SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

C. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.

1. Basis-of-Design Product: Subject to compliance with requirements, provide J. L. Industries Model # Cosmic 10E in cabinet where shown on drawings and on wall mount in Bay Area. Provide J. L Industries Model # Saturn 25 in Kitchen on wall mount where directed by Owner. Or comparable product by one of the following:

a. Amerex Corporation.
b. Ansul Incorporated; Tyco International Ltd.
c. Badger Fire Protection; a Kidde company.
d. Buckeye Fire Equipment Company.
e. Fire End & Croker Corporation.
f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
g. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
h. Larsen's Manufacturing Company.
i. Moon-American.
j. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.
k. Potter Roemer LLC.
l. Pyro-Chem; Tyco Safety Products.

2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

2.2 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following compatible with the fire extinguishers:

a. Amerex Corporation.
b. Ansul Incorporated; Tyco International Ltd.
c. Badger Fire Protection; a Kidde company.
d. Buckeye Fire Equipment Company.
e. Fire End & Croker Corporation.
f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
g. Larsen's Manufacturing Company.
h. Potter Roemer LLC.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 54 inches (1372 mm) above finished floor to top of fire extinguisher.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 114000 - FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes commercial ice-maker.

1.2 SUBMITTALS

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

B. Shop Drawings: For fabricated equipment. Include plans, elevations, sections, roughing-in dimensions, fabrication details, utility service requirements, and attachments to other work.

C. Samples: For each exposed product and for each color and texture specified.

D. Coordination Drawings: For foodservice facilities.

1. Indicate locations of foodservice equipment and connections to utilities.
2. Key equipment using same designations as indicated on Drawings.
3. Include plans and elevations; clearance requirements for equipment access and maintenance; details of equipment supports; and utility service characteristics.

E. Operation and maintenance data.

F. Sample warranties.

1.3 QUALITY ASSURANCE

A. NSF Standards: Provide equipment that bears NSF Certification Mark or UL Classification Mark certifying compliance with applicable NSF standards.

B. Regulatory Requirements: Install equipment to comply with the following:

1. ASHRAE 15, "Safety Code for Mechanical Refrigeration."
2. NFPA 54, "National Fuel Gas Code."
3. NFPA 70, "National Electrical Code."
4. NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations."

C. Seismic Restraints: Comply with SMACNA's "Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines," Appendix A, "Seismic Restraint Details," unless otherwise indicated.

1.4 WARRANTY

A. Refrigeration Compressor Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace compressors that fail in materials or workmanship within specified warranty period.

1. Failure includes, but is not limited to, inability to maintain set temperature.
2. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FOODSERVICE EQUIPMENT

A. Ice-Making Machine:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Scottsman AFE424A-1 self contained ice maker with storage or approved equal product.

2. Description: freestanding units.

a. Production: Ice flakes.
b. Capacity: 80 lb per 24-hour period.
c. Accessories:

1) Integral Storage Bin:

a) Storage Capacity: 80 lb.

2) Adjustable legs.
3) Water filter.
4) Ice scoop.

d. Electrical Service: Equip unit for connection to service indicated on Drawings.
e. ADA compatible.

2.2 FINISHES

A. Stainless-Steel Finishes:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

a. Run grain of directional finishes with long dimension of each piece.
b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

B. Powder-Coat Finishes: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard, baked-polymer, thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install foodservice equipment level and plumb, according to manufacturer's written instructions.

1. Connect equipment to utilities.
2. Provide cutouts in equipment, neatly formed, where required to run service lines through equipment to make final connections.

B. Complete equipment assembly where field assembly is required.

1. Provide closed butt and contact joints that do not require a filler.
2. Grind field welds on stainless-steel equipment until smooth and polish to match adjacent finish.

C. Install equipment with access and maintenance clearances that comply with manufacturer's written installation instructions and with requirements of authorities having jurisdiction.

D. Install cabinets and similar equipment on bases in a bed of sealant.

E. Install closure-trim strips and similar items requiring fasteners in a bed of sealant.

F. Install joint sealant in joints between equipment and abutting surfaces with continuous joint backing unless otherwise indicated. Produce airtight, watertight, vermin-proof, sanitary joints.

3.2 CLEANING AND PROTECTING

A. After completing installation of equipment, repair damaged finishes.

B. Clean and adjust equipment as required to produce ready-for-use condition.

C. Protect equipment from damage during remainder of the construction period.

3.3 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain foodservice equipment.

END OF SECTION 114000

SECTION 313116 - TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Soil treatment with termiticide.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for wood preservative treatment by pressure process.

1.3 PERFORMANCE REQUIREMENTS

A. Service Life of Soil Treatment: Soil treatment by use of a termiticide that is effective for not less than five years against infestation of subterranean termites.

1.4 SUBMITTALS

A. Product Data: For termiticide.

1. Include the EPA-Registered Label for termiticide products.

B. Product Certificates: For termite control products, signed by product manufacturer.

C. Qualification Data: For Installer of termite control products.

D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Brand name and manufacturer of termiticide.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes, and rates of application used.
6. Areas of application.
7. Water source for application.

E. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.

B. Regulatory Requirements: Formulate and apply termiticides according to the EPA-Registered Label.

C. Source Limitations: Obtain termite control products through one source from a single manufacturer for each product.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

1.7 COORDINATION

A. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Termiticides:

a. Aventis Environmental Science USA LP; Termidor.
b. Bayer Corporation; Premise 75.

c. Dow AgroSciences LLC; Dursban TC, Equity.
d. FMC Corporation, Agricultural Products Group; Talstar, Prevail FT, Torpedo.
e. Syngenta; Demon TC.

2.2 SOIL TREATMENT

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.

1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Adjacent soil including soil along the entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, piers, and chimney bases; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
3. Masonry: Treat voids.
4. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 313116

SECTION 21 05 00

FIRE PROTECTION GENERAL PROVISIONS

PART 1 GENERAL

1.1 SCOPE

A. Applicable requirements of the General Conditions, Supplementary General Conditions, and Special Conditions bound at the front of these specifications shall govern work under this heading.

B. The Contractor shall coordinate the work and equipment of this Division with the work and equipment specified elsewhere in order to assure a complete and satisfactory installation. Work such as excavation, backfill, concrete, flashing, wiring, etc., which is required by the work of this section shall be performed in accordance with the requirements of the applicable section of the specifications.

C. It is the intention of these specifications and drawings to call for finished work, tested and ready for operation. Whenever the word "provide" is used, it shall mean "furnish and install complete and ready for use".

D. Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work, the same as if herein specified or shown.

E. This Contractor is referred to the General and Special Conditions of the Contract which shall form a part and be included in this section of the specification and shall be binding on this Contractor.

F. Some items of equipment are specified in the singular; however, the Contractor shall provide and install the number of items or equipment as indicated on the drawings, and as required for complete systems.

1.2 DEFINITION

A. The word "Contractor" as used in this section of the specification refers to the Fire Protection Contractors unless specifically noted otherwise. The word "provide" means furnish, fabricated, complete, install, erect, including labor and incidental materials necessary to complete in place and ready for operation or use the item referred to or described herein and/or shown or referred to on the Contract Drawings.

1.3 CONTRACTOR'S QUALIFICATIONS

A. It is assumed that the Contractor has had sufficient general knowledge and experience to anticipate the needs of a construction of this nature. The Contractor shall furnish all items required to complete the construction in accordance with reasonable interpretation of the intent of the Drawings and Specifications. Any minor items required by code, law or regulations shall be provided whether or not specified or specifically shown where it is a part of a major item of equipment, or of the control system specified or shown on the plans.

PART 2 PRODUCTS

2.1 MATERIALS AND WORKMANSHIP

A. All materials and apparatus required for the work, except as specifically specified otherwise, shall be new, of first-class quality, and shall be furnished, delivered, erected, connected and finished in

every detail, and shall be so selected and arranged as to fit properly into the building spaces. Where no specific kind or quality of material is given, a first-class standard article as approved by the Architect shall be furnished.

B. The Contractor shall furnish the services of an experienced superintendent, who shall be constantly in charge of the installation of the work, together with all skilled workmen, fitters, metal workers, welders, helpers and labor required to unload, transfer, erect, connect-up, adjust, start, operate and test each system.

C. Unless otherwise specifically indicated on the plans or specifications, all equipment and material shall be installed with the approval of the Architect in accordance with the recommendations of the manufacturer. This shall include the performance of such tests as the manufacturer recommends.

D. All work must be done by first-class and experienced mechanics properly supervised and it is understood that the Architect has the right to stop any work that is not being properly done and has the right to demand that any workman deemed incompetent by the Architect be removed from the job and a competent workman substituted therefore.

2.2 EQUIPMENT APPLICATION AND PERFORMANCE

A. The Contractor and/or Equipment Supplier shall be responsible to see that equipment supplied is correct for the intended application and will perform within the limits of capacity, noise, life expectancy, pressure drop and space limitations intended for that equipment as shown on the plans or described in the specifications. The shop drawings shall show the capacity and operating characteristics of the equipment.

B. All equipment shall automatically restart after power outages. Motors shall restart after one minute delay unless specified otherwise.

2.3 EQUIPMENT DEVIATIONS

A. Where the Contractor proposes to use an item of equipment other than that specified or detailed on the drawings, which requires any redesign of the structure, partitions, foundations, piping, wiring or any other part of the mechanical, electrical, or architectural layout, all such redesign, and all new drawings and detailing required therefore, shall be prepared by the Subcontractor at his own expense and submitted for approval by the Architect.

B. Where such approved deviation requires a different quantity and arrangement of piping, wiring, conduit, and equipment from that specified or indicated on the drawings, the Contractor shall furnish and install any such piping, structural supports, insulation, controllers, motors, starters, electrical wiring and conduit, and any other additional equipment required by the system, at no additional cost to the Owner.

2.4 MOTORS

A. Motors shall be built in accordance with the latest standards of NEMA and as specified. Motors shall be tested in accordance with standards of A.S.A. C40 and conform thereto for installation resistance and dielectric strength. Each motor shall be provided with conduit terminal box, adequate starting and protective equipment as specified or required. The capacity shall be sufficient to operate associate driven devices under all conditions of operation and load and without overload, and at least shall be the horsepower indicated or specified. Each motor shall be selected for quiet operation. Motors shall be premium efficient with a minimum efficiency as specified by NEMA MG1-2006, Table 12-12. Motors shall be TEFC or TEAO construction as appropriate. ODP motors are not allowed. Motors shall be 1800 RPM whenever possible.

B. Motors 15 HP or less shall incorporate maintenance free sealed bearings.

2.5 FOUNDATIONS, SUPPORTS, PIERS, ATTACHMENTS

A. This Contractor shall furnish and install all necessary foundations, supports, pads, bases and piers required for all equipment, piping, pumps, tanks, compressors, and for all other equipment furnished under this contract, and shall submit drawings to the Architect for approval before purchase, fabrication or construction of same.

B. For pumps, compressors, and other rotating machinery and for all equipment where foundations are indicated, furnish and install concrete pads minimum 4 inches thick or as shown. All pads shall be extended six (6) inches beyond machine base in all directions with top edge hampered. Insert six (6) inch long, l/2" round steel dowel rods at 12" on center into floors to anchor pads. Shop drawings for all foundations and pads shall be submitted to the Architect for approval before same are constructed.

C. Construction of foundations, supports, pads, bases, and piers where mounted on the floor, shall be of the same materials and same quality of finish as the adjacent and surrounding flooring material.

D. All equipment, unless otherwise shown, shall be securely attached to the building structure in an approved manner. Attachments shall be of a strong and durable nature and any attachments that are, in the opinion of the Architect, not strong enough shall be replaced as directed.

2.6 DIELECTRIC CONNECTIONS

A. Dielectric connections shall be used at any points within the piping systems where dissimilar metals meet. Careful attention shall be given to support brackets and hangers to select proper materials to avoid dissimilar metal contact at these points.

2.7 DRAINS AND VENTS

A. In addition to the drains and vents indicated on the plans and piping details, the Contractor shall install additional drains and vents as required to remove all water and air from the piping systems.

2.8 MOTOR STARTERS AND DISCONNECTS

A. Individual motor controllers complete with auxiliary contacts, control transformers, push buttons, selector switches and remote push button stations not specifically specified to be furnished with the equipment shall be provided under this section. Motor controllers shall comply with NEMA Standards and be complete with proper size heaters and auxiliary contacts and shall be in NEMA enclosures as required. Unless otherwise noted, push button stations shall be oil-tight heavy duty type. Controllers shall be manual, magnetic, or combination type with disconnect switch or circuit breaker as indicated on the drawings or where required by the NEC. Controllers shall include motor over current protection in each phase conductor. Each motor controller shall be provided with phenolic nameplate, black with 1/4" high letters and white border, indicating equipment served, attached using counter sunk screws.

B. The Electrical Contractor shall furnish and install all disconnecting switches unless otherwise indicated or specified. Where disconnecting switches are indicated to be furnished under this Section, they shall be General Electric, Type TH in NEMA 1 enclosures, with voltage and amperage rating appropriate to the application. Unless otherwise noted, fuses shall be Buss "Fusetrons", or approved equal. Unfused motor disconnecting switches shall be Type TH in NEMA 1 or 4 applicable enclosures. Similar and equivalent equipment as manufactured by I.T.E., Square D, or Westinghouse is equally acceptable. Switches used as service switches shall bear such U.L. Label and nameplate on switch shall so indicate.

2.9 PAINTING

A. Paint material shall be selected from the products listed below and, insofar as practical, products of only one manufacturer shall be used. Contractor shall submit to the Architect the listed manufacturer he proposes to use in the work. Should the Contractor desire to use products of a manufacturer not listed below, or products made by a listed manufacturer but not scheduled herein, Contractor shall submit complete technical information on the proposed products to the Architect for approval. Only products approved by the Architect shall be used.

1. Rust Inhibitive Primer:
   a. Devoe: Bar-Ox Quick Dry Metal Primer, Red.
   b. Duron: Deluxe Red Primer.
   c. Glidden: Rustmaster Tank and Structure Primer.
   d. Pittsburgh: Inhibitive Red Primer.
2. Galvanized Metal Primer:
   a. Devoe: Mirrolac Galvanized Metal Primer.
   b. Duron: Duron Deluxe Galvanized Metal Primer
   c. Glidden: Rustmaster Galvanized Iron Metal Primer.
   d. Pittsburgh: Speedhigh Galvanized Steel Primer.

PART 3 EXECUTION

3.1 DUTIES OF CONTRACTOR

A. Contractor shall furnish and install all materials called for in these Specifications and accompanying drawings, and must furnish the apparatus complete in every respect. Anything called for in the specifications and not shown on the drawings or shown on the drawings and not called for in the specifications must be furnished by the Contractor.

B. Contractor is responsible for familiarizing himself with the details of the construction of the building. Work under these specifications installed improperly or which requires changing due to improper reading or interpretation of building plans shall be corrected and changed as directed by the Architect without additional cost to the Owner.

C. The Contractor shall follow drawings in laying out work and check drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, Architect shall be notified before proceeding with installation.

D. The plans are diagrammatic and are not intended to show each and every fitting, valve, pipe, pipe hanger, or a complete detail of all the work to be done; but are for the purpose of illustrating the type of system, showing pipe sizes, etc., and special conditions considered necessary for the experienced mechanic to take off his materials and lay out his work. This Contractor shall be responsible for taking such measurements as may be necessary at the job and adapting his work to local conditions.

E. Conditions sometimes occur which require certain changes in drawings and specifications. In the event that such changes in drawings and specifications are necessary, the same are to be made by the Contractor without expense to the Owner, providing such changes do not require furnishing more materials, or performing more labor than the true intent of the drawings and specifications demands. It is understood that while the drawings are to be followed as closely as circumstances will permit, the Contractor is held responsible for the installation of the system according to the true intent and meaning of the drawings. Anything not entirely clear in the drawings and specification will be fully explained if application is made to the Architect. Should, however, conditions arise

where in the judgment of the Contractor certain changes will be advisable, the Contractor will communicate with the Architect and secure his approval of these changes before going ahead with the work.

F. The right to make any responsible change in location of apparatus, equipment, routing of piping up to the time of roughing in, is reserved by the Architect without involving any additional expense to the Owner.

G. It shall be the duty of prospective Contractors to visit the job site and familiarize themselves with job conditions. No extras will be allowed because of additional work necessitated by, or changes in plans required because of evident job conditions, that are not indicated on the drawings.

H. Contractor shall determine the schedule of work as required by the General Contractor and must schedule his work to maintain the building construction schedule so as not to interfere with or hold up any other Contractors.

I. Contractor shall leave the premises in a clean and orderly manner upon completion of the work, and shall remove from the premises all debris that has accumulated during the progress of the work.

3.2 CODES, RULES, PERMITS AND FEES

A. The Contractor shall give all necessary notices, obtain all permits and pay all sales taxes, fees and other costs, including utility connections or extensions, in connection with his work; file all necessary plans prepare all documents and obtain all necessary approvals of all authorities having jurisdiction. Obtain all required certificates of inspection for his work and deliver same to the Architect before request for acceptance and final payment of the work.

B. The Contractor shall include in his work, without extra cost to the Owner, any labor, materials, service, apparatus, drawings, in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on drawings and/or specified.

C. All materials furnished and all work installed shall comply with the National Fire Codes of the National Fire Protection Association, and with the requirements of all governmental departments having jurisdiction.

D. All materials and equipment for the electrical portion of the mechanical system shall bear the approval label, and shall be listed by the Underwriters' Laboratories, Inc.

E. All work shall be done in accordance with the North Carolina State Building Code and requirements of governmental agencies having jurisdiction.

3.3 COOPERATION WITH OTHER TRADES

A. This Contractor shall give full cooperation to other trades and shall furnish any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.

B. Where the work of the Contractor will be installed in close proximity to, or may interfere with the work of other trades, he shall assist in working out space conditions to make a satisfactory adjustment. If so directed by the Architect, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than 3/8" = 1'-0", clearly showing how his work is to be installed in relation to the work of other trades. If the Contractor installs his work before coordination with other trades, or so as to cause any interference with work of other trades, he shall make the necessary changes in his work to correct the condition without extra charge.

3.4 RECORD DRAWINGS

A. The Contractor shall furnish drawings showing dimensioned location and depths of all exterior piping and structures, and shall indicate any and all changes in location of piping, ductwork, equipment or valves from that shown on the Contract Drawings. The drawings shall consist of clean, legible prints of the Contract Drawings, on which the Contractor shall mark all notes, dimensions, sizes and information required. The drawings shall be kept for this purpose only. Before final inspection the Contractor shall submit these drawings to the Architect.

B. The record drawings shall include mechanical identification on all serviceable components of piping and ductwork systems and shall reference applicable valve and damper tag charts and/or riser diagrams.

3.5 SURVEYS AND MEASUREMENTS

A. This Contractor shall base all measurements, both horizontal and vertical, from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.

B. Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the drawings and specifications, he shall notify the Architect through the General Contractor, and shall not proceed with his work until he has received instructions from the Architect.

3.6 SAFETY REQUIREMENTS

A. All systems shall be installed so as to be safe operating and all moving parts shall be covered where subject to human contact. All rough edges of equipment and materials shall be made smooth.

B. All safety controls shall be checked under the supervision of the Architect's representative and eight (8) copies of test date showing setting and performance of safety controls shall be submitted to the Architect.

3.7 SHOP DRAWINGS

A. Contractor shall submit within ten (10) days after award of contract eight (8) copies of a complete list of all manufacturers to be used on the job. No substitutions will be allowed after this date except in extenuating circumstances as determined by the Architect.

B. Submission of a manufacturer's name or equipment number on this list shall not be considered as equipment approved by the Architect.

C. The Contractor shall submit for approval eight (8) sets of detailed shop drawings of all equipment and all material required to complete the project, and no materials or equipment may be delivered to the job site or installed until the Contractor has in his possession the approved shop drawings for the particular material or equipment. The shop drawings shall be complete as described herein. The Contractor shall furnish the number of copies required by the General and Special Conditions of the Contract, but in no case less than eight (8) copies.

D. Prior to delivery of any material to the job site, and sufficiently in advance of requirements to allow the Architect ample time for checking, submit for approval detailed, dimensioned drawings or cuts, showing construction, size, arrangement, operating clearances, performance, characteristics and capacity. Each item of equipment proposed shall be standard catalog product of an established manufacturer and of equal quality, finish, performance, and durability to that specified.

E. Samples, drawings, specifications, catalogs, submitted for approval, shall be properly labeled indicating specific service for which material or equipment is to be used, Section and Article number of specification governing, Contractor's Name and Name of Job.

F. Catalogs, pamphlets, or other documents submitted to describe items on which approval is being requested, shall be specific and identification in catalog, pamphlet, etc. of item submitted shall be clearly marked. Data of a general nature will not be accepted. Data shall include eight (8) copies of computation sheets indicating how unit capacity was determined where ratings are at other than standard conditions. No payment for any equipment or labor will be allowed until all major pieces of equipment specified have been submitted to the Architect for approval.

G. The submittal of shop drawings shall be with the Contractor stamp affixed; this shall assure the Engineer that they are being submitted in accordance with Sub-Paragraph 4.13.4 in AIA Document A201 and/or Paragraph 6.26, in NSPE Document 1910-8. This stamp indicates that the Contractor, by approving and submitting shop drawings, represents that he has determined and verified all field measurements and quantities, field construction criteria, material, catalog material, and similar data that he has reviewed and coordinated information in the shop drawings with the requirements of the work and the Contract Documents. It, also, indicates that any deviation from the Contract Documents has been shown on the submittal and clearly defines the deviations from the specifications.

H. Approval rendered on shop drawings shall not be considered as a guarantee of quantities, measurements, or building conditions. Where drawings are approved, said approval does not mean that drawings have been checked in detail: said approval does not in any way relieve the Contractor from his responsibilities or necessity of furnishing material or performing work as required by the contract drawings and specifications.

I. Failure of the Contractor to submit shop drawings in ample time for checking shall not entitle him to an extension of Contract time, and no claim for extension by reason of default will be allowed.

J. All shop drawings and submittals are to be in the office of the Architect within 30 days after the Contracts have been awarded. Contractor shall be financially responsible for any price increase of shop drawing items from the time these drawings are issued until they are returned to the Contractor for purchase of items.

K. Contractor shall keep on the job at all times copies of all approved shop drawings.

3.8 OBSERVATION

A. The project will be observed periodically as construction progresses. The Contractor will be responsible for notifying the Architect at least 72 hours in advance when any work to be covered up is ready for inspection. No work will be covered up until after observation has been completed on such items as piping and insulation, etc.

3.9 ACCESSIBILITY

A. The Contractor shall locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Equipment shall include but not be limited to valves, traps, cleanouts, motors, controllers, and drain points. If required for better accessibility, furnish access doors for this purpose. Minor deviations from drawings may be made to allow for better accessibility and any change shall be submitted for approval.

3.10 CONCEALED PIPE

A. In general, all pipes in finished spaces shall be run concealed in floors, walls, partitions and above ceilings.

B. Concealment of pipe and covering of same shall not be done until authorized by the Architect, after proper tests have been made. This applies to all interior work and exterior work.

3.11 CUTTING AND PATCHING

A. This Contractor shall provide all cutting and patching necessary to install the work specified in this section.

B. No structural members shall be cut without the approval of the Architect and all such cutting shall be done in a manner directed by him.

C. This Contractor shall arrange for proper openings in building to admit his equipment. If it becomes necessary to cut any portion of building to admit his equipment, portions cut must be restored to their former condition by this Contractor through agreeable arrangement with the General Contractor.

D. The General Contractor will provide all openings or chases in masonry or concrete; however, it is this Contractor's responsibility to advise exact dimensions, shape and locations of openings required in sufficient time for the General Contractor to make the necessary provisions. This Contractor shall be responsible for correct size and location of each opening for his equipment even though these openings are provided by the General Contractor.

3.12 SLEEVES AND PLATES

A. This Contractor shall provide and locate all sleeves and inserts required before the floors and walls are built, or shall be responsible for the cost of cutting and patching required where sleeves and inserts were not installed, or where incorrectly located. This Contractor shall do all drilling required for the installation of his hangers.

B. Sleeves shall be provided for all mechanical piping passing through concrete floor slabs and concrete, masonry, tile and gypsum wall construction. Sleeves shall not be provided for piping running imbedded in concrete or in insulating concrete slabs on grade.

C. Where sleeves are placed in exterior walls below grade, the space between the pipe or conduit and the sleeves shall be packed with oakum and lead and made completely watertight.

D. Where pipe motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of pipe. Where sleeves pass insulated pipes, the sleeves shall be large enough to pass the pipe and insulation. Check floor and wall construction finishes to determine proper length of sleeves for various locations; make actual lengths to suit the following:

1. Terminate sleeves flush with walls, partitions and ceiling.
2. In areas where pipes are concealed, as in chases, terminate sleeves flush with floor or as shown on the plans.
3. In all areas where pipes are exposed, extend sleeves 1/4 inch above finished floor, except in rooms having floor drains, where sleeves shall be extended 3/4 inches above floor.

E. Sleeves shall be constructed of schedule 40 black steel pipe unless otherwise indicated on the drawings. Sleeves through concrete beams shall be constructed as indicated on the drawings.

F. Fasten sleeves securely in floor, walls, so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster, or other materials being forced into the space between pipe and sleeve during construction.

G. Where piping penetrates fire rated floors or walls, penetrations shall be sealed with a U.L. approved fire stopping system. System shall be as manufactured and detailed by 3M Company or approved equal.

H. Escutcheon plates shall be provided for all exposed pipes and all exposed conduit passing through walls, floors and ceilings. Plates shall be nickel plated, of the split ring type, of size to match the pipe or conduit. Where plates are provided for pipes passing through sleeves which extend above the floor surface, provide deep recessed plates to conceal the pipe sleeves.

3.13 UTILITIES

A. This Contractor shall bear the cost of utilities required to perform the work under this Contract. Where services such as electricity, hoist, etc. are provided by the General Contractor, he shall be responsible directly to the General Contractor for his portion of the utilities as may be agreed upon.

3.14 SCAFFOLDING, RIGGING, HOISTING

A. This Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises of any equipment and apparatus furnished. Remove same from premises when no longer required.

3.15 ELECTRICAL CONNECTIONS

A, The Electrical Contractor shall furnish and install all wiring except equipment control wiring and interlock wiring. The Electrical Contractor shall receive from the Fire Protection Contractor and mount all individually mounted motor starters and provide all power wiring to the motor terminals unless otherwise indicated. The Electrical Contractor will provide branch circuit protection and disconnects unless otherwise indicated or specified. The Fire Protection Contractor shall provide all other control and protective devices, and perform all control and interlock wiring required for the operation of the equipment.

B. After all circuits are energized and complete, the Electrical Contractor shall be responsible for all power wiring, and all control wiring shall be the responsibility of this Contractor. Motors and equipment shall be provided for current characteristics as shown on the drawings.

C. It shall be the responsibility of this Contractor to check with the Electrical Contractor on service outlets provided for this Contractor, to determine that the switches and wiring provided are of adequate size to meet Code requirements for this Contractor's equipment. Any discrepancy shall be brought to the attention of the Architect before work is installed. Otherwise, any cost for changes shall be at the expense of this Contractor, and in any case electrical cost increase due to equipment substitution of different electrical characteristics shall be this Contractor's expense.

3.16 PIPE WORK

A. All pipe work shown on the drawings and/or specifications or implied herein and required for a complete and operating system shall be done by experienced mechanics in a neat and workmanlike manner and subject to the approval of the Architect.

B. Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings and accessories which may be required and it shall be the responsibility of the Contractor to furnish and install all materials and equipment required for the operating systems.

C. The piping shall be installed as shown on the plans with strict conformity to the sizes listed and due provisions for expansion and contraction.

D. Unless otherwise noted on the plans, all piping shall be installed inside the insulated envelope of the building.

3.17 PROTECTION

A. The Contractor shall protect all work and material from damage, and shall be liable for all damage during construction.

B. The Contractor shall be responsible for work and equipment until all construction is finally inspected, tested and accepted. He shall protect work against theft, injury or damage; and shall carefully store material and equipment received on site which is not immediately installed. He shall close open ends of work including pipe, duct, or equipment with temporary covers or plugs during storage and construction to prevent entry of obstructing materials or dust and debris.

C. Provide a protective covering of not less than 0.004" thick vinyl sheeting (or a similar approved material) to be used in covering all items of equipment, immediately after the equipment has been set in place, (or if in a place of storage within the building under construction) to prevent the accumulation of dirt, sand, cement, plaster, paint or other foreign materials from collecting on the equipment and/or fouling working parts.

3.18 CLEANING

A. Clean from all exposed insulation and metal surfaces grease, debris or other foreign material.

B. Chrome plated fittings, fixtures, piping and trim shall be polished upon completion.

3.19 LABELS, TAGS, COLOR CODING AND INSTRUCTIONS

A. A tabulation shall be made of each panel number and circuit number serving each device with electrical service. This list shall be prepared and be ready to turn over to inspectors prior to calling for final inspection.

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

C. Stencils: Standard fiberboard stencils, prepared for required applications with letter sizes generally complying with recommendations of ANSI A13.1 for piping and similar applications shall be used. Stencil paint shall be standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.

D. Engraved Plastic-Laminate Signs

1. Provide engraving stock melamine plastic laminate, in the sizes and thickness indicated, engraved with engraver's standard letter style of the sizes and wording indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
2. Thickness: 1/16" for units up to 20 square inches or 8" length; 1/8" for larger units.
3. Fasteners: Self-tapping stainless steel screws.

E. Valve Tags

1. Brass Tags: Provide 19-gauge polished brass tags with stamp-engraved piping or duct system abbreviation in 1/4" high letters and sequenced numbers 1/2" high and with 5/32" hole for fastener. Provide 1-1/2" diameter tags except as otherwise indicated.
2. Plastic Laminate Tags: Provide manufacturer's standard 3/32" thick engraved plastic laminate tags, with piping or duct system abbreviation in 1/4" high letters and sequenced numbers 1/2" high, and with 5/32" hole for fastener. Provide 1-1/2" square black tags with white lettering, except as otherwise indicated.
3. Ceiling ID Tags: Provide manufacturer's standard 3/4" diameter ceiling tack, with color coding per owners standards.

F. Wrap-Around Plastic Identification

1. All piping identification shall adhere to ANSI A13.1 – 1981. Piping shall utilize pipe markers. All pipe markers shall be snap around whenever possible. Markers shall be located at each wall, floor or ceiling penetration, whether exterior or interior, and every 10 ft. thereafter. Markers shall be fully legible from floor level showing medium contained in pipe, and directional arrows.

G. Installation Requirements

1. Coordinate new labeling with existing labeling through Project Manager. Where identification is to be applied to surfaces that require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, identification shall be installed after completion of covering and painting. Identification is to be installed prior to installation of acoustical ceilings and similar removable concealment.

H. Piping System Identification

1. General: Provide for wrap around pipe marker plastic identification with application system as indicated in paragraph f. Include arrows to show normal direction of flow. For hot non-insulated pipes, install a segment of pipe insulation with appropriate piping identification.
2. Locate identification as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces and exterior non-concealed locations.
   a. Near each valve and control device.
   b. At locations where pipes pass through walls, floors, ceilings, or enter non-accessible enclosures.
   c. At major equipment items and other points of origination and termination.
   d. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
   e. On piping above removable acoustical ceilings, except omit intermediately spaced markers.
   f. Identify non potable piping and outlets.
3. The piping shall be color-coded in exposed locations by completely painting the piping with the indicated color. Use standard identification methods in concealed areas.

3.20 EQUIPMENT SERVICEABILITY

A. All equipment shall be serviceable. All equipment shall be installed so that it can be removed. All equipment in or connected to piping systems shall have valves to isolate this equipment from the piping system. Unions (screwed or flanged) shall be provided so that all equipment is removable.

B. Equipment installed in walls, ceilings or floors shall be accessible for service or removal without cutting walls, etc.

C. Equipment requiring periodic service shall be installed to allow clearance for service and have removable panels, access doors, etc. through which the service is to be performed.

3.21 ACCEPTANCE OF EQUIPMENT

A. In the event that the Architect considers it impractical, because of unsuitable test conditions, or some other factors, to execute simultaneous final acceptance of all equipment portions of the installation may be certified by the Architect for final acceptance when that portion of the system is complete and ready for operation.

B. Contractor shall make all necessary tests, trial operation balancing and balance tests, etc., as may be required as directed by the engineer to prove that all work under these plans and specification is in complete serviceable condition and will function as intended.

C. Upon completion of all work the system shall be tested to determine if any excess noise or vibration is apparent during operation of the system. If any such objections are detected in the system or noisy equipment found, the Contractor shall be responsible for correcting same. Equipment shall be wiped clean with all traces of oil, dust, dirt and paint spots removed.

3.22 GUARANTEE

A. The Contractor shall guarantee the complete mechanical system against defect due to faulty materials, faulty workmanship or failure due to negligence of the Contractor. This guarantee will exclude normal wear and tear, maintenance lubrication, replacement of expendable components, or abuse. The guarantee period shall begin on the date of the final acceptance and shall continue for a period of 12 months during which time the Contractor shall make good such defective workmanship and materials and any damage resulting there from, within a reasonable time of notice given by the Owner.

B. The period of Guarantee for equipment driven by electrical motors, etc., shall be 12 months from the date of acceptance.

3.23 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Submit 5 sets of complete operating and maintenance instructions.

B. Bind each set in plain black vinyl-covered, hard back, 3-ring binder. Individual paper shall be Boorum and Pease Reinforced Ring Book Sheet, No. S-212-101 or equivalent.

C. Organize material in the following format:

1. Section I:
   a. Name of Project
   b. Address
   c. Owner's Name
   d. General Contractor's Name and Address
   e. Fire Protection Contractor's Name and Address
   f. Warranty Dates
2. Section II:
   a. Major Equipment List (name, manufacturer, serial no., H.P. and voltage) (include all equipment with motors)
   b. Routine Maintenance Instructions in Step-by-Step form
   c. Valve Schedules
   d. Sound Power Level Readings (Where Required)
3. Section III:

a. Operating and Maintenance Instructions by Manufacturer
b. Shop Drawings (Major Requirement)
c. Wiring Diagrams

3.24 PAINTING

A. Painting shall be performed as detailed in Division 09.

B. All surfaces to receive paint shall be dry and clean.

C. Before priming, all surfaces shall be thoroughly cleaned of all dirt, oil, grease, rust, scale and other foreign matter. Cleaning shall be done with sandpaper, steel scraper, or wire brush where appropriate and necessary. Metallic surfaces which have been soldered shall be cleaned with benzol and all other metal surfaces washed with benzine.

D. Mixing shall be in galvanized iron pans. Paint shall be mixed in full compliance with manufacturer's directions. Thinning shall be done only in full compliance with manufacturer's directions.

E. Workmanship shall be highest quality, free from brush marks, laps, streaks, sags, unfinished patches, or other blemishes. Edges where paint joins other material or colors shall be sharp and clean without overlapping. Paint shall be brushed or sprayed on in strict compliance with manufacturer's directions and shall work evenly and be allowed to dry at least 48 hours before subsequent coating. Paint shall not be applied in damp or rainy weather or until surface has thoroughly dried. Contractor shall furnish and lay drop-cloths in all areas where painting is done as necessary to protect work of other trades. Varnish and enamel shall not be applied when temperature in the area is less than 60 degrees Fahrenheit nor paint when under 50 degrees Fahrenheit. Prior to final acceptance, Contractor shall touch up or restore any damaged finish. All insulation materials shall be provided with a paint suitable jacket.

F. The following materials and equipment require painting as noted:

1. All concealed piping, hangers and accessories except galvanized sheet piping:
   a. One coat rust-inhibitive primer.
2. All exposed, exterior and interior, piping, hangers and accessories, pumps, etc. except galvanized piping:
   a. One coat rust-inhibitive primer.
3. All concealed galvanized piping and accessories.
   a. One coat galvanized metal primer on threaded portions of piping and any damaged galvanized surfaces.
4. All exposed, exterior and interior galvanized piping and accessories.
   a. One coat galvanized metal primer.

G. All exposed piping shall be painted Crimson Red, 31 YR 10/591.

H. Do not paint sprinkler pipe until after the pressure test has been performed and the results are acceptable to the AHJ.

END OF SECTION

SECTION 21 13 00

FIRE PROTECTION

PART 1 GENERAL

1.1 SCOPE

A. This specification includes the furnishing of all labor, materials, equipment and service necessary or incidental to the complete installation testing, adjusting and placing into service of the several systems of fire protection, all as shown on the drawings and as hereinafter specified. Drawings and specifications are considered as mutually explanatory and all work called for by one and not the other shall be performed as though called for by both. In cases of conflicting information, the Architect/Engineer shall be notified at once in writing. Where incidental equipment or appurtenances as required, and are not listed as shown, same shall be furnished as required for a complete fire protection system.

B. Work included in this specification shall consist of, but is not necessarily limited to, the following items:

1. Arrange for, obtain and bear the cost of necessary permits, bonds and fees for the automatic sprinkler work.
2. Make the connection to the existing main.
3. Furnish and install sprinkler system to sprinkler the building where shown on the drawings. System to include all pipe, hangers, sprinkler heads, valves, controls, drains, and alarms.
4. Furnish and install all alarms, flow switches and alarm bells on the inside and outside of the building.
5. Do the testing of all piping work and necessary cleaning of the fire protection work.
6. Furnish the shop drawings and certificates of inspection.
7. Periodically remove from the job site all rubbish or debris resulting from the fire protection work.
8. Do all cutting and patching.
9. Miscellaneous items as hereinafter specified.

1.2 RELATED DOCUMENTS

A. The following related document shall apply to and govern the work in this section of the specifications:

1. General Conditions Section 21 05 00.

1.3 QUALIFICATIONS OF CONTRACTORS

A. The Contractor for the Fire Protection installation shall be a qualified Fire Protection Contractor, regularly engaged in the installation of automatic fire sprinkler systems and other fire protection equipment.

1.4 WORK BY OTHERS

A. Electrical Contractor to wire all water flow switches and tamper switches on valves to central alarm panel. He shall also wire alarm bells.

1.5 STANDARDS, CODES AND REGULATIONS

A. The applicable current standards for the fire protection systems shall be NFPA 13, the North Carolina State Building Code, and all other applicable state codes and ordinances.

1.6 SUBMITTAL (SHOP) DRAWINGS AND DATA

A. Before commencing any work or providing materials at the job site for this project, the Fire Protection Contractor shall submit to the Architect, for his approval, eight copies of catalog cuts and descriptive matter regarding materials and equipment which he intends to furnish and install. Shop drawings and data shall be submitted specifically for, but not limited to, the following items:

1. Sprinkler heads, valves, pipe, pipe hangers and couplings, hose valves and accessories.

B. The Fire Protection Contractor shall prepare construction (shop) drawings for automatic sprinkler work showing the arrangement of all automatic sprinkler piping and equipment, spacing of sprinkler heads, elevations of lines and details necessary for the conduct of work. The Contractor shall submit to the Architect, for approval, four (4) "Blue Line" prints of his construction drawings which have been examined and approved by the Owners Insurance Underwriter.

C. The Fire Protection Contractor shall not proceed with the installation of the work until he has received the Architect's approval of his shop drawings.

D. The Architect's approval of shop drawings, catalog cuts, etc., shall not relieve the Fire Protection Contractor of the responsibility for any errors or omissions which may exist in the items submitted, nor shall it relieve his from responsibility for deviations for the contract drawings or specifications. The stamped approval of the shop drawings, catalog cuts, etc. shall not be construed as a complete check, but will indicate only that the general design and method of construction is satisfactory.

E. In the event additional clarifying details are required by inspection authorities, the details shall be prepared and approval of same secured by the Fire Protection Contractor at his expense.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials and equipment furnished under this Section (211300) shall be new, approved by Underwriters' Laboratories, Inc. (UL), Factory Mutual (F/M), and American Water Works Association (AWWA) where applicable.

2.2 AUTOMATIC SPRINKLER SYSTEMS

A. Pipe shall be new, designed for 175 PSI working pressure, conforming to ASTM specifications, and have the manufacturer's name or brand, along with the applicable ASTM standard, marked on each length of pipe.

B. Pipe shall be steel, Schedule 40, black, and in accordance with specifications ASTM A120 or A53 or Schedule 10, black, and in accordance with specifications ASTM A135. All dry pipe system piping shall be galvanized.

2.3 FITTINGS

A. Screwed fittings shall be cast iron, 125 pound Class, black, and in accordance with ANSI B16.4 or malleable iron, 150 pound Class, black, and in accordance with ANSI B16.3.

B. Flanged fittings shall be cast iron, short body, Class 125, black, and in accordance with ANSI B16.1. Gaskets shall be full face of 1/8" minimum thickness red sheet rubber. Flange bolts shall be hexagon head machine bolts with heavy semi-flushed hexagon head nuts, cadmium plated, having dimensions in accordance with ANSI B18.2.

C. Weld fittings shall be steel standard weight, black, and in accordance with ANSI B16.9, ANSI B16.25, ASTM A234, ANSI B16.5 or ANSI B16.11.

D. Grooved couplings and mechanical fittings shall be malleable iron, 500 PSI working pressure, in accordance with ASTM A47. Coupling gasket material shall be butyl rubber. Grooved couplings shall be tested and listed by UL and/or FM. Mechanical locking fittings shall not be used.

2.4 VALVES

A. Outside screw and yoke (OS&Y) gate valves, shall be flanged, iron body, bronze mounted, 175 PSI working pressure, with handwheel turning counter-clockwise to open. Valve shall be tested and listed by UL and/or FM.

B. Check valve (ck.v.) shall be flanged, swing type, iron body, bronze seat ring and disc rings and 175 PSI pressure rating. Valve shall be tested and listed by UL and/or FM.

C. Check valve (ck.v) shall be butterfly wafer style, iron body, rubber seal, and 250 PSI pressure rating. Valve shall be tested and listed by UL and/or FM.

E. Valve for main riser drain shall be angle type or globe type, bronze body, screwed, 200 PSI pressure rating, 2" size, and a renewable composition soft disc.

F. Valve for auxiliary drain and inspector's test connection shall be globe type, bronze body, screwed, 200 PSI pressure rating, 1" size and a renewable composition soft disc.

2.5 ACCESSORIES

A. Air compressor for dry pipe system shall be base mounted, tankless single stage, splash lubricated, 110 volt electric driven, enclosed belt guard, and automatic start and stop pressure switch.

B. At each location where called for on plans, or where required by the Fire Department, provide an approved retard-type electric flow alarm switch. Provide alarm bells as required by governing code. Flow alarm switch shall have extra set of contacts for extension by others to central alarm panel.

1. Interior bell or horn shall be 12, 24 or 120 volt, AC or DC. Horn or bell shall be tested and listed by UL and/or FM.
2. Exterior bell or horn shall be weatherproof 12, 24 or 120 volt, AC or DC. Horn or bell shall be tested and listed by UL and/or FM.
3. Flow switch shall be vane type 12, 24 or 120 volt AC or DC. Flow switch shall be tested and listed by UL and/or FM.
4. OS&Y gate valve supervisory switch shall be 12, 24 or 120 volts, AC or DC. Supervisory switch shall be tested and listed by UL and/or FM.
5. Indicator post supervisory switch shall be weatherproof 12, 24 or 120 volt, AC or DC. Supervisory switch shall be tested and listed by UL and/or FM.

C. Sprinkler heads shall be upright, pendent, concealed, vertical sidewall, horizontal sidewall, and/or dry pendent type as required, 1/2" and/or 17/32" orifice, 1/2" and/or 3/4" pipe thread, rated 165 degrees F., 212 degrees F., and/or 286 degrees F. Sprinklers in areas with suspended ceilings shall be chrome plated with escutcheons. Sprinklers shall be tested and listed by UL and/or FM. Furnish steel enameled box housing 12 spare heads and a sprinkler wrench.

PART 3 EXECUTION

3.1 RECORD DRAWINGS

A. Contractor shall keep an accurate record of the location of all site firewater lines and site potable water lines installed by him and shall provide Owner upon completion of the work with a drawing showing all location dimensions and elevations.

3.2 AUTOMATIC SPRINKLER SYSTEMS

A. Schedule 40 black steel pipe shall be joined by screwed joints in accordance with specification ANSI B2.1, by welded joints in accordance with specifications ANSI B31.10, ANSI B31.1.0a and ANSI B31.1.0b, and by mechanical grooved couplings or push-on couplings, joined by a UL and FM approved combination of couplings, gaskets and grooves. Grooves may be rolled or cut and they shall be dimensionally compatible with the couplings.

B. Schedule 10 black steel ASTM A135 sprinkler pipe shall be joined by welded joints in accordance with specifications ANSI B31.1.0, ANSI couplings. Couplings may be of the rolled groove type or the mechanical locking type (push-on). Grooves for the rolled groove type shall be dimensionally compatible with the coupling. Pipe end preparation for the mechanical locking type couplings will be in according with the manufacturer's recommendations.

C. The interior surfaces of all piping and equipment shall be clean and free of all dirt, loose scale, rust, and other foreign material before installation.

D. Pipe ends shall be reamed to remove all burrs, and pipe sections shall be cleaned inside to remove all chips and foreign material prior to making up joints. Approved joint compound shall be applied to the threads of the pipe and not in the fitting when making up joints. Pipe shall not extend into the waterway of the fitting.

E. Sprinkler heads installed where they may be exposed or subjected to mechanical damage shall be furnished complete with head guards.

F. When welding pipe on job site, the fire hazard of the welding process shall be suitably safeguarded.

G. Pipe passing through building walls and floors above grade shall be provided with sleeves of standard weight galvanized steel pipe. The annular spaces between pipe and sleeves shall be packed tight with link seal hydrostatic pipe wall sleeve. Provide chrome plated escutcheon plates large enough to cover the pipe sleeve. Sleeves shall be sized in accordance with NFPA 13.

3.3 PIPE SUPPORTS

A. All piping shall be supported by means of hangers tested and listed as approved by UL and/or FM. Sizing, spacing and installation shall be in accordance with National Fire Protection Association Standard No. 13 "Sprinkler Systems", except as otherwise shown on drawings or specified herein.

B. No cutting, drilling, welding or burning of any structural steel member shall be allowed. Power driven studs and welding studs shall not be allowed.

C. All bolts and threaded rods shall be used with double nut washer, or single nut, washer and lock washer wherever a single unsecured nut could work loose and allow either threaded rod or supported piping to drop.

D. Starting length, end length and alternate lengths of main piping with grooved joint couplings shall be provided with two supports.

3.4 TESTS AND INSPECTION

A. The Fire Protection Contractor shall conduct and bear the costs of all necessary tests of the fire protection work, furnishing all labor power and equipment. All piping shall be tested with water, the tests witnessed by representatives of the Architect.

B. The fire protection piping shall be tested under a hydrostatic pressure of not less than 200 pounds PSIG, for a duration of not less than two (2) hours.

C. The piping subjected to the hydrostatic test shall be filled with water and thoroughly checked for the elimination of all air. The control valves of existing risers shall be closed during pressure testing of the new connection to the main. All joints shall be proven tight or acceptable by the test. Defective work or materials shall be corrected or replaced in an approved manner. If necessary, piping shall be dismantled and reassembled with the use of new pipe or fittings, as no caulking or makeshift method of temporary repair of defective work will be permitted. Tests shall be repeated until the particular line or system receives the approval of the representatives of the Architect.

D. Acceptance of the automatic sprinkler work shall be based upon the inspection and tests of the completed installation by representative of the local Fire Department and Architect.

3.5 WATER DAMAGE

A. The Fire Protection Contractor shall be responsible for any damage to the work of others, to building and property/materials of others caused by leaks in automatic sprinkler equipment, unplugged or disconnected pipes or fittings, and shall pay for necessary replacement or repair of work or items so damaged during the installation and testing periods of the automatic sprinkler work.

3.6 HYDRAULIC CALCULATIONS

A. The fire protection system is based on a combination of standpipe, sprinkler risers and sprinkler system. The Fire Protection Contractor shall prepare hydraulic calculations for the design of the system and submit for approval to the Engineer and Insurance Underwriters.

3.7 IDENTIFICATION SIGNS AND CHARTS

A. The drain, alarm test valves, etc., shall have standard identification signs, painted fire red with white lettering. The signs shall be attached to the valve in a conspicuous position.

END OF SECTION

SECTION 22 05 00

PLUMBING GENERAL PROVISIONS

PART 1 GENERAL

1.1 SCOPE

A. The Contractor shall coordinate the work and equipment of this Division with the work and equipment specified elsewhere in order to assure a complete and satisfactory installation. Work such as excavation, backfill, concrete, flashing, wiring, etc., which is required by the work of this section shall be performed in accordance with the requirements of the applicable section of the specifications.

B. Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work, the same as if herein specified or shown.

1.2 DEFINITION

A. The word "Contractor" as used in this section of the specification refers to the Plumbing Contractor unless specifically noted otherwise. The word "provide" means furnish, fabricated, complete, install, erect, including labor and incidental materials necessary to complete in place and ready for operation or use the item referred to or described herein and/or shown or referred to on the Contract Drawings.

1.3 CONTRACTOR'S QUALIFICATIONS

A. It is assumed that the Contractor has had sufficient general knowledge and experience to anticipate the needs of a construction of this nature. The Contractor shall furnish all items required to complete the construction in accordance with reasonable interpretation of the intent of the Drawings and Specifications. Any minor items required by code, law or regulations shall be provided whether or not specified or specifically shown where it is a part of a major item of equipment, or of the control system specified or shown on the plans.

PART 2 PRODUCTS

2.1 MATERIALS AND WORKMANSHIP

A. All materials and apparatus required for the work, except as specifically specified otherwise, shall be new, of first-class quality, and shall be furnished, delivered, erected, connected and finished in every detail, and shall be so selected and arranged as to fit properly into the building spaces. Where no specific kind or quality of material is given, a first-class standard article as approved by the Architect shall be furnished.

B. The Contractor shall furnish the services of an experienced superintendent, who shall be constantly in charge of the installation of the work, together with all skilled workmen, fitters, metal workers, welders, helpers and labor required to unload, transfer, erect, connect-up, adjust, start, operate and test each system.

C. Unless otherwise specifically indicated on the plans or specifications, all equipment and material shall be installed with the approval of the Architect in accordance with the recommendations of the manufacturer. This shall include the performance of such tests as the manufacturer recommends.

D. All work must be done by first-class and experienced mechanics properly supervised and it is understood that the Architect has the right to stop any work that is not being properly done and has the right to demand that any workman deemed incompetent by the Architect be removed from the job and a competent workman substituted therefor.

2.2 EQUIPMENT APPLICATION AND PERFORMANCE

A. The Contractor and/or Equipment Supplier shall be responsible to see that equipment supplied is correct for the intended application and will perform within the limits of capacity, noise, life expectancy, pressure drop and space limitations intended for that equipment as shown on the plans or described in the specifications. The shop drawings shall show the capacity and operating characteristics of the equipment.

2.3 EQUIPMENT DEVIATIONS

A. Where the Contractor proposes to use an item of equipment other than that specified or detailed on the drawings, which requires any redesign of the structure, partitions, foundations, piping, wiring or any other part of the mechanical, electrical, or architectural layout, all such redesign, and all new drawings and detailing required therefor, shall be prepared by the Subcontractor at his own expense and submitted for approval by the Architect.

B. Where such approved deviation requires a different quantity and arrangement of piping, wiring, conduit, and equipment from that specified or indicated on the drawings, the Contractor shall furnish and install any such piping, structural supports, insulation, controllers, motors, starters, electrical wiring and conduit, and any other additional equipment required by the system, at no additional cost to the Owner.

2.4 MOTORS

A. Motors shall be built in accordance with the latest standards of NEMA and as specified. Motors shall be tested in accordance with standards of A.S.A. C40 and conform thereto for installation resistance and dielectric strength. Each motor shall be provided with conduit terminal box, adequate starting and protective equipment as specified or required. The capacity shall be sufficient to operate associate driven devices under all conditions of operation and load and without overload, and at least shall be the horsepower indicated or specified. Each motor shall be selected for quiet operation. Motors 1 HP or more shall have a minimum acceptable nominal full load efficiency not less than that shown in Table 10.2 of ASHRAE Standard 90.1 – 1999 Edition.

2.6 FOUNDATIONS, SUPPORTS, PIERS, ATTACHMENTS

A. This Contractor shall furnish and install all necessary foundations, supports, pads, bases and piers required for all air conditioning equipment, piping, pumps, tanks, compressors, and for all other equipment furnished under this contract, and shall submit drawings to the Architect for approval before purchase, fabrication or construction of same.

B. For all equipment where foundations are indicated, furnish and install concrete pads minimum 4 inches thick or as shown. All pads shall be extended six (6) inches beyond machine base in all directions with top edge hampered. Insert six (6) inch long, l/2" round steel dowel rods at 12" on center into floors to anchor pads. Shop drawings for all foundations and pads shall be submitted to the Architect for approval before same are constructed.

C. Construction of foundations, supports, pads, bases, and piers where mounted on the floor, shall be of the same materials and same quality of finish as the adjacent and surrounding flooring material.

D. All equipment, unless otherwise shown, shall be securely attached to the building structure in an approved manner. Attachments shall be of a strong and durable nature and any attachments that are, in the opinion of the Architect, not strong enough shall be replaced as directed.

2.7 DIELECTRIC CONNECTIONS

A. Dielectric connections shall be used at any points within the piping systems where dissimilar metals meet. Careful attention shall be given to support brackets and hangers to select proper materials to avoid dissimilar metal contact at these points.

2.8 DRAINS AND VENTS

A. In addition to the drains and vents indicated on the plans and piping details, the Contractor shall install additional drains and vents as required to remove all water and air from the piping systems.

2.9 MOTOR STARTERS AND DISCONNECTS

A. Individual motor controllers complete with auxiliary contacts, control transformers, push buttons, selector switches and remote push button stations not specifically specified to be furnished with the equipment shall be provided under this section. Motor controllers shall comply with NEMA Standards and be complete with proper size heaters and auxiliary contacts and shall be in NEMA enclosures as required. Unless otherwise noted, push button stations shall be oil-tight heavy duty type. Controllers shall be manual, magnetic, or combination type with disconnect switch or circuit breaker as indicated on the drawings or where required by the NEC. Controllers shall include motor overcurrent protection in each phase conductor. Each motor controller shall be provided with phenolic nameplate, black with 1/4" high letters and white border, indicating equipment served, attached using counter sunk screws.

B. The Electrical Contractor shall furnish and install all disconnecting switches unless otherwise indicated or specified. Where disconnecting switches are indicated to be furnished under this Section, they shall be General Electric, Type TH in NEMA 1 enclosures, with voltage and amperage rating appropriate to the application. Unless otherwise noted, fuses shall be Buss "Fusetrons", or approved equal. Unfused motor disconnecting switches shall be Type TH in NEMA 1 or 4 applicable enclosures. Similar and equivalent equipment as manufactured by I.T.E., Square D, or Westinghouse is equally acceptable. Switches used as service switches shall bear such U.L. Label and nameplate on switch shall so indicate.

2.10 PAINTING

A. Paint material shall be selected from the products listed below and, insofar as practical, products of only one manufacturer shall be used. Contractor shall submit to the Architect the listed manufacturer he proposes to use in the work. Should the Contractor desire to use products of a manufacturer not listed below, or products made by a listed manufacturer but not scheduled herein, Contractor shall submit complete technical information on the proposed products to the Architect for approval. Only products approved by the Architect shall be used.

1. Rust Inhibitive Primer:
   a. Devoe: Ready-Mixed Red No. 20.
   b. Duron: Deluxe Red Primer.
   c. Glidden: Rustmaster Tank and Structure Primer.

d. Pittsburgh: Inhibitive Red Primer.

2. Galvanized Metal Primer:
   a. Devoe: Devoe Zinc Dust Primer.
   b. Duron: Duron Deluxe Galvanized Metal Primer
   c. Glidden: Rustmaster Galvanized Iron Metal Primer.
   d. Pittsburgh: Speedhigh Galvanized Steel Primer.

PART 3 EXECUTION

3.1 DUTIES OF CONTRACTOR

A. Contractor shall furnish and install all materials called for in these Specifications and accompanying drawings, and must furnish the apparatus complete in every respect. Anything called for in the specifications and not shown on the drawings or shown on the drawings and not called for in the specifications, must be furnished by the Contractor.

B. The Contractor shall follow drawings in laying out work and check drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. Where headroom or space condition appears inadequate, Architect shall be notified before proceeding with installation.

C. The plans are diagrammatic and are not intended to show each and every fitting, valve, pipe, pipe hanger, or a complete detail of all the work to be done; but are for the purpose of illustrating the type of system, showing pipe sizes, etc., and special conditions considered necessary for the experienced mechanic to take off his materials and lay out his work. This Contractor shall be responsible for taking such measurements as may be necessary at the job and adapting his work to local conditions.

D. The right to make any responsible change in location of apparatus, equipment, routing of piping up to the time of roughing in, is reserved by the Architect without involving any additional expense to the Owner.

3.2 CODES, RULES, PERMITS AND FEES

A. All materials furnished and all work installed shall comply with the National Fire Codes of the National Fire Protection Association, and with the requirements of all governmental departments having jurisdiction.

B. All materials and equipment for the electrical portion of the mechanical system shall bear the approval label, and shall be listed by the Underwriters' Laboratories, Inc.

C. All work shall be done in accordance with the North Carolina State Building Code, and requirements of governmental agencies having jurisdiction.

3.3 COOPERATION WITH OTHER TRADES

A. This Contractor shall give full cooperation to other trades and shall furnish any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.

B. Where the work of the Contractor will be installed in close proximity to, or may interfere with the work of other trades, he shall assist in working out space conditions to make a satisfactory adjustment. If so directed by the Architect, the Contractor shall prepare composite working

drawings and sections at a suitable scale not less than 3/8" = 1'-0", clearly showing how his work is to be installed in relation to the work of other trades. If the Contractor installs his work before coordination with other trades, or so as to cause any interference with work of other trades, he shall make the necessary changes in his work to correct the condition without extra charge.

C. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

3.4 RECORD DRAWINGS

A. The Contractor shall furnish drawings showing dimensioned location and depths of all exterior piping and structures, and shall indicate any and all changes in location of piping, ductwork, equipment or valves from that shown on the Contract Drawings. The drawings shall consist of clean, legible sepia prints of the Contract Drawings, available from the Architect on which the Contractor shall mark all notes, dimensions, sizes and information required. The sepias shall be kept for this purpose only. Before final inspection the Contractor shall submit to the Architect eight (8) sets of black line prints of the sepias.

3.5 SURVEYS AND MEASUREMENTS

A. This Contractor shall base all measurements, both horizontal and vertical, from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.

B. Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the drawings and specifications, he shall notify the Architect through the General Contractor, and shall not proceed with his work until he has received instructions from the Architect.

3.6 SAFETY REQUIREMENTS

A. All systems shall be installed so as to be safe operating and all moving parts shall be covered where subject to human contact. All rough edges of equipment and materials shall be made smooth.

B. All safety controls shall be checked under the supervision of the Architect's representative and eight (8) copies of test date showing setting and performance of safety controls shall be submitted to the Architect. All pressure vessels shall be ASME stamped and shall have stamped relief valves. Water heaters shall be provided with ASME stamped T & P relief valve.

3.7 SHOP DRAWINGS

A. The Contractor shall submit for approval eight (8) sets of detailed shop drawings of all equipment and all material required to complete the project, and no materials or equipment may be delivered to the job site or installed until the Contractor has in his possession the approved shop drawings for the particular material or equipment. The shop drawings shall be complete as described herein.

B. Catalogs, pamphlets, or other documents submitted to describe items on which approval is being requested, shall be specific and identification in catalog, pamphlet, etc. of item submitted shall be clearly marked. Data of a general nature will not be accepted. Data shall include eight (8) copies of computation sheets indicating how unit capacity was determined where ratings are at other than standard conditions. No payment for any equipment or labor will be allowed until all major pieces of equipment specified have been submitted to the Architect for approval.

3.8 ACCESSIBILITY

A. Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in double partitions and hung ceilings for the proper installation of his work. He shall cooperate with the General Contractor and all other Contractors whose work is in the same space, and shall advise the General Contractor of his requirements. Such spaces and clearances shall; however, be kept to the minimum size required.

B. The Contractor shall locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Equipment shall include but not be limited to valves, traps, cleanouts, motors, controllers, switch-gear, and drain points. If required for better accessibility, furnish access doors for this purpose. Minor deviations from drawings may be made to allow for better accessibility and any change shall be submitted for approval.

C. The Contractor shall provide the General Contractor with exact locations of access panels for each concealed valve or other device requiring service. Access panels shall be provided and installed by the General Contractor and as specified in the Architectural sections of the specifications. Locations of these panels shall be submitted in sufficient time to be installed in the normal course of work.

3.9 CONCEALED PIPE

A. In general, all pipe in finished spaces shall be run concealed in floors, walls, partitions and above ceilings.

B. Concealment of pipe and covering of same shall not be done until authorized by the Architect, after proper tests have been made. This applies to all interior work and exterior work.

3.10 CUTTING AND PATCHING

A. This Contractor shall provide all cutting and patching necessary to install the work specified in this section. Comply with requirements of Division 01 Section "Cutting and Patching."

3.11 SLEEVES AND PLATES

A. This Contractor shall provide and locate all sleeves and inserts required before the floors and walls are built, or shall be responsible for the cost of cutting and patching required where sleeves and inserts were not installed, or where incorrectly located. This Contractor shall do all drilling required for the installation of his hangers.

B. Sleeves shall be provided for all mechanical piping passing through concrete floor slabs and concrete, masonry, tile and gypsum wall construction. Sleeves shall not be provided for piping running imbedded in concrete or in insulating concrete slabs on grade.

C. Where sleeves are placed in exterior walls below grade, the space between the pipe or conduit and the sleeves shall be packed with oakum and lead and made completely watertight.

D. Where pipe motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of pipe. Where sleeves pass insulated pipes, the sleeves shall be large enough to pass the pipe and insulation. Check floor and wall construction finishes to determine proper length of sleeves for various locations; make actual lengths to suit the following:

E. Terminate sleeves flush with walls, partitions and ceiling.

F. In areas where pipes are concealed, as in chases, terminate sleeves flush with floor or as shown on the plans.

G. In all areas where pipes are exposed, extend sleeves 1/4 inch above finished floor, except in rooms having floor drains, where sleeves shall be extended 3/4 inches above floor.

H. Sleeves shall be constructed of schedule 40 black steel pipe unless otherwise indicated on the drawings. Sleeves through concrete beams shall be constructed as indicated on the drawings.

I. Fasten sleeves securely in floor, walls, so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster, or other materials being forced into the space between pipe and sleeve during construction.

J. Where piping penetrates fire rated floors or walls, penetrations shall be sealed with a U.L. approved fire stopping system. System shall be as manufactured and detailed by 3M Company or approved equal.

K. Escutcheon plates shall be provided for all exposed pipes and all exposed conduit passing through walls, floors and ceilings. Plates shall be nickel plated, of the split ring type, of size to match the pipe or conduit. Where plates are provided for pipes passing through sleeves which extend above the floor surface, provide deep recessed plates to conceal the pipe sleeves.

3.12 SCAFFOLDING, RIGGING, HOISTING

A. This Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises of any equipment and apparatus furnished. Remove same from premises when no longer required.

3.13 EXCAVATING AND BACKFILLING

A. Each trade shall perform all excavation and backfill required for the installation of its work.

B. Particular care shall be taken not to disturb or damage work of other Contractors.

C. Mass excavation to approximate levels will be carried out under a section of the architectural specifications. The Contractor shall, however, do all trench and pit excavation and backfilling required for work under this section of the specifications, inside and outside the building, including repairing of finished surfaces and all required shoring, bracing, pumping and all protection for safety of persons and property. State and OSHA Safety Codes shall be strictly observed. In addition, it shall be the responsibility of the Contractor to check the indicated elevations of the utilities entering and leaving the building. If such elevations require excavations lower than the footing levels, the Architect shall be notified of such conditions and a redesign shall be made before excavations are commenced. It is also the responsibility of the Contractor to make the excavations at the minimum required depths in order to avoid undercutting the footings.

D. No backfilling shall be done until work involved has been tested and approved by the Architect.

E. Contractor shall schedule excavation work so as not to unduly interfere with work of other trades on the job. Contractor shall be responsible for establishing all lines and grades required for proper location of his work.

F. When rock is encountered in excavation, it shall be paid for as outlined under the architectural section of these specifications.

G. In backfilling pipe trenches, approved fill shall first be compacted firmly and evenly on both sides of pipe in 6" layers to a depth of 12" over the top of the pipe. Remainder of trench shall be backfilled to established grade in 6" layers. Compact between each layer with a high-frequency vibrator tamper such as Dart Soil Compactor (as manufactured by Dart Manufacturing Company, Denver, Colorado). Fill shall be compacted to density specified under Earth Work Section of specifications for specified area through which trench passes. Compact fill to 95% maximum density at optimum moisture content all other areas. Earth bearing pressure as indicated shall be verified by a testing laboratory, which following the criteria specified for foundation wall trench, etc. in the Earth Work Section of the specifications. The reports shall be forwarded to the Architect for approval unless otherwise specified, the cost will be borne by this contractor, before any work is performed. If the earth bearing pressure is less than that required, the Contractor shall not begin additional work until notified by the Architect to do so. A copy of the report shall be forwarded to the Architect in triplicate.

H. Excess earth shall be distributed on premises as directed by the Architect.

I. Where ditches occur outside the building, the surface shall be finished to match existing surfaces. Any existing work or work of other trades which is damaged or disturbed shall be repaired or replaced, and left in good order.

3.14 ELECTRICAL CONNECTIONS

A. The Electrical Contractor shall furnish and install all wiring except: (1) temperature control wiring; (2) equipment control wiring and (3) interlock wiring. The Electrical Contractor shall receive from the Mechanical Contractor and mount all individually mounted motor starters and provide all power wiring to the motor terminals unless otherwise indicated. The Electrical Contractor will provide branch circuit protection and disconnects unless otherwise indicated or specified. The Mechanical Contractor shall provide all other control and protective devices, and perform all control and interlock wiring required for the operation of the equipment. Power wiring, from nearest panel, for control components (dampers, panels, etc.) shall be provided by the Mechanical Contractor unless specifically called for by Division 16.

B. After all circuits are energized and complete, the Electrical Contractor shall be responsible for all power wiring, and all control wiring shall be the responsibility of this Contractor. Motors and equipment shall be provided for current characteristics as shown on the drawings.

D. It shall be the responsibility of this Contractor to check with the Electrical Contractor on service outlets provided for this Contractor, to determine that the switches and wiring provided are of adequate size to meet Code requirements for this Contractor's equipment. Any discrepancy shall be brought to the attention of the Architect before work is installed. Otherwise, any cost for changes shall be at the expense of this Contractor, and in any case electrical cost increase due to equipment substitution of different electrical characteristics shall be this Contractor's expense.

3.15 PIPE WORK

A. All pipe work shown on the drawings and/or specifications or implied herein and required for a complete and operating system shall be done by experienced mechanics in a neat and workmanlike manner and subject to the approval of the Architect.

B. Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings and accessories which may be required and it shall be the responsibility of the Contractor to furnish and install all materials and equipment required for the operating systems.

C. The piping shall be installed as shown on the plans with strict conformity to the sizes listed and due provisions for expansion and contraction.

D. Unless otherwise noted on the plans, all piping shall be installed inside the insulated envelope of the building.

3.16 LUBRICATION

A. All bearing, except those specifically requiring oil lubrication, shall be pressure lubricated. All lubrication points shall be readily accessible, away from locations dangerous to workmen. In areas where lubrication points are not readily accessible Contractor shall provide extended lubrication tubes to positions where lubrication can be easily accomplished. Pressure grease lubrication fittings shall be "Zerk-Hydraulic" type as made by the Stewart-Warner Corporation, or approved equal, for each type of grease required.

B. The Contractor shall furnish lubrication charts or schedules for each piece of equipment or machinery. The charts or schedules shall designate each point of lubrication. Eight (8) copies of charts and schedules shall be submitted to the Architect prior to final inspection and approved copies of each schedule and chart shall be framed by the Contractor in metal frames with glass front and installed in the Equipment Room.

3.17 PROTECTION

A. The Contractor shall protect all work and material from damage, and shall be liable for all damage during construction.

B. The Contractor shall be responsible for work and equipment until all construction is finally inspected, tested and accepted. He shall protect work against theft, injury or damage; and shall carefully store material and equipment received on site which is not immediately installed. He shall close open ends of work including pipe, duct, or equipment with temporary covers or plugs during storage and construction to prevent entry of obstructing materials or dust and debris.

C. Provide a protective covering of not less than 0.004" thick vinyl sheeting (or a similar approved material) to be used in covering all items of equipment, immediately after the equipment has been set in place, (or if in a place of storage within the building under construction) to prevent the accumulation of dirt, sand, cement, plaster, paint or other foreign materials from collecting on the equipment and/or fouling working parts.

3.18 CLEANING

A. Clean from all exposed insulation and metal surfaces grease, debris or other foreign material.

B. Chrome plated fittings, fixtures, piping and trim shall be polished upon completion.

3.20 VALVE AND MOTOR TAGS AND SCHEDULE

A. Each valve and motor shall be provided with an engraved black finish, phenolic tag indicating service and number. Tag lettering shall be at least 1/4" high etched white letters and beveled white trim. Tags to be attached using brass chains.

B. The Contractor shall submit eight (8) copies of charts indicating number, location, service, "normal" position, manufacturer, size and model number to the Architect for approval.

C. Prior to final inspection an approved copy of each chart shall be framed by the Contractor in a metal frame with glass front and installed in the Equipment Room.

3.21 EQUIPMENT SERVICEABILITY

A. All equipment shall be serviceable. All equipment shall be installed so that it can be removed. All equipment in or connected to piping systems shall have valves to isolate this equipment from the piping system. This includes, but not necessarily limited to control valves, water heaters, sensors, switches, pumps, traps and strainers. Unions (screwed or flanged) shall be provided so that all equipment is removable.

B. Equipment installed in walls, ceilings or floors shall be accessible for service or removal without cutting walls, etc.

C. Equipment requiring periodic service shall be installed to allow clearance for service and have removable panels, access doors, etc. through which the service is to be performed.

3.22 ACCEPTANCE OF EQUIPMENT

A. In the event that the Architect considers it impractical, because of unsuitable test conditions, or some other factors, to execute simultaneous final acceptance of all equipment portions of the installation may be certified by the Architect for final acceptance when that portion of the system is complete and ready for operation.

B. Contractor shall make all necessary tests, trial operation balancing and balance tests, etc., as may be required as directed by the engineer to prove that all work under these plans and specification is in complete serviceable condition and will function as intended. Oil burners and gas burners shall be started by a representative of the equipment manufacturer. All costs of these procedures shall be borne by this Contractor.

C. Upon completion of all work the system shall be tested to determine if any excess noise or vibration is apparent during operation of the system. If any such objections are detected in the system or noisy equipment found, the Contractor shall be responsible for correcting same. Equipment shall be wiped clean with all traces of oil, dust, dirt and paint spots removed. Bearings shall be lubricated as recommended by the equipment manufacturer. All control valves and equipments shall be adjusted to setting indicated.

3.23 GUARANTEE

A. The Contractor shall guarantee the complete mechanical system against defect due to faulty materials, faulty workmanship or failure due to negligence of the Contractor. This guarantee will exclude normal wear and tear, maintenance lubrication, replacement of expendable components, or abuse. The guarantee period shall begin on the date of the final acceptance and shall continue for a period of 12 months during which time the Contractor shall make good such defective workmanship and materials and any damage resulting therefrom, within a reasonable time of notice given by the Owner.

3.24 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Submit 3 sets of complete operating and maintenance instructions.

B. Bind each set in plain black vinyl-covered, hard back, 3-ring binder. Individual paper shall be Boorum and Pease Reinforced Ring Book Sheet, No. S-212-101 or equivalent.

B. Organize material in the following format:

1. Section I:
   a. Name of Project
   b. Address
   c. Owner's Name
   d. General Contractor's Name and Address
   e. Contractor's Name and Address
   f. Warranty Dates
3. Section II:
   a. Major Equipment List (name, manufacturer, serial no., H.P. and voltage) (include all equipment with motors)
   b. Routine Maintenance Instructions in Step-by-Step form
   c. Lubrication Charts and Schedules
   d. Valve Schedules
   e. Sound Power Level Readings (Where Required)
4. Section III:
   a. Operating and Maintenance Instructions by Manufacturer
   b. Shop Drawings (Major Requirement)
   c. Wiring Diagrams

3.25 PAINTING

A. Painting shall be performed as detailed in Division 09.

B. All surfaces to receive paint shall be dry and clean.

C. Before priming, all surfaces shall be thoroughly cleaned of all dirt, oil, grease, rust, scale and other foreign matter. Cleaning shall be done with sandpaper, steel scraper, or wire brush where appropriate and necessary. Metallic surfaces which have been soldered shall be cleaned with benzol and all other metal surfaces washed with benzine.

D. Mixing shall be in galvanized iron pans. Paint shall be mixed in full compliance with manufacturer's directions. Thinning shall be done only in full compliance with manufacturer's directions.

E. Workmanship shall be highest quality, free from brush marks, laps, streaks, sags, unfinished patches, or other blemishes. Edges where paint joins other material or colors shall be sharp and clean without overlapping. Paint shall be brushed or sprayed on in strict compliance with manufacturer's directions and shall work evenly and be allowed to dry at least 48 hours before subsequent coating. Paint shall not be applied in damp or rainey weather or until surface has thoroughly dried. Contractor shall furnish and lay drop-cloths in all areas where painting is done as necessary to protect work of other trades. Varnish and enamel shall not be applied when temperature in the area is less than 60 degrees Fahrenheit nor paint when under 50 degrees Fahrenheit. Prior to final acceptance, Contractor shall touch up or restore any damaged finish. All insulation materials shall be provided with a paint suitable jacket.

F. The following materials and equipment require painting as noted:

1. All concealed piping, sheet metal, hangers and accessories except galvanized sheet metal or piping and tar coated cast iron piping:
   a. One coat rust-inhibitive primer except where exterior insulation is provided.
2. All exposed exterior and interior, piping, sheet metal, hangers and accessories, pumps, etc. except galvanized sheet metal or piping and tar coated cast iron piping:
   a. One coat rust-inhibitive primer except where exterior insulation is provided.
3. All concealed galvanized sheet metal, piping and accessories.
   a. One coat galvanized metal primer on threaded portions of piping and any damaged galvanized surfaces.
4. All exposed exterior and interior galvanized sheet metal, piping and accessories.
   a. One coat galvanized metal primer except where exterior insulation is provided.
5. All tar coated cast iron piping, and accessories.
   a. Two coats tar coat paint on any damaged surfaces.
6. All exposed exterior and interior, insulation equipment.
   a. Two coats exterior glass enamel over paint suitable insulation jacket.

G. All piping in Equipment Rooms shall be painted (color shown below) and identified by stenciling with letters minimum 1/2" high in a contrasting color. Piping outside Equipment Rooms shall be stenciled. Stenciling shall occur at each change of direction and every 20 feet. Arrows should be placed adjacent to letters signifying direction of flow.

1. Standard piping color codes:
   a. Hot Water - Dark Yellow (Gold)
   b. Cold Water - Dark Green
   c. Drains - Natural with Walls
   d. Electrical - Natural with Walls

H. All gas piping in shall be painted Light Yellow and identified by stenciling with letters minimum ½ " high in a contrasting color. Stenciling shall occur at each change of direction and every 20 feet. Arrows should be placed adjacent to letters signifying direction of flow.

END OF SECTION

SECTION 22 05 01

BASIC MATERIALS AND METHODS (PLUMBING)

PART 1 GENERAL

1.1 DESCRIPTION

A. The provisions of Section 22 05 00 apply to all the work in this Section.

B. This section of specifications and related drawings describe requirements pertaining to basic materials and methods.

1.2 SUBMITTALS

A. Submit the following in accordance with Section 22 05 00:

1. Manufacturer's cuts.
2. Certified capacity ratings.
3. Installation instructions.
4. Operating and Maintenance Instructions.

PART 2 PRODUCTS

2.1 PIPE SPECIALTIES

A. Pipe specialty equipment shall be provided on all piping on all piping system as specified or as required by code.

B. Provide dielectric unions on the inlet and outlet connection to water heaters storage tanks and at all places where dissimilar metals join in piping and plumbing systems. Use dielectric unions as manufactured by Watts Regulator Inc., Zurn/Wilkins, Victaulic or equal.

C. Vacuum breaker shall be provided on each hose outlet. This includes hose bibbs, service sinks, wall hydrants, etc.

D. Air chambers shall be provided on the water supply to each plumbing fixture. Air chambers shall be one pipe size larger than the line in which they occur and shall extend vertically 18" up and cap. In lieu of air cushions, a system of pulsation absorbers may be submitted, provided the system is selected in accordance with PDI Standard W-201. Absorbers shall be by JOSAM, ZURN, SMITH or approved equal.

E. Valves and Accessories

1. Provide valves as indicated and required as scheduled below. Figure numbers are provided to indicate type and quality. Insofar as possible, all valves shall be by a single manufacturer as specified or approved equal.

MANUFACTURER	GATES 125#	GLOBES 150#	CHECK 125#
NIBCO	T134	T235-Y	T413-B
CRANE	428-UB	7	37
STOCKHAM	B-105	B-22	B-319

F. SOLDER ENDS, SCREWED BONNET GATES, UNION BONNET GLOBES, (Globes with Teflon disc):

MANUFACTURER	GATES 125#	GLOBES 150#	CHECK 125#
NIBCO	S111	S235-Y	S413-B
CRANE	428-UB	-	1342
STOCKHAM	B-109	B-24	B-309

G. Hose end gate valves, 3/4 - 2" shall be JENKINS NO. 372, CRANE 451, POWELL 503 or approved equal.

H. Wall hydrants shall be cast brass non-freeze, heavy duty with polished chrome face, brass operating parts, adjustment locknut, renewable nylon seat, 3/4" standard hose outlet, locking cover.

I. Ball valves shall be full port Cast Red Bronze with Two Piece Body. When installed in insulated piing furnish extended tee handle. All isolation valves above ceiling shall be ball valves.

2.2 HANGERS AND SUPPORTS

A. Pipe supports shall be provided for all piping. Pipe support components shall conform to accepted standards.

B. Hangers shall adequately support the piping system. On horizontal, hangers shall be located near or at changes in piping direction and concentrated loads. They shall provide vertical adjustment to maintain pitch required for proper drainage. They shall allow for expansion and contraction of the piping.

C. Horizontal lines of copper tubing shall be supported as below:

Nominal Tubing Size	Rod Diameter	Maximum Spacing
Up to 1 inch	3/8 inch	6 feet
1-1/4" and 1-1/2"	3/8 inch	8 feet
2 inches	3/8 inch	9 feet
2-1/2 inches	1/2 inch	9 feet
3 and 4 inches	1/2 inch	10 feet

D. Horizontal cast iron soil pipe shall be supported with one hanger for each pipe length and at fittings as required for proper support with hanger located close to hub or joint.

E. Vertical Piping: When support locations are not indicated on the drawings, cast iron pipe shall be supported at every floor and cast iron soil pipe, and copper pipe at every other floor or as required to prevent vibration.

F. Devices for attaching pipe supports to building structure shall be provided as required and shall be as herein specified.

1. Grinnell Type CB insert shall be provided for poured-in-place concrete construction. Drilled inserts approved equal to "Phillips" self-drilling inserts shall be provided in existing concrete construction and in precast and cast-in-place concrete construction where drilled inserts are approved by the Engineer. Other type inserts, if required, are specified in the section of this Division requiring such inserts.

2. Grinnell Figure 86 malleable C - clamp with restraining clip shall be provided for attaching 2" and smaller piping to steel structure. MSS-SP-69 malleable beam clamp with extension piece shall be provided for attaching 2-1/2" and larger piping to steel structure.

G. Intermediate attachments shall be hanger rods of size herein before specified and with vibration control devices as specified in the separate section of the Division. Rods may be continuous threaded or threaded each end as required. No chain, wire or perforated strap hangers shall be used.

H. Pipe attachments and spring hangers shall be as specified in individual section of this Division of the specifications.

2.3 ESCUTCHEON PLATES

A. Pipes entering finished or occupied areas shall be provided with polished chrome plated escutcheon plates, held in place with set screws. Escutcheon plates shall be Grinnell Figure 20 or approved equal.

PART 3 EXECUTION

3.1 GENERAL

A. All products shall be installed as per the manufacturer's instructions.

3.2 CLEANING UP

A. Cleaning up is the responsibility of the Contractor. During construction, the site shall be kept neat so as not to be a safety hazard. Upon completion of the work, all surplus construction materials and debris shall be removed from the property.

END OF SECTION

SECTION 22 07 00

INSULATION (PLUMBING)

PART 1 GENERAL

1.1 DESCRIPTION

A. This section of specifications and related drawings describe requirements pertaining to insulation.

B. Provide all insulation in conjunction with equipment and piping furnished under this division.

C. The provisions of Section 22 05 00 apply to all the work in this section.

1.2 QUALITY ASSURANCE

A. Products of the manufacturers listed under MATERIALS will be acceptable for use for the specific functions noted. Adhesives, sealers, vapor barriers, and coatings shall be compatible with the materials to which they are applied, and shall not corrode, soften or otherwise attack such material in either the wet or dry state.

B. Materials shall be applied subject to their temperature limits. Any methods of application of insulating materials or finishes not specified in detail herein shall be in accordance with the particular manufacturer's published recommendations.

C. Insulation shall be applied by experienced workers regularly employed for this type of work.

1.3 SUBMITTALS

A. Submit the following in accordance with Section 22 05 00:

1. Catalog cuts.
2. Materials ratings.
3. Insulation instructions.

1.4 RATING

A. Insulation and accessories such as adhesives, mastics, cements, tape and jackets, unless noted otherwise, shall have a flame spread rating of not more than 25 and a smoke developed rating of not more than 50. Materials that are factory applied shall be tested individually. No fugitive or corrosive treatments shall be employed to impart flame resistance.

B. Flame spread and smoke developed ratings shall be determined by Method of Test of Surface Burning Characteristics of Building Materials, NFPA No. 255, ASTM E-84, UL 723.

C. Products of their shipping cartons shall bear a label indicating that flame and smoke ratings do not exceed above requirements.

D. Treatment of jackets or facings to impart flame and smoke safety shall be permanent. The use or water-soluble treatment is prohibited.

E. Certify in writing, prior to installation, that products to be used will meet RATING criteria.

PART 2 PRODUCTS

2.1 PIPE INSULATION

A. Materials shall be heavy density fiberglass with an all-service jacket composed of an outer layer of vinyl, fiberglass scrim cloth, aluminum foil, and kraft paper, in that order, from outside to inside of pipe covering.

1. Domestic cold water supply and hot water supply and return piping.

B. Thicknesses:

1. Domestic cold water supply: All pipe sizes: 1".
2. Domestic hot water supply and return: Pipe size 2-1/2" and larger - 1-1/2", Pipe size 2" and smaller - 1".

2.2 EQUIPMENT

A. Tanks and other equipment handling hot water (not factory insulated). Insulate with semi-rigid fiberglass board 1-1/2" thick. Cut to fit and cover with 8 oz. canvas jacket.

PART 3 EXECUTION

3.1 PIPE INSULATION

A. Application. Insulation and surfaces to be insulated shall be clean and dry when insulation is installed and during the application of any finish.

C. Fiberglass Insulation. All fiberglass pipe covering shall be furnished with self-seal lap and 3" wide butt joint strips. The release paper is pulled from adhesive edge, pipe covering closed tightly around pipe and self-seal lap rubbed hard in place with the blunt edge of an insulation knife. This procedure applies to longitudinal as well as circumferential joints. Under no circumstances will staples be allowed. Care shall be taken to keep jacket clean, as it is the finish on all exposed work. All adjoining insulation sections shall be firmly butted together before butt joint strip is applied, and all cold water service lines shall have vapor seal mastic thoroughly coated to pipe at butt joints every 21' and at all fittings. All fittings, valve bodies, unions, and flanges shall be finished as follows:

1. Apply molded or segmental insulation to fittings equal in thickness to the insulation on adjoining pipe and wire in place with 2#14 copper wires.
2. Apply a skim coat of insulating cement to the insulated fitting, if needed, to produce a smooth surface. After cement is dry, apply Owens-Corning Fiberglass Fitting Mastic, Type C, UL labeled.
3. Wrap the fitting with fiberglass reinforcing cloth overlapping the preceding layer by 1 to 2". Also, overlap mastic and cloth by 2" on adjoining sections of pipe insulation.
4. Apply a second coat of mastic over cloth, working it well into mesh of cloth and smooth the surface. Mastic to be applied at the rate of 40 square feet per gallon. All flanges and fittings on hot and cold lines in utility tunnels shall be insulated according to above. Omit insulation on flanges and unions over 60 degrees F. If painting is required, no sizing is necessary. To maintain the non-combustibility of the system only Glidden acrylic latex paint (#5370) is to be used.
5. All piping exposed to view (equipment rooms, etc.) shall be covered with an 8 oz. canvas jacket.

END OF SECTION

SECTION 22 11 16

DOMESTIC WATER SUPPLY PIPING

PART 1 GENERAL

1.1 SCOPE

A. The provisions of Section 22 05 00 and 22 07 00 apply to all the work in this Section.

B. Contractor shall furnish and install domestic water systems as shown on the plans complete in all respects.

C. Connect to water main and provide supply lines to all fixtures and equipment requiring water service.

1.2 SUBMITTALS

A. Manufacturer's cuts.

PART 2 PRODUCTS

2.1 WATER PIPING AND FITTINGS

A. Water Piping

1. All water piping shall be hard drawn copper tubing ASTM B 88 Type "L" above grade, Type "K" below grade. Fittings for copper tubing shall be ANSI B16.18 or B16.22 solder joint fittings. Ends of pipe shall be reamed, pipe and fittings cleaned. Use only 95-5 (95% tin and 5% antimony) solder with non-corrosive flux on 1-1/4" and smaller and on 1-1/2" and larger use silver solder (Minimum 12% Silver), with a melting point greater than 1000oF. Submit solder for approval.

PART 3 EXECUTION

3.1 INSTALLATION

A. Piping shall be installed so as to be free floating. 125 pound copper sweat pattern unions shall be provided in the piping as indicated on the drawings. Provide dielectric insulating unions where copper connects to ferrous piping. Use brass nipples or copper adapters at connections to fixtures.

B. Provide isolation valves for each individual riser and toilet group as required to service system.

C. Runouts

1. Runouts to fixtures shall be grouted in place at the fixture stop to prevent pipe movement at this point. Use concrete mortar grout. Remove insulation from pipe before grouting.
2. Runouts to urinal and water closet flush valves in block and concrete walls shall have an 8" long piece of 1/2" copper, flattened and soldered to the runout and anchored in the wall. Runouts in stud walls shall have a piece of 1/2" copper flattened and soldered to the runout and fastened to studs with 1/4" bolts with nuts and flat washers (two bolts each end).

D. Unions

1. Unions shall be installed at each piece of equipment.

3.2 STERILIZATION OF WATER PIPING

A. Sterilization of water piping shall be in accordance with AWWA Specification 0601. After the pressure tests have been made, the system shall be flushed with water. The chlorinating material shall be liquid chlorine-water mixture calcium hypochlorite, sodium hypochlorite, or chlorinated lime-water mixture. The solution shall have not less than 50 PPM available chlorine. The disinfecting solution shall be allowed to remain in the system for a minimum period of 24 hours. After disinfection, the system shall be flushed with clean water until residual chlorine content is not greater than .02 PPM. After the system is flushed, water samples shall be taken and tested at the Contractor's expense by an independent testing lab and reports shall be furnished to the engineer's for approval. If the water is found unsafe for human consumption, the disinfection procedure shall be repeated.

3.3 PIPE TEST

A. All water supply piping shall be testing before fixtures or faucets are connected by capping or plugging the openings and applying a hydrostatic test pressure of 150 psig. Pressure shall hold constant (exception for temperature variation) for a period of 24 hours or as directed by the Engineer.

B. Pipe found defective during tests shall be replaced at no additional cost to the Owner. Pipe joints found defective during tests shall be taken apart and remade.

C. The Contractor shall notify the Architect 72 hours before tests are to be made. Concealed work shall remain uncovered until specified tests are completed. All tests shall be conducted in the presence of the Architect or his representative. Repairs to defects disclosed by the test shall be made with new materials. Caulking of screwed joints, cracks or holes will not be permitted. Test shall be repeated until system is proven tight.

END OF SECTION

SECTION 22 13 00

SOIL, WASTE, VENT, AND DRAIN PIPING

PART 1 GENERAL

1.1 SCOPE

A. The provisions of Section 22 05 00 apply to all the work in this Section.

B. All fixtures and equipment specified as requiring waste shall be connected to the sewer system. The sewer system shall be extended as shown on the drawings.

1.2 SUBMITTALS

A. Submit the following in accordance with Section 22 05 00

1. Manufacturer's cuts.
2. Installation instructions.

PART 2 PRODUCTS

2.1 SOIL, WASTE, VENT AND DRAIN PIPING

A. **Soil, waste, vent and drain piping shall be PVC plastic drain, waste and vent pipe and fittings conforming to ASTM D 2665.**

2.2 WASTE ARMS

A. Waste arms serving lavatories, counter sinks and water coolers shall be threaded galvanized schedule 40 steel with schedule 40 drainage pattern fittings and adapters.

B. Waste arms serving urinals shall be standard pipe size threaded red brass pipe, with red brass threaded fittings.

2.3 SPECIALTIES

A. Cleanout Plugs: Cleanouts shall be of the same size as the pipe except that cleanout plugs larger than 4" will not be required. Cleanouts shall consist of long sweep fittings to an easily accessible place.

B. Traps: Each fixture and piece of equipment including floor drains and hub drains, requiring connections to the drainage system shall be equipped with a trap placed as near to the fixture as possible. No fixtures shall be double trapped. Traps for floor drains and hub drains shall be deep seal "P" traps. All other traps shall be supplied under the "Fixture Paragraph".

C. Floor Flanges: Cast iron floor flanges shall be provided for connection of all floor outlet water closets. The joint between the closet trap and the floor flange shall be made tight with a red or black rubber fixture setting gasket.

D. Flashing: Vent pipes shall be flashed and made watertight as the roof with 4 pound sheet lead. Flashing shall extend not less than 8" from the vent pipes in all directions. Flashing shall be

extended up the vent pipes and shall be turned down into the pipe. Minimum vent through the roof shall be 2" size.

E. Floor Drains: Floor drains shall be sized as indicated on the drawings. See plans for model number. Drains by Zurn, Josam, Jay R. Smith or equal will be acceptable.

PART 3 EXECUTION

3.1 PIPE INSTALLATION

A. Horizontal drain and waste piping with the building shall be given a grade of 1/8" per foot below ground and 1/8" per foot above ceilings unless otherwise indicated on the drawings. Piping 3" and smaller shall have minimum grade of 1/4" per foot. Main vertical soil and waste stacks shall be extended full size to the roof line and 12" above as vents, unless otherwise indicated on the drawings. Fittings shall be service weight when used on service weight pipe. Reduction of the size of drainage piping in the direction of flow is prohibited. Vent or tap tees will not be permitted on waste lines.

3.2 JOINTS

A. Joints for PVC pipe shall be solvent cement in accordance with the manufacturer's instructions.

3.3 CLEANOUTS

A. Cleanouts shall be installed where shown on the drawings but in no case shall they be more than 50 feet apart in piping 3" and under and 75 feet apart in piping 4" and larger.

3.4 PIPE TEST

A. All new soil, waste, drainage and vent piping shall be tested before fixtures are installed by capping or plugging the openings, except for the highest opening, and filling the entire system with water. If the system is tested in sections the minimum acceptable head shall be 10 ft. of water column. In testing successive sections, at least the upper 10 ft. of the preceding section shall be tested so that no joint or pipe within the building (except the uppermost 10 ft. of the system) shall have been submitted to a test of less than 10 ft. head of water. The water column shall be allowed to stand thus filled for a period of four hours.

B. Pipe found defective during tests shall be replaced at no additional cost to the Owner. Pipe joints found defective during tests shall be taken apart and remade.

C. The Contractor shall notify the Architect 72 hours before tests are to be made. Concealed work shall remain uncovered until specified tests are completed. All tests shall be conducted in the presence of the Architect or his representative. Repairs to defects disclosed by the test shall be made with new materials. Caulking of screwed joints, cracks or holes will not be permitted. Test shall be repeated until system is proven tight.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES AND EQUIPMENT

PART 1 GENERAL

1.1 DESCRIPTION

A. The provisions of Section 22 05 00 apply to all work in this Section.

B. The Contractor shall furnish and install all plumbing fixtures complete with all equipment, fittings, trimmings and supports as specified.

C. Products designed for dispensing potable water shall meet both the NSF 61 and NSF 372 standard.

1.2 SUBMITTALS

A. Submit the following in accordance with Section 22 05 00.

1. Manufacturer's cuts.
2. Certified capacity ratings.
3. Installation instructions.
4. Operating and Maintenance Instructions.

PART 2 PRODUCTS

2.1 FIXTURES

A. Flush Tank Water Closets. ASME A112.19.2/CSA B45.1, white vitreous china, siphon jet, elongated bowl, pressure assisted, floor-mounted, floor outlet. Provide wax bowl ring including plastic sleeve. Water flushing volume of the water closet shall not exceed 1.6 gallons per flush. Provide white solid plastic round closed-front seat with cover.

B. Wall Hung Lavatories. ASME A112.19.2/CSA B45.1, white, enameled cat iron straight back type, with supply openings for use with top mounted centerset faucets, and openings for concealed arm carrier installation. Provide aerator with faucet. Water flow rate shall not exceed 0.5 gpm when measured at a flowing water pressure of 60 psi. Provide ASME A112.6.1M concealed chair carriers with vertical steel pipe supports and concealed arms for the lavatory.

C. Kitchen Sinks. ASME A112.19.3/CSA B45.4, 18 gage stainless steel with integral mounting rim for flush installation with undersides fully sound deadened, with supply openings for use with top mounted washerless sink faucets with hose spray (where specified), and with 3.5 inch drain outlet. Provide aerator with faucet. Water flow rate shall not exceed 0.5 gpm when measured at a flowing water pressure of 60 psi. Provide stainless steel drain outlets and stainless steel cup strainers. Provide separate 1.5 inch P-trap and drain piping to vertical vent piping from each compartment.

D. Service Sinks. ASME A112.19.2/CSA B45.1, white vitreous china with integral back and wall hanger supports with two supply openings in back. Provide floor supported wall outlet cast iron P-trap and stainless steel rim guards as recommended by service sink manufacturer. Provide back mounted washerless service sink faucets with vacuum breaker and 0.75 inch external hose threads.

E. Plastic Shower Stalls. IAPMO Z124.1.2 four piece white solid acrylic pressure molded fiberglass reinforced plastic shower stalls. Shower stalls shall be scratch resistant, waterproof, and reinforced. Showerhead water flow rate shall not exceed 2.2 gpm when measured at a flowing water pressure of 80 psi. Provide recessed type shower stalls approximately 36 inches wide 36 inches front to rear 76 inches high, and 5 inch high curb with shower stall bottom or feet firmly supported by a smooth level floor. Provide PVC shower floor drains and stainless steel strainers. Shower stalls shall meet performance requirements of IAPMO Z124.1.2 and shall be labeled by NAHB Research Foundation, Inc. for compliance. Install shower stall in accordance with the manufacturer's written instructions. Finish installation by covering shower stall attachment flanges with dry-wall in accordance with shower stall manufacturer's recommendation. Provide smooth 100 percent silicone rubber white bathtub caulk between the top, sides, and bottom of shower stalls and bathroom walls and floors.

F. Emergency Eyewash and Shower. ANSI/ISEA Z358.1, floor supported free standing unit. Provide deluge shower head, stay-open ball valve operated by pull rod and ring or triangular handle. Provide eyewash and stay-open ball valve operated by foot treadle or push handle.

2.2 SEALED COMBUSTION GAS FIRED HEATER

A. Water heater shall be of seamless glass lined steel tank construction in which the glass coating is applied to the water side surfaces of the tank after the tank has been assembled and welded. The condensing flue coil shall be coated on the flue gas side with acid resistant glass lining designed for use in condensing heaters.

B. The heater shall be suitable for sealed combustion direct venting using a PVC air intake pipe and PVC exhaust pipe. Piping shall be sized according to manufacturer's recommendations. The heater shall be factory assembled and tested. The power burner shall be of a design that requires no special calibrations on start up. The heater(s) shall be approved for 0" clearances to combustibles.

C. The control shall be an integrated solid state temperature and ignition control device with integral diagnostics, LED fault display capability and a digital display of temperature settings.

D. The tanks shall be foam insulated and equipped with a ASME rated temperature pressure relief valve. The water heater shall be UL listed and exceed the minimum efficiency requirements of ASHRAE/IES 90.1b-1992.

E. The heater shall be listed by SCAQMD Rule 1146.2 Low NOx.

F. Units with a storage capacity of 120 gallons or more shall be constructed and stamped pursuant to the ASME Code, Section IV, or Section VIII, Division 1, as applicable.

G. Units with an input capacity of 200,000 BTUH or more shall be constructed and stamped pursuant to the ASME Code, Section IV, or Section VIII, Division 1, as applicable.

PART 3 EXECUTION

3.1 GENERAL

A. Install all fixtures as per manufacturer's requirements and local codes.

3.2 MANUFACTURERS START-UP

A. For each gas burner, start-up service shall be provided through the manufacturers representative and shall include the burner equipment and controls.

3.3 CAULKING

A. Fixtures, fittings and accessories shall be caulked at floor and wall perimeter and behind flanges and fittings in a fashion that the wall openings are sealed, but no sealant is exposed.

B. Caulking shall be silicone rubber.

C. Install all caulking per manufacturer's instructions.

END OF SECTION

SECTION 23 05 00

MECHANICAL GENERAL PROVISIONS

PART 1 GENERAL

1.1 SCOPE

A. The Contractor shall coordinate the work and equipment of this Division with the work and equipment specified elsewhere in order to assure a complete and satisfactory installation. Work such as excavation, backfill, concrete, flashing, wiring, etc., which is required by the work of this section shall be performed in accordance with the requirements of the applicable section of the specifications.

B. Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work, the same as if herein specified or shown.

1.2 DEFINITION

A. The word "Contractor" as used in this section of the specification refers to the HVAC Contractor unless specifically noted otherwise. The word "provide" means furnish, fabricated, complete, install, erect, including labor and incidental materials necessary to complete in place and ready for operation or use the item referred to or described herein and/or shown or referred to on the Contract Drawings.

1.3 CONTRACTOR'S QUALIFICATIONS

A. It is assumed that the Contractor has had sufficient general knowledge and experience to anticipate the needs of a construction of this nature. The Contractor shall furnish all items required to complete the construction in accordance with reasonable interpretation of the intent of the Drawings and Specifications. Any minor items required by code, law or regulations shall be provided whether or not specified or specifically shown where it is a part of a major item of equipment, or of the control system specified or shown on the plans.

PART 2 PRODUCTS

2.1 MATERIALS AND WORKMANSHIP

A. All materials and apparatus required for the work, except as specifically specified otherwise, shall be new, of first-class quality, and shall be furnished, delivered, erected, connected and finished in every detail, and shall be so selected and arranged as to fit properly into the building spaces. Where no specific kind or quality of material is given, a first-class standard article as approved by the Architect shall be furnished.

B. The Contractor shall furnish the services of an experienced superintendent, who shall be constantly in charge of the installation of the work, together with all skilled workmen, fitters, metal workers, welders, helpers and labor required to unload, transfer, erect, connect-up, adjust, start, operate and test each system.

C. Unless otherwise specifically indicated on the plans or specifications, all equipment and material shall be installed with the approval of the Architect in accordance with the recommendations of the manufacturer. This shall include the performance of such tests as the manufacturer recommends.

D. All work must be done by first-class and experienced mechanics properly supervised and it is understood that the Architect has the right to stop any work that is not being properly done and has the right to demand that any workman deemed incompetent by the Architect be removed from the job and a competent workman substituted therefor.

2.2 EQUIPMENT APPLICATION AND PERFORMANCE

A. The Contractor and/or Equipment Supplier shall be responsible to see that equipment supplied is correct for the intended application and will perform within the limits of capacity, noise, life expectancy, pressure drop and space limitations intended for that equipment as shown on the plans or described in the specifications. The shop drawings shall show the capacity and operating characteristics of the equipment.

2.3 EQUIPMENT DEVIATIONS

A. Where the Contractor proposes to use an item of equipment other than that specified or detailed on the drawings, which requires any redesign of the structure, partitions, foundations, piping, wiring or any other part of the mechanical, electrical, or architectural layout, all such redesign, and all new drawings and detailing required therefor, shall be prepared by the Subcontractor at his own expense and submitted for approval by the Architect.

B. Where such approved deviation requires a different quantity and arrangement of ductwork, piping, wiring, conduit, and equipment from that specified or indicated on the drawings, the Contractor shall furnish and install any such ductwork, piping, structural supports, insulation, controllers, motors, starters, electrical wiring and conduit, and any other additional equipment required by the system, at no additional cost to the Owner.

2.4 MOTORS

A. Motors shall be built in accordance with the latest standards of NEMA and as specified. Motors shall be tested in accordance with standards of A.S.A. C40 and conform thereto for installation resistance and dielectric strength. Each motor shall be provided with conduit terminal box, adequate starting and protective equipment as specified or required. The capacity shall be sufficient to operate associate driven devices under all conditions of operation and load and without overload, and at least shall be the horsepower indicated or specified. Each motor shall be selected for quiet operation. Motors 1 HP or more shall have a minimum acceptable nominal full load efficiency not less than that shown in Table 10.8 of ASHRAE Standard 90.1 – 2007 Edition.

2.5 DRIVES

A. Machinery drives shall be provided for all power driven equipment specified in this section.

B. Drives shall be V-belt and shall be selected to overcome the starting inertia of the equipment without slippage, but in no case shall be less than 150% of the full motor load. Drives 1/2 HP and smaller may be provided with single belts. Drives 3/4 HP and larger shall be provided with the number of belts necessary to transmit the required power with 95% minimum efficiency.

C. Where adjustable type sheaves are indicated they shall be selected such that the schedule speed of the driven equipment is at the midpoint in the adjustment range of the sheave.

D. Where fixed type sheaves are indicated the Contractor shall include in his price changing sheave sizes once during the balancing period to achieve proper air quantities.

E. Sheaves shall be machined cast iron of the same manufacturer as the belt provided. Shop drawings shall be submitted of each drive which shall include actual transmission capacity of each drive.

2.6 FOUNDATIONS, SUPPORTS, PIERS, ATTACHMENTS

A. This Contractor shall furnish and install all necessary foundations, supports, pads, bases and piers required for all air conditioning equipment, piping, pumps, tanks, compressors, and for all other equipment furnished under this contract, and shall submit drawings to the Architect for approval before purchase, fabrication or construction of same.

B. For pumps, compressors, and other rotating machinery and for all equipment where foundations are indicated, furnish and install concrete pads minimum 4 inches thick or as shown. All pads shall be extended six (6) inches beyond machine base in all directions with top edge hampered. Insert six (6) inch long, l/2" round steel dowel rods at 12" on center into floors to anchor pads. Shop drawings for all foundations and pads shall be submitted to the Architect for approval before same are constructed.

C. Construction of foundations, supports, pads, bases, and piers where mounted on the floor, shall be of the same materials and same quality of finish as the adjacent and surrounding flooring material.

D. All equipment, unless otherwise shown, shall be securely attached to the building structure in an approved manner. Attachments shall be of a strong and durable nature and any attachments that are, in the opinion of the Architect, not strong enough shall be replaced as directed.

2.7 VIBRATION ISOLATION:

A. All work shall operate under all conditions of loads without any sound or vibration which is objectionable in the opinion of the Architect. If requested, the Contractor shall record sound power level readings in all areas adjacent to mechanical rooms, over, under or beside, after all equipment is fully operational and all wall and ceiling systems are completed. Sound level readings shall not exceed NC levels as recommended in Table 1, Chapter 48 of 2011 ASHRAE Applications Handbook.

B. The readings are to be tabulated in the Maintenance and Operating Instruction Booklets.

C. Sound or vibration conditions in excess of listed quantities shall be corrected in an approved manner by the Contractor at his expense.

D. Unless otherwise noted mechanical equipment over one horsepower shall be isolated from the structure with resilient vibration and noise isolators supplied by one manufacturer to the Mechanical Contractor. Where isolator type and required deflection are not shown, equipment shall be isolated in accordance with the 2011 ASHRAE Applications Handbook, Chapter 48, Table 47. Submittals shall include complete design for the equipment bases, a tabulation of the design data for the isolators, including lateral stiffness, O.D., free operating and solid height of the spring isolators, free and operating height of the neoprene or fiberglass isolators. Selection of isolators for proper loading to obtain desired efficiency shall be the responsibility of the manufacturer of isolating units to suit the equipment being supplied on the job and shall be fully guaranteed by this supplier. All vibration isolation equipment complete with thorough selection data shall be submitted. Units shall be Vibration Eliminator Company, Mason, Peabody, or approved equal.

E. Flexible duct connections shall be provided at inlet and outlet of all fans or cabinets containing fans and shall be constructed such as to allow a minimum movement of 2 inches in any direction and will not restrict normal movement of any equipment.

2.8 DIELECTRIC CONNECTIONS

A. Dielectric connections shall be used at any points within the piping systems where dissimilar metals meet. Careful attention shall be given to support brackets and hangers to select proper materials to avoid dissimilar metal contact at these points.

2.9 DRAINS AND VENTS

A. In addition to the drains and vents indicated on the plans and piping details, the Contractor shall install additional drains and vents as required to remove all water and air from the piping systems.

2.10 MOTOR STARTERS AND DISCONNECTS

A. Individual motor controllers complete with auxiliary contacts, control transformers, push buttons, selector switches and remote push button stations not specifically specified to be furnished with the equipment shall be provided under this section. Motor controllers shall comply with NEMA Standards and be complete with proper size heaters and auxiliary contacts and shall be in NEMA enclosures as required. Unless otherwise noted, push button stations shall be oil-tight heavy duty type. Controllers shall be manual, magnetic, or combination type with disconnect switch or circuit breaker as indicated on the drawings or where required by the NEC. Controllers shall include motor overcurrent protection in each phase conductor. Each motor controller shall be provided with phenolic nameplate, black with 1/4" high letters and white border, indicating equipment served, attached using counter sunk screws.

B. The Electrical Contractor shall furnish and install all disconnecting switches unless otherwise indicated or specified. Where disconnecting switches are indicated to be furnished under this Section, they shall be General Electric, Type TH in NEMA 1 enclosures, with voltage and amperage rating appropriate to the application. Unless otherwise noted, fuses shall be Buss "Fusetrons", or approved equal. Unfused motor disconnecting switches shall be Type TH in NEMA 1 or 4 applicable enclosures. Similar and equivalent equipment as manufactured by I.T.E., Square D, or Westinghouse is equally acceptable. Switches used as service switches shall bear such U.L. Label and nameplate on switch shall so indicate.

2.11 PAINTING

A. Paint material shall be selected from the products listed below and, insofar as practical, products of only one manufacturer shall be used. Contractor shall submit to the Architect the listed manufacturer he proposes to use in the work. Should the Contractor desire to use products of a manufacturer not listed below, or products made by a listed manufacturer but not scheduled herein, Contractor shall submit complete technical information on the proposed products to the Architect for approval. Only products approved by the Architect shall be used.

1. Rust Inhibitive Primer:
   a. Devoe: Ready-Mixed Red No. 20.
   b. Duron: Deluxe Red Primer.
   c. Glidden: Rustmaster Tank and Structure Primer.
   d. Pittsburgh: Inhibitive Red Primer.
2. Galvanized Metal Primer:
   a. Devoe: Devoe Zinc Dust Primer.
   b. Duron: Duron Deluxe Galvanized Metal Primer
   c. Glidden: Rustmaster Galvanized Iron Metal Primer.
   d. Pittsburgh: Speedhigh Galvanized Steel Primer.

PART 3 EXECUTION

3.1 DUTIES OF CONTRACTOR

A. Contractor shall furnish and install all materials called for in these Specifications and accompanying drawings, and must furnish the apparatus complete in every respect. Anything called for in the specifications and not shown on the drawings or shown on the drawings and not called for in the specifications must be furnished by the Contractor.

B. The Contractor shall follow drawings in laying out work and check drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. Where headroom or space condition appears inadequate, Architect shall be notified before proceeding with installation.

C. The plans are diagrammatic and are not intended to show each and every fitting, valve, pipe, pipe hanger, or a complete detail of all the work to be done; but are for the purpose of illustrating the type of system, showing pipe sizes, etc., and special conditions considered necessary for the experienced mechanic to take off his materials and lay out his work. This Contractor shall be responsible for taking such measurements as may be necessary at the job and adapting his work to local conditions.

D. The right to make any responsible change in location of apparatus, equipment, routing of piping up to the time of roughing in, is reserved by the Architect without involving any additional expense to the Owner.

3.2 CODES, RULES, PERMITS AND FEES

A. All materials furnished and all work installed shall comply with the National Fire Codes of the National Fire Protection Association, and with the requirements of all governmental departments having jurisdiction.

B. All materials and equipment for the electrical portion of the mechanical system shall bear the approval label, and shall be listed by the Underwriters' Laboratories, Inc.

C. All work shall be done in accordance with the North Carolina State Building Code, and requirements of governmental agencies having jurisdiction.

3.3 COOPERATION WITH OTHER TRADES

A. This Contractor shall give full cooperation to other trades and shall furnish any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.

B. Where the work of the Contractor will be installed in close proximity to, or may interfere with the work of other trades, he shall assist in working out space conditions to make a satisfactory adjustment. If so directed by the Architect, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than 3/8" = 1'-0", clearly showing how his work is to be installed in relation to the work of other trades. If the Contractor installs his work before coordination with other trades, or so as to cause any interference with work of other trades, he shall make the necessary changes in his work to correct the condition without extra charge.

C. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

3.4 RECORD DRAWINGS

A. The Contractor shall furnish drawings showing dimensioned location and depths of all exterior piping and structures, and shall indicate any and all changes in location of piping, ductwork, equipment or valves from that shown on the Contract Drawings. The drawings shall consist of clean, legible sepia prints of the Contract Drawings, available from the Architect on which the Contractor shall mark all notes, dimensions, sizes and information required. The sepias shall be kept for this purpose only. Before final inspection the Contractor shall submit to the Architect eight (8) sets of black line prints of the sepias.

3.5 SURVEYS AND MEASUREMENTS

A. This Contractor shall base all measurements, both horizontal and vertical, from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.

B. Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the drawings and specifications, he shall notify the Architect through the General Contractor, and shall not proceed with his work until he has received instructions from the Architect.

3.6 SAFETY REQUIREMENTS

A. All systems shall be installed so as to be safe operating and all moving parts shall be covered where subject to human contact. All rough edges of equipment and materials shall be made smooth.

B. All safety controls shall be checked under the supervision of the Architect's representative and eight (8) copies of test date showing setting and performance of safety controls shall be submitted to the Architect. All pressure vessels shall be ASME stamped and shall have stamped relief valves. Water heaters shall be provided with ASME stamped T & P relief valve.

3.7 SHOP DRAWINGS

A. The Contractor shall submit for approval eight (8) sets of detailed shop drawings of all equipment and all material required to complete the project, and no materials or equipment may be delivered to the job site or installed until the Contractor has in his possession the approved shop drawings for the particular material or equipment. The shop drawings shall be complete as described herein.

B. Catalogs, pamphlets, or other documents submitted to describe items on which approval is being requested, shall be specific and identification in catalog, pamphlet, etc. of item submitted shall be clearly marked. Data of a general nature will not be accepted. Data shall include eight (8) copies of computation sheets indicating how unit capacity was determined where ratings are at other than standard conditions. No payment for any equipment or labor will be allowed until all major pieces of equipment specified have been submitted to the Architect for approval.

C. The Contractor, as part of the shop drawing submitted, shall submit shop drawing of all ductwork in the mechanical rooms, the risers including takeoffs to the floors with their associated dampers, and ells with unequal legs showing turning vanes.

D. Static pressure drops across fittings, dampers, heaters, attenuators, etc. shall not exceed minimum ASHRAE Standards when not specified.

3.8 ACCESSIBILITY

A. Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in double partitions and hung ceilings for the proper installation of his work. He shall cooperate with the General Contractor and all other Contractors whose work is in the same space, and shall advise the General Contractor of his requirements. Such spaces and clearances shall; however, be kept to the minimum size required.

B. The Contractor shall locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Equipment shall include but not be limited to valves, traps, cleanouts, motors, controllers, switch-gear, and drain points. If required for better accessibility, furnish access doors for this purpose. Minor deviations from drawings may be made to allow for better accessibility and any change shall be submitted for approval.

C. The Contractor shall provide the General Contractor with exact locations of access panels for each concealed valve, control damper or other device requiring service. Access panels shall be provided and installed by the General Contractor and as specified in the Architectural sections of the specifications. Locations of these panels shall be submitted in sufficient time to be installed in the normal course of work.

3.9 CONCEALED PIPE

A. In general, all pipe in finished spaces shall be run concealed in floors, walls, partitions and above ceilings.

B. Concealment of pipe and covering of same shall not be done until authorized by the Architect, after proper tests have been made. This applies to all interior work and exterior work.

3.10 CUTTING AND PATCHING

A. This Contractor shall provide all cutting and patching necessary to install the work specified in this section. Comply with requirements of Division 01 Section "Cutting and Patching."

3.11 SLEEVES AND PLATES

A. This Contractor shall provide and locate all sleeves and inserts required before the floors and walls are built, or shall be responsible for the cost of cutting and patching required where sleeves and inserts were not installed, or where incorrectly located. This Contractor shall do all drilling required for the installation of his hangers.

B. Sleeves shall be provided for all mechanical piping passing through concrete floor slabs and concrete, masonry, tile and gypsum wall construction. Sleeves shall not be provided for piping running imbedded in concrete or in insulating concrete slabs on grade.

C. Where sleeves are placed in exterior walls below grade, the space between the pipe or conduit and the sleeves shall be packed with oakum and lead and made completely watertight.

D. Where pipe motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of pipe. Where sleeves pass insulated pipes, the sleeves shall be

large enough to pass the pipe and insulation. Check floor and wall construction finishes to determine proper length of sleeves for various locations; make actual lengths to suit the following:

E. Terminate sleeves flush with walls, partitions and ceiling.

F. In areas where pipes are concealed, as in chases, terminate sleeves flush with floor or as shown on the plans.

G. In all areas where pipes are exposed, extend sleeves 1/4 inch above finished floor, except in rooms having floor drains, where sleeves shall be extended 3/4 inches above floor.

H. Sleeves shall be constructed of schedule 40 black steel pipe unless otherwise indicated on the drawings. Sleeves through concrete beams shall be constructed as indicated on the drawings.

I. Fasten sleeves securely in floor, walls, so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster, or other materials being forced into the space between pipe and sleeve during construction.

J. Where piping penetrates fire rated floors or walls, penetrations shall be sealed with a U.L. approved fire stopping system. System shall be as manufactured and detailed by 3M Company or approved equal.

K. Escutcheon plates shall be provided for all exposed pipes and all exposed conduit passing through walls, floors and ceilings. Plates shall be nickel plated, of the split ring type, of size to match the pipe or conduit. Where plates are provided for pipes passing through sleeves which extend above the floor surface, provide deep recessed plates to conceal the pipe sleeves.

3.12 SCAFFOLDING, RIGGING, HOISTING

A. This Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises of any equipment and apparatus furnished. Remove same from premises when no longer required.

3.13 ELECTRICAL CONNECTIONS

A. The Electrical Contractor shall furnish and install all wiring except: (1) temperature control wiring; (2) equipment control wiring and (3) interlock wiring. The Electrical Contractor shall receive from the Mechanical Contractor and mount all individually mounted motor starters and provide all power wiring to the motor terminals unless otherwise indicated. The Electrical Contractor will provide branch circuit protection and disconnects unless otherwise indicated or specified. The Mechanical Contractor shall provide all other control and protective devices, and perform all control and interlock wiring required for the operation of the equipment. Power wiring, from nearest panel, for control components (dampers, panels, etc.) shall be provided by the Mechanical Contractor unless specifically called for by Division 16.

B. After all circuits are energized and complete, the Electrical Contractor shall be responsible for all power wiring, and all control wiring shall be the responsibility of this Contractor. Motors and equipment shall be provided for current characteristics as shown on the drawings.

C. It shall be the responsibility of this Contractor to check with the Electrical Contractor on service outlets provided for this Contractor, to determine that the switches and wiring provided are of adequate size to meet Code requirements for this Contractor's equipment. Any discrepancy shall be brought to the attention of the Architect before work is installed. Otherwise, any cost for changes

shall be at the expense of this Contractor, and in any case electrical cost increase due to equipment substitution of different electrical characteristics shall be this Contractor's expense.

3.14 PIPE WORK

A. All pipe work shown on the drawings and/or specifications or implied herein and required for a complete and operating system shall be done by experienced mechanics in a neat and workmanlike manner and subject to the approval of the Architect.

B. Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings and accessories which may be required and it shall be the responsibility of the Contractor to furnish and install all materials and equipment required for the operating systems.

C. The piping shall be installed as shown on the plans with strict conformity to the sizes listed and due provisions for expansion and contraction.

D. Unless otherwise noted on the plans, all piping shall be installed inside the insulated envelope of the building.

3.15 LUBRICATION

A. All bearing, except those specifically requiring oil lubrication, shall be pressure lubricated. All lubrication points shall be readily accessible, away from locations dangerous to workmen. In areas where lubrication points are not readily accessible Contractor shall provide extended lubrication tubes to positions where lubrication can be easily accomplished. Pressure grease lubrication fittings shall be "Zerk-Hydraulic" type as made by the Stewart-Warner Corporation, or approved equal, for each type of grease required.

B. The Contractor shall furnish lubrication charts or schedules for each piece of equipment or machinery. The charts or schedules shall designate each point of lubrication. Eight (8) copies of charts and schedules shall be submitted to the Architect prior to final inspection and approved copies of each schedule and chart shall be framed by the Contractor in metal frames with glass front and installed in the Equipment Room.

3.16 PROTECTION

A. The Contractor shall protect all work and material from damage, and shall be liable for all damage during construction.

B. The Contractor shall be responsible for work and equipment until all construction is finally inspected, tested and accepted. He shall protect work against theft, injury or damage; and shall carefully store material and equipment received on site which is not immediately installed. He shall close open ends of work including pipe, duct, or equipment with temporary covers or plugs during storage and construction to prevent entry of obstructing materials or dust and debris.

C. Provide a protective covering of not less than 0.004" thick vinyl sheeting (or a similar approved material) to be used in covering all items of equipment, immediately after the equipment has been set in place, (or if in a place of storage within the building under construction) to prevent the accumulation of dirt, sand, cement, plaster, paint or other foreign materials from collecting on the equipment and/or fouling working parts.

3.17 CLEANING

A. Clean from all exposed insulation and metal surfaces grease, debris or other foreign material.

B. Chrome plated fittings, fixtures, piping and trim shall be polished upon completion.

3.18 LABELS AND INSTRUCTIONS

A. Label all switches and controls furnished under this Section with engraved bakelite permanent labels to indicate the function of each and the apparatus serviced.

B. Post in the Equipment Room framed under glass the following:

1. Lubrication instructions listing all equipment which requires lubrication, the type of lubricant to be used and the frequency of lubrication.
2. Photostatic copy of wiring diagram of temperature controls.
3. Step-by-step operating instruction for each piece of equipment with control sequence description.

C. All units shall be marked with unit numbers in three inch high letters with unit designated numbers.

D. A tabulation shall be made of each panel number and circuit number serving each air conditioning unit, fan or other device with electrical service. This list shall be prepared and be ready to turn over to inspectors prior to calling for final inspection.

3.19 VALVE, MOTOR AND DAMPER TAGS AND SCHEDULE

A. Each valve, motor and damper shall be provided with an engraved black finish, phenolic tag indicating service and number. Tag lettering shall be at least 1/4" high etched white letters and beveled white trim. Tags to be attached using brass chains.

B. The Contractor shall submit eight (8) copies of charts indicating number, location, service, "normal" position, manufacturer, size and model number to the Architect for approval.

C. Prior to final inspection an approved copy of each chart shall be framed by the Contractor in a metal frame with glass front and installed in the Equipment Room.

3.20 EQUIPMENT SERVICEABILITY

A. All equipment shall be serviceable. All equipment shall be installed so that it can be removed. All equipment in or connected to piping systems shall have valves to isolate this equipment from the piping system. This includes, but not necessarily limited to control valves, sensors, switches, pumps, traps and strainers. Unions (screwed or flanged) shall be provided so that all equipment is removable.

B. Equipment installed in walls, ceilings or floors shall be accessible for service or removal without cutting walls, etc.

C. Equipment requiring periodic service shall be installed to allow clearance for service and have removable panels, access doors, etc. through which the service is to be performed.

3.21 ACCEPTANCE OF EQUIPMENT

A. In the event that the Architect considers it impractical, because of unsuitable test conditions, or some other factors, to execute simultaneous final acceptance of all equipment portions of the

installation may be certified by the Architect for final acceptance when that portion of the system is complete and ready for operation.

B. Contractor shall make all necessary tests, trial operation balancing and balance tests, etc., as may be required as directed by the engineer to prove that all work under these plans and specification is in complete serviceable condition and will function as intended. Oil burners, gas burners, and water chillers shall be started by a representative of the equipment manufacturer. All costs of these procedures shall be borne by this Contractor.

C. Upon completion of all work the system shall be tested to determine if any excess noise or vibration is apparent during operation of the system. If any such objections are detected in the system or noisy equipment found, the Contractor shall be responsible for correcting same. Ducts, plenums and casings shall be cleaned of all debris and blown free of all particles of rubbish and dust before installing outlet faces. Equipment shall be wiped clean with all traces of oil, dust, dirt and paint spots removed. Temporary filters shall be provided for all fans that are operated during construction and after all construction dirt has been removed from the building, new filters shall be installed. Bearings shall be lubricated as recommended by the equipment manufacturer. All control valves and equipments shall be adjusted to setting indicated. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.22 GUARANTEE

A. The Contractor shall guarantee the complete mechanical system against defect due to faulty materials, faulty workmanship or failure due to negligence of the Contractor. This guarantee will exclude normal wear and tear, maintenance lubrication, replacement of expendable components, or abuse. The guarantee period shall begin on the date of the final acceptance and shall continue for a period of 12 months during which time the Contractor shall make good such defective workmanship and materials and any damage resulting therefrom, within a reasonable time of notice given by the Owner.

B. The period of Guarantee for equipment driven by electrical motors, etc., shall be 12 months from the date of acceptance. Refrigeration compressors shall have a five (5) year warranty.

3.23 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Submit 5 sets of complete operating and maintenance instructions.

B. Bind each set in plain black vinyl-covered, hard back, 3-ring binder. Individual paper shall be Boorum and Pease Reinforced Ring Book Sheet, No. S-212-101 or equivalent.

C. Organize material in the following format:

1. Section I:
    a. Name of Project
    b. Address
    c. Owner's Name
    d. General Contractor's Name and Address
    e. Contractor's Name and Address
    f. Control Subcontractor's Name and Address
    g. Warranty Dates
2. Section II:
    a. Major Equipment List (name, manufacturer, serial no., H.P. and voltage) (include all equipment with motors)

b. Control Sequence Description
c. Routine Maintenance Instructions in Step-by-Step form
d. Lubrication Charts and Schedules
e. Valve Schedules
f. Test and Balance Reports
g. Sound Power Level Readings (Where Required)

3. Section III:
   a. Operating and Maintenance Instructions by Manufacturer
   b. Shop Drawings (Major Requirement)
   c. Wiring Diagrams
   d. Control Drawings

3.24 PAINTING

A. Painting shall be performed as detailed in Division 09.

B. All surfaces to receive paint shall be dry and clean.

C. Before priming, all surfaces shall be thoroughly cleaned of all dirt, oil, grease, rust, scale and other foreign matter. Cleaning shall be done with sandpaper, steel scraper, or wire brush where appropriate and necessary. Metallic surfaces which have been soldered shall be cleaned with benzol and all other metal surfaces washed with benzine.

D. Mixing shall be in galvanized iron pans. Paint shall be mixed in full compliance with manufacturer's directions. Thinning shall be done only in full compliance with manufacturer's directions.

E. Workmanship shall be highest quality, free from brush marks, laps, streaks, sags, unfinished patches, or other blemishes. Edges where paint joins other material or colors shall be sharp and clean without overlapping. Paint shall be brushed or sprayed on in strict compliance with manufacturer's directions and shall work evenly and be allowed to dry at least 48 hours before subsequent coating. Paint shall not be applied in damp or rainey weather or until surface has thoroughly dried. Contractor shall furnish and lay drop-cloths in all areas where painting is done as necessary to protect work of other trades. Varnish and enamel shall not be applied when temperature in the area is less than 60 degrees Fahrenheit nor paint when under 50 degrees Fahrenheit. Prior to final acceptance, Contractor shall touch up or restore any damaged finish. All insulation materials shall be provided with a paint suitable jacket.

F. The following materials and equipment require painting as noted:

1. All concealed piping, sheet metal, hangers and accessories except galvanized sheet metal or piping:
   a. One coat rust-inhibitive primer except where exterior insulation is provided.
2. All exposed exterior and interior, piping, sheet metal, hangers and accessories, air handling units, chillers, pumps, etc. except galvanized sheet metal or piping:
   a. One coat rust-inhibitive primer except where exterior insulation is provided.
3. All concealed galvanized sheet metal, piping and accessories.
   a. One coat galvanized metal primer on threaded portions of piping and any damaged galvanized surfaces.
4. All exposed exterior and interior galvanized sheet metal, piping and accessories.
   a. One coat galvanized metal primer except where exterior insulation is provided.
5. All exposed exterior and interior, insulation equipment.
   a. Two coats exterior glass enamel over paint suitable insulation jacket.

G. All piping in Equipment Rooms shall be painted (color shown below) and identified by stenciling with letters minimum 1/2" high in a contrasting color. Piping outside Equipment Rooms shall be stenciled. Stenciling shall occur at each change of direction and every 20 feet. Arrows should be placed adjacent to letters signifying direction of flow.

1. Standard piping color codes:
   a. Drains - Natural with Walls
   b. Electrical - Natural with Walls

H. All gas piping in shall be painted Light Yellow and identified by stenciling with letters minimum 1/2" high in a contrasting color. Stenciling shall occur at each change of direction and every 20 feet. Arrows should be placed adjacent to letters signifying direction of flow.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.1 SCOPE

A. The provisions of Section 23 05 00 apply to all the work in this Section.

B. Work shall be performed by an independent balancing company certified by AABC or NEBB. Technicians shall be competent in the trade of testing and balancing environmental systems and shall be done in an organized manner utilizing appropriate test and balance forms.

C. The test and balance contractor shall be a sub-contractor to the HVAC contractor.

D. The test and balance report shall be submitted prior to the final inspection. The TAB sub-contractor shall attend the final to spot check air and water flows.

1.2 SUBMITTALS

A. Submit the following in accordance with Section 23 05 00:

1. Manufacturer's cut sheets for all equipment to be used.
2. Sample balancing charts and forms.
3. Completed final balancing data.

PART 2 PRODUCTS

2.1 INSTRUMENTATION

A. Instruments for use in the test and balancing procedures shall be of first quality and be accurately calibrated at the time of use. The following list is provided to indicate the instruments expected, however, other instruments as necessary to properly perform the work will be provided and subject to approval of the Architect.

1. Inclined manometer calibrated in no less that .006-inch divisions.
2. Combination inclined and vertical manometer (0 to 10 inch is generally the most useful).
3. Pitot Tubes. (Usually and 18 and 48 inch tube covers most balance requirements.
4. Tachometer. This instrument should be of the high quality self-timing type.
5. Clamp-on ampere meter with voltage scales.
6. Deflecting vane anemometer.
7. Rotating vane anemometer.
8. Thermal type (hot wire) anemometer.
9. Hook gage.
10. Dial and glass stem thermometers.
11. Sling psychrometer.

B. The accuracy of calibration of the field instruments used is of the utmost importance. All field instruments used in the balance should have been calibrated at least within the previous three months. Naturally, any suspect instruments should be checked more frequently.

PART 3 EXECUTION

3.1 SYSTEM START-UP

A. Starting date for mechanical system shall be scheduled well in advance of expected completion date and shall be established a minimum of two weeks prior to acceptance date. The system shall be in full operation with all equipment functional prior to acceptance date.

B. Performance readings shall be taken and recorded on all air and water distribution devices and the system shall be balanced out prior to acceptance. Balancing of the system shall be accomplished with duct dampers and only minor adjustments made with grille dampers. Record and submit results in table form along side of scheduled quantities.

C. All controls shall be calibrated by qualified personnel prior to acceptance date. Thermostats shall be in close calibration with one another and shall operate their respective units without interference from adjacent units.

D. All units shall be checked out thoroughly and the information recorded on each machine. Check sheets shall be included in Operating and Maintenance instructional Manual.

E. Replace fan sheaves as necessary to produce design air volume.

END OF SECTION

SECTION 23 07 00

INSULATION

PART 1 GENERAL

1.1 DESCRIPTION

A. This section of specifications and related drawings describe requirements pertaining to insulation.

B. Provide all insulation in conjunction with equipment, piping and ductwork furnished under this division.

C. The provisions of Section 23 05 00 apply to all the work in this section.

1.2 QUALITY ASSURANCE

A. Products of the manufacturers listed under MATERIALS will be acceptable for use for the specific functions noted. Adhesives, sealers, vapor barriers, and coatings shall be compatible with the materials to which they are applied, and shall not corrode, soften or otherwise attack such material in either the wet or dry state.

B. Materials shall be applied subject to their temperature limits. Any methods of application of insulating materials or finishes not specified in detail herein shall be in accordance with the particular manufacturer's published recommendations.

C. Insulation shall be applied by experienced workers regularly employed for this type of work.

1.3 SUBMITTALS

A. Submit the following in accordance with Section 23 05 00:

1. Catalog cuts.
2. Materials ratings.
3. Insulation instructions.

1.4 RATING

A. Insulation and accessories such as adhesives, mastics, cements, tape and jackets, unless noted otherwise, shall have a flame spread rating of not more than 25 and a smoke developed rating of not more than 50. Materials that are factory applied shall be tested individually. No fugitive or corrosive treatments shall be employed to impart flame resistance.

B. Flame spread and smoke developed ratings shall be determined by Method of Test of Surface Burning Characteristics of Building Materials, NFPA No. 255, ASTM E-84, UL 723.

C. Products of their shipping cartons shall bear a label indicating that flame and smoke ratings do not exceed above requirements.

D. Treatment of jackets or facings to impart flame and smoke safety shall be permanent. The use or water-soluble treatment is prohibited.

E. Certify in writing, prior to installation, that products to be used will meet RATING criteria.

PART 2 PRODUCTS

2.1 PIPE INSULATION

A. Materials shall be heavy density fiberglass with an all-service jacket composed of an outer layer of vinyl, fiberglass scrim cloth, aluminum foil, and kraft paper, in that order, from outside to inside of pipe covering.

1. Condensate drain lines.
2. Refrigerant Suction Piping - flexible foamed elastomeric plastic tubing with a density of 6 lbs./CF, K of 0.27 @ 70oF., self-extinguishing, and a water vapor transmission of less than 0.05 perm in., flame spread rating 25 or less, smoke developed rating of 50 or less (ASTM E84-75).

B. Thicknesses:

1. Condensate drain lines: Pipe size 2-1/2" and larger - 1-1/2", Pipe size 2" and smaller - 1".

2.2 DUCT INSULATION

A. Materials. Insulation shall be Owens-Corning as specified hereinafter or products of Certain-Teed/St. Gobain or Manville. Adhesives shall be as manufactured by 3-M Foster or Insulation Manufacturer. Insulation shall have composite (insulation, jacket and adhesive) fire and smoke hazard rating as tested by ASTM E-84, not exceeding Flame Spread -25 and Smoke Developed -50.

PART 3 EXECUTION

3.1 PIPE INSULATION

A. Application. Insulation and surfaces to be insulated shall be clean and dry when insulation is installed and during the application of any finish.

B. Refrigerant Piping. End joint strips and overlap seams shall be adhered with a vapor barrier mastic. Valves, fittings, and flanges shall be insulated with strips of pipe insulation, and finished with tape and vapor barrier mastic. Seal off vapor barrier to pipe at all fittings, hangers, and every 20 feet on straight runs.

C. Fiberglass Insulation. All fiberglass pipe covering shall be furnished with self-seal lap and 3" wide butt joint strips. The release paper is pulled from adhesive edge, pipe covering closed tightly around pipe and self-seal lap rubbed hard in place with the blunt edge of an insulation knife. This procedure applies to longitudinal as well as circumferential joints. Under no circumstances will staples be allowed. Care shall be taken to keep jacket clean, as it is the finish on all exposed work. All adjoining insulation sections shall be firmly butted together before butt joint strip is applied, and all cold water service lines shall have vapor seal mastic thoroughly coated to pipe at butt joints every 21' and at all fittings. All fittings, valve bodies, unions, and flanges shall be finished as follows:

1. Apply molded or segmental insulation to fittings equal in thickness to the insulation on adjoining pipe and wire in place with 2#14 copper wires.
2. Apply a skim coat of insulating cement to the insulated fitting, if needed, to produce a smooth surface. After cement is dry, apply Owens-Corning Fiberglass Fitting Mastic, Type C, UL labeled.

3. Wrap the fitting with fiberglass reinforcing cloth overlapping the preceding layer by 1 to 2". Also, overlap mastic and cloth by 2" on adjoining sections of pipe insulation.
4. Apply a second coat of mastic over cloth, working it well into mesh of cloth and smooth the surface. Mastic to be applied at the rate of 40 square feet per gallon. All flanges and fittings on hot and cold lines in utility tunnels shall be insulated according to above. Omit insulation on flanges and unions over 60 degrees F. If painting is required, no sizing is necessary. To maintain the non-combustibility of the system only Glidden acrylic latex paint (#5370) is to be used.
5. All piping exposed to view (equipment rooms, etc.) shall be covered with an 8 oz. canvas jacket.

3.2 DUCT INSULATION

A. All vapor barriers and joints shall be sealed to prevent condensation. Clean and dry all ductwork before installing insulation. All weld joints shall be wire brushed and give one (1) coat of red lead before insulating. Staples will not be permitted in insulation.

D. Lined Duct.

1. Ductwork indicated on plans shall be lined with Owens-Corning Aeroflex Vapor-Seal Duct Insulation, 1-1/2 pcf, 1" thick, or equal by Certain-Teed/St. Gobain or Johns Mansville.
2. Duct liner and adhesive shall meet requirements of NFPA 90A and shall have UL fire hazard classification not to exceed the following: flame spread -25; fuel contributed -50; smoke generated -50. There will be no erosion of duct liner material at velocities up to 4000 fpm. Duct liner shall be applied to the sheet metal with 100% coverage of adhesive. The duct liner shall be cut to assure corner joints with no gaps. On horizontal runs, tops of ducts over 12" in width and sides of 16" in height shall be additionally secured with mechanical fasteners. On spans less than 30" fasteners are to be placed at midpoints. On vertical runs, fasteners shall be placed on a maximum of 15" centers on all width dimensions over 12". Fasteners shall be flush with the liner surface. All exposed edges and leading edges of all transverse and longitudinal joints of the liner shall be coated with a fire resistant adhesive. The exposed mechanical fasteners shall be coated with a fire resistant adhesive. The upstream end must be continuously adhered to for a 6" width.

B. Wrapped Duct

1. All ducts unless noted shall be insulated by wrapping with 3" thick ¾ lb. density fiberglass with vapor barrier jacket with joints overlapped a minimum of two inches. Insulation shall be adhered to duct with non-combustible insulation bonding adhesive applied in 4" strips, 8" on center. All joints shall be secured with flare door staples on 3" centers through all laps over duct tape.

END OF SECTION

SECTION 23 09 00

AUTOMATIC TEMPERATURE CONTROLS

PART 1 GENERAL

1.1 SCOPE

A. The provisions of Section 23 05 00 apply to all work in this section.

B. A complete system of automatic temperature controls shall be furnished by the temperature control manufacturer in conjunction with controls furnished by unit manufacturers. It shall be an electric system and shall be complete in every respect as hereinafter specified and as shown on the control diagrams. The control equipment shall adapt readily to all equipment furnished in the mechanical system so as to provide the sequence necessary for proper operation of all equipment herein specified. The control system shall be installed, checked out, and guaranteed by the control manufacturer.

C. The control manufacturer shall guarantee the control system to be free from defects in workmanship and material under normal use and provide service for a period of one year after acceptance by the Engineer or beneficial occupancy of the building. Any defects in workmanship or material during this time shall be corrected by the control manufacturer at no charge to the Owner.

D. The control system shall consist of all thermostats, temperature transmitters, controllers, automatic dampers, damper operators, control panels, and accessory control equipment to fill the intent of the specifications and provide for a complete and operable system.

E. All wiring associated with the temperature control system (line voltage or low voltage) shall be installed by the Temperature Control Contractor or by an Electrical Subcontractor whose principal business is control and interlock wiring. If the wiring is performed by an Electrical Subcontractor, the Temperature Contractor will supervise the wiring installation and be responsible for the performance of the system. Wiring shall be in accordance with the electrical specifications.

F. Upon completion of the work and acceptance by the Owner, provide a 4 hour period of instruction to the Owner's operating personnel who have responsibility for the mechanical system. An additional 4 hour instruction period shall be given at the beginning of the next heating and cooling season.

1.2 SUBMITTALS

A. The Temperature Control Manufacturer shall submit copies of complete temperature control diagrams with written "sequence of control" and factory printed specification data sheets, covering each control device proposed to the used, for the Engineer's approval, prior to installation of any equipment.

B. After approval and installation provide sets of complete operating and maintenance instructions with "as-built" drawings, typewritten instructions and operating sequences, and descriptive data sheets. Assemble each set in a hard cover binder with "temperature control" title place on front cover and binding. Frame an auto-positive copy of the control drawings and mount in the equipment room.

PART 2 PRODUCTS

2.1 SENSORS

A. Outside Air Temperature Sensor.

1. Sensor shall be mounted in the outdoors where natural air flow occurs, away from any artificial affect from mechanical sources - Example: Windows, doors, exhaust fans, etc. The temperature range shall be -40 to 220 degrees F. Provide a sun shield and weatherproof assembly for mounting to 1/2 inch rigid conduit.

2.2 THERMOSTATS/CONTROLLERS

A. Programmable Room Thermostats (provided by equipment manufacturer).

1. 1H/1C, 2H/1C or 3H/2C stage heatpump thermostat.
2. Seven-day with copy or 24 hour programmable.
3. Outdoor temperature display (field selectable – on/off).
4. Adaptive Intelligent or Conventional Recovery. Assure that desired temperature is achieved at programmed time & maintained regardless of weather conditions; optimizes energy savings, field activated.
5. Minimum compressor run time (Factory set to 10 minutes, field adjustable).
6. Comfort enhancing droop.
7. Backlight display.
8. Filter clean/replacement key (field adjustable).
9. No Batteries required. Continue clock for 15 minutes.
10. Programming and other functions stored in permanent "E-Prom" memory.
11. Manual or auto change over (field selectable).
12. 3-10 degree F dead band between heating and cooling setpoints in the "auto" changeover mode (field adjustable).
13. Conventional or adaptive intelligent recovery.
14. Adjustable heating range (55 – 85 degree setpoint range) (highest heating setpoint field adjustable downward).
15. Adjustable cooling range (65 – 99 degree setpoint range) (lowest cooling setpoint field adjustable upward from 65 degree F).
16. Daylight savings time key.
17. Fan can be programmed in the "on" or "auto" mode for each period.
18. Vacation/Leave program, will hold vacation/Leave temperature for up to 256 days.
19. Field temperature re-calibration offset (field adjustable). Allows installer to set thermostat to customer's wall mounted thermostat setting.
20. Finish: White

B. Programmable time clock (Paragon 7000 series or equal) with the following functions:

1. Each day shall subdivided into light (day) and dark (night) portions with 30 minute increments.
2. Scheduling for up to 28 events for the week.
3. Scheduling for up to 4 on/off operation per day.
4. Any day may be omitted.
5. On event marker shall be light colour, off events shall be dark colour.
6. Three Hour Minimum time between events
7. Independent four pole switching that shall allow for SPST, DPST, SPDT switching.
8. Manual ON/OFF lever transfer switch operation.

2.3 AUTOMATIC CONTROL DAMPERS

A. The Control Subcontractor will provide control dampers as specified and as shown on the plans of the types indicated on the plans. Frames shall not be less than 16 gauge galvanized steel. Blades must not be over 8 inches wide nor less than 16 gauge galvanized steel roll formed. Bearings shall be oilite, ball bearing or nylon with l/2" shafts.

B. All two position control dampers shall be parallel blade type; all modulating dampers shall be opposed blade.

C. Dampers shall be minimum leakage type to conserve energy and the manufacturer shall submit leakage and flow characteristic data for all control dampers with the temperature control submittal. Maximum leakage shall be less than 1% at static pressure of 5 inches W.C. approach velocity of 2000 FPM.

D. Where low leakage dampers are required, the blade edges shall be fitted with replaceable, snap-on, inflatable seals to limit damper leakage to l/2 percent at applied static pressure. Airfoil blades required. Low leak dampers are required on all outside air applications.

PART 3 EXECUTION

3.1 SEQUENCE OF OPERATION

A. Unitary equipment

1. Programmable Thermostat by unit manufacturer shall index unit to cooling or heating mode as dictated by space temperature.
2. Air Circulation. When the unit control is in the occupied mode the indoor air fans operate continuously to provide ventilation.
3. Outside air dampers shall open/close in response to the time clock. Dampers shall be closed in unoccupied mode.

B. Fans

1. Control as indicated on plans. Enable through time clock.

C. Time clock zones:

1. Toilet exhaust fans.
2. Outside air dampers.
3. Water heater recirculation pumps.

END OF SECTION

SECTION 23 11 23

GAS PIPING

PART 1 GENERAL

1.1 SCOPE

A. The provisions of Section 23 05 00 apply to all the work in this Section.

B. Contractor shall furnish and install all gas piping as shown on the plans complete in all respects.

C. Installation shall be in accordance with ALL state, local and national codes including NFPA Pamphlet No. 54 and NBFU Pamphlet No. 58.

D. The Contractor shall arrange with the operating gas company for providing gas service. The Contractor shall be responsible for seeing that the Owner is notified well in advance by letter when to make application for the gas service; a copy of the letter shall be forwarded to the Engineer.

PART 2 PRODUCTS

2.1 GAS PIPING

A. All piping shall be steel or copper as follows:

1. Steel pipe; ANSI/ASTM A53 "welded and seamless steel pipe".
2. Copper pipe; ANSI/ASTM B42 "seamless copper pipe".

2.2 GAS PIPE FITTINGS

A. Fittings shall be steel, copper or malleable iron. Pipe joints in steel or copper pipe may be screwed, welded or brazed. Fittings shall be suitable for the appropriate working pressure.

PART 3 EXECUTION

3.1 GAS PIPING

A. Gas piping shall be extended from the meter as shown.

B. All gas piping shall be tested with air at 150 psig minimum. All joints shall be checked to determine if any leaks occur, using soap solution. Any joint or fitting found defective shall be removed and replaced. No caulking or other artificial means will be used to make repairs.

C. Ground plug shutoff cocks shall be installed at each equipment service stub. Piping shall be installed with valves, drip pockets, stop cocks, and other accessories that may be required to give proper service.

END OF SECTION

SECTION 23 20 00

HVAC PIPING

PART 1 GENERAL

1.1 SCOPE

A. The provisions of Section 23 05 00 apply to all work in this Section.

B. Furnish and install all refrigerant and condensate drain piping as shall be required in order to provide a complete and satisfactory system.

1.2 SUBMITTAL

A. Submit the following in accordance with Section 23 05 00:

1. Manufacturer's cuts.
2. Installation instructions.
3. Operating and Maintenance Instructions.

PART 2 PRODUCTS

2.1 REFRIGERANT PIPING

A. All refrigerant piping shall be Type "K" hard drawn copper of "ACR" tubing with wrought copper sweat fittings. All joints are to be made with hard solder such as "Sil-Fos" or "Silver Solder."

B. All joints in refrigeration pipe work shall be soldered with the use of nitrogen gas. Refrigerant piping shall be tested, evacuated, charged with nitrogen and completely dried before charging with freon.

C. All refrigerant piping underground shall be encased in plastic or PVC conduit.

D. Refrigerant piping shall include best grade brass refrigerant fittings, consisting of expansion valve, solenoid valve, sight glass with moisture indicator, filter dryer, check valves and/or specialties as may be recommended or required by the manufacturer or as shown on the drawings.

2.2 DRAIN PIPING

A. All drain lines shall be PVC drain pipe conforming to ASTM D 1785. Drains shall be run in a neat manner to the floor drain and turned down at the floor drain, unless otherwise indicated. Minimum of 1-1/4" unless otherwise shown.

PART 3 EXECUTION

3.1 GENERAL

A. Contractor shall install valves and specialties according to the best practice and manufacturer's recommendations.

3.2 PIPE AND PIPE FITTINGS

A. Provide all piping and connections to all items of equipment as shown and/or required to fully complete the system indicated, including drains and other connections. The drawings show the arrangement desired and the Contractor shall follow the drawings as accurately as possible. If conflict should arise, the Contractor shall verify all measurements on the job and cut pipe unless specifically noted for expansion loops. All piping shall be reamed or filed and cleaned to remove burrs and other obstructions.

B. The Contractor shall be responsible for installing all piping work in a neat workmanlike manner. This shall be interpreted to mean that all piping shall be neatly aligned, installed and supported in equally spaced parallel runs using trapeze hangers where applicable, install square, true and plumb with walls, equipment or other related surfaces using standard fittings. Any pipe work installed in a disorderly or unworkmanlike manner as adjudged by the Architect shall be corrected by the Contractor at the Contractor's expense.

3.3 BLOWING-OUT SYSTEM

A. All piping and equipment shall be thoroughly blown-out under pressure and clean of all foreign matter wasting condensate through temporary connections so long as necessary to thoroughly clean before system is placed in operation. Use every precaution to prevent pipe compound, scale, dirt, welding and other objectionable matter getting into piping system and equipment.

3.4 HANGERS

A. All piping shall be supported on not less than 10' centers and within 30" of each change of direction except that piping 1-1/4" size and smaller shall be supported on 8'-0" centers.

B. All piping shall be hung by means of split type wrought iron hanger rings similar to Grinnell Figure 104 except as otherwise noted. Copper piping not insulated shall be hung from copper plated hangers similar to Figure CT-97. All insulated piping shall be hung by means of clevis type hangers sized to fit outside of insulation, Grinnell Figure 260.

C. Pipe hangers shall be supported by means of iron hanger rods from the building construction or from structural steel members, and in an approved manner. Where required, piping shall be hung from angle iron slips or suitable brackets attached to sides of masonry construction.

D. All insulated piping shall be provided with insulating protection sheet metal saddles. These shall be 20 gauge galvanized iron. Saddles shall be of a length equal to two times the outside diameter of the insulation and shall extend to above the center line of the pipe.

3.5 TEST

A. Pressure test all chilled water, hot water and dual temperature water piping at a pressure of 150 psig for 24 hours. Architect/Engineer shall be notified 24 hours before test is to be performed.

END OF SECTION

SECTION 23 30 00

AIR DISTRIBUTION

PART 1 GENERAL

1.1 SCOPE

A. Furnish and install all sheet metal work shown or called for including ductwork and connections to fans and equipment.

B. Ductwork shall be provided and installed as shown on the drawings. All details of ductwork are not indicated, and necessary bends, offsets and transformation must be furnished whether shown or not.

C. The provisions of Section 23 05 00 apply to all the work in this Section.

1.2 SUBMITTALS

A. Submit the following in accordance with Section 23 05 00.

1. Manufacturer's cuts.
2. Certified capacity ratings.
3. Installation instructions.

1.3 RELATED DOCUMENTS

A. Section 23 07 00 - Insulation.

PART 2 PRODUCTS

2.1 GENERAL

A. All ductwork, plenums and casings shall be constructed of sheet metal, as herein specified. All sheet metal construction shall conform to the pressure classification shown on the contract drawings, or herein specified and shall be in accordance with the construction and installation details in Chapter 19 of the 2012 ASHRAE Systems and Equipment Handbook or the appropriate SMACNA Standards.

B. Duct sizes on drawings represent gross sheet metal dimensions. Allowance has been made, where applicable, for duct liner.

2.2 LOW PRESSURE DUCTWORK

A. Low pressure ductwork shall be constructed of zinc coated sheet steel and shall conform to the 1st Edition of SMACNA HVAC Duct Construction Standards -Metal and Flexible, 1985, as follows:

1. Rectangular Duct
   a. 1" w.g. pressure class - Table 1-4.
2. Round Duct
   a. 2" w.g. pressure class - Table 3-2.

2.3 GENERAL EXHAUST DUCTWORK

A. Unless otherwise noted, all exhaust ductwork shall be constructed the same as specified for low pressure ductwork.

2.4 FLEXIBLE DUCTWORK

A. Flexible air duct for connections between low pressure duct to diffusers shall be equal to Thermaflex M-KE. Duct shall be listed by Underwriter's Laboratories under UL 181 standards as Class 1 flexible air duct material and shall comply with NFPA Standards 90A and 90B. Duct shall be rated to operate at pressures up to 6" w.g. for sizes 10" and 4" w.g. for sizes 12" and above. Maximum length of flexible air duct shall be 6 feet.

B. Duct shall be a factory fabricated assembly composed of a polymeric liner duct bonded permanently to a coated spring steel wire helix and supporting a fiberglass insulating blanket. Outer vapor barrier shall be of fiberglass reinforced film laminate. Connections shall be made with Thermaflex, or equal, duct straps.

2.5 FIRE DAMPERS

A. Furnish and install, at locations shown on plans, or where required by code, fire dampers constructed and tested in accordance with UL Safety Standard 555. Each fire damper shall have 1-1/2 hour fire protection rating. In addition each fire damper shall include a 212°F fusible link, and shall include a UL label in accordance with established UL labeling procedures. Damper manufacturer's literature submitted for approval prior to installation shall include comprehensive performance data developed from testing in accordance with AMCA Standard 500 and shall illustrate pressure drops for all sizes of dampers required at all anticipated airflow rates. Fire dampers shall be equipped for vertical or horizontal installation as required by the location shown. Fire dampers required by the location shown. Fire dampers shall be installed in wall and floor openings utilizing steel sleeves, angles, other materials and practices required to provide an installation equivalent to that utilized by the manufacturer when dampers were tested at UL. Installation shall be in accordance with the damper manufacturer's instructions. Fire dampers shall be style "A", "B" or "C" as required.

2.6 ACCESS DOORS

A. Ventifabrics, Krueger or Duro-Dyne, (Min. 12" x 10" - use 16" x 12" where size permits) insulated doors shall be provided for fire dampers, control dampers, smoke dampers, smoke detectors, and other locations where shown. Door shall be minimum 24 gauge galvanized, double construction with 1" insulation complete collar mounting frame, steel butt hinges, felt gaskets, fasteners and handles. Doors shall be labeled as to function, (fire damper, smoke detector, etc.).

2.7 TURNING VANES

A. Turning vanes and Deflector Controls, Barber-Colman, Carnes Corporation, Kruger or Titus in length up to 18"; Aero-Dyne Duro-Dyne, or Airsan double thickness about 24" in length, installed in rails.

2.8 FLEXIBLE CONNECTIONS

A. Flexible duct connections shall be provided where ductwork connects to equipment; ventifabrics or Duro-Dyne 28 ounce minimum waterproof and fire retardant woven glass fabric double coated with neoprene, approved by UL. Maximum length of flexible connections shall be 10 inches.

2.9 MANUAL DAMPERS

A. American Warming and Ventilating Company Type DAA-P-50, opposed blade, constructed with 15 gauge steel blades. Manual dampers shall be provided with Ventlock No. 637 hand operated locking quadrants located outside of ducts. Locking quadrants shall be elevated 1-1/2" for insulation. Manual dampers 18" x 10" or smaller may be single blade type construction of 16 gauge galvanized sheet metal. Dampers of Ruskin, Krueger, Louvers and Dampers, or Advanced Air, Inc. will be acceptable.

2.10 SPLITTER DAMPERS

A. Install where shown and at duct splits; provide with Ventlock No. 690 self-locking device; constructed of 16 gauge galvanized steel with hemmed leading edge and reinforced at hinged side.

2.11 GRILLES, REGISTERS AND DIFFUSERS

A. Grilles, registers and diffusers shall be of the type, size and design as shown on the drawings and/or as specified below. Grilles within the same room or areas shall be of the same type and style to provide architectural uniformity.

B. Each supply, return and exhaust device shall be of the proper design as indicated to handle quantities of air within the space with maximum diffusion and without objectionable air movement or noise level.

C. Each supply outlet and register shall have a volume damper control operable from the front of the device with removable key. Where indicated on the drawings, all side wall registers shall be equipped with deflectors.

PART 3 EXECUTION

3.1 DUCTWORK

A. All ductwork shall be provided in a neat workmanlike manner. The ducts shall be properly braced and reinforced. All slip joints shall be made in the direction of flow. All ducts shall be true to the dimension indicated and shall be straight and smooth on the inside with neatly finished airtight joints. The ducts shall be securely anchored into the building construction in an approved manner and shall be completely free from vibration under all conditions of operation. All supply, return fresh-air and exhaust systems shall be completely balanced.

B. No duct transformation shall be of a ratio less than four to one and where possible, shall be of a ratio of six to one. No less than three vertical splitters shall be provided where these ratios cannot be met. No elbow shall have a throat center line radius of less that one and one-half times the duct width at the turn. All turns of less than this amount in rectangular duct shall be provided with duct turning vanes of standard design. Splitters or multi-blade volume dampers, where indicated, shall be provided in all branch.

C. Turning vanes shall be provided at all tees and square elbows. Turning vanes shall be factory fabricated and designed in accordance with the SMACNA or ASHRAE Guide for formed vanes. The first set of turning vanes on the leaving side of fans shall be of the acoustical type to aid in the elimination of unit noise with the exception of room fan coil units.

D. Splitter dampers and volume extractors shall be provided in all low velocity ductwork for proper air distribution. Each damper shall be provided, lubricated bearings at both ends of the shafts,

adjustments quadrant, and locking devices and shall be constructed of galvanized iron or steel sheet one gauge heavier than the duct in which they are installed. Access doors shall be located at all splitter dampers.

E. Handholes of not less than 6" x 6" shall be provided at all points where access is required. Manholes of not less than 18" x 24" shall be provided at all points where it is necessary to clean or remove parts of equipment. All access doors and handholes shall be rubber gasketed insulated type with frame and latches.

F. Install access doors at each fire damper and smoke detector. Label all access doors.

G. All ductwork must be sealed in accordance with Seal Class C as defined in SMACNA HVAC Duct Construction Standards - Metal and Flexible, 1985.

3.2 DUCT HANGERS AND SUPPORTS

A. Duct hangers and supports shall conform to those shown in Tables 4-1 and 4-2 of SMACNA HVAC Ductwork 1985, 1st Edition.

3.3 WALL PENETRATIONS

A. Where ducts pass through non-rated walls and is exposed to view the duct shall be finished with suitable metal collar.

B. Where ducts pass through one hour fire walls, provide not less than 1/2" clearance between the duct and combustible material. Seal the clearance space with non-combustible material retained, and the duct secured in place by steel collars of a gauge equivalent to that of the duct and fastened to both the duct and the enclosure.

C. Where fire dampers are shown or required, dampers shall be installed per manufacturer's UL listing.

3.4 CLEANING DUCT SYSTEMS

A. Before fan systems are put in operation, vacuum clean inside of air units, plenums and apparatus housing. Filters are to be installed before moving air through duct systems.

END OF SECTION

SECTION 23 34 00

FANS

PART 1 GENERAL

1.1 SCOPE

A. The provisions of Section 23 05 00 apply to all the work in this Section.

B. Furnish and install fans as required to provide a complete and satisfactory job.

1.2 SUBMITTALS

A. Submit the following in accordance with Section 23 05 00.

1. Manufacturer's cuts.
2. Certified capacity ratings.
3. Installation instructions.
4. Operating and Maintenance Instructions.

PART 2 PRODUCTS

2.1 ROOF MOUNTED EXHAUST FANS

A. Roof exhaust fans shall be of the centrifugal, belt driven or direct driven type. Construction of the fan housing shall be of heavy gauge aluminum mounted upon a rigid support structure which affords minimal resistance to airflow and noise generation. The fan wheel and inlet cone shall be aluminum and of the high performance, centrifugal blower type. Wheels shall overlap the spun inlet venturi for maximum performance. Wheels shall be statically and dynamically balanced to assure smooth and vibration-free operation. Entire drive assembly shall be mounted on vibration isolators.

B. Motor and drives shall be isolated from the exhaust airstream. Air for cooling the motor shall be taken into the motor compartment from a location free from discharge contaminants. Motors shall be of the heavy duty type with permanently lubricated, sealed ball bearings.

C. The entire drive assembly and wheel, as a unit, shall be removable through the support structure without dismantling the fan housing. The wheel shaft shall be mounted in heavy duty, permanently sealed pillow block ball bearings. Belt drives shall be sized for a minimum of 165% of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts. The motor pulleys shall be adjustable for final system balancing.

D. All fans shall bear the AMCA Certified Performance Seal for both air and sound performance.

E. Motor. The motor shall be of a standard type that is easily replaceable and may be either sleeve or ball bearing type. Maximum RPM of the motor shall be l750 RPM.

F. Wire Guard. The inlet side of the fan shall be provided with a wire guard which completely surrounds the fan blades.

G. Shutter. Gravity type.

2.2 CEILING EXHAUST FAN

A. Type: The fan shall have a forward curved centrifugal wheel.

B. Housing: The fan housing shall be constructed of heavy gauge galvanized steel. The housing interior shall be acoustically lined with 1/2" thick insulation. The discharge outlet shall be adaptable for horizontal or vertical mounting.

C. Motor: The motor shall be mounted on resilient elastic grommets.

D. Control: The fan shall be controlled as shown on the drawings.

E. Radiation Damper: Furnish with U.L. Listed radiation damper.

F. Wire toilet exhaust fans to light switches.

2.3 IN-LINE FANS - DIRECT DRIVE

A. Supply or exhaust fans shall be direct driven in-line type. The square fan housing shall be four sides of heavy gauge galvanized steel. One of the sides shall be hinged and shall support the motor and wheel assembly allowing the assembly to swing out for cleaning, inspection, or service without dismantling the unit in any way. The motor shall be isolated from the air stream by a motor enclosure and shall draw cooling air from outside the fan housing.

B. The fan inlet shall be spun venturi throat overlapped by a backward curved centrifugal wheel with spun cone for maximum performance.

2.4 IN-LINE FANS - BELT DRIVE

A. Supply or exhaust fans shall be belt driven in-line type. The square shaped fan housing shall be of heavy gauge galvanized steel. One of the sides shall be hinged and shall support the entire drive assembly and wheel allowing the assembly to swing out for cleaning, inspection, or service without dismantling the unit in any way. The motor shall be mounted on the hinged side exterior isolated from the airstream. The belt and pillow block ball bearings shall be protected from the airstream by an enclosure. The shaft shall be keyed to both the wheel and pulley.

B. The fan inlet shall be a spun venturi throat overlapped by a backward curved centrifugal wheel with spun cone for maximum performanc.

C. Air and sound shall be AMCA licensed.

2.5 PROPELLER FAN - BELT DRIVE:

A. Type. The fan shall be of the belt drive, three of four blade type, mounted on a steel mounting plate with orifice ring.

B. Mounting Plate. The mounting plate shall be the manufacturer's standard size and shall be of a size ample to fit the opening provided. The orifice ring shall be correctly formed by spinning or stamping to provide easy passage of air without turbulence and to direct the air. The thickness of the plate shall be not less than the following:

Wheel Diameter	Plate Thickness U.S.S. Gauge
Up to 12 inches	18
12 inches to 16 inches	16
18 inches to 24 inches	14
26 inches to 36 inches	12
38 inches to 60 inches	10

C. Fan Blades. Shall be constructed of steel or aluminum. The fan hub shall be of heavy construction and shall be steel or semi-steel, and blades shall be welded to the hub. Fan blades shall be quiet in operation and shall be statically and dynamically balanced at the factory.

D. Shafts. Shall be of steel, accurately ground and shall be of ample size for the loads transmitted, and shall not pass through a critical speed through the full range of speed shown for the fan. Shafts shall be mounted in permanently lubricated, sealed ball bearing pillow blocks (200,000 Hr.). Drives shall be sized for a minimum of 150% of driven horsepower.

E. Pulleys shall be fully machined cast iron keyed and securely attached to the motor and fan shafts. The motor sheave shall be adjustable.

F. Motor. The motor shall be of the heavy duty bearing type. Maximum RPM of the motor shall be 1750 RPM.

G. Wire Guard. the inlet side of the fan shall be provided with a wire guard which completely surrounds the fan blades.

H. Shutter. Gravity type.

I. Control. The fan shall be controlled as shown on the drawings.

2.6 PROPELLER FAN - DIRECT DRIVE

A. Type. The fan shall be of the direct drive, three of four blade type, mounted on a steel mounting plate with orifice ring.

B. Mounting Plate. The mounting plate shall be the manufacturer's standard size and shall be of a size ample to fit the opening provided. The orifice ring shall be correctly formed by spinning or stamping to provide easy passage of air without turbulence and to direct the air. The thickness of the plate shall be not less than the following:

Wheel Diameter	Plate Thickness U.S.S. Gauge
Up to 12 inches	18
12 inches to 16 inches	16
18 inches to 24 inches	14
26 inches to 36 inches	12
38 inches to 60 inches	10

C. Fan Blades. Shall be constructed of steel or aluminum. The fan hub shall be of heavy construction and shall be steel or semi-steel, and blades shall be riveted to the hub. Fan blades shall be quiet in operation and shall be statically and dynamically balanced at the factory.

D. Shafts. Shall be of steel, accurately ground and shall be of ample size for the loads transmitted, and shall not pass through a critical speed through the full range of speed shown for the fan.

E. Motor. The motor shall be of a standard type that is easily replaceable and may be either sleeve or ball bearing type. Maximum RPM of the motor shall be 1750 RPM.

F. Wire Guard. The inlet side of the fan shall be provided with a wire guard which completely surrounds the fan blades.

G. Shutter. Gravity type.

H. Control. The fan shall be controlled as shown on the drawings.

2.7 SIDEWALL MOUNTED EXHAUST FANS

A. Sidewall exhaust fans shall be of the centrifugal belt driven or direct driven type. Construction of the windband shall be of heavy gauge aluminum with a rolled bead on the outer edge for strength. The fan wheel and inlet cone shall be aluminum and of the high performance centrifugal blower type. The fan wheel shall be of the aluminum, non-overloading, backward inclined type, statically and dynamically balanced. Blades, fins, inlet cones and back plates shall be securely fastened together into a rigid assembly.

B. Motors and drives shall be isolated from the exhaust airstream. Air for cooling the motor shall be taken into the motor compartment by means of an air tube from a location free of discharge contaminants.

C. The entire drive assembly and wheel, as a unit, shall be removable through the support structure without dismantling the fan housing. The wheel shaft shall be mounted in heavy duty, permanently sealed pillow block ball bearings. Belt drives shall be sized for a minimum of 165% of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts. The motor pulleys shall be adjustable for final system balancing. The entire drive assembly shall be mounted on vibration isolators to minimize noise transmission.

D. All fans shall bear the AMCA Certified Performance Seal for both air and sound performance.

E. Motor. The motor shall be of a standard type that is easily replaceable and may be either sleeve or ball bearing type. Maximum RPM of the motor shall be 1750 RPM.

F. Wire Guard. The inlet side of the fan shall be provided with a wire guard which completely surrounds the fan blades.

G. Shutter. Gravity type.

H. Control. The fan shall be controlled as shown on the drawings.

2.8 VANE-AXIAL FANS

A. Furnish the required fan (Vane-Axial) where shown on the drawings and of the capacities and types as indicated in the Fan Schedule.

B. Fan housing shall be hot rolled steel SAE 1020 with a minimum 1/4" thickness with 3/8" end flanges. End flanges shall be continuously welded around the entire periphery of fan housing and shall be provided with both holes for bolting to inlet bell, cones, companion flanges, or duct, etc.

Housing shall be continuously welded and shall be expanded by mechanical means to insure concentricity. Housing shall be sandblasted to ensure good paint adherence inside and outside. Not less than eight (8) stationary guide vanes of 3/16" thickness shall be welded inside the fan housing. The motor support plate shall be 3/4" plate steel and welded to fan housing by means of motor support ring and vances. Motor support ring shall be not less than 3/8" support ring shall be continuously welded to motor support plate.

C. Fan motor hub and blades shall be of cast aluminum construction. Hub to be cast of #356-T6 Aluminum Alloy, Heat treated, and blades shall be cast of #356 Aluminum Alloy. Fan blades shall be airfoil shaped for maximum efficiency and shall vary in twist and width from hub to tip to obtain equal air distribution along the blade length. Blade tip clearance to fan housing shall not exceed 0.10".

D. Fan blades shall be automatically controllable through the design pitch range to vary volume and pressure characteristics across this range. Each blade must be index marked for various pitch settings and shall be capable of stepless control across the complete pitch range while the motor is operating at full speed. The blades in the controllable pitch hub shall be remote controlled by a pneumatic/electric actuator.

D. Vane-axial fans shall be direct motor driven as indicated on the drawings and/or Fan Schedule as follows:

1. Direct driven vane-axial fans shall be Arrangement No. 4 with motor inside the fan housing and fan rotor assembly directly to motor shaft, properly keyed and secured by means of a ball bearing locknut and washer for a positive locking method of securing rotor to fan shaft.
2. The fan rotor shall be whirl tested to 125% of operating speed and shall be statically and dynamically balanced on fan motor shaft to a maximum tolerance guaranteed in writing, of one (l) mil double amplitude at design operating speed.
3. Motor shall be equipped with ball bearings AFEMA "PP", with B-10 life, Class "F" insulation using thermo setting insulation varnish fortified with water repelling Silicone to allow operation up to 95 degrees C. rise over 40 degrees ambient. External copper grease leads for lubrication of motor bearings shall be provided by the fan manufacturer. Motors shall be capable of operating at the voltage specified on the schedules.
4. Fan motors shall be NEMA standard totally enclosed air-over, "C" face, flange mounted, squirrel cage induction, single speed, single winding, continuous duty variable torque, and suitable for operation in either vertical or horizontal or angular position. Motor flange shall be recessed into motor support plate to preclude and shear effect on bolts misalignment.
5. A conduit box shall be mounted on the exterior of fan casing, and lead wires from the motor conduit box shall be protected from the air stream by being encased in an air tight metal conduit pipe.

F. Inlet bells shall be provided for vane-axial fans.

G. Provide discharge cones where shown on drawings with flanges on both ends for attachment and for attachment to discharge ductwork or plenum and fan. Cone flanges shall be same thickness as fan flanges.

H. Vane-axial fans shall be provided with supports for horizontal mounting where indicated. Horizontal fan supports shall be provided by the fan manufacturer and shall be bolted to the inlet and discharge flanges of the fan. Supports shall be constructed of: 1/4" carbon steel.

I. Provide companion flanges where required to receive sheet metal duct or flexible connectors. Companion flanges shall be of the same thickness as the fan flanges, and shall be provided by fan manufacturer.

J. The fan manufacturer must furnish published performance curves, and such data is to be based on tests in accordance with current AMCA Standards and in an AMCA approved laboratory. Fan must carry AMCA label.

K. The fan manufacturer must furnish published sound power lever data based on actual test on the fan sizes being furnished, and conducted in accordance with current AMCA Standards. Such data is to define Sound Power Levels (PWL), re: 10-12 watts for each of the eight (8) frequency bands. Manufacturers furnishing estimated data will not be approved.

L. All controllable pitch vane-axial fans shall be provided with a means whereby operation in a stall region (no flow situations), cannot occur regardless of the operating condition. If the anti-stall arrangement is accomplished by mechanical or electrical monitoring devices, these devices shall shut the fan down until manual restarting is achieved. Fans operating in parallel shall be equipped with a breaking device to stop fan "windmilling" before starting current is applied to the fan motor.

PART 3 EXECUTION

3.1 INSTALLATION

A. Fan shall be installed in accordance with the manufacturer's recommendations.

B. Fan shall be installed in fully accessible locations.

END OF SECTION

SECTION 23 37 26

LOUVERS

PART 1 GENERAL

1.1 DESCRIPTION

A. Work Included: Provide exterior metal louvers where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

A. Submit materials list of items proposed to be provided under this Section.

B. Submit manufacturer's specifications and other data needed to prove compliance with the specified requirements.

C. Submit Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.

D. Submit samples of the proposed products, showing profiles, joining, and finish.

E. Submit manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

PART 2 PRODUCTS

2.1 METAL LOUVERS

A. Standard Intake/Exhaust

1. Provide metal louvers in the arrangements and dimensions shown on the drawings, and with the following attributes:
   a. Provide louver blades and frames fabricated from 6063-T5 alloy, with a minimum thickness of 0.081" in all sections.
   b. Fabricate from extruded or roll-formed aluminum only; brake-shapes will not be acceptable.
   c. Louver Depth: 4".
   d. Blade Angle: Mfg. standard.
   e. Blade Centers: 5 3/32".
   f. Provide birdscreen of ½" square 14 ga. Aluminum, finished similar to the louvers. Install at interior side of louver.
   g. Provide 50% KYNAR 500 finish, color selected by Architect.

h. Accessories: Sill and jamb extensions, flashing and wall anchors, solid blank-off panels.

2. Manufacturer and Model:
   a. Ruskin: ELF375 DX
      (1) Approved Substitution: Construction Specialists.
      (2) Approved Substitution: Reliable

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Coordinate as required with other trades to assure proper and adequate provisions in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the approved Shop Drawings and the recommendations of the manufacturers as approved by the Architect, anchoring all components firmly into position in true alignment with a tolerance of one in 1000 vertically and horizontally. Use concealed stainless steel fasteners.

C. Coordinate installation of these fixed louvers with any operable louvers provided in the mechanical section. The entire louvered opening shall be caulked and sealed at the edges to minimize water penetration.

END OF SECTION

SECTION 23 54 19

GAS FIRED FURNACE - CONDENSING

PART 1 GENERAL

1.1 SCOPE

A. The provisions of Section 23 05 00 apply to all the work in this Section.

B. Furnish and install gas fired-condensing warm air furnaces as required to provide a complete and satisfactory job.

1.2 SUBMITTALS

A. Submit the following in accordance with Section 23 05 00.

1. Manufacturer's Cuts.
2. Certified Capacity Ratings.
3. Installation Instructions.
4. Operating and Maintenance Instructions.

1.3 PERFORMANCE

A. Unit performance with regards to capacity, airflow, and efficiency shall be equal to or greater than the values listed on the equipment schedule on the plans.

PART 2 PRODUCTS

2.1 GAS FIRED FURNACE

A. Blower shall be centrifugal type, statically and dynamically balanced. Motor shall have factory lubricated bearings and shall be multiple speed direct drive.

B. Shall have 1" throw away-type filters.

C. Casing shall be of 20 gauge steel with baked enamel finish.

D. Heat exchangers (primary) shall be aluminized steel and sectional in design, secondary heat exchanger shall be constructed of stainless steel. Both heat exchangers shall be include lifetime warranty.

E. Burners shall be aluminized steel and tapered for even gas distribution. Ignition shall be accomplished by means of an electronic ignition device.

F. Controls shall include: redundant gas valve which regulates gas flow, filters pilot gas, and provides manual main burner shutoff, blower door safety switch, combustion air safety switch, prewired indoor fan relay with transformer on heating/cooling furnaces; a low voltage heating/cooling thermostat.

G. The combustion system shall be of the direct vent sealed combustion chamber type with a draft inducer blower. Inlet and exhaust venting shall be thru PVC piping.

H. Cooling applications shall be feasible with furnace fan supplying sufficient air for cooling when used with cooling components.

END OF SECTION

SECTION 23 55 23

GAS FIRED INFRARED TUBE HEATERS

PART 1 GENERAL

1.1 SCOPE

A. The provisions of Sectin 23 05 00 apply to all the work in this Section.

B. Furnish and install gas fired infrared heaters as indicated or required to provide a complete and satisfactory job.

1.2 SUBMITTALS. Submit the following in accordance with Section 23 05 00:

A. Catalog cuts,

B. Certified ratings.

C. Installation instructions.

D. Operating and Maintenance Instructions.

PART 2 PRODUCTS

2.1 GAS FIRED INFRARED HEATERS

A. Heaters shall be equipped with a 24-volt direct spark ignition with automatic 100% shutoff system. Power supplied to each heater shall be 120 VAC, 60 Hz. The heater controls shall include a pressure switch designed to provide complete unit shutoff in the event of combustion air or flue blockage. The heaters shall be equipped with an on-line diagnosis monitoring light system. The three lights shall monitor the power to the heater, insufficient air flow, and the spark ignition and the combination gas valve operation.

B. The heater's burner shall consist of a cast iron atmospheric burner. The flame characteristics shall be highly luminous for maximum radiant heat transfer through the emitter tube wall.

C. The heater's emitter tube shall operate at an average surface temperature of 750oF and shall be made of 16-gauge, aluminized steel for long life. The emitter tube shall be calorized for longevity, corrosion resistance, and high radiant efficiency. The measured surface emissivity shall be .83 - .86 at operating temperature. The calorization process shall produce an emitter tube that is highly radiant absorptive on the interior and highly radiant emissive on the exterior.

D. To assure a high degree of safety and increased radiant efficiency, the heaters shall operate under negative pressure at all times during operation to preclude the escape of combustion gases inside the building. The heater exhaust assembly shall include a 115-volt draft inducer. The draft inducer shall be equipped with a permanently lubricated, totally enclosed and shielded, fan cooled, and heavy duty ball bearing motor. The motor shall not require maintenance or lubrication for the life of the unit. The draft inducer assembly shall be capable of rotating 90o for vertical or horizontal venting.

E. The heaters will be A.G.A. and C.G.A. design certified for vertical or horizontal venting, maximum 75 feet horizontal sidewall venting, and for 50 feet outside fresh air inlet duct. There shall be no draft hoods. The combustion chamber shall be totally enclosed.

F. The heaters shall utilize factory assembled, highly efficient aluminum reflectors with a reflectivity of 97.5%. The reflector ends shall be enclosed for maximum radiant heat output and minimum convection losses.

G. Heaters shall operate satisfactorily in any position form horizontal to forty-five degrees (45o) from horizontal, and shall be suitable for vented/indirect vented applications. Heaters shall be designed to operate on natural or propane gas.

H. The manufacturer shall provide a written limited warranty covering the heavy one piece cast iron burner for a period to ten (10) years, the emitter tube for a period of three (3) years, and all components utilized in the heater's control assembly for a period of one (1) year.

END OF SECTION

SECTION 23 63 13

AIR COOLED CONDENSING UNIT

PART 1 GENERAL

1.1 SCOPE

A. The provisions of Section 23 05 00 apply to all the work in this Section.

B. Furnish and install air cooled condensing units as required to provide a complete and satisfactorily job.

1.2 SUBMITTALS

A. Submit the following in accordance with Section 23 05 00.
   1. Manufacturer's Cuts.
   2. Certified Capacity Ratings.
   3. Installation Instructions.
   4. Operating and Maintenance Instructions.

PART 2 PRODUCTS

2.1 AIR COOLED CONDENSING UNITS

A. Furnish and install where indicated on plans an air cooled condensing unit. The unit shall contain sufficient refrigerant for complete system and be equipped with refrigerant line fittings which permit mechanical or sweat connection. Brass service valves with fittings and gauge ports shall be located on exterior of unit.

B. Compressor shall be of the welded hermetic type with internal vibration isolation and be located in an isolated section of the unit.

C. Controls shall be factory wired and placed in a location readily accessible from top of unit. Compressor motor shall have both thermal and current sensitive overload devices.

D. Condenser coil shall be constructed with aluminum fins mechanically bonded to nonferrous tubing. Condenser fan shall be propeller type, direct driven, and arranged for vertical air discharge. Fan motor shall be factory lubricated, totally enclosed and inherently protected.

E. Compressor shall be furnished with a 4 year extended warranty.

END OF SECTION