of four (4) hours, without discernable loss. All below grade piping and joints shall be clearly visible during test.
3. Water Piping: (Domestic and circulating systems) 125 psi hydrostatic or 100 psi air, in conjunction with manufacturer’s recommendations, with no discernable pressure loss for a period of eight (8) hours. Potable water piping shall be pressurized with water or air during all phases of construction such that leaks can be promptly identified and remedied.
4. Natural Gas Piping: All gas piping shall be tested at twice the operating pressure, but not less than 30 psig, with compressed air or nitrogen, with no discernable pressure loss, for a period of not less than eight (8) hours. Oxygen shall not be used. All factory coated and wrapped piping below grade to be tested and proven tight with Holiday Leak Detector. All new and/or modified piping shall be tested to a minimum of 1.5 times the operating pressure or a minimum of 3 psig, whichever is greater.
5. Refrigerant piping: 450 psig nitrogen for 8-hour period unless more stringent requirements are recommended by the equipment manufacturer. Test piping with all piping accessories such as charging valves and filter/driers in

place, unless not recommended by equipment manufacturer's installation instructions. Refrigerant piping shall be left with minimum 60 psi pressure during all phases of construction such that leaks can be promptly identified and remedied.

6. Backflow Preventers: Per local and state governing authority requirements.

7. Fire Sprinkler System: Test fire lines hydrostatically for two (2) hours at 200 psi for steel piping system. Obtain certificate of approval from local Fire Marshal. In addition, dry pipe systems shall also be pressure tested with air at 40 psi for a minimum of 24 hours without loss of more than 1.5 psi. Provide additional acceptance testing per NFPA 13.

3.6 SYSTEM CLEANING, TREATMENT AND PROTECTION

A. Potable Water System: All new and modified existing potable water lines shall be thoroughly flushed and sterilized with a solution containing not less than 50 ppm available chlorine for eight (8) hours. During sterilization, operate all valves, faucets, etc., so that all portions of the system are reached. Flush system with clear water until concentration drops to 0.5 ppm. CONTRACTOR shall furnish sample to State Health Department attesting to satisfactory condition of water. Submit copy of test reports to ARCHITECT near end of project and prior to OWNER'S use of potable water distribution system.

3.7 BELOW GRADE PIPING INSTALLATION

A. Preparation

1. Prior to excavation, investigation shall be made to the extent necessary to determine the location of existing underground structures and conflicts. This CONTRACTOR shall coordinate and utilize the services of public and private "locators" to ascertain the whereabouts of all underground utilities in the area where work is to be performed.

2. When obstructions that are not shown on the Contract Drawings are encountered during the progress of work and interfere so that an alteration of the Drawings is required, the PROFESSIONAL will alter the Drawings or order a deviation in line and grade or arrange for removal, relocation, or reconstruction of the obstructions.

3. Appropriate traffic control devices shall be provided in accordance with federal, state, or local regulations to regulate, warn, and guide traffic at the work site.

4. Trees, shrubs, fences, and all other property and surface structures shall be protected during construction unless their removal is shown on the Contract Drawings and Specifications or approved by the OWNER.

B. Excavation

1. During excavation, material meeting the Type S1 requirements shall be stock piled in an orderly manner and at a sufficient distance from the banks of the trench to avoid over-loading and to prevent slides or cave-ins. Submit test reports to verify soil properties.

2. All excavated materials not required or suitable for backfill shall be removed and disposed of off-site at CONTRACTOR's expense.

3. Excavation and trenching shall be performed to allow utilities to be installed to lines and grades established by the Contract Drawings and Specifications with fittings and valves at the required locations unless otherwise approved by the PROFESSIONAL.

4. All excavation of every description and of whatever substances encountered shall be performed to the depths indicated or as otherwise specified.

5. Excavated material shall be placed in a manner that will not obstruct sidewalks, driveways, or other structures.

6. Care should be exercised by the CONTRACTOR during excavation to avoid damage to existing structures and utilities.

7. When excavation of rock is encountered, all rock shall be removed to provide a clearance of at least 9 inches below and on each side of all pipe, valves, and fittings. The same shall also be performed when pieces of concrete or masonry and other debris or subterranean structures, such as masonry walls, piers, or foundations are encountered during excavation.

8. When crossing existing pipelines or other structures, alignment and grade shall be adjusted as necessary, with the approval of the PROFESSIONAL, to provide clearance as required by federal, state or local regulations or as deemed necessary by the PROFESSIONAL to prevent future damage or contamination of either structure.

9. Removal of pavement and road surfaces shall be a part of the trench excavation and the amount removed shall depend upon the width of trench required for the installation of structures. The dimensions of pavement removed shall not exceed the dimensions of the opening required for installation of pipe and other structures by more than 6 inches in any direction unless required or approved by the OWNER.

10. Should the trench pass over a sewer or other excavation, the trench bottom shall be sufficiently compacted to provide support equal to that of the native soil or conform to other regulatory requirements in a manner that will prevent damage to the existing installation.

11. Temporary support, adequate protection, and maintenance of all underground and surface structures, drains, sewers, and other obstructions encountered in the progress of the work shall be furnished by the CONTRACTOR. All properties that have been disturbed shall be restored as nearly as practical to their original condition.

12. When the sub grade is found to be unstable or to include ashes, cinders, refuse, organic material, or other unsuitable material, such material shall be removed, to a minimum of at least 12 inches below the pipe level and backfilled up to original trench depth with Type S1 material.

13. Ditches shall be kept free of water during piping installation. Grading shall be done as necessary to prevent surface water from flowing into trenches or other excavations, and any water accumulating therein shall be removed by pumping or by other approved methods. Discharge from any trench dewatering pumps shall be conducted to natural drainage channels, storm sewers, or an approved reservoir.

C. Bedding and Backfilling

1. General Requirements:

   a. The trenches shall not be backfilled until the installation conforms to the requirements specified.

   b. Do not install backfill over porous, wet, frozen or spongy sub-grade surfaces.

   c. In areas where less than 16" of ground cover exists, the piping shall be encased in concrete. Concrete shall be minimum 3000 PSI with reinforcing as indicated or required. Backfill shall be provided above concrete to original grade or sub-grade.

   d. Pavement, base course, and compacted sub grade disturbed by trenching operations shall be replaced in an acceptable manner with materials equal to the adjacent compacted sub grade, base course, and pavement for a minimum distance of 12 inches on each side of the trench.

   e. If compaction tests indicate Work does not meet specified requirements, CONTRACTOR shall remove Work, replace and retest until specified requirements are met.

2. Bedding and Backfilling Requirements:

   a. Bedding shall be provided for all piping, valves, etc.

   b. Bedding material shall be either Type S3 or S4.

   c. Bedding shall extend from 4” below bottom of pipe to 12” above top of pipe.

   d. Backfill shall extend from 12” above top of pipe up to top of trench or original grade/sub-grade.

3. Placement and compaction of bedding and backfilling materials under roads, parking areas, etc. shall be performed as follows:

   a. Place materials in continuous 6” thick horizontally placed loose layers and compact to 98% ASTM D698 maximum density with stability (stability shall be the absence of significant pumping or yielding of the soils while compaction is being performed).

   b. Adjust moisture content of materials utilized for bedding and backfilling with lime or other Professional approved method of restoring stability as required to obtain specified compaction requirements.

   c. Compaction tests shall be performed for each lift of bedding and/or backfilling per 200 linear foot of piping length.

4. Placement and compaction of bedding and backfilling materials under grassy areas, sidewalks, etc. shall be performed as follows:

   a. Place materials in continuous 9” thick horizontally placed loose layers and compact to 95% ASTM D698 maximum density with stability (stability shall be the absence of significant pumping or yielding of the soils while compaction is being performed).

b. Adjust moisture content of materials utilized for bedding and backfilling with lime or other Professional approved method of restoring stability as required to obtain specified compaction requirements.

c. Compaction tests shall be performed for each lift of bedding and/or backfilling per 200 linear foot of piping length.

END OF SECTION

Wier Boerner Allin
8/16/2023

PIPE TEST LOG

DATE	SYSTEM	LOCATION OF TEST	TEST PRESSURE	LENGTH OF TEST	RESULTS	CONTRACTOR' S SUPERINTENDENT WITNESS INITIALS	
						PRIME	MECHANICAL

Note: Turn in all forms filled out with project closeout documentation. Copy this form if more sheets are needed. These forms and/or log shall be kept at jobsite and upon request made available to ARCHITECT and/or PROFESSIONAL.

Valves

PART 1 – GENERAL

1.1 SCOPE

Provide all material, equipment and labor, etc., required to complete installation as specified herein and/or shown or scheduled on Contract Drawings.

1.2 APPLICABLE STANDARDS

Insofar as possible, all valves of the same type shall be of the same manufacturer.

1.3 VALVE DESCRIPTION AND IDENTIFICATION

A. Valves shall have name or trademark of manufacturer and working pressure cast or stamped on valve body.

B. Valve hand wheels shall be oriented when installed to provide maximum accessibility for operation.

C. Valve discs shall be the manufacturer's standard material for the service in which the valve is used unless otherwise indicated under the individual type valve specification.

PART 2 PRODUCTS (**OTHER VALVES FROM THOSE LISTED MAY BE SUBMITTED FOR APPROVAL**)

2.1 VALVES FOR DOMESTIC WATER APPLICATIONS

A. All valves shall be NSF 61 compliant and contain less than 0.25% lead (Pb) by weight.

B. Ball Valves:

1. Valves 2" and smaller shall be two-piece brass or stainless-steel construction, 1-1/4" extended neck, chrome plated ball with full port, P.T.F.E. seals and seats. Heavy duty steel handle with vinyl grip, quarter turn operation. Valves shall be suitable for working pressure of 200 psig and maximum 250deg F.

2. Valves 2-1/2” and larger shall be same as above except that two or three-piece brass or stainless-steel construction may be utilized.

C. Silent Check Valves:

1. Silent check valves 2" and smaller shall be horizontal or vertical silent spring check type. Valves shall be rated for 200# WOG.

D. Balancing Valves:

1. Manual Type:

a. Combination balancing and positive shut-off valves shall incorporate a position indicator and memory stop or locking device so the valve can be closed without disturbing the setting, and be returned to the balanced position without further adjustment.

b. Balancing valves for sizes 3" and smaller shall be calibrated bronze balancing valves with provisions for connecting a portable differential pressure meter. Meter connections shall have built-in check valves and knurled caps. Valves shall have integral pointers to indicate the degree of valve opening.

2.2 VALVES FOR NATURAL GAS SYSTEM

A. Plug Valves (for sizes 1¼” and larger, and at main service valves):

1. Valves shall be iron body (semi steel) lubricated, bolted glad type with Teflon coated plug. Flange unit for installation between 150# ASA steel flat-faced slip on weld flanges. All valves shall be wrench operated and wrench shall be furnished with each size valve. Each plug valve shall be serviced with the silicone sealant/lubricant recommended by the valve manufacturer. Valves 2" and smaller shall be short pattern type with threaded end connections. Valves shall be rated at 175# WOG.

2. Valves shall be equal to:

a. Nordstrom Fig. 142

b. Walworth No. 655

c. Powell No. 2200

B. Ball Valves (for sizes 1” and smaller)

C. Valves shall be one quarter turn shut-off, listed for gas service, bronze construction, CSA B16.44 5 psig rated, UL 842 5 psig rated and ANSI Z21.15 ½ psig rated.

D. Provide lever handle for equipment connections equal to McDonald Model 10710.

2.3 CHROME PLATED VALVES

Valves in exposed domestic plumbing connections to equipment shall have chrome plated finish.

2.4 KITCHEN COOKING BATTERY GAS SERVICE PIPING VALVE

A single mechanical or electric solenoid valve for each kitchen cooking hood shall be installed concealed above ceiling or as directed by local governing authority to isolate all gas-fired equipment under kitchen hood should fire alarm in same zone annunciate or by hood fire protection system manual pull station. Coordinate type and location of valve with hood fire suppression system and fire alarm Sub-contractors.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Installation shall be such that the valve can be fully opened and have at least 6" clearance beyond valve stem handle and sufficient clearance to remove stem for repair.

B. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally, locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawings. Install butterfly valves with the valve open as recommended by the manufacturer to prevent binding of the disc in the seat.

3.2 DISCHARGE FROM SAFETY AND/OR RELIEF VALVES

Relief valves relieving steam, gas of any type, including compressed air, or liquid above 120 degrees F., shall be piped full size to outside building or as indicated so that discharge cannot hit any person or structure.

3.3 RELIEF VALVE CAPACITY

Valve relieving capacity shall meet all code requirements and also be equal to at least 1.25 of possible heat input to be relieved.

END OF SECTION

PIPING SPECIALTIES

PART 1 – GENERAL

1.1 SCOPE

A. Provide all labor, equipment, materials, etc., required to complete installation as specified herein and/or shown or scheduled on Contract Drawings.

B. Work Included: Piping specialties to connect fire protection and plumbing equipment.

PART 2 – PRODUCTS

2.1 BACKFLOW PREVENTERS

A. Install a backflow prevention device at any point in the domestic water system where the potable water supply comes in contact with a potential source of contamination. Devices shall be certified by a recognized testing laboratory and be AWWA C-511-89 FCCCHR of USC, UPC, and IPC compliant. Listed below is a partial list of connections to the water system which shall be protected against backflow or back siphonage.

1. Double Check Backflow Preventer:

a. Fire Protection water service/riser to building

2. Atmospheric Vacuum Breaker:

a. Hose bibbs and sink faucets w/threaded outlets.

B. Fire sprinkler water backflow preventers shall be provided with the following:

1. UL/FM OS&Y shut-off valves on both sides of assembly with tamper switches

2. Provide pressure gauges both sides of backflow device.

3. Flanged connections on both ends.

4. Valves 2-1/2” and larger shall be equal to Watts Series 709-OSY.

2.2 GAUGES, PRESSURE

A. Type 1, (pressure for water), initial mid-scale accuracy one-percent of scale (Qualify grade), metal or phenolic case, 4-1/2 inches in diameter, 1/4-inch NPT bottom connection, white dial with black graduations and pointer, clear glass or acrylic plastic window, suitable for board mounting. Provide red “set hand” to indicate normal working pressure.

B. Provide brass, lever handle union cock. Provide brass/bronze pressure snubber for gauges in water service. Gauge cocks shall be Weksler Type A, Trecise No. 880 or Weiss Type LC.

C. Range of Gauges: For services not listed provide range equal to at least 130 percent of normal operating range:

Domestic Water.....0 to 100 psig

2.3 THERMOMETERS

A. Light powered, liquid crystal display, °F or °C selector switch and 6” brass stem with adjustable angle as required to read display from eyelevel.

B. Separable Socket (Well): Brass, extension neck type to clear pipe insulation.

C. Scale range may be slightly greater than shown to meet manufacturers' standard. Required ranges in degrees F:

Domestic Water.....30 to 180

D. Equal to Weiss Instruments, Inc “Digital Vari-angle” or Weksler “AAD” series.

PART 3 – EXECUTION

3.1 INSTALLATION

All equipment shall be installed as per manufacturer's recommendation and applicable codes and standards. Provide appurtenances as required for a complete system. Provide all appurtenances as indicated on Contract Drawings, where specified or not.

END OF SECTION

Supports and Anchors

PART 1 – GENERAL

1.1 SCOPE

Provide all labor, equipment, material, etc., required to complete installation as specified herein and/or shown or scheduled on Contract Drawings.

1.2 SUPPORT

Supports shall be installed in one of the following methods: (1) from wood using coach screw on open construction and hanger flanges on sheeting, (2) from concrete using inserts, (3) from steel using beam clamps, rivets or bolts, (4) from concrete blocks using toggle or through bolts. Fasten supports to building in following order of preference: (1) steel framing, (2) concrete, (3) wood framing, (4) masonry, (5) wood sheathing. Do not support from roof deck without approval. All hangers, rods, and inserts shall be Underwriters' Laboratories approved for the service intended and meet MSS #SP 58 and 69.

PART 2 – PRODUCTS

2.1 HANGERS, SUPPORTS, ANCHORS AND GUIDES

A. All hangers, fasteners and accessories exposed to view indoors shall be galvanized or zinc plated. Similar installations outdoors shall be hot dipped galvanized materials and fasteners.

B. Supports, hangers, anchors and guides shall be provided for all horizontal and vertical piping. Selection and application shall be in accordance with ANSI/MSS SP-69.

C. All pipe supports shall be of type and arrangement hereinafter specified. They shall be so arranged as to prevent excessive bending stresses between supports. Specifically designed hangers shall be fabricated and installed in accordance with ANSI/MSS SP-69.

D. All bracket clamp and rod sizes indicated in this specification are minimum size only. The CONTRACTOR under this section shall be responsible for structural integrity of all supports. All structural hanging materials except variable spring units shall have a safety factor of 5 built in.

E. All piping routed on trapeze hangers shall be attached rigidly to same unistrut hanger bar with clamps designed by unistrut manufacturer as approved by PROFESSIONAL. Insulated piping clamps shall encapsulate piping, insulation and saddle.

2.2 BASES AND PADS

A. Concrete equipment pads shall be constructed of minimum 3000 psi reinforced concrete. Provide ¾” chamfer on all exposed top perimeter edges of pads.

B. Top of equipment pads outdoors shall be minimum 3” above and below worst case finished grade and be reinforced and of a strength suitable for application.

C. Pads shall be provided in the following applications:

1. Air conditioning equipment outside building. Size pads to extend from building perimeter and extend minimum eighteen (18) inches around equipment on remaining three sides, or as indicated.

2. Backflow preventer enclosures outside building. Size pads to extend

minimum twelve (12) inches around equipment on all sides, or as indicated.

3. Floor mounted water heaters, air handling units, boilers, pumps, and where shown or specified on Drawings.

4. Provide similar concrete surrounds at cleanouts, grease interceptors, wet wells, etc., and as indicated.

PART 3 – EXECUTION

3.1 PIPING SUPPORT

A. All hangers for insulated piping shall be sized to accommodate insulation and shield. No hangers for insulated piping may be installed directly below or unto pipe itself except domestic cold water, and condensate drain piping where insulation is for condensation and/or freeze protection only.

B. Provide hanger spaced per International Plumbing Code, International Fuel Gas Code, and International Mechanical Code requirements for piping type and size.

C. Support horizontal PVC pipe with hanger or pier, located close to hub; use one support for each pipe length, or every other joint, whichever is closer. Where maintenance requirements may impose torque, as at a cleanout, support on both sides of torque point.

D. Provide hanger within 18" of each elbow, also provide hanger with 18" of connection to each piece of equipment.

E. Support vertical pipe at base and at each floor. In addition, 1" or smaller copper pipe shall be supported at 5' intervals or midway between floors, whichever distance is shorter.

F. Provide PVC or other approved coating for steel, cast iron or PVC pipe riser clamps. See applicable details.

G. Pipes passing thru walls shall not bear on building construction. Provide sleeves and fire proofing sealant as per Section *Basic Mechanical Materials and Methods*.

H. Maximum weights on hanger rods assuming a maximum operating temperature of 450 degrees F. shall be such that stress in tension shall not exceed 9000 psi, using root area of threaded portion.

I. For copper pipe, supports shall follow schedule and specifications. Supports for uncovered lines shall be especially designed for copper tubing, and shall be of exact O.D. diameter of tubing and shall be copper plated.

J. Shields at Hangers: Insulated pipe shall be protected at the point of support by a 180 degree insert of high density, 100 psi, waterproofed calcium silicate encased in a 180-degree galvanized sheet metal inverted saddle. Insert to be same thickness as gauges shown in chart below. Insulation insert to extend 1" beyond sheet metal on all insulated water lines. If pipe hanger spacing exceeds 12 feet, use double layer sheet metal shields. Check Section *Mechanical Insulation* for Alternatives.

PIPE SIZE	SHIELD LENGTH	MINIMUM GAUGE
1/2" - 2"	8"	24
2-1/2" - 4"	12"	20
6" - 8"	16"	16

K. Provide all steel required for support of pipes and equipment other than steel shown on STRUCTURAL ENGINEER'S Drawings.

L. All pipe supports shall be designed to avoid interferences with other piping, hangers, electrical conduits and supports, building structures and equipment.

3.2 OTHER MOUNTINGS

A. Any piece of equipment installed in a finished ceiling or wall area shall be supported independently of the building finish. Ceiling mounted items shall be supported directly from the building structure.

B. Support piping from structural steel members by malleable iron or formed steel beam clamps. Where suspended from concrete slabs, install inserts of malleable iron during building construction.

C. Wire or perforated hangers will not be permitted. Provide adjustable split ring swivel malleable iron hangers for horizontal runs up to and including 3" pipe size. Provide adjustable steel clevis type hangers for pipes over 3".

D. Provide malleable iron split ring hanger with copper finish and copper plated malleable iron adjuster for use with copper piping. For insulated piping, provide hangers sized to accommodate insulation.

END OF SECTION

Electrical Requirements

PART 1 – GENERAL

1.1 MECHANICAL WORK

All work performed under this Contract shall be in accordance with Division Electrical.

PART 2 – PRODUCTS

2.1 STARTERS

A. For each and every motor provided by CONTRACTOR, a new proper motor starter shall be furnished for installation, except that all starters for ½ horsepower single phase and smaller motors as specified and/or required shall be manual type.

B. Heaters shall be of the melting alloy type, sized to the exact nameplate running current of the motor. Manually operated motors with magnetic controllers shall be provided with oil tight pushbutton stations and automatically controlled motors shall be provided with oil tight "hands off auto" automatic switches. All magnetic starters shall be provided with red bull's eye pilot light in cover. Energy for controlled circuits shall be taken from the load contacts from the starters. All power wiring and control wiring shall be run in rigid conduit in damp locations or electrical metallic tubing in dry locations, and shall conform to NEC Standards. Provide two sets each of normally open and normally closed auxiliary contacts for all magnetic starters.

C. For all starters for three phase motors, provide both overload and under voltage and over-voltage protection in all phases and protection from phase loss and phase reversal.

D. For manual and automatic controlled operation of 3/4 HP and larger motors, furnish magnetic motor starter with:

1. Maintained contact starter with "hand off auto" switches.
2. Trip free, thermal overload relays.
3. Capable of accepting 3 external electric interlocks.
4. "Red" run pilot bulb indicator.

E. Where interlock or automatic operation is specified, regardless of HP, provide magnetic starter complete with "run off auto" switch so connected that in "run" or "auto" all safety controls shall stop the motor. Provide number and type of auxiliary normally open and/or closed contacts as required by specified control sequence.

F. Size 2 and larger starters shall have control circuits individually fused from line side of starter, or lead side of breaker, on combination unit. Starters on service above 240 volts shall have 120 volts, built in control circuit transformer fused from line side.

G. Each electrically operated item of equipment shall be suitable for proper operation on the electrical supply to which it is to be connected as directed on the Electrical Drawings. Prior to delivery on job site, it shall be the responsibility of the CONTRACTOR and any Sub-Contractors, equipment suppliers, etc. to determine from the Electrical Drawings the characteristics of the electrically operated item, and to furnish each item accordingly. CONTRACTOR shall pay the cost due to any modifications resulting from differences as compared to Basis of Design products.

H. Provide soft start and soft stop magnetic motor starters for all motor three phase loads above 5 HP, as Magnetek Series RVS–DN with digital microprocessor

circuitry, and include the safeties as detailed above, with auto reset.

2.2 MOTORS

A. All motors under this Contract shall be provided with thermal overload protection.

B. Equipment shall operate properly under a 10% plus or minus voltage variation, and a 5% plus or minus frequency variation.

C. Unless noted otherwise, motors shall be squirrel cage induction type with ball bearings. Motors ½ HP and smaller shall be 120 volts, single phase, with permanently lubricated bearings; 3/4 HP and larger shall be 3-phase, Design "B" or "C", drip proof type, of minimum power factor and energy efficiency as listed herein.

D. Motors shall be premium efficiency type as defined by energy policy act of 1992 (EPACT) and latest version of IEEE Standard 112, Test Method B.

HP	EFFICIENCY	POWER FACTOR
1	84	72
1.5	85.5	73..5
2	85.5	70.6
3	89.5	77.5
5	89.5	81
7.5	91.7	78.9
10	91.7	83
15	93	81
20	93.6	84
25	93.6	83.5
30	94	85.1
40	95.5	76
50	95.5	84.2
60	95.5	84.5
75	96	83.4
100	96	84.4

E. Motors shall be rated for continuous, full load duty and capable of withstanding momentary overloads of 50%. Select motors so actual load does not exceed nameplate ratings, and does not use motor "service factor". All motor furnished for this project shall have minimum service rating factor of 1.15. All motors shall be highest energy efficient type for all mechanical applications.

F. Except where interlock or automatic control is required, single speed single phase motors, ½ HP and smaller shall have manual motor switch with pilot light and thermal overload protection.

G. Each motor to be installed outdoors shall be of the totally-enclosed fan-cooled type, or housed in a weatherproof housing. Motors for hazardous locations shall be properly furnished to suit application.

H. Multi-speed motors shall, except as noted, be consequent pole, variable torque, single winding. When the speed ratios or the load characteristic dictates, the multispeed motors shall be separate winding types. Variable speed motors operating over an adjustable range of speeds shall be motors specifically designed

and rated for this duty.

2.3 ELECTRICAL FOR EQUIPMENT

A. Motor controllers, protection devices, etc., for control and protection of equipment shall be furnished with the equipment, but installed and electrically connected to power source under Division Electrical.

B. NEMA Standards shall be taken as minimum requirements for Electrical equipment.

C. CONTRACTOR shall provide and install all disconnects for all MECHANICAL motors and loads unless equipment is provided with integral disconnect(s).

D. All three phase motors in occupied areas shall be "quiet" rated and so marked.

E. On all three phase motors, provide both overload and under voltage and over-voltage protection in all phases and protection from phase loss and phase reversal.

F. Suitable enclosures for all electrical equipment shall be provided to suit environment as per NEMA and NFPA standards.

G. Clearances of 36” shall be maintained around equipment less than 400V. Clearances of 48” shall be maintained around equipment greater than 400V.

PART 3 – EXECUTION

3.1 GENERAL

A. Where electrical voltage and phase characteristics are specified hereinafter, verify them with the Electrical Drawings. In case of discrepancy between the Specifications and the Electrical Drawings, the Electrical Drawings shall govern.

B. The CONTRACTOR shall provide power to all circuits, controls, and safety devices to every piece of mechanical equipment specified or shown on Drawings whether a power source is indicated or not on Electrical Drawings.

C. The CONTRACTOR shall provide and extend fire alarm connections to all larger air handling equipment and provide code required smoke/heat detection sensors, etc., and automatic shutdown in the event of positive fire/smoke detection from any fire alarm sensor in same zone as served by same air system.

D. Control wiring (120V. and less) shall be provided under *Division 20, 21, 22 and 23* and extended from the 120V. power circuits indicated on the Electrical Drawings. All wiring for voltages higher than 30 volts shall be done by a licensed electrician.

END OF SECTION

Mechanical Identification

PART 1 – GENERAL

1.1 SCOPE

A. Piping System Identification

B. Valve Identification System

C. Equipment Identification

D. Miscellaneous Identification

1.2 REFERENCES

ANSI A13.1 – Scheme for the Identification of Piping Systems

PART 2 – PRODUCTS – SPECIFIED AS PER INDIVIDUAL APPLICATION IN PART 3

PART 3 – EXECUTION

3.1 IDENTIFICATION OF PIPING SYSTEMS

A. Identify all pipe after final painting and/or insulation with manufacturer's preprinted labels at the following minimum locations:

1. Straight runs of piping with a maximum spacing of twenty (20) feet.
2. Adjacent to each valve.
3. Adjacent to each branch takeoff point.
4. On each side of where piping passes through walls/floors.

B. Letter shall be sized in accordance with the following:

OUTSIDE DIAMETER OF PIPE COVERING	MINIMUM WEIGHT OF LEGEND LETTERS
Up to 3/4"	1/2"
1" to 1-1/4"	3/4"
1-1/2" to 2"	1"
2-1/2" to 6"	1-1/2"

C. At each legend, include a manufacturer's label with an arrow to show normal flow.

D. Identify location of outside underground piping by: (1) 4" x 18" concrete stakes, flush with finish grade, located above lines at end and/or corners or (2) by 2" x 2" brass plates embedded in building walls above pipes.

E. Identify all non-metallic piping below grade with 2" wide metalized tracer continuous roll identification tape, with service, as Brimar Industries "Underground Tape 2" Detectable". Install tape ± 12" below finished grade directly atop buried pipe, and 12-gauge bare copper tracer wire taped continuously to top of piping service. All tracer tape/wire shall be extended continuously between concrete stakes, and tied to stakes ± 6" below finished grade.

3.2 IDENTIFICATION OF PIPING ABOVE GRADE

A. All piping exposed to view or concealed shall include manufactured labels on pipe in a visible location. Label shall be attached to pipe every twenty feet (20'). Labels shall be installed after piping has been painted and/or insulated.

B. Labels to be utilized as follows.

1. In exposed applications, CONTRACTOR shall utilize pre-coiled, snap in place type markers as Seton “Setmark”. On 6” and larger pipe, CONTRACTOR shall utilize nylon ties to secure marker to piping.

2. In concealed applications, CONTRACTOR shall utilize a pressure-sensitive tape manufactured legend on all installations. Tape shall be tamper resistant vinyl tape for indoor as Seton “Opti-Code” and outdoor installations as Seton “Ultra-mark.”

3. Tape legend colors shall meet ANSI recommendations.

4. On piping where markers do not include directional arrows, CONTRACTOR shall include similar manufactured stick-on flow arrows on all pumped circulating systems as Seton “Arrows On A Roll” with colors to match pipe legend tape identification.

C. All insulated piping exposed to view everywhere and in mechanical rooms, shall include factory colored PVC jackets, non-insulated shall be similarly comprehensively painted in accordance with DIVISION 09 (colored coded as follows). (Verify colors with ARCHITECT prior to painting).

SERVICE	SYMBOL	COLOR
Sanitary Waste and Vent	San. W.	Dark Brown
Domestic Cold Water	DCW	Dark Green
Domestic Hot Water (115°)	DHW (115)	Light Blue
Domestic Hot Water Recirc. (115°)	DHWR (115)	Light Blue
Natural Gas	N. Gas	Yellow
Fire Protection Sprinkler	Fire Sprinkler	Red

D. See Section Basic Mechanical Materials and Methods for paint specification. NOTE: Factory colored PVC jacket, per Section Mechanical Insulation, required on all insulated water piping in all equipment rooms and where piping is exposed inside finished spaces. Outside insulated water piping and fittings shall include additional metal jacketing cover.

3.3 VALVE IDENTIFICATION

A. All major and branch valves in the HVAC, plumbing or fire protection system (except check valves) shall be tagged and numbered. A complete system schematic and floor plan location drawing with all such valves referenced to the tag assigned to that valve shall be framed and mounted where directed by the Professional. A copy of this system schematic shall also be in included in each of the Operations and Maintenance Manuals. Submit same to PROFESSIONAL for approval, prior to final mounting and inclusion in O & M Manual. Valve tags shall be brass, minimum 1¼” in diameter, engraved with white lettering on a colored background.

B. Lettering shall be minimum ½” high, with sequential lettering designations distinct for each separate functional service, i.e. CW-1 for 1st cold water valve, etc. Submit proposed floor plan layout with valves to be tagged, schematic of valve chart and system, etc., to PROFESSIONAL for approval. Tags shall be as Seton Series 31490.

3.4 EQUIPMENT IDENTIFICATION

A. All equipment, starters, controls panels, switches, thermostats, humidistats and other control devices shall be permanently labeled with equipment being served. Equipment labels shall correspond to those shown on the Contract Documents.

B. Individual functions and equipment on indicators and controllers on control panels shall be clearly permanently identified. Color code of labels, marking and identification shall be approved by PROFESSIONAL. This applies to the HVAC system, override panel, microprocessor time clocks and specialty annunciation specified in Section Controls and Instrumentation.

1. Labels for equipment, starters and control panels shall be phenolic type with minimum 3/4-inch tall engraved lettering.

2. Identification for individual controls devices including thermostats, humidistats, relays, switches, etc. shall be labeled with either phenolic type with minimum 1/2-inch tall engraved lettering or stick-on type from lettering machine.

C. A reduced scale floor plan drawing with all devices referenced to the equipment served shall be framed and mounted where directed. A copy of this reduced scale floor plan drawing shall also be in included in each of the Operations and Maintenance Manuals. Submit same to PROFESSIONAL for approval, prior to final mounting and inclusion in O & M Manual.

3.5 LIFE SAFETY DAMPER IDENTIFICATION

Each and every fire, smoke or combination damper shall be permanently labeled on duct adjacent to damper and/or neatly visible on wall above ceiling. Damper labels shall be phenolic type, minimum 3/4" tall lettering, color of lettering and background, and exposed label location approved by ARCHITECT. Damper identification (above ceiling) may be spray-on stencil type, with minimum 3" tall lettering identifying “Fire Damper, Fire/Smoke Damper”, etc. Provide, also, for above ceiling installations, on top of ceiling tile directly below damper locations, color coordinated tape dots +/- ½” diameter, as can be coordinated with PROFESSIONAL.

3.6 SAFETY/CONCERN NOTIFICATION

A. Provide OSHA and ANSI required safety signage at all kitchen hood fire protection pull stations, safety and critical operating controls, etc. Signage shall be phenolic engraved type; submit to PROFESSIONAL for approval.

3.7 FIRE PROTECTION IDENTIFICATION

See Section *Fire Sprinkler System.*

END OF SECTION

Mechanical Sound and Vibration Control

PART 1 – GENERAL

1.1 SCOPE

Provide all material, equipment and labor, etc., required to complete installation specified herein and/or shown or scheduled on Contract Drawings.

1.2 APPLICABLE STANDARDS

A. ASHRAE, 2019 HVAC Applications Handbook, Chapter 49, "Noise and Vibration Control".

B. The CONTRACTOR shall be responsible for providing and installing vibration isolation of the appropriate type and size for proper weight loading to meet the requirements of the specifications, and in accordance with instructions of the equipment manufacturer or vibration isolator manufacturer or its vendor.

C. On completion of the work, the ENGINEER shall carry out an inspection and shall inform the installing CONTRACTOR of any further work that must be completed before final approval is obtained.

1.3 MANUFACTURER

A. All vibration isolators shall be supplied by a single approved manufacturer.

B. The manufacturer's standard vibration isolation will be acceptable only if it meets this specification.

1.4 VIBRATION AND SOUND CONTROL

A. All rotating equipment shall be isolated from correcting piping, ductwork, structure or other rigid utilities, etc., by means of the appropriate vibration isolation. The CONTRACTOR shall provide and install the appropriate vibration isolation on any equipment, etc., with moving parts, whether indicated on Plans or not.

B. The CONTRACTOR shall provide and install appropriate sound isolation as required to restrict sound production or transmission. CONTRACTOR shall install this insulation, baffle, etc., where indicated or as directed by ENGINEER.

PART 2 – PRODUCTS

2.1 VIBRATION ISOLATOR TYPES

A. Unit FN (Floor Neoprene) - Smaller floor mounted equipment and for spacing between equipment and drain pans.

1. These isolators shall be double deflection neoprene waffle pad. Pads shall be a minimum of 5/16” thick with size cut as required for particular equipment weight being supported.

2. Isolators shall be Mason Type W – Neoprene Waffle Pads or approved equal.

2.2 EXTERIOR METAL PARTS

A. All metal parts of vibration isolation units installed out of doors shall be hot dip galvanized after fabrication.

B. Galvanizing shall comply with ASTM A123, A153 and 386 as applicable.

C. At the time of shipment to the job site, submit to the CONTRACTOR with copy to the

ENGINEER, a certified statement by the galvanizer indicating conformity of galvanizing to ASTM Specification.

PART 3 – EXECUTION

3.1 GENERAL

A. Minimum static deflection of each vibration isolator unit shall be as shown in the equipment schedules and/or as described for each specific piece of equipment in these Specifications.

B. Locations of all vibration isolation devices shall be selected for ease of inspection and adjustment.

3.2 EQUIPMENT MOUNTING

A. No equipment unit shall bear directly on vibration isolators unless its own frame is suitably rigid to span between isolators and such direct support is approved by the equipment manufacturer. All support frames shall be sufficiently stiff and rigid so as to prevent distortion and misalignment of components installed thereon.

B. Unless otherwise indicated, all equipment mounted on vibration-isolated bases shall have a minimum operating clearance of 2 inches between the equipment and the concrete housekeeping pad or floor beneath the equipment. The clearance space shall be checked by the CONTRACTOR to ensure that no construction debris has been left to short circuit or restrict the proper operation of the vibration isolation system.

C. All wiring and other connections to vibration-isolated units shall be made flexible in order to avoid short-circuiting the isolators. A minimum 4-foot length of armored flexible conduit or cable installed in the shape of a U is acceptable for electrical connections. In the case of large diameter conduits, a sheet metal duct with flexible connection may be used for conduit connections to vibrating equipment. Flexible material shall be the same as that described for ducts connecting to fans.

D. Under no conditions shall piping, ductwork or conduit be suspended from one another or physically contact one another. Vibrating systems shall be kept free from non-vibrating systems.

E. Vibration isolation hangers shall be positioned so that hanger housings may rotate a full 360 degrees without contacting any object.

3.3 DUCTS

A. The AHU returns, OSA, and discharge shall be connected to the ductwork with a flexible connector as described below, in order to prevent short-circuiting, and for sound and vibration isolation. Weatherproofing material shall be utilized when installed on exterior installations. Install connectors with slack, avoiding tight or misaligned connections.

B. All other ducts connecting fans, etc., shall have a flexible connector as described above.

C. Flexible duct connectors shall be:

APPLICATION	METAL END CONNECTIONS	FABRIC
Split systems and fans less than 2200 CFM air delivery capacity.	Minimum 3" wide 28 gauge galvanized, as Duro Dyne "Econo Fab" Series with minimum 4" wide fabric.	Indoors: Minimum 15 oz./sq. yd., as Duro-Dyne "Excelon" Series with vinyl coated woven nylon/polyester blend. Outdoors: Minimum 17 oz./sq. yd., as Duro-Dyne "Therma Fab" Series with Silicon Rubber coated woven fiberglass fabric.
Larger Commercial HVAC Systems with air delivery above 2200 CFM air delivery capacity.	Minimum 3" wide 24 gauge galvanized, as Duro Dyne "Super Metal Fab: Series, with minimum 6" wide fabric.	Indoors: Minimum 22 oz./sq. yd., as Duro-Dyne "Excelon" Series with vinyl coated woven nylon/polyester blend. Outdoors: Minimum 24 oz./sq. yd. As DD "Durolon" Series with Hypalon coated woven fiberglass.

END OF SECTION

Mechanical Insulation

PART 1 – GENERAL

1.1 SCOPE

A. It is intended that all heating and/or air conditioning ductwork, all storm drain piping above slab on grade and all domestic water piping above slab on grade throughout this project be insulated, except as specifically stated otherwise hereafter.

B. Insulation shall include all insulating materials their applications, bands, tie wire, and weather protection for all pipe, fittings, valves, and equipment as indicated and as specified herein.

C. Piping systems requiring insulation, types of insulation required, and insulation thickness shall be as listed herein. All fittings, flanges, and valves (except valve stems, hand wheels, and operators) in piping systems requiring insulation shall be insulated unless otherwise specified. Fitting, flange, and valve insulation shall be premolded, precut, or job fabricated insulation of the same thickness and conductivity as used on adjacent piping. Insulation exterior shall be cleanable, grease resistant, non-flaking and non-peeling.

PART 2 – PRODUCTS

2.1 PIPING INSULATION

A. Fiberglass pipe insulation (FG)

1. Insulation shall have a thermal conductivity k=0.23 at 75 degrees F.
2. Insulation shall include a white ASJ with self-sealing overlap joints and seams.
3. Insulation shall be equal to Johns Manville "Micro-Lok" or approved equal.

B. Flexible elastomeric pipe insulation (FU)

1. Insulation shall have a thermal conductivity k=0.25 at 75 degrees F.
2. Insulation shall be equal to Armacell “AP Armaflex”.

C. Phenolic (P)

1. Insulation shall have a thermal conductivity k=0.15 (density 10 pcf nominal)
2. Insulation shall be equal to Insul-Phen.

D. PVC pipe and fitting covers.

1. Pipe and fitting covers shall be 20 mill thick flame retardant PVC. Fitting covers shall be neat, tight fitting radius type.
2. Pipe and fitting covers shall be equal to Zeston type 300 or approved equal.

E. Metal Protective Jacket

1. Sheet Aluminum: ASTM B209, 3003 alloy, H 14 temper, 0.016 inch thick.
2. Fitting Covers: Factory fabricated from not lighter than 0.020-inch thick type 3003 sheet aluminum.
3. Bands: 3/4-inch wide .007 aluminum (or .005 stainless steel.

2.2 DUCTWORK INSULATION

A. Rectangular Ductwork Interior Acoustical Liner

1. See Section *Ductwork*.

B. External Duct Wrap Insulation (Duct Wrap)

1. Insulation shall be 2.2" thick and 3/4 pcf density fiberglass material with FSK facing. The "k" factor at 75° F., mean temperature shall not exceed 0.31 and shall meet NFPA 90A & 90B Standards.

C. Rigid Board Insulation (Board)

1. Insulation shall be one inch (1”) thick with FSK outer skin and black matte durable finish meeting the requirements of ASTM G21 and G22.

2. Insulation shall be equal to Knauf “Ductboard M” or CertainTeed “Ductboard with Enhanced Facing”.

D. Fire Wrap Insulation

1. Insulation system shall be tested and classified to provide 2-hour clearance to combustible construction and a 1 hour fire rating per ASTM E 2336.

2. Insulation shall be equal to “FireMaster FastWrap XL” by Thermal Ceramics.

PART 3 – EXECUTION

3.1 GENERAL INSULATION INSTALLATION REQUIREMENTS

A. The insulation shall be applied by licensed insulation applicators and all work shall be performed in a neat and workmanlike manner.

B. No insulation shall be applied over pipes, fittings, or other surfaces, which are not clean.

C. Insulation shall be applied after pipes have been thoroughly tested and proven tight by the CONTRACTOR.

D. Piping insulation thru rated walls shall be coordinated with Section *Basic Mechanical Materials and Methods* and approved pipe sleeve and fire stop with UL Listing.

E. Color coding of piping systems shall be in accordance with Sections *Basic Mechanical Materials and Methods* and *Mechanical Identification*. Piping identification after color coding shall be a specified in Section *Mechanical Identification*.

F. Insulation shall be clean and dry when installed and during the application of any finish.

G. Install materials neatly with smooth and even surfaces with jackets drawn tight and smoothly cemented down on longitudinal and end laps.

H. Scrap pieces shall not be used where a full-length section will fit.

I. Pipe insulation shall be continuous through sleeves, wall and ceiling openings.

J. A PVC grommet shall be utilized at metal stud penetrations of piping, and insulation shall be installed snug to both sides of penetration with ends of piping insulation vapor sealed if specified.

K. Piping and ductwork shall be individually insulated.

L. Chrome plated pipes and pipes used solely for fire protection shall not be insulated.

M. Equipment nameplates, access plates in fan housings and ductwork and the like for ventilating and air heating systems, shall not be insulated but insulation must be carefully beveled and sealed around it.

N. Ductwork insulation shall be continuous through sleeves, wall and ceiling openings except at fire dampers in ductwork systems.

O. Vapor Barrier Installation

1. A complete moisture and vapor seal shall be provided wherever insulation terminates against metal hangers, anchors and other projections through insulation on cold surfaces for which a vapor seal is specified as identified in Part 3 paragraph 3.03 of this specification section.

2. Seam and fitting covers shall be sealed with two (2) generous brush coat of fire resistant vapor barrier coating, applied at all longitudinal and circumferential laps.

3. Ends of sections of insulation that butt against flanges, unions, valves, and fittings, and joints at intervals of not more than 12 feet on continuous runs of pipe shall be coated with a vapor barrier coating.

4. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and cementing, coating as specified for butt strips. The patch shall extend not less than 1½” past the break in both directions.

5. At penetrations such as thermometers, valve stems, etc., the voids in the insulation shall be filled with vapor barrier coating and the penetration sealed with a brush coat of the same coating.

6. PVC fitting jackets in concealed applications shall be with a strip of insulation jacket and brush coat of vapor barrier sealant.

7. PVC fitting jackets in exposed applications shall be neatly covered with a PVC/vinyl tape neatly smoothed.

P. Installation at Hangers and Anchors

1. Pipe insulation shall be continuous through pipe hangers.

2. Where pipe is supported by the insulation, galvanized sheet metal shields or saddles 12 inches long shall be provided. Shields/saddles shall be 20-gauge galvanized sheet metal for pipes 6" and smaller and 18 gauge for pipes 8" and larger.

3. Where shields are used on pipes 2 inches and larger, insulation inserts shall be provided at points of hangers and supports.

a. Insulation inserts shall be of calcium silicate, cellular glass (minimum 8 pcf), molded glass fiber (minimum 8 pcf), or other approved material of the same thickness as adjacent insulation.

b. Inserts shall have sufficient compressive strength to adequately support the pipe without compressing the inserts to a thickness less than the adjacent insulation.

c. Insulation inserts shall cover the bottom half of the pipe circumference 180 degrees and be not less in length than the protection shield.

d. Vapor barrier facing of the insert shall be of the same material as the facing on the adjacent insulation.

e. Seal inserts into the insulation with vapor barrier coating.

4. Where protection saddles are used, fill all voids with the same insulation material as used on the adjacent pipe.

5. Insulate and vapor seal insulation at anchors same as piping for a distance not less than four times insulation thickness to prevent condensation.

3.2 PIPING INSULATION INSTALLATION

A. Fiberglass pipe insulation (FG)

1. Install insulation with longitudinal laps and butt strips additionally smoothly secured with Benjamin-Foster 85-20 adhesive.

2. Fittings and valves on pipe shall be similarly insulated with thickness equal to the adjacent pipe.

B. Flexible elastomeric pipe insulation (FU)

1. Miter 90 degree turns and elbows, tees, and valve insulation.

2. Secure longitudinal joints with vinyl tape on 9-inch centers.

3. Bond cuts, butt joints, ends, and longitudinal joints with adhesive. After adhesive cures, apply 2-inch wide pressure sensitive adhesive vinyl tape over bonded cuts, joints, and ends.

C. PVC pipe and fitting covers.

1. PVC pipe and fitting covers shall be installed with a smooth appearance and no visible wrinkles.

2. All longitudinal seams shall be installed such the joints facing up or to the back of the finished product.

3. All longitudinal and circumferential PVC jacket joints and connections shall be spot welded every 12" with Perma Weld Adhesive and subsequently neatly sealed with tight fitting pressure sensitive vinyl tape, installed without wrinkles.

4. See Section *Mechanical Identification* for color coding of factory PVC jackets in exposed applications.

D. Metal Jacket Installation

1. Metal jackets shall have side and end laps at least 2 inches wide with the cut edge of the side lap turned under one inch to provide a smooth edge.

2. Secure jackets in place with aluminum or stainless-steel bands on 9 inch centers.

3. Place laps to shed water.

4. Seal laps with weatherproof coating.

5. Where pipes penetrate exterior walls, continue the increased insulation thickness required for piping exposed to weather and the metal jackets through the sleeve to a point 2 inches beyond the interior surface of the wall.

6. In outside locations protect fittings, flanges, and valves with a weatherproof coating prior to installation of metal covers. Secure metal covers for fittings, flanges, and valves in place with metal bands and seal with a weatherproof coating.

3.3 PIPING INSULATION APPLICATIONS

PIPING INSULATION MATERIAL TYPE, SERVICE JACKET, VAPOR BARRIER AND THICKNESS TABLE

SERVICE	INSULATION MATERIAL (NOTE 'A')	TYPE OF SERVICE JACKET REQ'D (NOTE 'B')	VAPOR BARRIER REQ'D	INSULATION THICKNESS (INCHES) ½" – 1 ¼"	1 ½" – 3"	3 ½" – 6"	8" – 10"	11" – 36	NOTES
DOMESTIC HOT AND RECIRCULATING	FG	B	YES	1	1.5	1.5	1.5	1.5	1,2,4,8,10,11
	FU	C	NO	1	1.5	1.5	1.5	1.5	
	P	B	NO	0.5	1	1	1	1	
DOMESTIC COLD WATER	FG	B	NO	0.5	1	1	1	1	1,2,4,8
	FU	C	NO	0.5	0.75	0.75	0.75	0.75	
A/C CONDENSATE DRAIN LOCATED INSIDE BUILDING	FG	A OR B	YES	1	1	1	1	1	4,5
	FU	C	NO	0.75	1	1	1	1	
DRINKING FOUNTAIN DRAIN PIPING (ON SEWER TIE-ON)	FG	B	YES	1	1	1	1	1	5
	FU	C	NO	1	1	-	-	-	
REFRIGERANT PIPING	FU	C	NO	SEE NOTES	SEE NOTES	-	-	-	6, 8

NOTE 'A' – INSULATION MATERIAL

	MATERIAL	SPEC	TYPE	CLASS / GRADE
FU	FLEXIBLE UNICELLULAR	ASTM C 534	-	-
FG	FIBER GLASS	ASTM C 547	I	1
P	PHENOLIC	ASTM C 552	-	-

NOTE 'B' – TYPE OF SERVICE JACKET REQUIRED

A	FOIL BACKED ALL SERVICE JACKET (ASJ)
B	PAPER ASJ
C	NONE

TABLE NOTES:

1. Flexible unicellular insulation shall be utilized on domestic piping concealed within interior and exterior walls and plumbing chases. After the building is completely in the dry, the Contractor may utilize fiberglass insulation in these applications.

2. Note that higher density insulation inserts shall be utilized on all water piping larger than 1-1/2" size, at all hanger/saddle supports, etc.

3. Not used.

4. A full coverage color-coded PVC jacket shall be required on insulated piping and fittings exposed in mechanical rooms, in crawlspace, and in interior exposed applications everywhere. See Section *Mechanical Identification* for color requirements.

5. Drain piping in concealed applications may be insulated with flexible unicellular or fiberglass.

6. Refrigerant piping shall be insulated as follows. Conventional heat pump or 2-pipe variable refrigerant systems shall have the larger pipe (hot gas line during heating operation) based upon the thickness corresponding to hot gas lines below and NOT the suction line thickness.

   a. Suction lines - ¾" thick for pipes less than 1" in size, 1" thick for pipes equal to or greater than 1" in size.

   b. Liquid lines – 1" thick for pipes less than 1-1/2" in size, 1.5" thick for pipes equal to or greater than 1-1/2" in size.

   c. Hot gas lines – 1.5" thick for pipes less than 1-1/2" in size, 2.0" thick for pipes equal to or greater than 1-1/2" in size.

7. Not used.

8. Provide metal jackets over insulation on all insulated piping exposed to outdoor weather (including refrigerant piping).

9. Not used.

10. All potable water piping outside, exposed to view in finished spaces, within mechanical/equipment rooms, etc., shall be insulated with phenolic.

11. Unless exposed to view in finished spaces or located in an exterior wall, all domestic hot water branch piping which is not recirculated shall not be required to be insulated. At these locations, utilize either copper clad hangers or dielectric isolation wrap to support piping.

3.4 DUCTWORK INSULATION INSTALLATION

A. Rectangular Ductwork Interior Acoustical Liner

1. See Section *Ductwork*.

B. External Duct Wrap Insulation

1. Insulation shall be installed in a manner to prevent compression of the insulation.

2. When ductwork (rectangular or flat oval) with any vertical or bottom side is greater than 18", install pins and clips in a 12" o.c. grid, with pins within 4" of any longitudinal edge. Excess length of pins shall be snipped and top of pin/washer covered with pressure UL 181 pressure sensitive tape.

3. All longitudinal and circumferential insulation seams shall be sealed with 3" wide pressure sensitive tape bearing the UL 181 label.

C. Rigid Board Insulation

1. Insulation shall be installed in a manner to prevent compression of the insulation.

2. When ductwork (rectangular or flat oval) with any vertical or bottom side is greater than 18", install pins and clips in a 12" o.c. grid, with pins within 4" of any longitudinal edge. Excess length of pins shall be snipped and top of pin/washer covered with pressure UL 181 pressure sensitive tape.

3. All longitudinal and circumferential insulation seams shall be sealed with 3" wide pressure sensitive tape bearing the UL 181 label.

D. Fire Wrap Insulation

1. Install per instructions specified in an ICC-ES building code report and manufacturer's recommendations to provide specified fire rating.

3.5 DUCTWORK INSULATION APPLICATIONS

DUCTWORK INSULATION MATERIAL TYPE, VAPOR BARRIER AND THICKNESS TABLE

DUCTWORK FUNCTION/TYPE	INSULATION MATERIAL	VAPOR BARRIER REQ'D	INSULATION THICKNESS (INCHES)	NOTES
Rectangular Low Pressure Supply Air	DUCT WRAP	YES	2.2	1
Round/Oval Low Pressure Supply Air	DUCT WRAP	YES	2.2	2
Rectangular Low Pressure Return Air	DUCT WRAP	YES	2.2	1
Round/Oval Low Pressure Return Air	DUCT WRAP	YES	2.2	
Rectangular Low Pressure Exhaust Air	SEE NOTES	-	-	3
Round/Oval Low Pressure Exhaust Air	NONE	-	-	
Rectangular Low Pressure Outside Air	DUCT WRAP	YES	2.2	
Round/Oval Low Pressure Outside Air	DUCT WRAP	YES	2.2	
Rectangular Low Pressure Transfer Air	SEE NOTES	-	-	1
Round/Oval Low Pressure Transfer Air	DUCT WRAP	YES	2.2	
Residential Range Hood Exhaust Air	DUCT WRAP	YES	2.2	
Transfer and Return Air Grille Plenum Boxes	BOARD	YES	1.00	5
Miscellaneous Ductwork and Accessories	DUCT WRAP	YES	2.2	4

TABLE NOTES:

1. See Section *Ductwork* for:
   a. Additional acoustical internal insulation required in addition to specified external insulation. Omit external duct wrap insulation on indoor exposed ductwork.
   b. Interior liner required on ductwork located outdoors.
2. See Section *Ductwork* for additional double wall sandwich insulation required in addition to specified external insulation.
3. See Section *Ductwork* for acoustical internal insulation required.

4. Miscellaneous Insulation and Acoustical Treatment Requirements:

    a. Air Distribution Devices (Grilles, Registers and Diffusers):

        i. The concealed frame and housing of all such devices above ceilings, in attics, walls, crawlspaces, etc., shall be factory insulated.

        ii. When factory insulation is not available, duct wrap insulation shall be installed on any concealed frame, housings, plenums, etc.

    b. Fire, Smoke, Combination Fire/Smoke shall be insulated per detail on Drawings and Damper Manufacturer's recommendations.

    c. Control and Manual dampers shall be insulated such that automatic or manual operator is not impeded.

    d. Dryer exhaust ductwork routed concealed indoors, in walls, attics, etc., shall be insulated. Where indicated on drawings utilize fire wrap insulation in lieu of duct wrap.

5. See Details on Drawings for more information and construction requirements.

END OF SECTION

Fire Sprinkler System

PART 1 GENERAL

1.1 SCOPE

A. Provide all material, equipment and labor, etc., required to complete installation specified herein and/or shown or scheduled on Contract Drawings.

B. The CONTRACTOR shall provide a new fire sprinkler arrangement including piping and heads, and other appurtenances as shown on Contract Drawings or as specified, to provide wet pipe system coverage to the entire facility, including riser, piping and heads, with new as required to suit areas, as shown on Contract Drawings.

C. The system shall include all piping, valves, fittings, fire alarm interface, and heads required for the type of construction and as required by OWNER'S insurance and local fire authority requirements.

D. Standard Products:

1. Equipment furnished under this Specification is 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 products of the same manufacturer.

E. System shall include general wet pipe area sprinkler piped arrangement, including new heads of type indicated hereinafter, per NFPA-13 (latest edition) requirements for all new interior (and exterior covered) space(s), and interstitial spaces, attics, etc., as required for comprehensive fire sprinkler protection.

F. It is the CONTRACTOR’s responsibility to review the plans, available as-builts, and visit the site to familiarize themselves with the conditions for installation.

G. The CONTRACTOR shall be responsible for verifying static and residual and flow of existing water distribution system and design requirements of the local governing authority which vary from the minimum code standards imposed by these Specifications, and include same in his bid and install same in this project. Should an ENGINEER’s stamp be required, same will be coordinated and cost for same included in his bid.

1.2 APPLICABLE STANDARDS

A. All equipment used must meet the requirements of the National Board of Fire Underwriters for the service intended.

B. The CONTRACTOR shall conform to standards prescribed by City, County and State regulations or ordinances having jurisdiction and be approved by the OWNER'S insurance company. Any changes that may be necessary to conform to such regulations or ordinances shall be made by the CONTRACTOR without extra cost to the OWNER.

C. The interior sprinkler system shall be designed for type occupancy and hazard protection per NFPA 13, newest edition, or as applicable.

D. It is the CONTRACTOR’S sole responsibility to ascertain and verify the specifics of the characteristics (pressure and flow) of the water service available and include same in the hydraulic calculations for design and installation. The review of the

sprinkler Shop Drawings by the A/E does not relieve the CONTRACTOR of this responsibility.

1.3 GENERAL REQUIREMENTS

A. The entire work must be executed in a neat, substantial, and workman like manner, according to the true intent and meaning of the plans and specifications, which are intended to include everything dependent upon them and required for the completion of the work with materials best adapted to the purpose.

B. Unless otherwise shown, specified, or approved by the ENGINEER, use materials and equipment in the installation of the sprinkler system listed as approved by the Underwriters' Laboratories Inc. List of Inspected Fire Protection Equipment and Materials, or approved by any other appropriate nationally known and recognized testing laboratory for use in sprinkler systems, and of the latest design of the manufacturer.

C. In general, ductwork and other graded piping drainage systems have the right-of-way. The CONTRACTOR shall provide, install, and arrange his piping layout to avoid conflicts with other installations.

D. Seismic restraints:

1. Submit shop drawings for all devices specified herein and as indicated and scheduled on the drawings. Submittals shall indicate full compliance NFPA 13 requirements. Any deviation shall be specifically noted and subject to engineer approval. Submittals shall include device dimensions, placement, attachment and anchorage requirements.

2. Provide calculations for selection of seismic restraints, certified by a qualified professional engineer, licensed in the state of the project.

PART 2 PRODUCTS

2.1 SPRINKLER HEADS

A. Unless otherwise specified or shown, provide and install sprinkler heads of regular automatic closed type, or new spray type heads, for ordinary degree temperature rating except that type and temperature ratings of sprinkler heads installed in the vicinity of heating equipment shall be as required for such locations by NFPA 13, where, in the opinion of the OWNER's insurance company, special occupancies and installations indicate the need for special heads, high temperature rating, etc., for such heads by actual tests at the site. Provide quick response heads in all applications.

B. Utilize chrome plated semi-recessed pendant type heads in areas with lay-in ceilings.

C. Utilize concealed pendent-type heads with flush mounted covers in areas with hard ceilings.

D. Utilize chrome plated upright heads, with the deflectors parallel to ceiling or roof slope, in areas without ceilings. Clearances between the deflectors and the ceilings, roof decking, or roof joists to be in accordance with NFPA 13, unless otherwise shown on Drawings.

E. Utilize non-freeze heads on wet systems at freeze susceptible non-conditioned area applications.

F. All heads in lay-in acoustical tile ceiling areas shall be installed with swing joints so as to be able to center same in ceiling tile. (No exceptions). An accepted alternative to swing joints are flexible stainless-steel hoses and lay-in or sheetrock mounting brackets manufactured by FlexHead®.

2.2 DRAINS

A. Install main drains on main risers and auxiliary drains at low points in the system. Install inspector's test drains on each sprinkler system as near the outer end of system as possible. Drain valves to be of the angle type. Install in accordance with NFPA 13. Pipe drain valves to a safe place of discharge; discharge to be visible either by open end drain pipe or sight drain fitting. Provide permanent metal signage at each test valve installation.

2.3 TAMPER SWITCHES

A. Provide tamper switches for all above grade and interior building shut-off valves and coordinate fire alarm connections for all switches.

2.4 WATER FLOW INDICATOR SWITCHES

Provide water flow indication switches for all zones and systems of the sprinkler installations. Coordinate all fire alarm connections and zones.

2.5 FIRE ALARM

The CONTRACTOR shall provide all wiring and interlocks as required for connection to the building fire alarm system for new and existing replaced tamper and flow switches. See *Division 28* for further requirements.

2.6 MISCELLANEOUS EQUIPMENT AND ACCESSORIES

A. Piping and fittings: Refer to Section *Pipes and Pipe Fittings*.

B. Pipe Hangers and Seismic Restraints: Use types indicated as acceptable in NFPA 13 and Section *Supports and Anchors*. Galvanized hanger materials and fasteners shall be utilized in outdoor and exposed to view indoor applications.

C. Provide separate NEMA 1 box with two (2) spare sprinkler heads of each type utilized, wrench(es) to install same, and wall mount in a location adjacent to main building riser.

D. Piping Identification: See Section *Mechanical Identification*. All piping exposed to view and concealed everywhere shall be properly labeled.

E. Signage at riser and Inspector’s Test Station - per NFPA 13 and Section *Mechanical Identification*.

F. Backflow Preventer: Section *Piping Specialties*. Include pressure drop in hydraulic calculations.

G. Backflow Preventer Testing and Certification: Section *Piping Specialties*

H. Fire Stopping: Section *Basic Mechanical Materials and Methods*

I. Coordination: Section *Basic Mechanical Requirements* and *Basic Mechanical Materials and Methods*

J. Insulation: Section *Mechanical Insulation*

K. Fire Alarm Interactions: *Division 28* Specifications and NFPA requirements.

L. Seismic Restraint: See Section *Mechanical Seismic and Wind Restraints*

PART 3 EXECUTION

3.1 WATER CONNECTION

A. CONTRACTOR to coordinate and connect to nearby utility system as shown on mechanical site plan. Utilize thrust blocking at all turns in service piping routing.

3.2 GENERAL PIPING INSTALLATION:

A. Install pipe, fittings, and hangers where shown on drawings in accordance with NFPA No. 13 and NFPA 231C.

B. Cutting Structural Members: Cutting of structural members for the passage of sprinkler piping or for pipe hanger fastenings will not be permitted unless approved by metal building vendor and/or STRUCTURAL ENGINEER.

C. Holes through Walls, Floors, and Ceilings: Where sprinkler pipes pass through walls, floors, and ceilings, the holes shall be large enough to accommodate pipe expansion. Provide chrome plated escutcheon at each hole to ensure the effectiveness of the floor or wall as a fire stop. Provide fireproof material around pipes to maintain fire integrity as per Section *Basic Mechanical Materials and Methods*. Expansion and Contraction: Provide long runs of pipe with means to permit free movement resulting from expansion and contraction.

D. Reducers: Make reductions in pipe sizes with one piece reducing fittings. Bushings not acceptable, except that when one piece reducing fittings of proper size are not obtainable, single bushings of the face type will be permitted up to 5 percent of total number of reducing fittings in the system. Where face bushings are used, install with outer face flush with the face of fitting opening being reduced.

E. Couplings: Couplings not to be used except where length of pipe between fittings exceeds 20 feet.

F. Flanged Fittings: Use flanged fittings in the control valve and drain assembly at base of risers of multiple-story sprinkler systems at each floor-system connection. Where part of a sprinkler system is on the opposite side of a wall or partition, a flanged connection may be used.

G. Unions and Companion Flanges: Use ground joint malleable iron unions in looped sprinkler systems where pipe is 2" in diameter or smaller. Where loops are larger than 7" are used, install companion flanges.

3.3 SEISMIC RESTRAINTS

A. All piping associated with Life Safety systems, including fire protection sprinkler systems: Ip=1.5.

B. Install seismic restraint devices per the manufacturer’s submittals and per NFPA 13 requirements. Any deviation from the manufacturer’s instructions shall be reviewed and approved by the Engineer whose stamp appears on the calculations and shop drawings.

C. Attachment to structure for suspended equipment and pipe: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

D. Wall penetrations may be used as bracing locations provided the wall can provide

adequate resistance without significant damage.

E. Coordinate sizes and locations of cast-in-place inserts for post-tensioned slabs.

F. Provide hanger rod stiffeners where indicated or as required to prevent buckling of rods due to seismic forces.

G. Where rigid restraints are used on equipment, piping, or support rods for the equipment, ductwork or piping at restraint locations they must be supported by anchors rated for seismic use. Post-installed concrete anchors must be in accordance with ACI 355.2.

3.4 TESTS

A. Upon completion and prior to the acceptance of the installation, subject the system to the tests required by Fire Department Authorities and the OWNER'S insurance company and NFPA 13, and subsequently furnish the OWNER with a certificate as acceptable by same, indicating the CONTRACTOR certifies the sprinkler system is completely operable and conforms to local and national code requirements, specifically NFPA 13 (Material and Test Certificates).

3.5 SYSTEM TESTING

A. The CONTRACTOR shall test the system and controls, relief valves, etc., as it pertains to proper operation in conjunction with a new or existing system fire pump, fire alarm, system, dry pipe or anti-freeze loop, etc. CONTRACTOR shall provide any and all equipment and installations necessary to provide a fully operable system conforming to the latest codes and standards. CONTRACTOR to report all discrepancies and concerns to ENGINEER-OF-RECORD.

3.6 OWNER’S EDUCATION

A. The CONTRACTOR in conjunction with the requirements of Section *Mechanical Close-out Requirements*, shall educate the OWNER’S personnel in the proper use, testing, operation and maintenance of all new and renovated fire protection sprinkler systems. These instruction session(s) shall be coordinated with designated OWNER’S representative and A/E.

B. The CONTRACTOR shall furnish to the ARCHITECT, a letter from the OWNER indicating his staff has received adequate instruction in the proper use and maintenance of the fire protection sprinkler systems.

3.7 GUARANTEE: SEE PARAGRAPH “GUARANTEE AND WARRANTY” IN SECTION *MECHANICAL SYSTEMS AND EQUIPMENT WARRANTIES*.

END OF SECTION

Plumbing Specialties

PART 1 – GENERAL

1.1 SCOPE

A. Domestic water, sewer, roof drainage and condensate drains, including piping, equipment and all necessary accessories as designated in this section.

B. Furnish all cleanouts and/or test tees as shown on Contract Drawings and required by Code. Cleanouts shall be the same size as the pipe they serve, except that 4 inches shall be the largest size required. Cleanouts shall be provided at the foot of each soil stack and of each run, change in direction, and mains, not to exceed 50 feet apart inside of building and 80 feet apart outside of building. The smallest flush floor cleanout shall be 3" unless otherwise noted.

PART 2 – PRODUCTS

2.1 FLOOR DRAINS

A. Floor drains shall be in accordance with ANSI A112.21.1. Provide caulking flange for connection to cast iron pipe, screwed outlets for connection to steel pipe, and side outlet when shown. Provide suitable clamping device and extensions if required, where installed in connection with waterproofing membrane. (Submit detailed shop drawings of these drains). Double drainage pattern floor drains shall have integral seepage pan for embedding in floor construction, and weep holes to provide adequate drainage from pan to drain pipe.

B. The following plumbing drains are Jay R. Smith Models, however equal Zurn, Wade, Jonespec, MIFAB, Watts or Josam models are acceptable. Note: Provide flashing clamp when required with waterproofing membrane.

1. FD-1 – Floor Drain: (Toilet Areas) Zurn Model Z415-7B, duco coated cast iron body with polished bronze 7" round strainer, clamping collar. Drain shall have trap primer connections where indicated. Size as indicated.

2. FD-2 – Floor Drain: (Area Mechanical Room Traffic Type) Zurn Model Z539, duco cast iron body (10” deep), flashing collar, 12" square cast iron traffic ½ grate and slotted sediment bucket.

3. FD-3 – Floor Drain: (Recessed Grate) Zurn Model Z415-7I, duco coated cast iron body with polished bronze 7" diameter extended rim strainer, clamping collar. Drain shall have trap primer where indicated. Size as indicated. Top lip to be installed flush with finished floor.

4. FD-4 – Floor Drain: (Commercial Washer Lint Trough) Watts LI-LT Series, stainless steel lint trough with removable stainless steel filter screens, and perforated stainless steel dome bottom strainer. Size 14”x14”x48” long.

5. FD-5 – Floor Drain: (Commercial Washer Lint Trough) Watts LI-LT Series, stainless steel lint trough with removable stainless steel filter screens, and perforated stainless steel dome bottom strainer. Size 14”x14”x144” long.

2.2 TRAPS

A. Provide traps on all sanitary branch waste connections from fixtures or equipment not provided with traps. Exposed brass shall be polished brass chromium plated with nipple and setscrew escutcheons. Concealed traps may be wrought cast brass. Slip joints not permitted on sewer side of trap. Traps shall correspond to

fittings on cast iron soil pipe or steel pipe respectively, and size shall be as required by connected service or fixture, or as scheduled.

B. All drains, overflow, condensate and relief, to be routed to a trapped hub or floor drain. If plans are not specific, check with PROFESSIONAL over routing of such drains.

2.3 OTHER DRAINS

Other required drains, including condensate drain piping, relief and overflow drain piping shall be provided and installed by CONTRACTOR. See BASIC MECHANICAL MATERIALS AND METHODS for piping specifications. Drains with outlets outdoors shall include insect screen neatly attached over opening.

2.4 CLEANOUTS

A. Cleanouts shall be as manufactured by Wade, Jay R. Smith, Zurn, Watts, or Josam, and shall be as follows:

1. Inside building, exposed on walls Zurn Model Z1446.
2. Inside building where tile floors occur Zurn Model Z1400.
3. Inside building where ceramic or quarry tile occurs Zurn Model Z1400.
4. Outside building where concrete occurs Zurn Model Z1406.
5. Outside building, no paving Zurn Model Z1449 with 18" x 18" x 4" concrete pad poured around cleanout with sloped top to shed water.

B. All interior cleanouts to have polished bronze finish and exterior cleanouts a brass finish unless otherwise noted. All flush grade cleanouts and cleanouts in walks, etc., shall have inset square key stainless-steel covers.

PART 3 – EXECUTION

3.1 INSTALLATION: (DRAINS)

A. Floor drains shall be installed according to manufacturer's recommendations. Provide and install all flashing and weatherproofing as required. Adjust extension sections on all drains as required for proper height adjustment.

B. All floor drains connected to sanitary waste system to be trapped. Connect floor drains to sanitary waste piping as indicated on Contract Drawings.

C. The CONTRACTOR shall connect to roof drains and exterior roof downspouts and route new piping to its conclusion outside of building as indicated on Contract Drawings.

D. Each AC equipment drip and drain opening which normally or frequently discharges water (such as air conditioning unit drains, pump base and stuffing box drips, overflows, and similar drips and drains) shall be connected to the drain openings or piped down directly over the floor drains which are provided for the purpose, as applicable, whether indicated on the Drawings or not.

E. Each water relief valve discharge shall be piped down to 6" above floor, but not necessarily over a floor drain or connected to a drain opening, unless otherwise indicated. No drain piping is required from the discharges of drain valves, unless otherwise indicated.

F. The top of all floor and trench drain strainer covers shall be cleaned and polished

prior to final inspection by the PROFESSIONAL.

G. Drains shall be provided at all coils, receivers, pump suction lines, pump plates where facilities are provided and at all low points of the systems. Such drains shall consist of the necessary pipe, valves and fittings required in the opinion of the PROFESSIONAL to permit servicing of equipment, systems, etc.

3.2 INSTALLATION: (CLEANOUTS)

A. Install cleanouts such that each type is flush with floor, walls, outside grade, etc. Except as explicitly noted, all inside floor cleanouts shall be flush with finished floor surface.

B. Flush grade cleanouts shall include a concrete pad surrounding cleanout as indicated above concrete pad and cleanout top shall be flush with finished grade.

C. All cleanout plug threaded sections to be installed with appropriate lubricant and sealant for future maintenance and access.

D. The top and faceplate of all cleanouts indoors shall be cleaned and polished prior to final inspection by the PROFESSIONAL.

END OF SECTION

Plumbing Fixtures, Trim & Accessories

PART 1 – GENERAL

1.1 SCOPE

A. Provide all labor, equipment, materials, etc., required to complete installation as specified herein and/or shown or scheduled on plans.

B. Work Included: Plumbing fixtures, associated trim and fittings necessary to make a complete installation from wall or floor connections to rough piping, and certain accessories.

PART 2 – PRODUCTS

2.1 FIXTURE TRIM

A. All exposed metal parts of all fixtures, including faucets, waste fittings, waste plugs, flush valves, traps, supplies, nipples, and escutcheons shall be chrome-plated brass unless other materials or finish is specified. Basket and similar strainer assemblies for sinks shall be stainless steel.

B. Drain and waste assemblies below lavatories and sinks shall be minimum 17-gauge chrome plated brass and traps shall include cleanout plugs.

C. Stops and supplies:

1. All stops and supplies shall be NSF 61 compliant and contain less than 0.25% lead (Pb) by weight.

2. Chrome plated brass/copper supplies shall be provided on all water supplies to fixtures. All hot/cold faucet handles for lavatories, sinks and bath/shower supply fittings shall include red and blue color code indications.

3. Stops shall be chrome-plated brass, angle all bronze compression quarter turn ball type as McQuire LFBV series. Locate stops centrally above or below fixture in accessible locations.

2.2 ESCUTCHEONS

A. Provide chrome-plated escutcheons on all water and drain piping in wall, floor and ceiling penetrations.

B. Heavy-duty type escutcheons, with setscrews shall be utilized in exposed applications under wall mounted lavatories and sinks and on exposed piping applications on tank type water closet stops and on exposed piping to flush valves, etc.

C. Light duty slip-on type may be utilized in concealed installations within cabinets.

2.3 CARRIERS

A. Provide appropriate carriers for all wall mounted water closets, urinals, lavatories, electric drinking fountains, and sinks, and as indicated elsewhere in these specifications or on the drawings, or as required. All carriers shall be concealed, floor mounted type unless otherwise approved by the PROFESSIONAL.

B. Where wall hung water closets, urinals, lavatories, electric drinking fountains, or sinks are installed back to back and carriers are specified, provide one carrier to serve both fixtures in lieu of individual carriers.

2.4 HANDICAPPED SERVICES

A. Provide where required and/or indicated plumbing fixtures and installations that comply with the latest version of "American with Disabilities Act" (ADA).

B. Provide neat pre-packaged molded insulation protection on an exposed drain and water piping below sinks and lavatories equal to TRUEBO Models #102 and #105.

2.5 PLUMBING FIXTURES AND TRIM

Furnish and install all plumbing fixtures specified herein and shown on plans. Kohler fixtures are specified, however, Eljer, or American Standard may be used if they are equal in all respects to those specified. CONTRACTOR shall submit data on trim as well as fixtures. All water closets, urinals and other fixtures associated with flush valves shall be water conservation type unless specified otherwise. All lavatory and shower supply fittings shall be of the flow restrictor type, unless specified otherwise. Flush valves shall be Zurn type “AV” or Sloan Royal with clog resistant design.

A. Water Closets: All water closet seats shall have stainless steel mounting post and fasteners with “Sta-Tite” technology as Bemis or Church.

1. WC-1 – ADA Compliant floor mounted vitreous china siphon jet with elongated bowl and 1-1/2” top spud, 2” passage and 1.6-gallon flush. (Coordinate with grab bar and ARCHITECT’s details per ADA requirements. Install with handle opposite nearest corner installation).
   a. Fixture: Kohler Model K96057 (Highcliff Ultra).
   b. Flush valve: Sloan Royal 111.
   c. Seat: Bemis Model 10SSCT.

2. WC-2 Floor mounted vitreous china siphon jet with elongated bowl and 1-1/2” top spud, 2” passage and 1.6-gallon flush.
   a. Fixture: Kohler Model K96053 (Welcomme Ultra).
   b. Flush valve: Sloan Royal 111.
   c. Seat: Bemis Model 10SSCT.

B. Lavatories:

1. L-1 – Rectangular under-counter vitreous china (size 20”x16”) with overflow.
   a. Fixture: American Standard Model 0610.000 (Boulevard).
   b. Faucet: T&S Brass Model B-2867-04-VF05, rigid gooseneck faucet, 10-1/2” high, 5” clearance, 5-1/2” reach, 4” wrist blade handles, 0.5 gpm vandal resistant aerator.

2. L-2 – ADA Compliant wall mounted vitreous china with 8” faucet centers and 5” backsplash.
   a. Fixture: Kohler Model K 2006 (Kingston).
   b. Faucet: T&S Brass Model B-2867-04-VF05, rigid gooseneck faucet, 10-1/2” high, 5” clearance, 5-1/2” reach, 4” wrist blade handles, 0.5 gpm vandal resistant aerator.
   c. Carrier: Wade adjustable floor mounted wall carrier(s) as required.

C. Service Sinks:

1. SS-1 – Terrazzo, drop front, floor mounted, corner mop sink (size 24”x24”x12”).
   a. Fixture: Acorn Model TNC-24.

b. Faucet: T&S Brass Model B-0665-BSTR mop sink faucet with vacuum breaker, wall brace and pail hook.
c. Accessories and Trim:
i. 20 ga. stainless steel cap on drop front
ii. 12" high stainless-steel back panels on all walls.
iii. Acorn Model KMH mop hanger (mounted above sink).

2. SS-2 – Molded Stone, floor mounted utility tub (size 23"x23"x16").
a. Fixture: Mustee Model 17F.
b. Faucet: T&S Brass Model B-0892-VRS, centerset rigid gooseneck faucet, centerset, 10-1/2" high, 5" clearance, 5-1/2" reach, 4" wrist blade handles, 2.2 gpm vandal resistant aerator
b. Accessories and Trim:
i. White baked enamel steel legs
ii. Strainer drain and tailpiece.

D. Sinks: Sink sizes herein are listed as overall dimensions. Unless noted otherwise the order of dimensions is listed as front-to-back x left-to-right x bowl depth. Coordinate number of holes required with faucet and other accessories specified.

1. S-1 – Single compartment, 18 ga. under counter mounted (size 33"x22"x9").
a. Fixture: American Standard Model 18SB.9332211.075
b. Faucet: American Standard Model 4803300, swivel gooseneck faucet with pull down dual spray, 18" high, 11" clearance, 8" reach, 1.8 gpm.
c. Trim: Stainless steel basket strainer.
d. Accessories and Trim:
i. Soap Dispenser to match faucet design.
ii. Food waste disposal – equal to In-Sink-erator Evolution Compact, 3/4 HP motor, 120V.,1phase and dishwasher drain connection.

E. Showers:

1. SH-1 – ADA Compliant shower fittings and drain.
a. Shower Base: American Standard Model A8007D-FCO, 64"x34" ADA acrylic shower base with brushed stainless steel center drain. See Architectural Drawings/Specifications for shower wall construction requirements.
b. Shower Valve: Delta Model T17TH305-25, thermostatic mixing valve with adjustable screw stop limit, single metal lever handle, metal cover, diverter valve, escutcheon, stem handle, in-line vacuum breaker, integral service stops.
c. Spray Head: Fixed shower head equal to Speakman Anystream Model S-2252 (2.5 gpm).
d. Accessories and Trim:
i. 2.5 gpm hand/wall shower head
ii. 69" flexible metal hose
iii. 36" wall mounted stainless steel slide bar

F. Drinking Fountains/Bottle Fillers: All capacities (G. P. H.) are based on 50-degree F., drinking water, 80-degree F., inlet water and 90-degree F. ambient. All shall be NSF 61 compliant and contain less than 0.25% lead (Pb) by weight.

1. EDF-1 – ADA Compliant, dual height, barrier-free, one-piece stainless-steel basin with integral drain and push button and stainless-steel cabinet. 8.0 gallons per hour.

    a. Fixture: Murdock Model A172408F-UBL.
    b. Accessories and Trim:
        i. BF12 – Sensor operated water stainless steel bottle filling station
        ii. WF1 – Water Filter, NSF 42 and 53, 1500-gallon capacity, 1 micron.
        iii. Cane touch apron for installation on exposed wall applications
    c. Carrier: Wade adjustable floor mounted wall carrier(s) as required.

2. EDF-2 – ADA Compliant wall mounted barrier-free, one-piece stainless-steel basin with integral drain and push button and stainless-steel cabinet. 8.0 gallons per hour.
    a. Murdock Model A171408F.
    b. Accessories and Trim:
        i. BF12 – Sensor operated water stainless steel bottle filling station
        ii. WF1 – Water Filter, NSF 42 and 53, 1500-gallon capacity, 1 micron.
        iii. Cane touch apron for installation on exposed wall applications
    c. Carrier: Wade adjustable floor mounted wall carrier(s) as required.

G. Hose Bibbs:

1. HB-1 - Hose Bibb: Non-freeze wall hydrant (designed to fit one standard modular masonry course), stainless steel box with hinged locking cover stamped “WATER”, bronze hydrant, hose connection with integral vacuum breaker, and "T" handle key, Wade Model 8701-BB, Hydrant shall be 3/4 inch.

2. HB-2 - Hose Bibb: Quarter-turn ball hose end valve equal to American Valve Model M74QT. Provide with American Valve Model MVB vacuum breaker.

H. Trap Primers:

1. TP-1 Trap Primer: Trap primer shall be connected to water closet flush valve. Exposed piping shall be chrome plated, provide chrome-plated escutcheon at mount to wall. Zurn Model Z-6000 TPO.

I. Trap Guard

1. TG-1 - Trap Guard: Flexible elastomeric tube treated to roll up when water is not passing through to resist emission of sewer gases, as ProSet®, MiFab, Smith, or Green Drain. Trap guard to be designed to meet dimensional and installation requirements of specified floor drain.

J. Water Hammer Arrestors (WHA):

1. Water hammer arrestors shall be piston type.

2. Water hammer arresters shall be type approved for installation with no access panel required.

3. All water hammer arresters shall be NSF 61 compliant and contain less than 0.25% lead (Pb) by weight.

4. The following schedule for Sioux Chief Hyrda-Rester arrestors shall apply:

P.D.I SYMBOL	FIXTURE UNIT RATINGS
A	4-11
B	12-32
C	33-60
D	61-113
E	114-154
F	155-330

K. Oil/Water Separator (OW-1):

1. Provide a separator as detailed on plans. Interceptor to be (single) (double) wall fabricated steel construction. Provide with integral sand interceptor compartment, non-clog flow distributor and energy dissipater device, stationary under flow baffle, presettling chamber for solids, sludge baffle, oil coalescing chamber with removable parallel flat/corrugated plate coalescer, with removable plates and sectionalized removable polypropylene impingement coalescers to optimize separation of free oil from water, effluent downcomer positioned to prevent discharge of free oil that has been separated from the water. Provide with fittings for vent, oil pump-out, sampling, gauging and lifting lugs.

2. Provide with access ways for coalescers and each chamber. All access ways to have integral extension to depth requirements. Verify extension length required prior to ordering. Provide heavy duty traffic rated type lid/cover for all grease interceptors installed in paved areas

3. Separator to be externally coated with 75 mils DFT self-reinforcing polyurethane and internally coated with 10 mils DFT heavy duty polyurethane.

4. Tank to be designed for maximum flow rate of 55 GPM and 500-gallon capacity equal to Highland Tank Model HTC-550 Series “G”.

L. WMB – Washing Machine Supply and Drain Units: White powder coated steel recessed metal box with 2” PVC drain fitting, 1/2” MIP/Sweat quarter-turn turn ball valves and integral water hammer arresters. Box equal to Guy Gray Model T200TPPVCHA where installed in non-fire rated construction or Guy Gray Model FRM12SHA where installed in fire rated construction. Provide 48” long stainless steel braided 3/4” hose connectors (2 ea.).

M. IMB – Ice Maker Box: White powder coated steel recessed metal box with quarter-turn ball valve and integral water hammer arrester. Box equal to Guy Gray Model MIB1HAAB where installed in non-fire rated construction or Guy Gray Model FRIB12ABSHA where installed in fire rated construction. Provide with NSF 61 compliant (lead free) 10-foot-long stainless-steel icemaker connector equal. Make final connection to equipment.

N. DW – Dishwasher Connections: Provide with NSF 61 compliant (lead free) 60” long stainless-steel hose connector. Provide dual handle or 3-way stop at sink connection. Make final connection to equipment.

O. COF – Coffee Maker Connections: 1/4” copper tube. Provide with quarter-turn valve stop valve. Make final connection to equipment.

P. Air Admittance Valve: Air admittance valves shall be equal to the following only as indicated on drawings.

1. Sanitary and grease waste vents shall be equal to Studor “Mini-Vent”.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Fixture Setting: Opening between fixture and floor and wall finish shall be sealed with silicone based caulking. Grout other excessive gaps as required.

B. Supports and Fastenings: Secure all fixtures, equipment and trimmings to partitions, walls, etc., with brass through bolts, toggle bolts, expansion bolts, or power set fasteners, as required. Exposed heads of bolts and nuts in finished rooms to be hexagonal, polished chromium plated brass with rounded tops.

C. Support wall hung lavatories and urinals by appropriate carriers.

D. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury.

E. Where water closet waste pipe rough-in is misaligned with fixture location, modify piping to eliminate relocation of water closet. On floor mounted water closets, offset closet flanges shall not be more than 3/4” and shall be non-reducing.

F. Attach floor mounted water closets to closet flange.

G. Items supplied by others as denoted are to be furnished complete with stops, risers, faucets, strainers, tailpiece, and traps. The intent is that this CONTRACTOR shall provide all "rough in" through face of wall and shall connect equipment provided by others, except where otherwise noted.

H. All exposed metal trim and piping shall be chrome plated brass and polished.

I. Trim which can be removed or disassembled without tools is not permitted.

J. Furnish and install plumbing fixtures and pertaining appurtenances of the manufacturer and model number as indicated in these specifications and/or noted on the plans.

K. Replace any fixtures or equipment broken, cracked, discolored, pitted, or otherwise imperfect.

L. Setting height or location of fixtures shall be as dimensioned or as directed by ARCHITECT.

M. Provide plumbing fixtures with accessible stops in supplies or with integral stops in faucets. Provide lavatory faucets, sink faucets, and supply stops with renewable seats.

N. Provide closets with white bolt caps with retainer clips. Use all mineral gasket with plastic discharge sleeve having ethane core reinforcement.

O. Install all wall, roof and ground hydrants in strict accordance with manufacturer's recommendations and applicable details on Drawings. Hydrants shall be installed such that box/hydrant is square and plumb with adjacent building construction. Where wall hydrants are specified to match standard brick dimensions, adjust location in field to avoid cutting bricks and install with long dimension horizontal and hinge on bottom of box.

P. Install all fixtures in strict accordance with manufacturer's recommendations.

Q. Water Hammer Arrestors:

1. All water supply piping fittings and fixtures shall be protected against water hammer, shock or surge pressure by installation water hammer arrestors.

2. Water hammer arresters shall be installed per the manufacturer's recommendations. This shall include spacing, sizing, etc.

3. Fixture piping shall be adequately anchored to prevent vibration.

4. CONTRACTOR must guarantee against water hammer at end of project.

3.2 CLEANING:

At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned.

3.3 OPERATIONAL TESTS

Pour at least five (5) gallons of water into every floor drain to test for pipe stoppage. Remedy all stoppage.

END OF SECTION

Domestic Water Heaters and Accessories

PART 1 – GENERAL

1.1 SCOPE

Provide all labor, equipment, material, etc., required to complete water heater installations specified herein and/or shown or scheduled on Contract Drawings.

1.2 APPLICABLE STANDARDS

A. A.S.M.E. Code Sections where referenced or applicable.

B. The water heater shall include all standard equipment as shown on manufacturer's specification sheet, shall fit properly into the space provided for it and shall conform to the Drawing requirements. The complete installation shall be in accordance with all applicable state and local codes and installation drawings/details.

PART 2 – PRODUCTS

2.1 DOMESTIC HOT WATER EQUIPMENT

A. Large Commercial Natural Gas Water Heaters:

1. Heater shall be of ASME glass lined design, UL listed with a working pressure of 160 psi, and ASME rating at 125 psi with appropriate stamp. Minimum storage capacity shall be as scheduled on Drawings.

2. Heater and insulation shall meet minimum requirements of ASHRAE 90A.

3. Heater shall be equipped with stainless steel water connections, and boiler type hand hole cleanout.

4. Heater shall be equipped with an integrated control system consisting of a 180º F., adjustable thermostat with upper and lower sensing bulbs.

5. Heaters shall be equipped with a manual reset gas shut off device, a gas pressure regulator set for fuel provided, coated steel burners, draft diverter and anodes for cathodic protection.

6. The outer jacket shall have a baked enamel finish.

7. Required approvals A.G.A. certification and NSF certification for 180-degree F service.

8. Units to be furnished with properly sized ASME temperature and pressure relief valve.

9. Unit shall be of energy efficient design, with flue damper and minimum A.F.U.E. of 90%.

10. Provide separated combustion and venting/intake ducting per manufacturer's recommendations.

2.2 ACCESSORIES

A. Water Tempering and/or Mixing Valves:

All valves shall be furnished with integral check stops and a dial thermometer with the temperature range, of indicated extents, on the outlet of the valve assembly.

1. MV-1: Digital (Electronic) Mixing

Furnish and guarantee a single temperature mixing valve assembly with

ASSE 1017 compliance and CSAB/25 certified, that is constructed of bronze and/or stainless steel, to accurately (within +/-2º F.) control potable hot water from 140º F. stored water heater to mixed 110º F., with varying flow rate from a minimum 1.0 to a maximum 50 gallons per minute usage flow rate at 10 psi water pressure drop at the specified high end flow rate, and an entering cold water part temperature between 45º F. and 75º F. As Powers IntelliStation Jr.

B. Relief Valve for Gas and Electric Water Heaters: Brass or bronze, fully automatic, self-closing combination pressure and temperature ASME relief valve. Pressure relief valve shall be spring operated with testing lever, set for 100 pounds pressure. Temperature relief valves shall contain a non-corrosive metal thermostat with bulb. Pipe discharge to floor or as directed on Drawings or by PROFESSIONAL.

C. Circulating Pump:

In line pumps shall be circulators with all bronze or stainless-steel waterway design. Pumps shaft shall have mechanical seal and shall be connected to motor shaft. Pump motor shall be sized for continuous duty operation, with sleeve or ball bearings and lubrication fittings, or system lubricated type. Pump shall be B & G, Grundfos, Taco or equal.

D. Potable Water Expansion Tank (EXPT)

Provide potable water expansion tanks with factory finished metal outer jacket with FDA approved rubberized bladder with pre-charged tank and charging valve. Acceptance volume shall be within five percent (5%) of minimum specified (see detail(s) on schedule on Drawings). Support units as recommended by unit manufacturer and Industry Standards. Expansion tanks shall be rated for 125 psi. ASME construction shall be provided where water heater is ASME constructed. See Schedule/Drawings for more information.

PART 3 – EXECUTION

3.1 LEAKAGE TEST:

Before connections are made, test heaters and tanks with hydrostatic pressure of 150 psig and prove tight.

3.2 PERFORMANCE TEST:

A. Prove system is balanced and 105 degrees F. is available at farthest outlet from heaters.

B. Install heater as per manufacturer's instructions. Refer to Section *Basic Mechanical Materials and Methods* for instruction of ferrous to non-ferrous piping connections. Refer to Drawings for detail of water heater installation, if applicable.

C. Provide all pipe, fittings, and accessories as indicated or required for complete installation.

D. See Section *Testing, Adjusting and Balancing* for balancing flow through mixing valves, setting water heaters, and testing/setting fixtures and valves, etc.

END OF SECTION

Packaged Air Conditioners

PART 1 – GENERAL

1.1 SCOPE

A. Provide all material, equipment and labor, etc., required to complete installation specified herein and/or shown or scheduled on Contract Drawings.

B. Work Included: Direct Expansion split systems.

C. Definitions:

1. Energy Efficiency Ratio (EER): A ratio calculated by dividing the cooling capacity in Btuh by the power input in watts at any given set of rating conditions, expressed in Btuh per watt (Btuh/watt).

2. Unitary (ARI): Consists of one or more factory-made assemblies, which normally include an evaporator or cooling coil, a compressor and condenser combination, and may include a heating function.

1.2 APPLICABLE STANDARDS

A. Refer to Section *Basic Mechanical Materials and Methods*.

B. Safety Standards:

1. Design, manufacture and installation of mechanical refrigeration equipment: ANSI B9.1.

2. Machinery Guards: Provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor. Drive guards may be excluded where motors and drives are inside factory fabricated unit casings.

C. Corrosion Prevention: Unless specified otherwise, equipment fabricated from ferrous metals that do not have a zinc-coating conforming to ASTM A386 or a duplex coating of zinc and paint shall be treated for prevention of rust with a factory coating or paint system that will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall be tested for 500 hours. The salt-spray fog test shall be in accordance with ASTM B117 using a 20 percent sodium chloride solution. Immediately after completion of the test, the coating shall show no signs of blistering, wrinkling or cracking, no loss of adhesion, and the specimen shall show no signs of rust creepage beyond 1/8 inch on either side of the scratch mark. The film thickness of the factory coating or paint system applied on the equipment, shall be not less than film thickness used on the test specimen.

D. ARI Standards:

1. Capacity 135,000 BTU/HR and Greater: ARI 360.

2. Capacity Below 135,000 BTU/HR: ARI 210. Units shall be listed in the ARI Directory of Certified Unitary Air Conditioners.

PART 2 – PRODUCTS

2.1 SPLIT DIRECT EXPANSION SYSTEMS

A. Warm Air Furnace and Evaporator

1. Natural Gas Furnaces:

a. Furnaces shall be of the natural gas fired, up flow or horizontal type as indicated, complete with filters centrifugal blower and motor, burners, heat exchangers, controls, and cabinet.

b. Filters shall be of the high velocity replaceable pleated type to serve the airflow capacity indicated on Contract Drawings. The filter rack assembly shall be easily accessible, and shall include clips, spring and/or other suitable means to hold air filter secure. Filter rack shall also include a track or other suitable framework such that filter is set in place without adjustment to ensure no more than 5% air bypass around air filter assembly. Filters shall be in accordance with Section *Air Cleaning/Treatment*.

c. Blower shall have forward curved blades, statically and dynamically balanced. Motor shall be of the three speed permanent split capacitor direct driven type, for 5 ton units and smaller, complete with built-in overload protection.

d. Controls shall consist of blower fan delay relay, manual shut-off gas electronic valve, electronic pilot ignition, transformer (120-24 volt), combination fan and limit switch control blower fan delay relay, and room thermostat with heating and cooling switch, one or two stage as indicated.

e. Furnace cabinet shall be thermally and acoustically insulated with fiberglass coated to prevent erosion.

f. Furnaces shall be AGA approved and shall have capacities and characteristics indicated on Contract Drawings. All units shall be rated 90% A.F.U.E. or better.

g. Warranty: See Section *Mechanical Systems and Equipment Warranties* for more information.

2. Evaporator Coil: (Matched to Gas Furnace)

a. Coil shall be sized to fit above warm air furnace. Coil shall have copper tubes and aluminum fins. An insulated casing shall be provided around coil.

b. Capacity and characteristics shall be as indicated on Contract Drawings. Provide data on air pressure drop of evaporator.

c. Evaporator coil shall be constructed of aluminum fins, mechanically bonded to copper tubes. Coil shall be tested for 300 psi. Coil shall be dual circuited on units larger than 5 tons.

d. Warranty: See Section *Mechanical Systems and Equipment Warranties* for more information.

e. Provide evaporator face mounted low temperature sensor and adjustable compressor timed delay/auto-restart controls where low ambient controls for condensing units are indicated.

B. Condensing Unit:

1. Units shall be single or dual circuit type, as scheduled, and shall consist of scroll compressor(s) and, condenser coil(s), condenser fans, refrigerant

receiver, charging valves, controls and holding charge, all enclosed in weatherproofed zinc-coated steel casing, phosphatized and coated in epoxy resin primer and finished with baked-on enamel.

2. Condenser Hail Coil Guards: Provide manufacturer approved heavy-duty louvered or approved expanded metal, factory primed and painted to match unit enclosure and mounted in a rigid frame with a minimum of 2" clearance to coils. See detail on Contract Drawings.

3. Compressor shall be of the scroll type and shall include high and low pressure cutouts, overloads, and inherent thermostat. Compressors shall include anti-slugging device, timed automatic restart delay and crankcase heaters.

4. Condenser coils shall be constructed of copper tubes and aluminum fins, tested for 425 psi.

5. Condenser fans shall be of the propeller type, statically and dynamically balanced, weatherproofed, and powered by heavy-duty permanently lubricated ball bearing motor with built-in thermal overload protection.

6. Controls shall include contactors, high-pressure outlet with thermostatic reset, low-pressure cutout and reset relay to prevent unit cycling on overloads when once the automatic resetting safety control trips. Where indicated or scheduled, provide units with low ambient controls with stable operation down to 0 degrees F including variable feed refrigerant head pressure controlled condenser fan operation. All wiring and devices shall be internal to cabinet. Exposed wiring is not acceptable.

7. Refer to Section *Pipes and Pipe Fittings* for refrigerant piping specifics. CONTRACTOR shall note that any piping, joint, fitting, etc. that comes in contact with the refrigerant system shall be brazed. Compression fittings are not acceptable.

8. Capacities and characteristics shall be as indicated on Contract Drawings.

9. Warranty: See Section *Mechanical Systems and Equipment Warranties* for more information.

C. Ductless Mini-Split Systems:

1. Unit shall consist of reverse-cycle heating section and cooling coil in preassembled package. Unit shall consist of a supply fan, evaporator/heat pump coil and air filter section assembled in common cabinet.

2. Compressor shall be inverter driven variable speed type. Provide with refrigerant isolation valves on unit.

3. Unit shall include automatic restart capability following power outage.

4. Capacity and characteristics shall be as indicated on Contract Drawings. Provide data on air pressure drop of evaporator.

2.2 REFRIGERANT SPECIALTIES

A. Refrigerant specialties shall be provided and include thermostatic type expansion valves, refrigerant strainers, liquid sight-flow fittings, moisture indicator, and other devices indicated by the drawings and diagrams. Thermostatic expansion valves

shall have externally mounted thermostatic elements connected to valve through capillary tubing of suitable length with external equalizer and with super heat adjustment.

B. Solenoid valves shall be suitable for a minimum of 250 lbs. working pressure fitted solder type or threaded connections and with seal-cap type manual lifting stem. Valves shall be suitable for operation with available current and provided with suitable solenoid coil protector. Specialties shall be Alco or Sporlan.

C. Provide ahead of each expansion valve a sight glass. Provide ahead of each expansion valve and/or solenoid valve a filter-dryer and moisture indicator.

PART 3 – EXECUTION

3.1 INSTALLATION

Handle and install units and accessories in accordance with ARI 260 and the manufacturer's printed instructions. Unit shall be started up and checked out by a factory service representative. CONTRACTOR shall furnish PROFESSIONAL completed start-up report covering unit operation and start-up. A copy of same shall be included in Close-out Documents. See Section MECHANICAL CLOSE-OUT REQUIREMENTS.

3.2 TESTS

Perform tests and make reports in accordance with Sections *Basic Mechanical Materials and Methods* and *Testing, Adjusting, and Balancing*.

3.3 UNIT CAPACITY

Characteristics and capacity of systems shall be as indicated on Contract Drawings.

3.4 CONTROLS

All systems will be provided with automatic heating/cooling changeover controls; one or two stage heating and/or cooling as required. Provide auxiliary time clocks and thermostats and/or humidistats as indicated in Section *Controls and Instrumentation*.

3.5 AIR FILTRATION

See Section *Air Cleaning/Treatment* for specific requirements.

END OF SECTION

Heating/Cooling Terminal Units

PART 1 – GENERAL

1.1 SCOPE

Unit heaters, electric ceiling and duct heaters or Gas-fire radiant tube heaters

PART 2 – PRODUCTS

2.1 UNIT HEATERS

A. General: Horizontal or vertical discharge type for gas heating medium, as indicated.

B. Casing: Steel sheet phosphatized to resist rust and finished in baked enamel. Provide hanger supports as indicated on drawings.

C. Fan: Propeller or centrifugal type, direct or belt driven as indicated, with manufacturer's high efficiency electric motor. Provide resilient mounting. Provide fan guard for horizontal discharge units.

D. Discharge Air Control:

1. Horizontal Discharge: Horizontal, adjustable louvers.

E. Provide stainless steel heat exchanger, electric pilot ignition, and minimum 80% induced draft gas fired heat exchanger.

F. Provide single or two-stage heating thermostat with fan "on-auto" sub base capability, to match scheduled system capability and capacity.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Handle and install units in accordance with manufacturer's written instructions.

B. Support units rigidly so they remain stationary at all times. Cross-bracing or other means of stiffening shall be provided as necessary. Method of support shall be such that distortion and mal-operation of units cannot occur.

C. Provide adequate vibration isolation as indicated or necessary.

D. Provide complete and operational controls, including low voltage thermostats, relays, transformer, etc. with all wiring in approved conduit. See *Division 26* specifications.

END OF SECTION

Fans

PART 1 – GENERAL

1.1 SCOPE

A. Provide all material, equipment and labor, etc., required to complete installation specified herein and/or shown or scheduled on Contract Drawings.

B. Work included: Fans for heating, ventilating and air conditioning.

C. Product Definitions: AMCA Publication 99, Standard 1-66.

1.2 APPLICABLE STANDARDS

A. Fans and power ventilators shall be listed in the current edition of AMCA 261, and shall bear the AMCA performance seal.

B. Operating Limits for Centrifugal Fans: AMCA 99 (Class 1, 11, and 111).

C. Fans and power ventilators shall comply with the following standards:

1. Testing and Rating: AMCA 210.

2. Sound Rating: AMCA 300.

D. Performance Criteria:

1. The fan schedule shows CFM and design static pressure. Scheduled fan motors, ½ horsepower and larger, are to be sized for design CFM at 110 percent design static pressure, but not to exceed ¾-inch additional pressure.

2. Provide fans and motors capable of stable operation at design conditions and at 110 percent pressure as stated above.

3. Lower than design pressure drop of approved individual components may allow use of a smaller fan motor and still provide the safety factor. When submitted as a deviation, a smaller motor may be approved in the interest of energy conservation.

4. Select fan operating point as follows:

a. Forward curved and axial fans: Right hand side of peak pressure point.

b. Airfoil, backward inclined or tubular: Near the peak of static efficiency.

E. Safety Criteria: Provide manufacturer's standard screen on fan inlet and discharge exposed to operating and maintenance personnel.

PART 2 – PRODUCTS

2.1 CENTRIFUGAL FANS

A. General:

1. Standards and Performance Criteria: Refer to Paragraph, QUALITY ASSURANCE.

2. Construction: Wheel diameters and outlet areas shall be in accordance with AMCA standards.

a. Housing: Low carbon steel, arc welded throughout, braced and supported by structural channel or angle iron to prevent vibration or

pulsation, flanged outlet, inlet fully streamlined. Provide lifting clips, and casing drain. Provide manufacturer's standard access door. Provide screens for fan inlets without duct connections.

b. Wheel: Steel plate with die formed blades welded or riveted in place, factory balanced statically and dynamically.

c. Shaft: Designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fans class.

d. Bearings: Heavy-duty ball or roller type sized to produce a B10 life of not less than 40,000 hours, and an average fatigue life of 200,000 hours. Extend lubrication tubes for interior bearings or ducted units to outside of housing.

e. Painting: AMCA Standard preparation for coating 2601-66-1E33, followed by manufacturer's standard rust resistant baked enamel colored coating inside and out.

3. See Section *Electrical Requirements* for motor and starter requirements.

4. See Detail on Drawings for roof curb construction requirements.

B. Exhaust Air Fans

1. Belt Drive Roof Mounted Type:

a. Fan shall be of the belt driven centrifugal type. Construction of fan housing shall be heavy gauge spun aluminum, mounted upon a rigid support and aluminum bird screen. The fan inlet shall have a spun venture throat overlapped by a backward curved centrifugal wheel with spun cone for maximum performance.

b. The motor and drive housing shall be mounted on vibration isolators and shall be completely sealed from the exhaust air.

c. The entire drive assembly and wheel shall be removable through the support structure without dismantling the fan housing.

d. The well shaft shall be mounted in heavy-duty ball bearing pillow blocks, equipped with grease fittings. Both pulleys shall be fully machined cast iron type, keyed to the wheel and motor shafts. Bearings shall be of design of not less than 200,000 hours.

e. See Detail on Drawings for roof curb construction requirements.

f. Capacity and characteristics shall be as indicated on Contract Drawings. The fan shall bear the A.M.C.A. Seal for rated sound and capacity.

2. Direct Drive Above Ceiling Type:

a. Fan shall be mounted above ceiling and vent routed as indicated. Fan shall have forward curved wheel constructed of aluminum. Fan motor shall be of the shaded pole type. Housing shall be of the steel construction with baked enamel finish. Grille mounted in ceiling shall be of extruded aluminum.

b. Capacity and characteristics shall be as indicated on Contract Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fan, motor and drive in accordance with manufacturer's instructions.

B. Align fan and motor sheaves to allow belts to run true and straight.

C. Bolt equipment to curbs with galvanized lag bolts, number and location per manufacturer’s instructions.

3.2 PRE OPERATION MAINTENANCE

A. Grease bearings and install maintenance notation chart per Section *Basic Mechanical Materials and Methods*.

B. Rotate impeller by hand and check for shifting during shipment and check all bolts, collars, and other parts for tightness.

3.3 START UP AND INSTRUCTIONS

Check vibration and correct as necessary for air balance work.

3.4 ACCESSORIES

Provide all accessories including roof curbs, solid state speed controllers, wall mounting collars, insect and/or bird screen, OSHA approved motor and inlet/outlet protecting guards, back draft damper (motorized or manual as indicated), thermostats, vibration isolators and starters with pilots, etc., as indicated or required.

END OF SECTION

Air Cleaning/Treatment

PART 1 – GENERAL

1.1 SCOPE

A. Provide all material, equipment and labor, etc., required to complete installation specified herein and/or shown or scheduled on Contract Drawings.

B. Descriptions:

1. Air filters for Heating, Ventilating and Air Conditioning.

2. Definitions: Refer to newest edition of ASHRAE 52.2 for definitions of face velocity, net effective filtering area, media velocity, resistance (pressure drop), minimum efficiency reporting value (MERV), etc.

1.2 APPLICABLE STANDARDS

Air Filter Performance Report for Extended Surface Filters:

A. Submit a test report for each type of filter being offered. The report shall be less than two years old and have been prepared by an independent testing laboratory using test equipment, method and duct section as specified by ASHRAE Standard 52.2-1999 for type filter under test and acceptable to ENGINEER, indicating that filters comply with the requirements of this specification. Test for 500 fpm will be accepted for lower velocity filters provided the test report of an independent testing laboratory complies with all the requirements of this specification.

1. Selection procedures for manufacturer's standard products: All filters tested shall have been procured by the independent testing laboratory from the open market independent of manufacturer of these filters and a statement to this effect must accompany test report.

2. Selection procedures for new products not available on open market: Testing laboratory will certify that filters are not available in areas remote from manufacturer’s facilities. For each required test the independent Testing Laboratory shall select from the manufacturer's stock or production the number of samples required. The samples selected shall be representative of standard production considering media utilized and manufacturing locations. These test reports shall be less than six months old.

B. Filter Supplier Warranty for Extended Surface Filters: Guarantee the filters against leaks, blow-outs, and other deficiencies during their normal useful life. Defective filters shall be replaced at no cost to the Owner.

C. Identification: Each filter shall bear markings indicating manufacturer's name, filter size, and MERV & MERV-A ratings per ASHRAE Standard 52.2.

D. Definitions and Abbreviations

1. Spares: Filter(s) in sets to be turned over to the OWNER at the end of the project for the OWNER’S use after the project or any portion thereof, is complete.

2. Construction Period: This term generally includes the time period beginning with the OWNER’S notice-to-proceed and ending with the OWNER’S final acceptance of a project, or any phase of a project.

3. Temporary: A term generally depicting the use of air filters for use during the construction period.

4. Filter Grille: An inlet device connected to an HVAC system where an air filter is to be installed and maintained during construction and permanently after project is completed.

5. Pleated Filters: An extended surface filter with folds of air filtration media.

6. Filter or Filter Set: Air filter(s) in sizes as recommended by equipment or supplier manufacturer to prevent air bypass and to provide the maximum face size and minimum velocity to promote longer filter life expectancy.

7. F/G: fiberglass

1.3 RESPONSIBILITY

A. The CONTRACTOR is responsible for providing, monitoring and maintaining all air filtration specified provisions during the construction period.

B. The CONTRACTOR is also responsible for providing spare sets of air filter(s) to the OWNER, labeled and in boxes for storage, for the OWNER'S use after the project is complete and at which time the OWNER assumes control of operation and maintenance functions for the systems. One of the filter spare sets shall be installed on the day of the final inspection by the PROFESSIONAL.

1.4 AIR FILTRATION PROTECTION REQUIRED

The following systems and installations shall be provided with proper air filtration prior to startup or use of the facilities new HVAC systems and existing or renovated HVAC systems in the area(s) affected by this project.

A. All new air handling systems, including up-flow/horizontal furnaces, roof top packaged systems, outdoor air and heat recovery systems, blower coil, central station and built-up air handling system with water, or refrigerant coils.

B. Filter grilles or registers.

C. Ducted return air systems: Provide temporary air filtration over all return air grilles, registers and filter grilles (in addition to filters in frame of filter grille).

1.5 TYPE OF AIR FILTRATION REQUIRED

The following is a listing of generic equipment and installation air filtration requirements. The CONTRACTOR may submit alternate filter thickness(es) to match specific applications but shall not be less than that listed, for PROFESSIONAL'S approval. The CONTRACTOR shall verify size, including thickness matched to CONTRACTOR supplied equipment and air distribution device accessory.

AIR FILTRATION REQUIREMENTS					
GENERAL INFORMATION			CONSTRUCTION PERIOD FILTRATION	SPARES (PROJECT COMPLETION FILTRATION)	
FILTER FUNCTION/ LOCATION	FILTER TYPE	NOMINAL FILTER DEPTH/ THICKNESS	MINIMUM MERV & MERV-A RATINGS	MINIMUM MERV & MERV-A RATINGS	NUMBER OF SETS REQUIRED
RETURN AIR GRILLES/ REGISTERS	PLEATED	1”	11	N/A	N/A
FURNACE EVAPORATORS	PLEATED	1”	8	8	3
DEHUMIDIFIERS	PLEATED	2”	11	11	3
DUCTLESS MINI-SPLIT, (DSS)	WASHABLE	-	4	4	1

PART 2 – PRODUCTS

2.1 EXTENDED SURFACE AIR FILTERS

A. Filter shall be pleated, disposable type. Filter shall consist of non-woven cotton and synthetic fabric media, media support grid and enclosing frame.

B. The filter shall be listed by Underwriters Laboratories as Class 2.

C. The media support shall be a welded wire grid with an effective open area of not less than 96%. The welded wire grid shall be bonded to the filter media to eliminate the possibility of media oscillation and media pull away.

D. The enclosing frame shall be constructed of a rigid, heavy-duty beverage board with diagonal support members bonded to each side of the filter to insure pleat stability. The inside periphery of the enclosing frame shall be bonded to the filter pack to eliminate possibility of air bypass.

E. Filter Characteristics

MINIMUM EFFICIENCY REPORTING VALUE (MERV & MERV-A)	FILTER DEPTH/ THICKNESS	PRESSURE DROP (IN. W.G. @ 350 F.P.M.)		PRESSURE DROP (IN. W.G. @ 500 F.P.M.)	
		INITIAL	FINAL	INITIAL	FINAL
8	1”	0.23	0.5	-	-
8	2”	-	-	0.29	0.75
11	1”	0.30	0.50	-	-
11	2”	-	-	0.35	0.75

PART 3 – EXECUTION

3.1 INSTALLATION AND COORDINATION

A. Install supports, filters and gages in accordance with manufacturer's instructions.

B. At end of project, provide list of all HVAC air handling equipment and filter grilles, with size and quantity of air filters and MERV rating for each, and submit for Owner’s future use and maintenance record. Furthermore, submit a letter signed by the

OWNER acknowledging receipt of all spare sets of air filters outlined above. All boxes of air filters shall be labeled to match the individual HVAC system or return air filter grille location for which the filters are to be utilized.

3.2 START-UP AND TEMPORARY USE

A. Clean and vacuum air handling units and plenums to the satisfaction of the ENGINEER prior to starting air-handling systems.

B. Change out replaceable air filters, as filters are 60% loaded during construction use period and just prior to OWNER'S acceptance of project. Filters for use during construction period are in addition to OWNER'S spare sets, as specified herein.

C. Thoroughly wash wall unit filters as filters are 40% loaded during construction period, and just prior to OWNER'S acceptance of project.

END OF SECTION

Ductwork

PART 1 – GENERAL

1.1 SCOPE

A. Provide all material, equipment and labor, etc., required including all supply, return, outside air, exhaust, and other ductwork and as required for the A/C system, including mains, branches, plenums, mixing boxes, fittings, accessories, and other related sheet metal work for a complete installation as specified herein and/or shown on Drawings.

B. Work under this Section includes but is not necessarily limited to the following items: Ductwork for heating, ventilating and air conditioning systems.

C. Construct ductwork to meet all functional criteria defined in the SMACNA “HVAC Duct Construction Standards - Metal and Flexible” Latest Edition. This shall be subsequently referred to as the SMACNA Manual.

1.2 APPLICABLE STANDARDS

APPLICABLE PUBLICATIONS: The publications listed below form a part of this Specification to the extent referenced. The publications are referenced in the text by the basic designation only.

A. National Fire Protection Association (NFPA):

1. 90A.....Air Conditioning and Ventilating Systems – Latest Edition
2. 90B…….. Warm Air Heating and Air-Conditioning Systems – Latest Edition
3. 96.....Vapor Removal from Cooking Equipment – Latest Edition

B. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

1. Low Pressure Duct Construction Standards – Latest Edition
2. Guidelines for Welding Sheet Metal – Latest Edition
3. Duct Liner Application Standard – Latest Edition

1.3 DEFINITIONS

A. Seal or Sealing: Use of liquid or mastic sealant, with or without compatible tape overlay, or gasketing of flanged joints, to keep air leakage at duct joints, seams and connections to an acceptable minimum.

B. Exposed Duct: Exposed to view in a finished room or outdoors.

1.4 QUALITY ASSURANCE

A. The CONTRACTOR must comply with the enclosed specification in its entirety.

B. At the discretion of the PROFESSIONAL, sheet metal gauges, reinforcing and sealant may be checked at various times during the construction period to verify all duct construction is in compliance.

C. If during site observations the PROFESSIONAL finds changes have been made without prior approval, the CONTRACTOR will correct deficiencies identified to comply with this specification solely at the CONTRACTOR’s expense.

D. Duct penetrations and/or doors, etc., necessary for the PROFESSIONAL to observe the duct installations, shall be made/installed and repaired, etc. by this

CONTRACTOR, in ductwork as selected by PROFESSIONAL, at no additional cost to the OWNER or PROFESSIONAL.

E. All ductwork shall be installed un-insulated (except duct liner), subsequently sealed and observed/approved by PROFESSIONAL prior to insulating.

PART 2 – PRODUCTS

2.1 DUCTWORK PRESSURE CLASS CONSTRUCTION REQUIREMENTS

A. Ductwork shall be constructed to meet or exceed the SMACNA Standards based upon the following table of ductwork type and function.

DUCTWORK FUNCTION	DUCTWORK TYPE	DUCTWORK PRESSURE CLASS (IN. W.G.)
Low Pressure Supply Air	Rectangular	2 (pos.)
Low Pressure Supply Air	Round or Oval	2 (pos.)
Low Pressure Return Air	Rectangular	2 (neg.)
Low Pressure Return Air	Round or Oval	2 (neg.)
Low Pressure Exhaust Air	Rectangular	2 (neg.)
Low Pressure Exhaust Air	Round or Oval	2 (neg.)
Low Pressure Outside Air	Rectangular	2 (pos. or neg.)
Low Pressure Outside Air	Round or Oval	2 (pos. or neg.)
Low Pressure Transfer Air	Rectangular	2 (pos. or neg.)
Low Pressure Transfer Air	Round or Oval	2 (pos. or neg.)
Residential Range Hood Exhaust	Round or Oval	2 (neg.)

2.2 RECTANGULAR DUCTWORK

A. General Requirements

1. Construct all rectangular ductwork with approved new prime G-90 or better galvanized steel sheet ASTM S27 (LFQ) with chemical treatment or as specified, with careful, neat, and accurate workmanship and with all joints and seams air tight. Longitudinal seams, transverse joints and bracing, sheet metal gauges and other construction details shall be as recommended in the latest edition of the ASHRAE Guide and SMACNA "HVAC Duct Construction Standards – Metal and Flexible", and as specified below.

2. **The rectangular duct sizes as indicated on the Drawings are inside dimensions, or net free area.** All necessary allowances should be made in the sizes shown on the Drawings to accommodate internal insulation or acoustic lining.

3. All ductwork shall be provided with any re-enforcements factory installed to meet the SMACNA pressure classifications listed in paragraph 2.01.

4. Transitions shall have a ratio of at least 4 to 1 except where prevented by job conditions. In such case the transition shall be made as gradual as possible.

5. All duct transitions from square to round shall be smooth square-to-round transitions. Spin-in fittings at the end of capped ducts are not acceptable.

6. Flanged (TDC or TDF) ductwork with reinforced gasketed joints shall be

installed in the following applications:

a. Indoor ductwork with any dimension greater than 30 inches.

b. All indoor ductwork exposed to view regardless of size.

c. All outdoor ductwork regardless of size.

7. Rectangular ductwork exposed to weather shall be crowned to shed water.

B. Low Pressure Ductwork

1. Elbows shall be either mitered or radius type for 90 degree turns and radius only for all turns less than 90 degrees as indicated on the Drawings.

2. Mitered elbows shall be constructed using turning vanes in each mitered 90 degree turn. Turning vanes shall be galvanized steel of double-wall air foil design. Where ductwork is greater than or equal to 12” in the plane of the turn, install turning vanes with 4" minimum radius of curvature on a maximum of 4" centers. Where ductwork less than 12” in the plane of the turn, install turning vanes with 2" minimum radius of curvature on a maximum of 2" centers.

3. Curved elbows shall have a centerline radius of 1-1/2 times the cross-sectional dimension of the duct in the plane of the turn.

4. All rectangular branch connections to rectangular ducts shall be a lateral or radius type and include an externally adjustable factory fabricated air turning vane assembly. Where lateral types are installed, the length of the lateral shall be equal to one quarter of the duct width but in no case less than 4”. Where radius types are installed, the centerline radius shall be 1-1/2 times the branch duct dimension in the plane of the turn.

2.3 INTERNAL INSULATION (DUCT LINER) FOR RECTANGULAR DUCTWORK

A. Duct liner shall meet all of the following requirements and include independent testing lab verification of conformance with all of the following product characteristics.

1. Duct liner shall be made of spun or flame attenuated fiberglass with a factory-applied edge coating and of thickness and density based upon the application listed below.

a. Indoor applications – 1” thick, 1-1/2 pcf density.

b. Outdoor applications – 1-1/2” thick, 1-1/2 pcf density.

2. The thermal conductivity shall be equal to or less than 0.25 at 75 degree F. mean temperature.

3. The liner shall meet the Life Safety Standards as established by NFPA 90A and 90B and shall not support microbial growth as tested in accordance with ASTM G21 and G22.

4. The duct liner shall conform to the requirements of ASTM C 1071, with an NRC not less than 0.70 as tested per ASTM C 423 using a Type "A" mounting.

B. Comparable Products

1. Knauf “Ductliner EM”
2. CertainTeed “Toughgard”
3. Johns Manville “Linacoustic RC”.

2.4 LONGITUDINAL SEAM ROUND LOW PRESSURE DUCTWORK

A. Concealed round ductwork shall be constructed with SMACNA minimum pressure classification of 2" w.g.

B. Snap lock pipe is acceptable as long as all longitudinal and circumferential seams are sealed and screws as indicated in Part 3 - Execution.

C. All elbows and fittings shall be factory fabricated items by the same manufacturer as ductwork. Wye and laterals at diffusers take-offs shall be factory fabricated.

2.5 FLEXIBLE AIR DUCTWORK

A. Insulated Flexible Air Duct: Factory made including mineral fiber insulation with maximum C factor of 0.16 (R=6) at 75 degrees F. mean temperature, encased with a low permeability moisture barrier metalized outer jacket, having a puncture resistance of not less than 50 Beach Units. Acoustic insertion loss shall be not less than 3db per foot of straight duct, at 500 Hz, based on 6-inch duct, air velocity at 2500 fpm.

B. Flexible ducts shall be listed by Underwriters Laboratories, Inc., complying with UL 181. Ducts larger than 8-inches diameter shall be Class 1. Ducts 8-inches in diameter and smaller may be Class 1 or Class 2.

C. Minimum working pressure for low and medium pressure systems: 6 inches w.g. positive, 2 inches w.g. negative.

D. Duct Clamps

1. Stainless steel strap with cadmium plated worm gear tightening device.
2. Nylon tie wrap minimum ¼” wide.

2.6 FLEXIBLE DUCTWORK ELBOW SUPPORTS

Elbow supports shall be constructed of durable composite material and be fully adjustable to support flexible duct diameters 6" – 16". Elbow supports shall be UL listed for use in return air plenum spaces. Flexible ductwork elbow supports equal to Thermaflex FlexFlow Elbow.

2.7 JOINT SEALING

A. Sealant: Elastomeric compound, gun or brush grade, maximum 25 flame spread and 50 smoke developed (dry state) compounded specifically for sealing ductwork. Use products as recommended by the manufacturer for low, medium or high-pressure metal duct systems.

B. Tape/Gaskets in flanged joints such as TDC or TDF: Soft butyl rubber/elastomeric composition equal to Sticky Tape manufactured by Ductmate.

2.8 SPECIAL DUCTWORK:

A. Residential clothes dryer ductwork shall be same as Longitudinal Seam Round Low Pressure Ductwork paragraph except that screws shall not be utilized for joining transverse or longitudinal seams.

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Comply with provisions of Section, *BASIC MECHANICAL MATERIALS AND METHODS*, particularly regarding coordination with other trades.

B. Fabricate and install ductwork and accessories in accordance with referenced SMACNA Standards and manufacturer's printed instructions.

C. Fabricate ductwork based on field measurements of space available. Sizes on plans may be altered by the CONTRACTOR, when approved by the ENGINEER, to other dimensions without increasing air pressure friction losses where necessary to avoid interferences and clearance difficulties.

D. All ductwork located outdoors shall be sealed water tight on all seams and connections.

E. Provide duct transitions, offsets and connections to dampers, coils, and other equipment.

F. Weld sheet metal in accordance with SMACNA, Guidelines for Welding Sheet Metal. Repair damaged galvanized areas with galvanizing repair compound.

G. Each collar for outlet and intake devices on exposed ducts shall be flanged inward at the device mounting end, and the outside dimensions of the collar shall not be less than the overall flange dimensions of the devices attached thereto.

H. At each location where exposed ductwork passes through finished walls, floors, or ceiling, install a neat sheet metal collar completely covering the rough opening in the building construction secured to ductwork with sheet metal screws.

I. Provide UL approved flexible connectors per Section *Mechanical Sound and Vibration Control*.

J. Construct casings, eliminators, and pipe penetrations in accordance with applicable SMACNA Standards. Design casing access doors to swing against air pressure so the pressure helps to maintain a tight seal.

K. Install fire, smoke and combination fire/smoke dampers in accordance with the manufacturer's instructions to conform to the installation used for the rating test.

L. Where diffusers, registers and grilles cannot be installed to avoid seeing inside the duct, or items and other installations above the ceiling through plenum grilles, paint the inside of the duct or above ceiling installations, with flat black paint to reduce visibility.

M. Protection and Cleaning

1. Adequately protect ductwork and equipment against physical damage and entry of foreign matter to the inside at all times both prior to and after installation into project.

2. Cap open ends of ducts and equipment when not in operation.

3. Clean ductwork and equipment prior to painting. See PAINTING section for specific requirements pertaining to surface preparation.

4. Both the inside and outside of all ductwork and equipment shall be clean and free of dust, debris, foreign material, etc. prior to final acceptance of the

project.

5. Place equipment in first class operating condition, or return to source of supply for repair or replacement, as determined by PROFESSIONAL.

N. Control Damper Installation:

1. Provide necessary transitions required to install dampers which do not match the duct size indicated.

2. Assemble multiple section dampers with required interconnecting linkage and extend required number of shafts through duct for external mounting of damper motors.

3. Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by experimentation, and affix and seal permanently in place, only after stratification problem has been eliminated.

3.2 INTERNAL INSULATION (DUCT LINER) FOR RECTANGULAR DUCTWORK

A. The following rectangular ductwork shall be interior acoustically lined:

1. Ductwork within ten (10) feet of any supply or return fan for HVAC applications, except built-up R/A plenums.

2. Ductwork within ten (10) feet of exhaust fans.

3. Ductwork exposed to view indoors.

4. Supply and Return ductwork located outdoors.

5. Transfer air ductwork and plenums.

6. Supply air plenums adjacent to air moving equipment, etc.

7. Ductwork within ten (10) feet of any air terminal unit (variable air volume box).

8. Where specifically indicated on Drawings.

B. The duct liner shall be applied to the flat sheet with 100% coverage of adhesive with the black matte surface facing the air stream.

C. Ducts with the sides or bottom dimension exceeding 20" shall have the liner additionally secured with welded pins and speed clips or "Gripnails" on a maximum of 12" centers and within 3” of edges. Pins shall be cut close to the speed clips.

D. Provide sheet metal nosing on all liner, where liner terminates and ductwork continues.

E. All seams, exposed edges and leading edges of all longitudinal and cross-joints of the liner shall be coated with an approved white sealant "butter".

F. Wet butter shall also be applied to duct to duct seams and connections simultaneously with the jobsite installation.

3.3 LONGITUDINAL SEAM ROUND LOW PRESSURE DUCTWORK

A. Screws shall be installed every 18" O.C. along longitudinal seams and minimum 6” from end connections

B. Screws shall be installed every 4" on center, but not less than 4 equally spaced, on

circumferential ductwork and fitting joints.

C. All elbows and fittings shall be factory fabricated items by the same manufacturer as ductwork. Wye and laterals at diffusers take-offs shall be factory fabricated.

D. No dovetail field joints or fittings are allowed.

3.4 FLEXIBLE AIR DUCTWORK

A. Flexible ducts shall be installed with stainless steel strap or nylon tie wraps with sealant and as approved for UL 181, Class 1 installation. A “tightening gun” shall be utilized when installing nylon tie wraps.

B. Flexible ducts shall not penetrate any wall, floor, partition or ceiling.

C. Flexible duct shall be installed in continuous single pieces not over five (5') feet long, as straight and short as feasible, adequately supported.

D. Centerline radius of bends shall be not less than two duct diameters.

E. Flexible ductwork shall be suspended on 36" centers with a minimum 1-1/4-inch wide flat banding material.

3.5 JOINT SEALING

A. **All ductwork joints and longitudinal seams shall be sealed airtight.** Sealant shall be visibly sealed on the exterior of duct, including all factory fittings, all connections, both longitudinal and circumferential.

B. Duct tape (gray or foil type) shall NOT be utilized as a ductwork sealer.

C. Elastomeric or hard cast duct sealer shall NOT be utilized on fire damper sleeve to duct connections.

D. Utilize flanged style ductwork joining system in conjunction with tape/gasket for sealing breakaway joints and connections to fire, smoke and/or combination fire/smoke dampers.

3.6 DUCT LEAKAGE TESTS AND REPAIR

A. ALL ductwork shall be sealed airtight, as specified herein. Designated ductwork, as hereafter identified, shall be field pressure tested and proven tight. Other ductwork, not specified to be field tested may be randomly inspected by PROFESSIONAL; any or all ductwork not found to be comprehensively sealed (by visual inspection) may be thereafter required to be field pressure tested, solely at PROFESSIONAL’S discretion, to prove air tightness to specified tolerances.

B. The following ductwork shall be tested by the CONTRACTOR and witnessed and logged by a representative of the TAB Agency performing the work identified in Section *Testing, Adjusting and Balancing*. This includes all supply, return, exhaust, outside air, etc. trunk and all branch ducts, and plenums excluding flexible duct run-outs to individual air distribution devices, shall be tested and proven tight within specified tolerances.

1. All Low Pressure Ductwork.

a. Exceptions:

i. Ductwork within an above ceiling return air plenum or space utilized as a plenum.

ii. Ductwork connected to HVAC equipment with two (2) or less outlets/inlets.

b. Test pressure shall be at pressure class construction requirements identified in Part 2 of this specification.

C. Measured air quantity leakage test

1. The CONTRACTOR shall use recently calibrated orifice run, manometers and portable blower as recommended by AABC.

2. Instruments used for testing and balancing of system shall have been calibrated within six months preceding tests and checked for accuracy prior to start of work.

3. Instruments shall be of a type normally recognized as adequate and accurate for the test contemplated. List type of instrument, manufacturer, serial number and latest calibration date as a part of the submitted test data.

4. Allowable Leakage

a. Low Pressure Ductwork shall have a maximum leakage of five (5) percent of design flow rate (cfm) for complete system or portions thereof. Summation of leakage for all sections shall not exceed the total allowable for a single system.

5. Verification: By TAB Agency. See attached Duct Test Log.

DUCT TEST LOG						
DATE	**SYSTEM**	**LOCATION OF TEST**	**TEST PRESSURE**	**ACTUAL LEAKAGE (CFM)**	**RESULTS % OF LEAKAGE**	**TAB WITNESSED (INITIALS)**
Remarks: (Include Narrative of Procedure, List of Instrumentation, Last Calibration Date, etc.)						
Note: Turn in all forms filled out with project closeout documentation. Copy this form if more sheets are needed. These forms and/or log shall be kept at jobsite and upon request made available to ARCHITECT and/or PROFESSIONAL.						

I certify that the data listed above is accurate and was witnessed by myself or qualified employees of the TAB Agency.

_____ _____

TAB Agent Date

END OF SECTION

Ductwork Accessories

PART 1 – GENERAL

1.1 SCOPE

Ductwork accessories for HVAC including supply air, return air, outside air, transfer air and general exhaust systems.

1.2 APPLICABLE STANDARDS

A. Refer to Paragraph, QUALITY ASSURANCE, in Section *BASIC METHODS AND REQUIREMENTS* (MECHANICAL).

B. Fire Safety Code: Comply with NFPA 90A

C. Duct System Construction: Referenced SMACNA Standards are the minimum acceptable quality.

D. Duct accessories exposed to the air stream, such as dampers turning vanes, extractors, etc. and access openings, shall be of the same material as the duct or provide at least the same level of corrosion resistance.

1.3 DEFINITIONS

A. Seal or Sealing: Use of liquid or mastic sealant, with or without compatible tape overlay, or gasketing of flanged joints, to keep air leakage at duct joints, seams and connections to an acceptable minimum.

B. SMACNA duct pressure classification for Low Pressure: Static pressure rating up to 2 inches wg (water gauge), positive or negative, for rectangular ducts, and 1 inch wg for round ductwork.

PART 2 – PRODUCTS

2.1 TAKE-OFF FITTINGS

A. Round ductwork take-offs shall be conical/bellmouth type or 45 deg lateral (shoe-tap) type. Provide take-offs with volume damper including continuous shaft, locking quadrant handle, nylon bushings and stand-off bracket. Located where indicated and accessible.

B. Conical take-off fittings shall be equal to Flexmaster model CBD SOG with B03 option.

C. 45 deg lateral (shoe-tap) take-off fittings shall be equal to Flexmaster model STOD with B03 option.

2.2 DAMPERS

A. Rectangular Volume Dampers: Opposed blade, multi-louver type. Provide end bearing for all dampers. Quadrant or other operator for externally insulated duct shall have stand-off mount so operation is clear of the insulation.

B. Backdraft Dampers: Self-operating, multi-blade damper to open fully on 0.06 inch wg pressure difference and close by gravity. Aluminum, 16 gauge frame, 0.023 inch blades of airfoil or elliptical shape, with tie-bar to connect blades for parallel operation. Provide resilient gasket for air seal and quiet operation. Blade pivots shall be in nylon bushings. Provide adjustable counter-balance weight(s) where indicated or required to achieve specified performance.

2.3 DUCT ACCESS DOORS, PANELS AND SECTIONS

A. Provide access doors, sized and located for maintenance work, upstream where possible, in the following locations:

1. Each fire damper (for link service), fire/smoke damper, smoke damper and automatic control damper.

B. Openings shall be as large as feasible in small ducts, 8" diameter minimum, with round spin-in access door and sash lock(s). Access sections in insulated ducts shall be double wall, insulated.

1. For low and medium pressure rectangular ducts, provide Flexmaster Model SDSM with R6 insulation option, flange with stick on gasket and cable door retention accessories.

2. For round and flat oval ducts provide Ruskin Model ADR.

2.4 LIFE SAFETY DAMPERS (FIRE, SMOKE AND COMBINATION FIRE/SMOKE)

A. Dampers shall meet the requirements of NFPA 80, 90A, 92A, 92B, 101, & 105 and further shall be tested, rated, and labeled in accordance with the latest edition of UL Standards 555 and/or 555S.

B. Dampers shall be of leakage Class I design per the applicable standards referenced herein.

C. Dampers shall be constructed for the following velocities based upon application:

1. Low pressure (velocity) ductwork installations shall have dampers rated up to 2000 fpm unless noted specifically otherwise on Drawings.

2. Medium pressure (velocity) ductwork installations shall have dampers rated as follows unless noted specifically otherwise on Drawings:

a. For ductwork sizes up to 18" inside diameter (or equivalent oval/rectangular) dampers shall be rated 2000 fpm.

b. For ductwork sizes greater than 18" inside diameter (or equivalent oval/rectangular), dampers shall be rated 3000 fpm.

D. Dampers shall be provided with factory **fully welded** wall sleeve of adequate length matched for each location and retaining angles for both sides of wall, except in shaft wall applications where dampers shall be rated for single angle installation.

E. Dampers shall be provided with flanged break-away connections on each side for connection to ductwork.

F. Dampers shall be constructed of materials to match the associated ductwork distribution system (stainless steel construction dampers where ductwork is required to be stainless steel).

G. Multi-blade dampers (fire, smoke or combination fire/smoke) shall be of the airfoil blade design and be of a single piece design.

H. Multi-blade dampers must be rated for mounting vertically (with blades running horizontal) or horizontally and be rated for airflow in either direction through the damper.

I. Dampers shall have a fire rating of 1-1/2 hours for fire rated installations up to 2 hours. Fire rated installations requiring protection for 3 or more hours shall be rated

for 3 hours. See wall type legend on Drawings for more information.

J. Fire dampers shall be of the dynamic type and include a 160 degree F fusible link.

K. All fire dampers of the curtain type shall be constructed with no part of the blade stack in the air steam except where installed directly behind sidewall grilles.

2.5 CEILING RADIATION DAMPERS

UL listed devices for mounting above ceiling mounted approved air distribution devices, 20 gauge galvanized frame, with insulation blanket. Provide 1-1/2 rated 212° F. fusible link. Air volume control shall be made through damper adjustment through face of device. Provide extended frame for connection to flexible duct, as Ruskin Model CFD R5 (rectangular) or CFD 5 (round). Provide ceiling radiation dampers above all air distribution devices mounted in fire rated ceiling assemblies.

2.6 WALL INTAKE/EXHAUST LOUVERS

A. See Schedule on Drawings for more information.

2.7 SMALL WALL BRICK VENTS

Extruded aluminum with galvanized welded wire screen (square opening size to be 1/4" for intake and 1/2" for exhaust/relief applications) and factory baked enamel colored finish (color as selected by ARCHITECT) as Greenheck Model BVE or BVF (as approved by Architect for wall type) with wall sleeve. Provide brick vent with integral opposed blade balancing damper (adjustable from exterior) on O/A intake applications, and backdraft damper (where noted on drawings).

2.8 DRYER VENTS AND CONNECTIONS

A. Four inch (4") diameter dryer vent pipe shall be field fabricated of 26 gauge sheet metal and shall extend two inches (2") inside building to allow for flexible metal duct connection. Provide integral round escutcheon on inside wall, six inches (6") in diameter; caulk between duct and wall, inside and outside. Provide flexible metal duct extension and connection to dryer.

2.9 SPUN ALUMINUM ROOF MOUNTED INTAKE/ RELIEF HOODS

A. Exterior construction is heavy gauge aluminum. A prepunched mounting base includes an integral spun venturi to reduce pressure drop losses. The internal structure is constructed of galvanized steel for rigid support and includes a windband and birdscreen.

B. Sizes shown designate throat size. Area of hood perimeter opening shall be not less than the throat area.

C. Hoods shall be equal to Greenheck model GRS.

2.10 AIR DISTRIBUTION DEVICES

A. Including supply, return, transfer and exhaust ceiling, floor and sidewall installation, aluminum gasketed construction as indicated. Provide steel construction and matching UL Listed ceiling radiation damper on applications in fire rated ceiling assemblies.

B. All inside ceiling units shall have factory finish, white color unless otherwise noted.

C. All soffit outdoor units shall have factory finish, color to match soffit. Submit color chart to ARCHITECT for custom color selection.

D. See Schedule on Drawings for more information.

2.11 PREFABRICATED ROOF CURBS

A. Roof curbs for concealed applications, where curb is essentially hidden on flat/low slope roof (built up, modified bitumen, etc.) may be galvanized steel construction.

B. All roof curbs to be provided with continuous welded corner seams and treated wood nailer. Curbs shall be built for pitched roof or ridge mounting as required to keep top of curb level.

C. See details on Contract Drawings for more information.

D. All roof curbs on metal roofs to provided and installed by the CONTRACTOR. Roof curbs shall be structurally sound and built for pitched roof mounting as required to keep top of curb level (except where specifically noted or detailed otherwise). Roof curbs shall be constructed in accordance with roofing manufacturer's requirements to maintain all specified roofing warranties.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Comply with provisions of Section *BASIC MECHANICAL MATERIALS AND METHODS*, particularly regarding coordination with other trades.

B. Construct casings, eliminators, and pipe penetrations in accordance with LPDS, Chapter 3. Design casing access doors to swing against air pressure so the pressure helps to maintain a tight seal.

C. Install duct hangers and supports in accordance with SMACNA, LPDS, Chapter 5, and HPDS, Chapter 6, in concealed applications.

D. Install life safety dampers in accordance with the manufacturer's instructions to conform to the installation used for the rating test. Install multiple access doors to provide access to all damper linkages/fusible links of multiple section life safety dampers.

E. Seal openings around duct penetrations of fire rated ceilings and partitions with fire stop material as required by NFPA 90A. See Section *Basic Mechanical Materials and Methods*. Provide sound sealant around duct penetrations in wall indicated as sound and/or full height walls.

F. Provide primary and secondary balance dampers on all supply distribution devices. Provide a supply air duct damper and air extractor off main ductwork to branch ductwork of the types as listed below:

1. Round Ductwork: Provide conical or lateral type taps with integral butterfly damper. Submit information for approval.

2. Rectangular Ductwork: Provide radius or lateral elbow tap, as indicated with air extractor assembly and opposed blade multi-blade damper.

3. Provide exterior duct damper and extractor controller arm assemblies that extend past proposed ductwork installation for accessible operation.

G. When splitter dampers occur above other than lay-in ceiling, provide damper assembly complete with supports, bearings, chromium plated ceiling escutcheons and adjustable regulator, as Young Models No. 1 and No. 890-A.

END OF SECTION

Controls and Instrumentation

PART 1 – GENERAL

1.1 DESCRIPTION

A. Provide complete HVAC controls and instrumentation for the following items:

1. Air Handling Systems Including:

a. Exhaust Fans

b. Direct Expansion Systems

2. Miscellaneous

a. Unit Heaters

B. Definitions:

1. Deviations: The difference between the controller set point and the value of the controlled variable (such as room temperature) at any instant.

2. Dead band: A temperature range over which no heating or cooling energy is supplied, such as 72-78 degrees F, i.e., as opposed to single point changeover or overlap.

3. Control Wiring: Includes conduit, wire and wiring devices to install complete HVAC control systems including motor control circuits, interlocks, thermostats, switches and like devices.

1.2 QUALITY ASSURANCE

A. Criteria:

1. The maximum deviation of occupied room conditions from the controller set point shall not exceed plus or minus one degree F for temperature, and plus or minus three percent for relative humidity unless the system is operating in the dead band range.

B. Performance tests:

1. Demonstrate to the Owner that all controls are installed, adjusted, and can perform all functions required by the contract drawings and specifications.

1.3 SUBMITTALS

A. Manufacturer's Literature and Data for all components, including the following:

1. Controllers.

2. Relays and switches.

3. Control dampers, control valves and operators.

4. Instrumentation products.

B. Certificates:

1. Compliance with paragraph, QUALITY ASSURANCE.

2. Name and address of a permanent service organization maintained or trained by the manufacturer that will render satisfactory service within eight hours after notification that service is required.

C. Control Drawings: Integrate with flow diagrams; show outlines of HVAC equipment

with control devices, schematic one line control piping and wiring, and written sequence of operation and operation instructions. Equipment numbers shall correspond to those shown on the Contract Drawings. Provide three (3) complete sets of blue-line as-built drawings.

D. Operation and Maintenance Manuals:

1. Submit in accordance with Section *Mechanical Close-Out Requirements*.

2. Include the following documentation:

a. General description and specification for all components.

b. Detailed illustrations and complete calibration procedures.

c. Complete trouble shooting procedures and guidelines.

d. Complete operating instructions for all systems.

e. Piping schematic/flow diagrams.

1.4 INSTRUCTIONS

A. Instructions to OWNER Operations Personnel: Perform in accordance with Section *Mechanical Close-Out Requirements*.

B. Training by independent or franchised dealers who are not direct employees of the temperature control company will not be acceptable.

1.5 GUARANTY

Any defects in workmanship or material during the guaranty period shall be corrected by the CONTRACTOR at no cost to the OWNER. Correction of defects shall be accomplished during regular working hours.

PART 2 – PRODUCTS

2.1 SENSORS AND CONTROLLERS

A. Combination heating/cooling thermostat:

1. Digital, low voltage, color touch-screen, graphical display, 7-Day programmable autochangeover WiFi. Thermostat shall support up to 2 stages of cooling and 3 stages of heating as well as heat pump configurations. Device shall support remote-mounted space temperature sensors.

2. Remote connectivity and simplified setup shall be provided via mobile application. Mobile application shall include functionality for one-to-many setup and configuration tasks.

3. Operating and storage range of -40 to 175°F and 5 to 95% RH non-condensing.

4. Equal to Trane Pivot Smart Thermostat.

B. Humidistat: Low voltage or electronic type sensor/controller capable of minimum 2% relative humidity accuracy, and no more than 1% drift per year temperature compensating, non-condensing, early field calibratable, sensor/controller shall energize humidity control equipment/capability on a rise in space above setpoint. Provide multistage or multiple setpoint humidity sensor/controllers to match equipment scheduled and/or specified capability and/or control.

Duct or Plenum sensing humidity sensor/controllers shall include duct penetration probe or other suitable PROFESSIONAL approved sensing capability, as Johnson Controls HE-67 or as approved.

Space wall mounted humidity sensor/controllers shall be as KELE Series HF/HW-20K-T81 or as approved. Calibration shall be guaranteed for minimum period of two (2) years.

C. Heating only thermostat: Thermostats for unit heaters, duct heating units, wall and/or ceiling heaters, and for low limit zone temperature control, shall be heating only low voltage (24 VAC or less) type, with number of stages matched to equipment scheduled or specified capability. Provide thermostat with fan “auto-on” sub base and control capability for heating equipment when an integral fan is included. Heating capability, with fan where applicable, shall be energized on a drop in temperature below controller setpoint.

D. Ventilation thermostat: Thermostats for control of ventilation equipment shall be single stage cooling only low voltage (24 VAC or less) thermostats. On a rise in temperature above setpoint, ventilation equipment shall be energized. Provide fan “auto-on” sub base and control capability for manual override and ventilation equipment sequencing.

E. Provide specialty sensor/controllers to match specified sequence of operation as delineated hereafter,

F. Switches

1. Manual Switches:

a. Electric: Provide manual switches as required in the sequence of operation. Switch contact ratings shall be adequate to handle the functions being switched, with minimum rating 15A. at 120 volts.

2.2 RELAYS:

A. Provide as required for system functions.

B. Electrical Pilot Duty or Contactor Types: Provide inductive rated contacts for circuits with coils, motors or other inductive devices, minimum 120V, 15A. rating.

2.3 MOTORIZED CONTROL DAMPERS

A. Dampers shall be of the airfoil, ultra low leakage, opposed blade design. Dampers shall be constructed of minimum 16 gauge galvanized steel. Side mounted linkage shall be out of airstream. Blades shall include rubber edge seals for tight seal.

B. Damper actuators shall be two-position normally closed low-voltage type.

C. Design and install control dampers to "fail safe" in either the normally open or normally closed position as required for freeze, moisture, smoke or fire protection.

2.4 FINAL CONTROL ELEMENTS AND OPERATORS

A. Fail Safe Operation: Design and install control valves and dampers to "fail safe" in either the normally open or normally closed position as required for freeze, moisture, smoke or fire protection.

B. Spring Ranges: As required for system sequencing and to provide tight close off.

2.5 WIRING MATERIALS

A. Comply with applicable sections of *Division 26 and 28*. Provide wiring for control devices furnished under this Section, HVAC motor control conduits and interlocks. Color code and number all wires, whether individual or in cables, for identification.

B. A complete wiring system shall be provided for all direct digital control (DDC) and electric controlled apparatus. All wiring shall be installed in a neat, workmanlike manner, of sufficient size and tested to be continuous and without unnecessary "short".

Wiring shall be as follows:

1. Exposed Areas and Mechanical Equipment Rooms: Wiring shall be routed in metallic conduit per *Division 26 and 28* requirements. Provide flexible conduit connections to rotating equipment.

2. Concealed, Accessible Areas: Wiring may be routed outside in above ceiling accessible spaces conduit, however wiring outside conduit shall be sheathed with plenum rated jacket with maximum rating of 50/25 smoke developed/fire rated per NFPA 90A.

   a. All wiring will be routed in the bar joists and/or roof structure space and supported with tie-straps at maximum 6'-0" on center.

   b. All drops and risers to HVAC equipment, fans, sensors, etc., will have a tie-strap installed directly above each device to insure a vertical support to the device.

   c. Any open wiring that enters a conduit in the walls or drop/rise to connect equipment will have a minimum of 12" of wire looped outside the conduit above the ceiling and will be attached utilizing a tie-strap within 12" of the conduit end or connection.

3. Inaccessible Areas: Same as #1 above - includes wiring in walls, above hard ceilings, in chases, etc.

4. Inside Panels or Unit Enclosures: Wiring may be run outside conduit and neatly tied in bundles for neatness and function.

5. Wiring in exterior and moist environments shall be routed in weatherproof liquid tite conduit with matching fittings and connections.

6. Minimum gauge for low voltage (24VAC or less) control wiring shall be 18 AWG copper solid conductor(s).

2.6 TAMPERPROOF INSTALLATIONS

A. All unit heater(s), low limit thermostats and high limit humidistat sensor/controllers shall be enclosed in a white tamperproof cover, Kenall "Thermo-Gard", or as approved. Provide OWNER with four (4) tamperproof cover screw tools at completion of project. Mount these devices in a location approved by PROFESSIONAL.

B. Relays for all HVAC systems, exhaust fans, and ceiling heaters shall be mounted in large junction boxes with covers above accessible ceilings near individual equipment.

C. Designated room thermostats shall be mounted 48” above finished floor behind

clear locking removable cover, as Berko. Provide two (2) keys for each and every cover, to OWNER at end of project.

1. Heat recovery units

2.7 CONTROL SEQUENCES

Control sequences shall be:

A. SPLIT-DX HEAT SYSTEMS WITH ACTIVE HUMIDITY CONTROL

1. UNIT CONTROLS SHALL BE ENERGIZED FROM THERMOSTAT LOCATED AS INDICATED ON DRAWINGS.

2. WHEN THE UNIT CONTROLS ARE ENERGIZED, WITH THERMOSTAT FAN "AUTO-ON" SWITCH IS IN "ON" POSITION, EVAPORATOR FAN SHALL RUN CONTINUOUSLY AND ZONE HEATING AND COOLING THERMOSTAT SHALL CONTROL THE HEATING FUNCTION AND CYCLE CONDENSING UNITS TO MAINTAIN ZONE ENVIRONMENT CONDITIONS.

3. DURING UNOCCUPIED PERIODS, SUPPLY FAN SHALL BE CYCLED IN CONJUNCTION WITH A CALL FOR HEATING/COOLING OR DEHUMIDIFICATION.

B. FANS:

1. SEE CONTROL SEQUENCE AT SCHEDULE(S) ON DRAWINGS.

C. SELF CONTAINED DEHUMIDIFIER(S)

1. UNIT(S) SHALL BE SEQUENCED BY UNIT MOUNTED CONTROLLER SET TO INITIALLY MAINTAIN MAXIMUM 60% RELATIVE HUMIDITY (RH).

D. DOMESTIC WATER RECIRCULATING PUMPS

1. SHALL BE ENABLED TO RUN WHEN PIPE MOUNTED AQUASTAT FALLS BELOW SETPOINT.

E. DUCTLESS SPLIT SYSTEMS

1. CONTINUOUS OPERATION. CONTROLLED BY MANUFACTURER'S AUTOMATIC HEATING/COOLING CHANGEOVER THERMOSTATS.

F. OTHER CONTROLS AND/OR CONTROL FUNCTIONS AS LISTED ON DRAWINGS OR SPECIFIED ELSEWHERE.

PART 3 – EXECUTION

3.1 INSTALLATION AND ADJUSTMENT

A. Install and adjust required control components and systems in accordance with instructions of the manufacturer. Work shall be performed by employees of the manufacturer or an authorized representative.

B. All control wiring shall be routed in accordance with paragraph 2.05 herein. Install control wiring and connections in accordance with applicable Sections of *DIVISION 26 and 28*.

C. Except for short apparatus connections run conduit parallel to or at right angles to the building structure. Conceal conduit in finished spaces.

D. Do not run conduit concealed under insulation or inside ducts. Mount control devices and conduit located on ducts or apparatus with external insulation or stand-off support to avoid interference with insulation.

E. Run wire connecting devices on or in control cabinets parallel with the sides of the cabinet neatly racked to permit tracing. Rack connections bridging a cabinet door along the hinge side and protect from damage. Provide grommets, sleeves or vinyl tape to protect plastic tubing or wires from sharp edges of panels, conduit, and other items.

F. Provide all necessary factory and/or field labor for complete calibration and adjustment of the air flow control components, and be responsible for setting all control set points, operating sequences, and alarm systems contained within the control center to produce the system performance specified.

G. Provide water heater controls, operating instructions, controls and piping schematic in neat laminated displays for mounting in water heater room.

H. CONTRACTOR shall provide all power wiring and connect relays, time clocks, control panels, MCP, etc. which are furnished by CONTRACTOR.

I. Provide permanent identification of panel MCP, time clock, and all controllers, by zone, etc. as per Section *Mechanical Identification* and PROFESSIONAL'S instruction. Submit details of proposed identification along with control schematics and device specifications for PROFESSIONAL'S approval. Submit Drawings, schematics, operating instructions, etc. to be posted, framed, laminated, etc. to PROFESSIONAL for approval.

END OF SECTION

Testing, Adjusting and Balancing

PART 1 – GENERAL

1.1 SCOPE

A. The process of Testing, Adjusting and Balancing (TAB) for mechanical HVAC and Plumbing systems is a requirement for this project.

B. Definitions and Abbreviations:

1. TAB: Testing, Adjusting and Balancing. The process of checking and adjusting HVAC and plumbing systems to meet design objectives and performance intent.

2. AABC: Associated Air Balance Council.

3. NEBB: National Environmental Balancing Bureau.

4. Plumbing Systems: Domestic hot water and re-circulating systems.

5. Air Systems: Included all supply air, return air, exhaust air, transfer air and outside air systems.

C. The CONTRACTOR shall provide the services of a qualified independent TAB Agency for testing, adjusting, and balancing as described herein and include same in his bid. CONTRACTOR shall submit TAB AGENCY experience, agenda and associated credentials to PROFESSIONAL for TAB AGENCY and agenda approval.

1.2 APPLICABLE STANDARDS

A. TAB Agency Qualifications: Current membership in AABC or NEBB.

B. Performance Criteria: Work shall be performed in accordance with the approved TAB agenda requirements.

C. Test Equipment Criteria: The basic instrumentation requirements and accuracy/calibration required by AABC (Section Two) or Section II of the NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems.

D. A factory air test hood, recently calibrated, shall be utilized for ceiling air device CFM measurement.

1.3 APPLICABLE PUBLICATIONS:

The following publications form a part of this Specification to the extent indicated by the reference thereto. In text the publications are referred by to by the initials of the organization.

A. Associated Air Balance Council (AABC):

1. National Standards for Total System Balance, 2002 Edition

B. National Environmental Balancing Bureau (NEBB):

1. Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems, 8th Edition, 2015

2. Procedural Standards for Measuring Sound and Vibration, 2nd Edition, September 2006

1.4 CORRESPONDENCE

A. Representative of TESTING, ADJUSTING and BALANCING Agency shall report to the CONTRACTOR, during all phases of the test and balance process, any deficiencies that will impair the proper balance and operation of the systems involved. This shall include, but not limited to, reporting balancing valves/dampers, controls, and safety sensors, etc. not installed as called for on the Plans or in the Specifications.

B. The TAB Agency shall submit preliminary reports a minimum seven (7) days prior to scheduled substantial completion for this project or any phase thereof, and including a comprehensive narrative of problems, obstacles, recommendations, and remedial actions for PROFESSIONAL'S review and approval.

C. TAB Agency shall not release any reports to other parties until such has been approved by the PROFESSIONAL.

PART 2 PRODUCTS NOT APPLICABLE

PART 3 – EXECUTION

3.1 GENERAL

A. Coordinate TAB procedures with any phased construction requirements for the project so that usable increments of finished work may be accepted for beneficial occupancy. Systems serving partially occupied phases of the project may require balancing for each phase prior to final balancing and shall required separate TAB effort and reports for each phase and submittal prior to advancing to next phase of project.

B. Allow sufficient time in construction schedule for TAB prior to substantial completion inspection for the project.

C. Conduct final TAB after system has been completed and is in full working order. Put all HVAC systems into full operation and continue operation of the systems during each working day of TAB. Accomplish TAB in accordance with the CONTRACTOR provided Agenda approved by PROFESSIONAL.

D. Substantial Completion: Substantial Completion of mechanical systems shall not be given without TAB Agency's written certification that the mechanical systems and controls have been thoroughly tested and are safely performing as intended. See certification required herein. No other certification will be acceptable.

E. Preparation of Equipment and Systems for Testing and Balancing:

1. The CONTRACTOR shall, upon completion of items or work required by this contract, thoroughly clean all dirt and debris from equipment, ducts, piping systems, strainers, accessories, etc. All bearings, gear boxes, wearing surfaces, or other equipment components requiring lubrication shall be properly serviced as recommended by the equipment manufacturer and shall be tagged with the date of service and type of lubricant used. All specified cleaning and protective devices shall then be installed in equipment, piping, plenums, ductwork, etc., and systems shall be placed in continuous operation. All fans shall have been in operation for at least twenty-four (24) hours prior to the start of testing and balancing so that initial stretch of drive belts will have taken place, and all other mechanical equipment including all temperature and operating control devices will have

been adjusted and calibrated for complete and functional operating service.

F. System balancing and performance testing:

1. The CONTRACTOR shall secure copies of all report forms, data sheets, and instrumentation to be used by the agency in the performance of their services and submit the same for approval. This submittal data shall include a tabulation of instruments and devices to be utilized in the performance of testing and balancing operations and shall include the name of the manufacturer of the instrument of devices, model number, range, degree of accuracy, date of last calibration, or the other pertinent information that may be required to determine the utility of the instrument of device. As a minimum requirement, the following instrumentation shall be employed in the performance of balancing and testing of mechanical system: swinging vane or hot wire type anemometer, low ran (0-0.25 in. water column) inclined tube manometer, high range (0-20 in. water column) U-tube manometer, pilot tube, ammeter, volt-meter, self-timing tachometer (maximum scale Division 2 rpm) pyrometer, powered psychrometer, vibration meter, other instruments, tools, and devices as required to accurately balance and test mechanical systems and components.

G. It is the responsibility of this section to make certain that all the submitted and/or existing equipment has proper motor size, sheave size, belt size, etc.

3.2 AIR BALANCE

A. Place all interactive systems in operation with all filters installed and automatic control systems completed and operating. Artificially load air filters by partial blanking or other means to provide air pressure drop midway between the clean and dirty condition. Set/reset room thermostats and humidistat, and/or equipment controls as necessary to check heating and cooling functions, and air flow rates for air distribution devices and adjust units if not within specified tolerances.

B. Balance systems to design ratings. Adjust fan speeds to provide design flows, including system diversities, at actual system pressures. Belt drives, including sheaves, belts, etc. shall be adjusted and/or replaced as required to safely obtain specified performance.

C. Make pitot tube traverses of all trunk lines and major branches when required to determine proper proportioning of air flows. Airflow measuring devices, where installed, may be utilized for this purpose. Seal duct access holes with snap in plugs.

D. Record pressure drop readings across all major system components and significant drops within duct systems such as air filters, coils, heaters, etc.

E. Make flow and pressure measurements at each terminal device, and each supply, return, or exhaust diffuser. Adjust each air outlet unit within plus or minus 10 percent of design requirements, but total air for each system shall be not less than shown unless otherwise approved by PROFESSIONAL. Adjust grilles and diffusers to minimize drafts in all areas. Mark permanently all damper quadrants at final set points. Total differentials between ventilation and exhaust for the purpose of proper pressurization, shall be maintained.

F. Adjust exhaust systems to indicated CFM requirements (+/- 10%).

3.3 VIBRATION TESTING

Check for excessive vibration of rotating equipment.

3.4 SOUND TESTING

Check for excessive noise from equipment, air distribution devices, etc. and notify PROFESSIONAL of any objectionable noise levels. Perform noise/sound measurement and provide noise level calculations/results in rooms and areas requested by PROFESSIONAL.

3.5 DUCT LEAKAGE TESTS

See Section *Ductwork* for duct testing requirements.

3.6 BUILDING/ZONE PRESSURIZATION:

The Tab Agency shall test the building pressurization and report same to PROFESSIONAL. These tests shall include various simulations between maximum and minimum ventilation capacities, to assure proper relief capability and pressurization per current ASHRAE recommendations.

3.7 MINIMUM TAB DATA REQUIRED

Approved TAB Agency shall furnish all labor and materials to balance the following new and/or modified equipment and systems: The following minimum information shall be provided:

A. DX Split System Air Handler: on systems scheduled to have multiple stages of heating and/or cooling capacity, or CFM requirements, provide the information for temperatures and/or airflow to indicate same for each operating condition (single and multi-stage).

1. Total S/A CFM –
2. R/A CFM –
3. O/A CFM –
4. R/A E.A.T. Db/Wb (Cooling) –
5. O/A E.A.T. Db/Wb (Cooling) –
6. S/A L.A.T. Db/Wb (Cooling) –
7. R/A E.A.T. Db/Wb (Heating) –
8. O/A E.A.T. Db/Wb (Heating) –
9. S/A L.A.T. Db/Wb (Heating) –
10. Fan Motor Voltage –
11. Motor Horsepower –
12. Fan Motor Amperage at 100% Capacity –
13. External Static Pressure –
14. Size, Type, Efficiency and Relative Condition of all Air Filters –

B. Condensing Units:

1. E.A.T. –

2. L.A.T. –

3. Voltage –

4. F.L.A. –

5. Outdoor ambient (ºF) –

C. Fans:

1. CFM –

2. Voltage –

3. F.L.A. –

4. External Static Pressure –

D. Dehumidifiers:

1. CFM –

2. Voltage –

3. F.L.A. –

4. External Static Pressure –

5. E.A.T. Db/Wb (Unit on) –

6. L.A.T. Db/Wb (Unit on) –

7. Size, Type, Efficiency and Relative Condition of all Air Filters –

E. Pump (Domestic Hot Water):

1. GPM

2. F.L.A.

F. Test all re-circulating potable hot water systems near the end of pump runs to ensure proper temperature. CONTRACTOR shall make any adjustments required of domestic water heaters, mixing valves, etc., in order to achieve scheduled domestic hot water temperature (+/- 5º F).

G. Balance all S.A., E.A. and O.A. air distribution devices to within 10% of specified C.F.M., yet main area pressurization and differentials.

H. Mark all flow C.F.M., balance valve set points, etc. on an 11”x17” reduced scale set of working drawings and submit to PROFESSIONAL with TAB report prior to completion of work.

I. Submit list of equipment with excessive vibration.

J. Submit the Test and Balance report as indicated above, along with the working drawing to PROFESSIONAL for approval prior to completion and substantial completion inspection to job.

K. Verify that all mechanical system controls, safety and shutdown interlock and sequence of operation is as specified. TAB Agency shall provide written certification that he has verified same and/or note any and all discrepancies. See paragraph 3.11 for specific certification.

3.8 TAB SITE VISIT COORDINATION

A. The TAB Agency shall inform the PROFESSIONAL, in writing seven (7) calendar days prior to his site visit for final TAB of systems such that PROFESSIONAL may be present to witness same, at PROFESSIONAL'S sole discretion. Changes to schedule shall be coordinated with and approved by PROFESSIONAL, with sufficient advance notice. TAB Agency shall be required to coordinate with PROFESSIONAL'S office representative, date of final inspection, and provide random tests and verification of TAB report information, at PROFESSIONAL'S selection.

B. It shall also be the responsibility of the TAB agency to include the cost of any opposite season check-out of all system components which might be required and modify air distribution delivery and/or temperature to any room, area, or zone which may require adjustment during the first year of system operation.

3.9 SYSTEM CHANGES

A. Final balancing changes shall be approved by the CONTRACTOR'S who installed the equipment. Changes may encompass, but not be restricted to, changing the pulleys, belts, dampers or adding dampers, balancing valves, etc.

B. The TAB Agency shall coordinate with the CONTRACTOR any changes required including belts, sheaves, etc. to balance systems within specified tolerances. All cost of any modifications is the responsibility of the CONTRACTOR.

3.10 VERIFICATION / INSPECTION

A. After the final TAB report is submitted and reviewed by the PROFESSIONAL, he will soon afterward schedule a verification inspection with the TAB Agency. At this inspection, the TAB Agency will test airflow flows, water flows, sound levels, control operation and sequence, for random air distribution grilles, fans, AHU's, equipment, piping, etc., as selected by PROFESSIONAL.

B. This inspection will last no longer than four (4) hours for each completed phase of the project. Should this verification information exceed the specified tolerance, the TAB Agency may be required to retest and balance the entire system(s) to these tolerances, solely at the PROFESSIONAL's discretion. A follow-up verification inspection shall then be required, and the procedure will begin again. The cost of these inspections, re-inspections, TAB and reports shall be borne by the CONTRACTOR.

3.11 CERTIFICATION

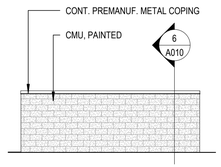
The TAB Agency shall provide the following written TAB certification within the final TAB report (see also Section *Mechanical Submittals and Shop Drawings*):

> "The Testing, Adjusting and Balancing (TAB) Agency certifies that the HVAC air and plumbing water systems and controls have had a full range of tests and checks carried out by the TAB Agency, to determine if all components, sub-systems, systems and interfaces between systems operate in accordance with the Contract Documents. This includes all modes and sequences of control operation, interlocks and conditional and specified control responses to abnormal, safety and emergency conditions. The (TAB) Agency had provided to the OWNER the specified training and documentation on the operation of these systems such that these systems can be safely and efficiently operated in line with design requirements."

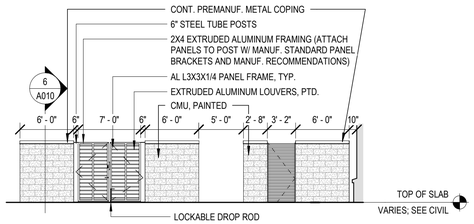
3.12 OWNER EDUCATION REQUIREMENTS AND INVOLVEMENT

See Section *Mechanical Close-out Requirements* for Owner Education requirements.

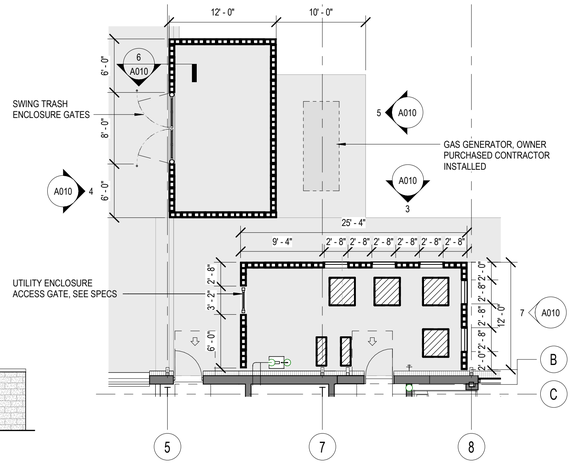
END OF SECTION



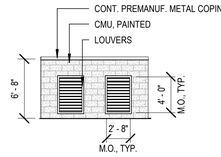
5 TYP. ENCLOSURE ELEVATION
1/8" = 1'-0"



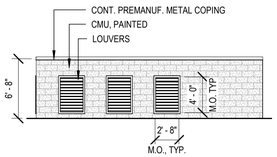
4 TYP. ENCLOSURE ELEVATION
1/8" = 1'-0"



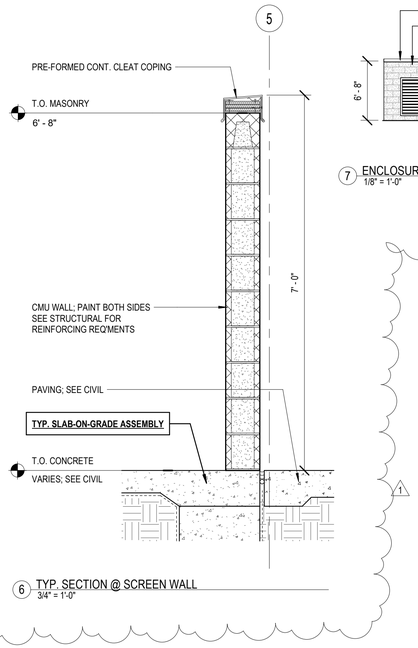
2 ENLARGED PLAN - CENTRAL FIRE STATION ENCLOSURE
1/8" = 1'-0"



7 ENCLOSURE ELEVATION - OPENINGS
1/8" = 1'-0"



3 ENCLOSURE ELEVATION
1/8" = 1'-0"



6 TYP. SECTION @ SCREEN WALL
3/4" = 1'-0"

ZONING

SITE INFORMATION

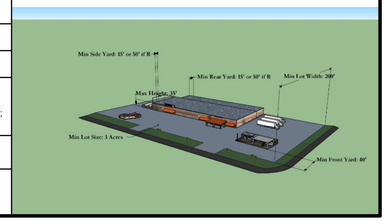
SITE INFORMATION	ID: F09A000017 00000
	PPIN: 15165
	ACREAGE: 6.17
	OWNER: CITY OF PEARL
	WARD: 2
	Land Roll: https://www2.rankincounty.org/TA/result.asp?PPIN=15165
PARKING	OTHER BUISNESS & PROFESSIONAL OFFICES:
	1 SPACE PER 300 SW. FT. GROSS FLOOR AREA GROSS SQ. FT.: 6,211.3 SQ. FT. / 300 = 20.7 = 21
	PARKING SPACE COUNTS:
	TOTAL PARKING SPACES: 21
	MINIMUM TOTAL # OF ACCESSIBLE PARKING SPACES: 1
	MINIMUM NUMBER OF VAN ACCESSIBLE PARKING SPACES: 1
NOTES	REQUIRED 90 DEGREE PARKING ANGLE UNLESS DEVELOPER CAN DEMONSTRATE TO THE CITY OF PEARL MAYOR AND BOARD OF ALDERMAN DURING REQUIRED SITE PLAN REVIEW; DESIGN STANDARDS FOR PARKING SPOTS (PAGE 64)
REFERENCES	ARTICLE XVII: GENERAL COMMERCIAL DISTRICT (C-2) SECTIONS 1700-1708 (PAGES 129 -132)
	ARTICLE V: OFF-STREET PARKING, LOADING SPACE AND ACCESS REQUIREMENTS SECTIONS 500-503 (PAGES 61-66)

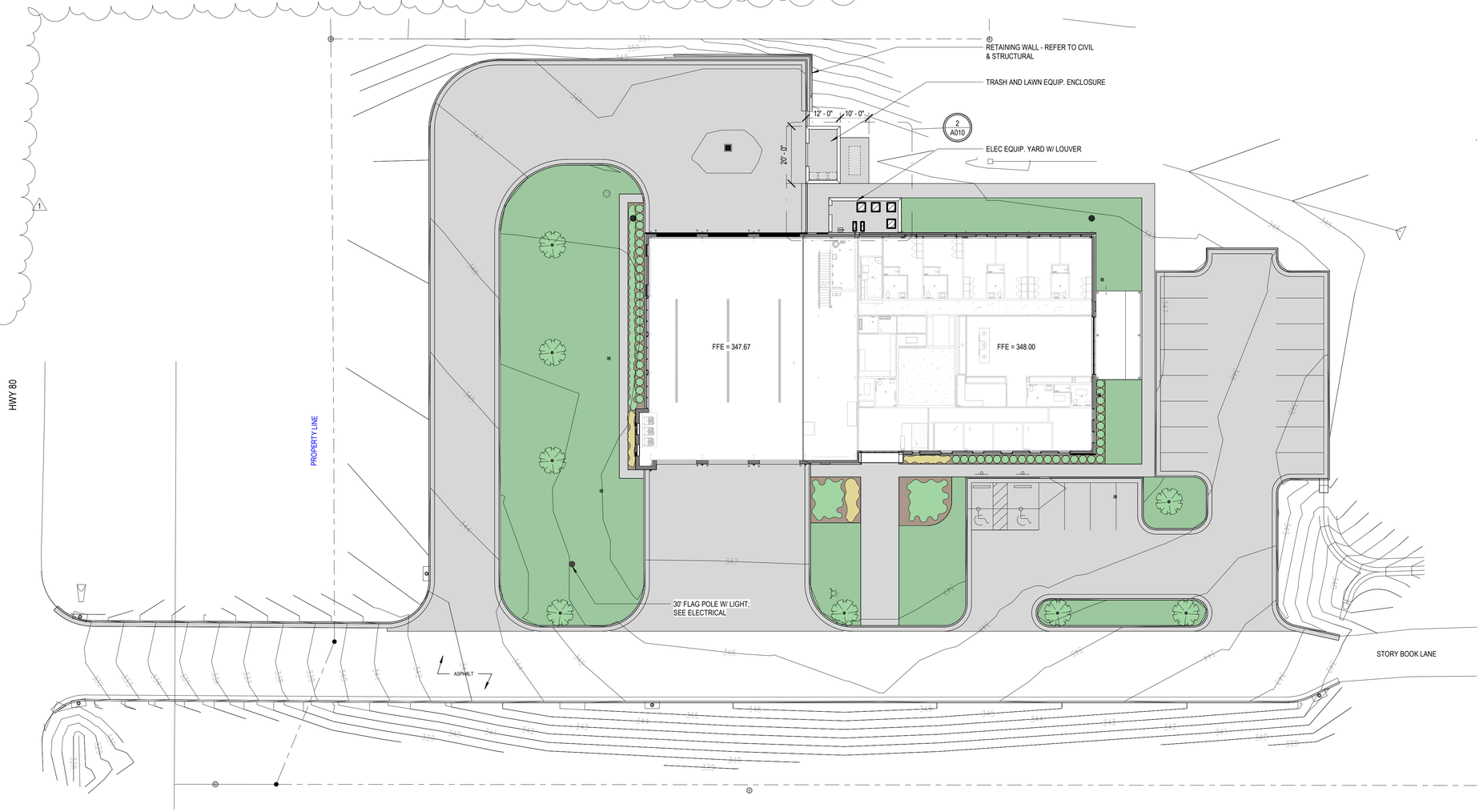
ARTICLE XVII: GENERAL COMMERCIAL DISTRICT (C-2)

Quick Reference Guide

Dimensional Requirements	
Maximum Building Height	35 feet
Minimum Lot Area: Multi-Tenant	3 acre
Minimum Lot Width: Multi-Tenant	200 feet

Minimum Yards		Buffer Yard Requirements	
Front Yard	40 feet	**When Abutting Districts**	All Ag & Res. Districts
Side & Rear Yard	15 feet	**Minimum Width**	20 feet
Side & Rear Yard if Abutting Residential	50 feet	**Screen Height Minimum**	6 feet





1 ARCHITECTURAL SITE PLAN
1" = 20'-0"

NORTH
0 5' 10' 20'

WBA ARCHITECTURE

PEARL FIRE STATIONS

CITY OF PEARL
2420 Old Brandon Rd.
Pearl, MS 39208

REGISTERED ARCHITECT
JAMES RICHMOND WIER, JR.
4446
STATE OF MISSISSIPPI

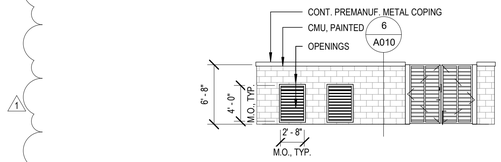
2023.08.16

CONSTRUCTION DOCUMENTS
WBA # 22-099 & 22-108

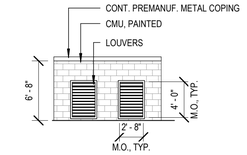
REVISIONS

NO.	DESCRIPTION	DATE
1	ADDENDUM 1	9/1/23

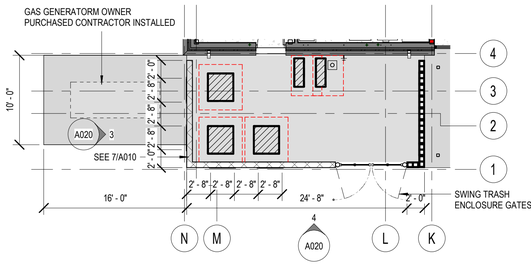
A010
SITE PLAN & SITE DTLS - CENTRAL FIRE STATION



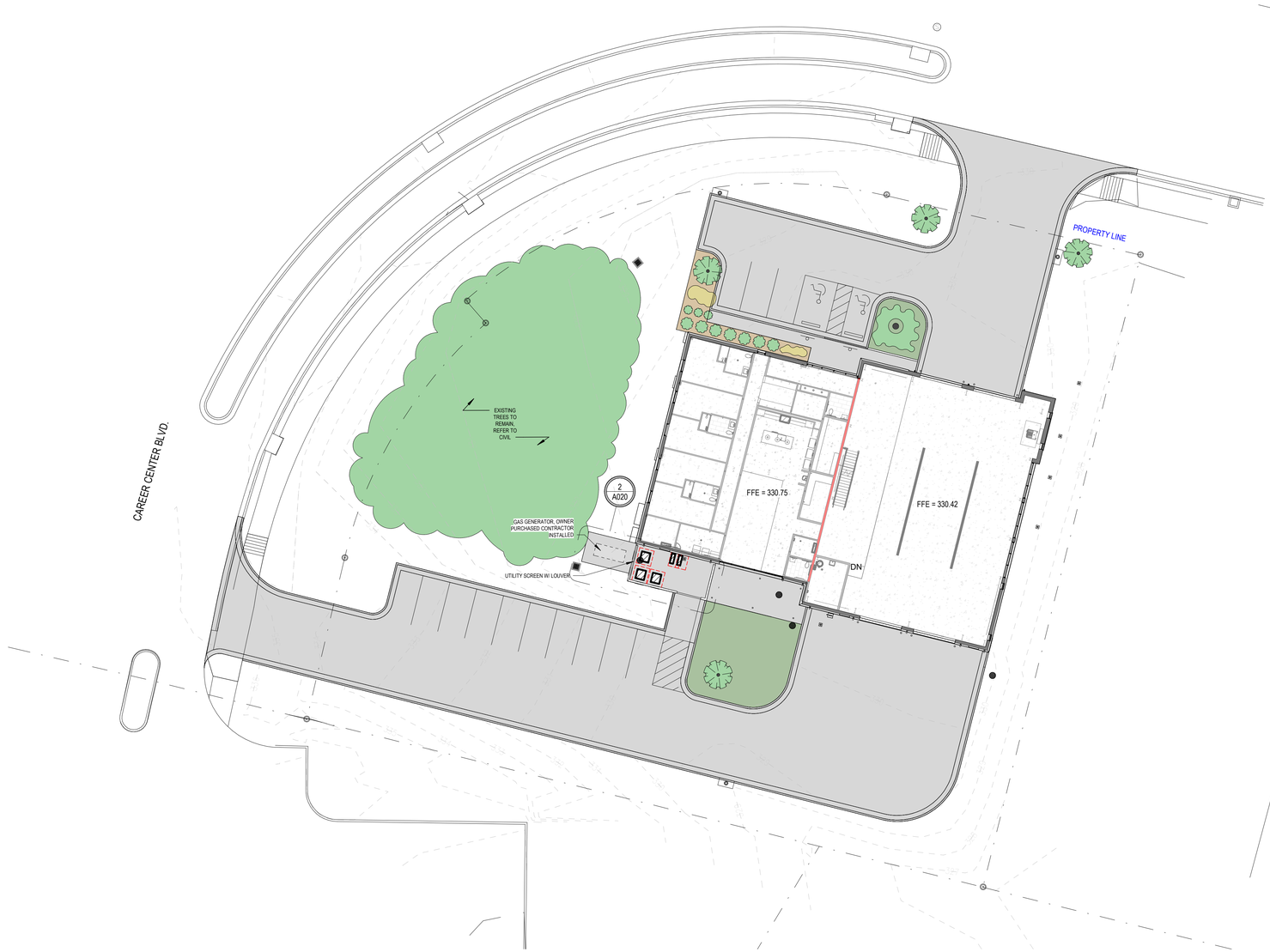
4 ENCLOSURE ELEVATION
1/8" = 1'-0"



3 ENCLOSURE ELEVATION - OPENINGS
1/8" = 1'-0"



2 ENLARGED PLAN - FIRE STATION 5 ENCLOSURE
1/8" = 1'-0"



1 ARCHITECTURAL SITE PLAN
1" = 20'-0"

ZONING

SITE INFORMATION

SITE INFORMATION	C-2 GENERAL COMMERCIAL DISTRICT PARCEL
	ID: G08 000099 00321
	PPIN: 80085
	ACREAGE: 0.98
	OWNER: CITY OF PEARL
	WARD: 1
	Land Roll: https://www2.rankincounty.org/TA/result.asp?PPIN=80085
PARKING	OTHER BUISNESS & PROFESSIONAL OFFICES:
	1 SPACE PER 300 SW. FT. GROSS FLOOR AREA GROSS SQ. FT.: 4,577 SQ. FT. / 300 = 15.3 = 16
	PARKING SPACE COUNTS:
	TOTAL PARKING SPACES: 16
	MINIMUM TOTAL # OF ACCESSIBLE PARKING SPACES: 1
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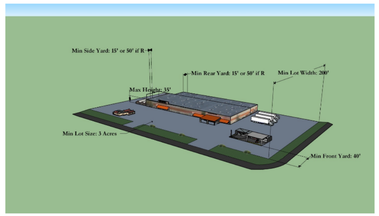

0 5' 10' 20'

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REGISTERED ARCHITECT
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STATE OF MISSISSIPPI

2023.08.16

CONSTRUCTION DOCUMENTS
WBA # 22-099 & 22-108

REVISIONS

NO.	DESCRIPTION	DATE
1	ADDENDUM 2	9/1/23

A020
SITE PLAN & EXT. SITE DETAILS - STATION 5