Hight Jackson ASSOCIATES

An Addition
Benton County Justice Center
Bentonville, Arkansas

Project No. 2311

Volume 2 of 2

PROJECT MANUAL FOR CONSTRUCTION OF

AN ADDITION
BENTON COUNTY JUSTICE CENTER
BENTONVILLE, ARKANSAS

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SECTION 21 01 00

GENERAL FIRE SUPPRESSION PROVISIONS

PART 1 GENERAL

1.1 WORK INCLUDED

A. The work covered by Division 21 sections consist of furnishing all labor, equipment, appliances and material for the piping and plumbing systems in strict accordance with Codes, Specifications and the applicable drawings and subject to the terms and conditions of the contract. Include all appurtenances necessary to the proper operation of the systems and equipment specified.

B. Some equipment may be furnished by other divisions. Fire Suppression Contractor is responsible to check the drawings and specifications for equipment that will be furnished by the others.

C. General Contractor shall furnish and install all ceiling access panels required to service equipment, valves and controls above gyp board or hidden spline ceilings.

D. General Contractor shall provide all site drive, sidewalk, and other surfaced areas, saw cutting, and repairs back to preexisting conditions for the required mechanical piping. Fire Suppression Contractor shall provide the trenching, bedding and backfill required for the pipe installation.

1.2 RELATED SECTIONS

A. The General Conditions and Division 1, General Requirements, as bound in the specification preamble, apply to all work under Division 21. Carefully note its contents in performance of the work.

B. The Architectural, Plumbing, Mechanical, Electrical and Structural plans and Specifications, including Information to Bidders and other pertinent documents issued by the Engineer are a part of the Specifications and the accompanying mechanical plans. Comply with them in every respect. Examine all the above carefully. Failure to comply does not relieve the Contractor of responsibility nor may it be used as a basis for additional compensation due to omission of architectural, electrical and structural details from the mechanical drawings.

C. All electrical power wiring is specified under Division 26 of the Specifications. Fire Suppression Contractor shall furnish all motor starters required for the control and protection of all motors furnished for Division 21, any air compressors, or other fire suppression equipment to be wired by a licensed electrician.

D. All concrete pads and bases required for installing equipment are specified in another section of the Specifications. Advise the General Contractor as to the exact sizes required, location of anchor bolts, etc.

1.3 CODES, FEES AND LATERAL COSTS

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

1. 2021 Bentonville, Arkansas Fire Prevention Code.
2. 2021Bentonville, Arkansas AFPLB Rules and Regulations.
3. IBC - International Building Code; latest adopted edition.
4. ASA - American Standards Association.
5. ASME - American Society of Mechanical Engineers.
6. ASTM - American Society of Testing Materials.
7. AWWA - American Water Works Association.
8. NBS - National Bureau of Standards.
9. NEMA - National Electrical Manufacturers Association.
10. NFPA - National Fire Protection Association; the edition referenced by the governing Fire Code or else the latest edition.
11. UL - Underwriters' Laboratories, Inc.
12. OSHA - Occupational Safety and Hazard Association.
13. IFC - International Fire Code; currently adopted edition.

B. In case of difference between building codes, Specifications, state Laws, local ordinances, industry standards and utility company regulations and the Contract Documents, the most stringent governs. Promptly notify the Engineer in writing of any such difference.

C. Remove any work installed that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards, or utility company regulations, correct the deficiencies, and reinstall all work at no cost to the Owner.

D. The architectural drawings show the general arrangement of all rooms and finishes. Follow as closely as actual building construction and the work of other trades will permit. Final layout will be governed by actual field conditions with all measurements verified at the site. Conform to the requirements shown on all of the drawings. General and structural drawings take precedence over mechanical drawings. Investigate the existing and finish conditions affecting the work and arrange the work accordingly, providing such fittings, valves and accessories as may be required to meet such conditions. Contractor shall verify that all equipment, pipes and all other components will fit in the space provided before fabrication or ordering.

E. Obtain any and all required permits in connection with this work under the Contract and pay any and all fees in connection therewith. Arrange with the serving utility companies for the connections to all utilities and pay all charges for same including inspection fees and meters if required. Refundable deposits will be paid by the Owner.

1.4 GUARANTEE

A. Furnish a written certificate guaranteeing all materials, equipment and labor furnished to be free of all defects for a period of one (1) year from and after the date of final acceptance of the work by the Owner and further guarantee to replace such work without charges if any defects appear within the stipulated guaranty period.

1.5 SOIL CONDITIONS

A. The Specifications and the drawings in no way imply the conditions of the soil to be encountered. When excavating may be required in execution of the work, this Contractor agrees that he has informed himself regarding conditions affecting the work.

1.6 INSPECTION OF PREMISES

A. Before submitting a bid, visit the site of the proposed job and determine the conditions relating to this work.

1.7 UTILITIES, LOCATIONS AND ELEVATIONS

A. Locations and elevations of the various utilities included within the scope of this work have been obtained from substantially reliable sources and are offered as a general guide only, without guarantee as to accuracy. Verify the location and elevation of all utilities and their relation to the work before entering into a contract.

B. Identify outdoor underground lines with continuous strip of plastic utility marker tape at regular intervals (maximum of 10 feet) "Caution FIRELINE below". Install one

foot directly above pipe before backfilling to grade.

PART 2 PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Provide new materials bearing the manufacturer's name, trade name and the UL label in every case where a standard has been established for the particular material. Furnish the standard product of a manufacturer regularly engaged in the production of the required type of equipment. Provide the manufacturer's latest approved design.

B. Deliver equipment and materials to the site and store in original containers, suitably sheltered from the elements, but readily accessible for inspection by the Engineer until installed. Store all items subject to moisture damage (such as controls) in dry, heated spaces.

C. Provide equipment and materials of the same general type and of the same make throughout the work to provide uniform appearance, operation and maintenance.

D. Tightly cover equipment and protect against dirt, water and chemical or mechanical injury and theft. At the completion of the work, clean fixtures, equipment and materials and polish thoroughly. Turn over to the Owner in a condition satisfactory to the Engineer. Repair damage or defects developing before acceptance of the work at no expense to the Owner.

E. Insure that items to be furnished fit the space available. Make necessary field measurements to ascertain space requirements, including those for connections. Furnish and install such sizes and shapes of equipment that the final installation suits the true intent and meaning of the drawings and Specifications.

F. Follow manufacturer's directions completely in the delivery, storage, protection and installation of all equipment and materials. Promptly notify the Engineer in writing of any conflicts between any requirements of the Contract Documents and the manufacturers' directions. Obtain the Engineer's written instruction before proceeding with the work. Replace any work that does not comply with the manufacturers' directions or such written instructions from the Engineer, at no cost to the Owner.

G. Support all products by service organizations with adequate spare parts inventory and personnel located within fifty (50) miles of the site.

H. Where multiple units of the same type or class of products are required, provide all units of the same manufacturer.

2.2 EQUIPMENT ACCESSORIES

A. Furnish and install all equipment, accessories, connections and incidental items necessary to fully complete all work, ready for use, occupancy and operation by the Owner.

B. Where equipment requiring different arrangement or connections from those shown is provided, install the equipment to operate properly and in harmony with the intent of the drawings and Specifications.

C. Support, plumb, rigid and true to line, all work and equipment furnished. Study thoroughly all fire sprinkler, general, structural, electrical and mechanical drawings, shop drawings and catalog data to determine how equipment, valves, piping, etc., are to be supported, mounted or suspended and provide extra steel bolts, inserts, pipe stands, brackets and accessories for proper supports whether or not shown on the drawings. When directed, submit drawings showing supports.

D. If accessories are required to complete the work and meet the intent of the specification, it is the responsibility of the Contractor to provide such accessories.

2.3 MATERIAL AND EQUIPMENT SCHEDULE

A. Submit to the Engineer as soon as practical, six (6) complete sets of the schedule of materials and equipment proposed for the installation. Include manufacturers' names, catalog data, diagrams, drawings and other descriptive data and submit under one cover with an index sheet in front. Also, provide a CD containing PDFs of the materials and equipment proposed, fire sprinkler drawings, and all RFI correspondence. Use the following folders: Product Manual, FP Drawings, RFIs.

B. Provide written certification that shop drawings are in accordance with the specifications and are dimensionally correct with reference to available space.

C. All submittals will be reviewed a maximum of two (2) times. The cost of additional submittal reviews beyond those two specified will be charged to the Contractor.

D. Shop drawings for the Engineer's files are required on the following items:

1. Booster pumps, starters, controls and instrumentation, etc.

2. Pipe hangers and supports, including any seismic bracing/restraints.

3. Piping materials, including flexible connections, and valves.

4. Complete equipment electrical data and wiring details. Include specifications for pressure switches, flow switches, alarm devices, and air compressors.

5. Sprinkler heads, escutcheons, and guards. Include manufacturer's data sheets for all sprinklers and finish trim, indicating which sprinkler wrenches apply.

6. Sprinkler plans including calculations and approval from the Authorities Having Jurisdiction.

7. Include all information pertaining to any standpipe and hose systems required, such as hose connections, stations, and cabinets.

8. Include information for all exterior installation, such as joints, restraints, valves, tapping, fire hydrants, bedding, thrust blocking, and preliminary Contractor's Material Test Certificate, to be signed at later date.

2.4 EQUIPMENT AND MATERIAL SUBSTITUTIONS

A. It is the responsibility of the Contractor to investigate any desired substitutions for specified equipment prior to submission of his bid. The Fire Suppression Contractor shall be responsible for any changes required in mechanical, electrical, or structural systems and shall bear all cost for those changes whether the substitute equipment is named by manufacturer in the specifications or is submitted to the Architect for "or equal" consideration. All changes shall be accomplished in a manner acceptable to the Architect per Section 01 60 00 at no additional cost to the Owner.

B. In order to obtain prior approval on equipment or material not specified in Fire Suppression Specifications or Equipment Schedules, Fire Suppression Contractor MUST submit to the Engineer any proposed equipment or material ten (10) working days prior to the bid date.

C. If ANY substitute equipment is submitted to Engineer for approval, without said equipment having been pre-approved, the entire submittal will be rejected for resubmittal.

D. Any equipment manufacturers which are a subsidiary to the listed acceptable manufacturers are not considered equal. Therefore, it is the responsibility of the Contractor and equipment supplier to obtain prior approval as described in paragraph 2.4, this Section.

2.5 ELECTRICAL MOTORS

A. Provide motors of a recognized manufacturer, wound for the voltage specified, and in conformance to latest standards of the manufacturer and performance of the National Electrical Manufacturers Association and the Institute of Electrical and Electronic Engineers. Provide motors as manufactured by General Electric, Westinghouse, Century or Siemens-Allis, Baldor or approved equal.

B. Provide motors rated for continuous duty at 100% of rated capacity and temperature raise of 40 degrees Centigrade open type; 50 degrees Centigrade drip and splash proof; 55 degrees Centigrade explosion proof and totally enclosed above an ambient of 40 degrees Centigrade.

C. Unless otherwise required, provide integral horsepower, polyphase motors, Class B, general purpose, squirrel cage, open type induction motors, T-frame.

D. Provide single phase fractional horsepower motors of the open capacitor type. Generally, motors under 1/2 horsepower may be split phase type unless otherwise specified. Provide motors rated 1/2 horsepower or less with integral overcurrent protection.

E. Insure the insulation resistance between stator conductor and frames of motors is not less than 1/2 megohm. Provide shop test of motors including temperature rise, insulation resistance, motor terminal voltage, normal operating line current, RPMs, breaker or switch size with fusing and overload relay sizes.

PART 3 EXECUTION

3.1 COORDINATION OF WORK

A. Compare the Fire Suppression drawings and Specifications with the drawings and Specifications for other trades and report any discrepancies between them to the Engineer and obtain from him written instruction for changes necessary in the fire suppression work. Install the fire suppression work in cooperation with other trades installing inter-related work. Before installation, make proper provisions to avoid interferences in a manner approved by the Engineer. Make all changes required in the work caused either by neglect or existing field conditions at no cost to the Owner.

B. It is the responsibility of the General Contractor, Mechanical Contractor, Electrical Contractor and Sprinkler Contractor to coordinate installation of all equipment. Equipment installed prior to proper coordination, which interferes with the harmony and intent of the specifications and drawings, will be removed and reinstalled at the cost of the responsible Contractor.

C. Furnish anchor bolts, sleeves, inserts and supports required for the fire suppression work. Locate anchor bolts, sleeves, inserts and supports as directed by the trade requiring them and insure that they are properly installed.

D. Adjust locations of pipes, equipment, etc., to accommodate the work and for interferences anticipated and encountered. Determine the exact route and location of each pipe prior to fabrication.

1. Provide right-of-way to lines that pitch over those that do not pitch. For example, Plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have the right-of-way over lines whose elevations can be changed.

2. Make offsets, transitions and changes in direction in pipes as required to maintain proper head room and pitch.

E. Install all Fire Suppression work to permit removal without damage to all parts requiring periodic replacement or maintenance. Insure proper clearance for the backflow prevention, fire sprinkler valves, alarm switches, and all such components. Arrange pipes and equipment to permit ready access to valves, cocks, traps, starters, motors, control components and to clear the openings of swinging and overhead doors and of access panels.

3.2 RECORD DRAWINGS

A. Maintain record drawings showing exact locations and sizes, as actually installed, of piping, drains, cleanouts, ductwork, controls and equipment as specified herein. Deliver to the Owner/Architect upon completion and acceptance of the work, one (1) complete set of contract drawings marked to indicate all deviations from intended installation.

3.3 CUTTING AND PATCHING

A. The General Contractor shall be responsible for all required cutting, patching, etc., incidental to this work and shall make all required repairs thereafter to the satisfaction of the Engineer. Do not cut into any major structural element, beam or column without the written approval of the Engineer.

B. Cut, patch, repair and/or replace pavements, sidewalks, roads and curbs as required to permit the installation of the work and pay all expenses incurred for this work.

C. Pipes, conduits, cables, wires, pneumatic tubes and similar equipment that pass through fire or smoke barriers shall be protected by the Fire Suppression Contractor in accordance with NFPA 101.

D. All fire stopping assemblies must be UL approved assemblies.

3.4 EXCAVATION AND TRENCHING FOR PIPING

A. Excavate to the depths indicated on the Drawings or as required to provide adequate slope and burial depth. Excavated materials not required or suitable for backfill or fill shall be removed from the site. Do such grading as is necessary to prevent surface water from flowing into trenches or other excavations. Water accumulating therein

shall be removed by pumping or by other method. Sheeting and shoring shall be installed as may be necessary for protection of the work and for safety of personnel. Excavation shall be by open cut except that short sections of a trench may be tunneled if the pipe can be safely and properly installed and backfill can be properly tamped in such tunnel sections.

B. Trench Excavation: Grade bottom of trenches to provide uniform bearing and support for each section of pipe on undisturbed soil. Where rock is encountered excavate to a minimum overdepth of 4" below trench depths indicated on the Drawings or specified. Overdepth in rock excavation and unauthorized overdepths shall be backfilled. Whenever wet or otherwise unstable soil incapable of properly supporting the pipe is encountered such soil shall be removed and the trench backfilled to proper grade as hereinafter specified.

C. Depth of Cover: Trenches shall be of depth that will provide three feet (3') minimum cover or as required by the local utility authorities for fire lines from existing grade or from indicated finish grade, whichever is lower, unless otherwise specifically shown.

D. Utilities Locating: Locate existing utility lines prior to beginning any excavation

E. Protection of Existing Utilities: Existing utility lines to be retained that are shown on the Drawings or the locations of which are made known to the Contractor prior to excavation, as well as all utility lines uncovered during excavation operations, shall be protected from damage during excavation and backfilling, and if damaged, shall be repaired by the Contractor at his expense.

F. Trenches shall not be backfilled until required pressure and other tests have been performed and until the utilities systems as installed conform to requirements of Drawings and Specifications.

G. Backfill trenches with excavated materials consisting of earth, sandy clay, sand, gravel, soft shale or other approved materials, free from clods of earth or stones 2-1/2" maximum dimension, deposited in 6" layers and compacted to 95% Standard Proctor Compaction Test of the maximum laboratory density determined in accordance with ASTM D698, Moisture-Density Relation of Soils. If fills fail to meet the specified densities, the Contractor shall remove and re-compact the fill until specified densities are achieved. Compaction test shall be performed for each fifty linear feet of trench.

H. Provide a 4-inch thick (minimum) layer of 3/4-inch No. 4 gravel aggregate bedding beneath all buried piping. Bedding shall be compacted and leveled to provide sloping required.

3.5 EQUIPMENT START-UP AND TESTING

A. Instruct the Owner's operating personnel during start-up and separate operating tests of each major item of equipment. During the operating tests, prove the operation of each item of equipment to the satisfaction of the Engineer. Give at least seven (7) days notice to the Engineer of equipment start-up and operating tests.

3.6 CATALOG DATA FOR OWNER

A. Provide, in looseleaf binders, two (2) sets of a compilation of catalog data of each manufactured item of equipment used in the Fire Suppression work and present this compilation to the Owner/Architect for transmittal to the Owner before final payment is made. Include descriptive data and printed installation, operating and maintenance instructions for each item of equipment. Provide a complete double index as follows:

1. Listing of products alphabetically by name or by a clearly established, organized method approved by the engineer.

2. Listing the names of manufacturers whose products have been incorporated in the work alphabetically together with their addresses and the names and addresses of the local sales representatives.

3. Certificates of Final Inspections.

4. Complete spare parts data with current prices and supply sources.

5. Extended warranties.

6. As Built Drawings and calculations.

7. Final Release of Lien confirming, or contingent upon, final payment.

B. Deliver to the Owner all special tools, lubricants, extra materials and any other products necessary for the proper operation and maintenance of the fire suppression systems.

C. Provide project record documents indicating all changes from contract documents made during construction.

D. Submit all Certificates of Final Inspections from the Administrative Authorities.

3.7 INSTRUCTION OF OWNER'S REPRESENTATIVE

A. Instruct the representative of the Owner in the proper operation and maintenance of all elements of the fire suppression system.

3.8 PROTECTIVE COATINGS

A. Paint exterior surfaces of steel piping run in or through concrete floor fill, under tile floors or underground, and aluminum surfaces in contact with masonry, with one coat of acid resisting bituminous base paint.

B. Sprinkler Contractor shall clean and prep all exposed sprinkler piping. Painting by others with an acceptable color selected by the Architect.

3.9 CLEANING AND ADJUSTING

A. Do not allow waste material and rubbish to accumulate in or above the premises. After completion of this work, remove rubbish, tools, scaffolding and surplus materials from and about the building and leave all work clean and ready for use. Clean all equipment, pipes, valves and fittings of grease, metal cuttings and sludge. Repair any stoppage, discoloration or other damage to parts of the building, its finish or furnishings due to failure to properly clean the fire suppression systems, without additional cost to the Owner. Adjust all automatic control devices for proper operation.

3.10 ACCESS PANELS

A. General Contractor shall provide access panels as required in all walls and ceilings to service and have access to all valves and operating parts. For all ceiling and wall access doors that are required in gypsum board and plaster, provide minimum 24" x 24", unless noted otherwise, Milcor type appropriate for the construction involved. Sprinkler Contractor shall coordinate with the General Contractor required access locations. See paragraph 1.1C. this Specification Section for additional information.

3.11 FINALLY

A. It is the intention that this specification shall provide a complete installation except as herein before specifically excluded or noted. All accessory construction and apparatus necessary or advantageous in the operation and testing of the work shall be included. The omission of specific reference to any part of the work necessary for such complete installation shall not be interpreted as relieving this Contractor from furnishing and installing such parts.

END OF SECTION

SECTION 21 05 01

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, fittings, valves, and connections for sprinkler systems.

1.2 RELATED REQUIREMENTS

A. Section 21 05 53 - Identification for Fire Suppression Piping and Equipment: Piping identification.

B. Section 21 13 01 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.3 REFERENCE STANDARDS

A. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2007.

B. ASME/ANSI B16.1 - 1998 - Cast Iron Pipe Flanges and Flanged Fittings; The American Society of Mechanical Engineers; (R2006).C.ASME/ANSI B16.3 - 1998 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; (R2006).

C. UL 668 - Hose Valves for Fire Protection Service, 2004 rev 2008.

D. ASME/ANSI B16.5 - 1996 - Pipe Flanges and Flanged Fittings; The American Society of Mechanical Engineers.

E. ASME/ANSI B16.9 - 2001 - Factory-Made Wrought Steel Buttwelding Fittings; The American Society of Mechanical Engineers.

F. ASME/ANSI B16.11 - 2001 - Forged Steel Fittings, Socket-Welding and Threaded; ; The American Society of Mechanical Engineers.

G. ASME/ANSI B16.18 - 1984 (R1994) - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers.

H. ASME/ANSI B16.21 - 2005 - Nonmetallic Flat Gaskets for Pipe.

I. ASME/ANSI B16.22 - 1995 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers.

J. ASME/ANSI B16.24 - 1991 (R1998) - Cast Copper Alloy Pipe Flanges and Flanged Fittings; The American Society of Mechanical Engineers.

K. ASME/ANSI B16.25 - 1997 - Buttwelding Ends; The American Society of Mechanical Engineers.

L. ASME/ANSI B16.42 - 1998 - Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300; The American Society of Mechanical Engineers.

M. ASME/ANSI B 36.10 Welded and Seamless Wrought Steel Pipe; The American Society of Mechanical Engineers; 1998.

N. ASTM A47/A47M-99(2009) - Standard Specification for Ferritic Malleable Iron Castings.

O. ASTM A53/A53M-07 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

P. ASTM A 135/A 135M - Standard Specification for Electric-Resistance Welded Steel Pipe; 2006.

Q. ASTM A 183 - Standard Specification for Carbon Steel Track Bolts and Nuts.

R. ASTM A 193/A193M - Standard Specification for Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service.

S. ASTM A 234/A 234M-07 Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service R.

T. ASTM A 449 - Standard Specification for Hex Cap Screws, Bolts, and Studs, Steel, heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.

U. ASTM A 536 - Standard Specification for Ductile Iron Castings.

V. ASTM A 563 - Standard Specification for Carbon and Alloy Steel Nuts.

W. ASTM A 795/A 795M - Standard Specification for Black and Hot Dipped Zinc-coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.

X. ASTM F 436 - Standard Specification for Hardoned Steel Washers, 2009.

Y. AWWA C110/A21.10 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm Through 1200 mm), for Water and Other Liquids; American Water Works Association; 2003.

Z. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; 2007 (ANSI/AWWA C111/A21.11).

AA. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; 2002, and Errata 2002 (ANSI/AWWA C151/A21.51).

BB. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; edition adopted by the state.

CC. NFPA 14 - Standard for the Installation of Standpipes and Hose Systems.

DD. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

EE. NFPA 1963 - Standard for Fire Hose Connections, edition adopted by the state.

FF. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

GG. UL 262 - Gate Valves for Fire-Protection Service; Underwriters Laboratories Inc.; 2004.

HH. UL 312 - Check Valves for Fire-Protection Service; Underwriters Laboratories Inc.; 2004.

1.4 SUBMITTALS

A. See Section 21 01 00 - General Fire Suppression Provisions.

B. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.

C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

D. Project Record Documents: Record actual locations of components and tag numbering.

E. Operation and Maintenance Data: Include installation instructions and spare parts lists.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Valve Stem Packings: Two for each type and size of valve.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years experience. approved by manufacturer.

C. Conform to UL, FM, and Warnock Hersey requirements.

D. Valves: Bear UL, FM, and Warnock Hersey label or marking. Provide manufacturer's name and pressure rating marked on valve body.

E. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

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

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

PART 2 PRODUCTS

2.1 FIRE PROTECTION SYSTEMS

A. Sprinkler Systems: Conform work to NFPA 13, with components being UL listed for 175 psig working pressure, made of materials compatible with piping. Where high pressure systems or regions are called out, such components shall be UL listed for 300 psig working pressure.

B. Welding Materials and Procedures: Conform to ASME Code, meeting requirements set forth by NFPA 13.

2.2 BURIED PIPING

A. Cast Iron Pipe: AWWA C151/A21.51.

1. Fittings: AWWA C110, standard thickness.

2. Joints: AWWA C111, rubber gasket.

3. Mechanical Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.

B. Ductile Iron Pipe: AWWA C151/A21.51.

1. Ductile Fittings: AWWA C110/A21.10 standard thickness.

2. Joints: AWWA C111, rubber gasket with steel nuts and bolts.

3. Mechanical Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.

4. Encasement shall apply and conform to ASTM A 674 or AWWA C105, PE Film, .008 inches (.20 mm) thick.

2.3 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A 135/A 135M Schedule 10, black for grooved piping.

1. Grooved End Fittings: UL listed, ASTM A 536, ductile iron casting with OD matching steel pipe OD.

2. Cast Iron Fittings: ASME B16.1, threaded fittings.

3. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

4. No XL pipe allowed.

5. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

B. Steel Pipe: ASTM A 135/A 135M Schedule 30 or 40, black for threaded piping.

1. Steel Fittings: Steel Fittings: ASME B16.5, B16.9, B16.11, B16.25 & A234

2. Cast Iron Fittings: ASME B16.1 & B16.4

3. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

4. Pipe Nipples: ASTM A733 made of ASTM A 53 or A 106, Schedule 40, seamless steel pipe.

5. Steel Threaded Couplings: ASTM A 865

6. No XL pipe allowed.

7. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

C. Ductile Iron Pipe: AWWA C151/A21.51.

1. Fittings: AWWA C110/A21.10, standard thickness.

2. Joints: AWWA C111, rubber gasket with steel nuts and bolts

3. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped composition sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

2.4 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 6 inch: Carbon steel, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 8 inches and Over: Carbon steel, adjustable, clevis.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D. Trapeze Hangers: Should be attached to two (2) steel members.

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

F. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

G. Vertical Support: Steel riser clamp.

H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.5 GATE VALVES

A. Up to and including 2 inches:

1. Manufacturers: Nibco, Kennedy or equal.

2. Bronze body, bronze trim, rising stem, handwheel, solid wedge or disc, threaded ends.

B. Over 2 inches:

1. Manufacturers: Nibco, Kennedy or equal.

2. Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid bronze or cast iron wedge, flanged ends.

C. Over 4 inches:

1. Manufacturers: Nibco, Kennedy or equal.

2. Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends, iron body indicator post assembly.

2.6 GLOBE VALVES (COMPLY WITH UL 262)

A. Up to and including 2 inches:

1. Manufacturers: Nibco, Kennedy or equal.

2. Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable rubber disc, threaded ends, with backseating capacity.

B. Over 2 inches:

1. Manufacturers: Nibco, Kennedy or equal.

2. Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.7 BALL VALVES (COMPLY WITH UL 1091)

A. Up to and including 2 inches:

1. Manufacturers: Nibco, Kennedy or equal.

2. Bronze two piece body, brass or stainless steel ball, teflon seats and stuffing box ring, lever handle, threaded ends.

B. Over 2 inches:

1. Manufacturers: Nibco, Kennedy or equal.

2. Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle or gear drive handwheel for sizes 10 inches and over, flanged.

2.8 BUTTERFLY VALVES (COMPLY WITH UL 1091)

A. Bronze Body:

1. Manufacturers: Nibco, Kennedy or equal.

2. Stainless steel disc, resilient replaceable seat, threaded or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and built-in tamper proof switch rated 10 amp at 115 volt AC.

B. Cast or Ductile Iron Body

1. Manufacturers: Nibco, Kennedy or equal.

2. Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and internal tamper switch rated 10 amp at 115 volt AC.

2.9 CHECK VALVES (COMPLY WITH UL 312)

A. Up to and including 2 inches:

1. Manufacturers: Nibco, Kennedy or equal.

2. Bronze body and swing disc, rubber seat, threaded ends.

B. Over 2 inches:

1. Manufacturers: Nibco, Kennedy or equal.

2. Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends.

C. 4 inches and Over:

1. Manufacturers: Nibco, Kennedy or equal.

2. Iron body, bronze disc, stainless steel spring, resilient seal, threaded, wafer, or flanged ends.

2.10 DRAIN VALVES

A. Size and install per NFPA 13. Must be readily accessible with location, elevations, and accessibility subject to approval.

B. Compression Stop:

1. Manufacturers: Nibco, or equal.

2. Bronze with hose thread nipple and cap.

C. Ball Valve:

1. Manufacturers: Nibco, or equal.

2. Brass with cap and chain, 3/4 inch hose thread.

D. Auxiliary Drain Valve:

1. Manufacturers: Nibco, or equal.

2.11 POST INDICATOR VALVES (WALL TYPE OR UPRIGHT)

A. Comply with UL 789, upright post type, ductile iron body, with extension rod, locking device, and ductile iron barrel.

1. Manufacturers: Nibco Model NIP-1AJ, NIP-2AJ, or equal.

2. Bronze with hose thread nipple and cap.

2.12 INDICATING VALVES (COMPLY WITH UL 1091)

A. Integral indicating device, indoor/outdoor rated, ends matching connection piping.

1. Electrical 115 V ac, prewired, single circuit, supervisory switch.

2. All wiring to be performed by a licensed electrician.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and foreign material, from inside and outside, before assembly.

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

3.2 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

B. Route piping in orderly manner, plumb and parallel to building structure, sloping as required by NFPA 13. Maintain gradient.

C. Install piping to conserve building space, to not interfere with use of space and other work.

D. Coordinate sprinkler piping installation with work of all other trades. Installation shall maintain harmony of entire mechanical, electrical and plumbing installation.

E. Group piping whenever practical at common elevations.

F. Sleeve pipes passing through partitions, walls, and floors. Fire walls should be fire caulked.

G. Where pipes pass through fire rated walls, use UL listed assembly to maintain the fire rating of wall.

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

I. Inserts:

1. Provide inserts for placement in concrete formwork.

2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

J. Pipe Hangers and Supports:

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

2. Place hangers within 12 inches of each horizontal elbow.

3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

4. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

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

K. Slope piping and arrange systems as needed to drain at low points. Use eccentric reducers to maintain top of pipe level.

L. Prepare pipe, fittings, supports, and accessories for finish painting where exposed to view (not concealed above ceilings, in walls, etc.). Where pipe support members are

welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

M. Do not penetrate building structural members unless indicated.

N. Provide sleeves when penetrating footings and floors. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.

O. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

P. Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

Q. Install valves with stems upright or horizontal, not inverted. Remove protective coatings after installation.

R. Provide ball valves for shut-off or isolating service.

S. Provide drain valves at main shut-off valves, low points of piping and apparatus.

T. The Fire Sprinkler Contractor is responsible for calling into question any deficiencies or inconsistencies relating to remote areas, hydraulic calculations/pipe sizing, sprinkler coverages, and system riser/fire pump/standpipe locations PRIOR to submitting a bid.

END OF SECTION

SECTION 21 05 53

IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe Markers.

E. Ceiling tacks.

1.2 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2007.

1.3 SUBMITTALS

A. See Section 21 01 00 - General Fire Suppression Provisions, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Automatic Controls: Tags.

B. Control Panels: Nameplates.

C. Instrumentation: Tags.

D. Major Control Components: Nameplates.

E. Piping: Tags.

F. Pumps: Nameplates.

G. Relays: Tags.

H. Small-sized Equipment: Tags.

I. Thermostats: Nameplates.

J. Valves: Namplates and ceiling tacks where above lay-in ceilings.

2.2 NAMEPLATES

A. Manufacturers:

1. Kolbi Pipe Marker Co.

2. Seton Identification Products

3. Substitutions: See Section 21 01 00 General Fire Suppression Provisions for requirements.

B. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.

2. Letter Height: 1/2 inch.

3. Background Color: Black.

2.3 TAGS

A. Manufacturers:

1. Advanced Graphic Engraving.

2. Brady Corporation.

3. Kolbi Pipe Marker Co.

4. Seton Identification Products.

5. Substitutions: See Section 21 01 00 General Fire Suppression Provisions for requirements.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.4 STENCILS

A. Manufacturers:

1. Brady Corporation.

2. Kolbi Pipe Marker Co.

3. Seton Identification Products.

4. Substitutions: See Section 21 01 00 General Fire Suppression Provisions for requirements.

B. Stencils: With clean cut symbols and letters of following size:

1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.

2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.

3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.

4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24 inch long color field, 2-1/2 inch high letters.

5. Over 10 inch Outside Diameter of Insulation or Pipe: 32 inch long color field, 3-1/2 inch high letters.

6. Equipment: 2-1/2 inch high letters.

C. Stencil Paint: Semi-gloss enamel, colors conforming to ASME A13.1.

2.5 PIPE MARKERS

A. Manufacturers:

1. Brady Corporation.

2. Kolbi Pipe Marker Co.

3. MIFAB, Inc.

4. Seton Identification Products.

5. Substitutions: See Section 21 01 00 General Fire Suppression Provisions for requirements.

B. Color: Conform to ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

F. CEILING TACKS

1. Manufacturers:

a. Craftmark.

b. Substitutions: See Section 21 01 00 General Fire Suppression Provisions for requirements.

2. Description: Steel with 3/4 inch diameter color coded head.

3. Color code as follows:

a. Standard colors.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Install metallic detection tape located approximately 12 inches above pipe, where in ground utility lines are buried outside building footprint. Tape shall be continuous and be marked, indicating utility type (ie. water, sewer, gas, electric, etc).

F. Locate ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

SECTION 21 13 01

FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wet-pipe sprinkler system, submittals and quality control.

B. System design, installation, and certification.

C. Fire department connections, Life Safety System coordination and field quality control.

1.2 RELATED REQUIREMENTS

A. Section 28 31 04 - Fire Detection and Voice Evacuation System

B. Section 21 05 01 - Common Work Results for Fire Suppression: Pipe, fittings, and valves.

C. Section 21 05 53 - Identification for Fire Suppression Piping and Equipment.

D. Division 26 Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2007.

B. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

C. IFC - International Fire Code, latest accepted edition.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meeting: Convene one week before starting work of this section.

1.5 SUBMITTALS

A. See Section 21 01 00 - General Fire Suppression Provisions, for submittal requirements.

B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Shop Drawings:

1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.

2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.

3. Submit shop drawings, product data, and hydraulic calculations to Fire Marshall for approval. Submit proof of approval to Engineer.

D. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

E. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds code requirements.

F. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.

2. Sprinkler Wrenches: For each sprinkler type.

1.6 QUALITY ASSURANCE

A. Maintain one copy of referenced design and installation standard on site.

B. Conform to all code requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum five years experience approved by manufacturer.

E. Equipment and Components: Provide products that bear UL label or marking.

F. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation. Keep all materials clean and free of debris and material damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Tyco Fire Products.

B. Grinnell.

C. Star Manufacturing Company.

D. Reliable Automatic Sprinkler.

E. Substitutions: Approved equal.

2.2 SPRINKLER SYSTEM

A. Sprinkler System: Contractor shall extend existing fire protection system as required to provide coverage for new building addition. Contractor shall field verify existing conditions to determine extent of the work, including required piping connection points and coverage calculations per NFPA 13, prior to bid and construction.

B. Sprinkler System: Contractor shall rework existing fire protection system as required to provide coverage for remodeled areas within project scope. Contractor shall field verify existing conditions to determine extent of the work, including required piping connection points and coverage calculations per NFPA 13, prior to bid and construction.

C. Refer to civil and mechanical plans, Sprinkler Contractor shall provide connections for future building expansions where indicated.

D. Provide anti-freeze loop where required for coverage where wet system areas are exposed to freezing conditions. Include RPZ and expansion chamber as needed. Coordinate floor drain/sink locations and sizes needed for proper draining.

E. Remote Area may be decreased where quick response sprinklers are at level, flat ceilings of light or ordinary hazard wet systems - when such is the case, this SHALL BE THE FIRST modification made and shall be in accordance with this formula:

1. 675 + 22.5*H (where H is the peak ceiling height, up to 20 ft - minimum remote area is 900 sf).

F. Design Areas (Remote Areas) shall be increased 30% where dry systems are utilized.

G. Where sprinklers are under slopes exceeding 2:12, the remote area (obtained by figures, tables, or the above formula) must be increased 30%.

H. Occupancy per NFPA 13, Appendix A and elsewhere, and as clarified, amended and outlined below:

1. Automobile Parking Areas: Ordinary Hazard, Group 1.
2. Building Service Areas: Ordinary Hazard, Group 1.
3. Churches: Light Hazard.
4. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
5. Dry-Cleaners: Ordinary Hazard, Group 2.
6. General Storage Areas: Ordinary Hazard, Group 1.
7. Laundries: Ordinary Hazard, Group 1.
8. Libraries, Except Stack Areas: Light Hazard.
9. Library Stack Areas: Ordinary Hazard, Group 2.
10. Machine Shops: Ordinary Hazard, Group 2.
11. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
12. Office and Public Areas: Light Hazard.
13. Plastics Processing Areas: Extra Hazard, Group 2.
14. Printing Plants: Extra Hazard, Group 1.
15. Repair Garages: Ordinary Hazard, Group 2.
16. Residential Living Areas: Light Hazard.
17. Restaurant Service Areas: Ordinary Hazard, Group 1.
18. Solvent Cleaning Areas: Extra Hazard, Group 2.
19. Upholstering Plants: Extra Hazard, Group 1.
20. Laboratories, including Classroom Laboratories: Ordinary Hazard, Group 1 or 2 as determined by criteria set forth in NFPA 13.

I. Minimum Density for Automatic-Sprinkler Piping Design:

1. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft.
2. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft.
3. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft.
4. Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq. ft.
5. Extra-Hazard, Group 2 Occupancy: 0.40 gpm over 2500-sq. ft.

J. Maximum Protection Area per Sprinkler: Per UL listing.

1. Office Spaces: 225 sq. ft. (20.9 sq. m).
2. Storage Areas: 130 sq. ft. (12.1 sq. m).
3. Mechanical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
4. Electrical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
5. Other Areas: NFPA 13, unless otherwise indicated.

K. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:

1. Light-Hazard Occupancies: 100 gpm (6.3 L/s) for 30 minutes.
2. Ordinary-Hazard Occupancies: 250 gpm (15.75 L/s) for 60 to 90 minutes.
3. Extra-Hazard Occupancies: 500 gpm (31.5 L/s) for 90 to 120 minutes.

L. Water Supply: Obtain static pressure and volumetric flow at residual pressure from a water flow test data conducted per NFPA 291.

M. Margin of Safety for Available Water Flow and Pressure:

1. Contact the Water Department to request a hydraulic model pressure based on maximum usage in peak season and maintain 20% safety margin unless flow test was conducted in peak season in the last 6 months, in which case 10% safety margin is acceptable. If a Fire Pump is required to meet the requirements of this section, fire sprinkler contractor shall submit a request for waiver of this requirement to the contractor.

N. If pressure booster pump will be required for achieving required pressure in fire sprinkler system, sprinkler designer shall size pump to provide required flow and

pressure unless such information is provided in Section 21 30 00.

O. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve. Include water flow switch tamper resistant hex key (allen wrench), paperwork related to all riser switches, sprinkler wrenches for each type of sprinkler provided on the job, and spare sprinklers of number and ratio provided by NFPA 13.

P. Standpipes: Provide wet type, manual, interconnected standpipes per the pipe schedule method or calculated and sized, in accordance with NFPA 14. Where Standpipes cover stage areas, Fire pump sizing shall be based upon NFPA 13 for the fire sprinkler demand and hose connections shall be provided on each side of the stage designed per the latest accepted edition of the Arkansas Fire Protection Code.

Q. Provide standpipes and hose connections in all stairwells. In addition, provide hose connections at any point exceeding 100 feet of travel distance plus 30 feet of hose spray from egress or adjacent hose connections where locations of such hose connections are required by the fire department. Refer to fire protection drawings, details, and notations for standpipe and hose connection requirements and locations.

R. Manual Wet-type, Class 1 Standpipe Systems: System includes NPS 2-1/2-inch hose connections with small water supply to maintain water in the standpipes. Piping is wet, however, water must be pumped into standpipes to satisfy demand.

S. 175 PSIG Hose Connection: Comply with UL668, FM and UL approved bronze [no copper alloy (brass) allowed containing more than 15 percent zinc], 175 psig minimum pressure rating. Include angle pattern design; female NPS inlet and male hose outlet, and lugged cap, gasket and chain. Include NPS 1-1/2" or NPS 2-1/2" as required and hose valve threads according to NFPA 1963 and matching local fire department threads. Provide NPS 2-1/2" x 1-1/2" adapters where 1-1/2" male hose threads are furnished throughout the project, so the fire department connects to 2-1/2" NPS male thread.

T. Reference FP drawings for other information pertaining to the design of this project.

2.3 SPRINKLERS (PER UL 199) SPECIFIED FIRE SPRINKLERS ARE SUBJECT TO TYPES AND LOCATIONS AS INDICATED BELOW.

A. Suspended Ceiling Type: Concealed pendant type with listed concealed plate.

1. Finish: Enamel, color as selected.

2. Escutcheon Plate Finish: Enamel, color as selected.

3. Glass Bulb Ordinary Temperature Rating with listed Concealed Plate.

4. Fusible Link: Temperature rated for application.

B. Suspended Ceiling Type: Semi-recessed pendant type with matching screw on escutcheon plate.

1. Finish: Enamel, color as selected.

2. Escutcheon Plate Finish: Enamel, color as selected.

3. Glass Bulb: 155 degrees.

4. Fusible Link: Temperature rated for application.

C. Exposed Area Type: Standard upright type with guard.

1. Finish: Brass plated or color to match painted area.

2. Glass Bulb: 200 degrees.

3. Fusible Link: Temperature rated for application.

D. Sidewall Type: Semi-recessed horizontal sidewall type with matching screw on escutcheon plate.

1. Finish: Enamel, color as selected.

2. Escutcheon Plate Finish: Enamel, color as selected.

3. Fusible Link: Temperature rated for application.

E. Sprinkler Guards: Finish to match sprinkler finish and to be listed with the fire sprinkler being protected. Wire cage type, including fastening device for attaching to sprinkler such guard is listed with. Provide Sprinkler Guards where sprinklers are less than 7'9 from finished floor and anywhere sprinklers are subject to being damaged (such as when located near shelving or racks, in or in proximity to gymnasiums, over conveyors, in trash chutes, etc…).

F. Special Coatings: Use special coatings where required; however, do not utilize quick response sprinklers where special coatings are needed. In such cases, manufacturer's corrosion resistant paint will be sufficient.

2.4 PIPING SPECIALTIES

A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm and electric alarm, with pressure retard chamber and variable pressure trim, with test and drain valve.

B. Water Motor Alarm per UL 753: Hydraulically operated impeller type alarm with aluminum alloy red enameled gong and motor housing, nylon bearings, and inlet strainer.

C. Electric Alarm per UL 464: Electrically operated red enameled 8” gong with pressure alarm switch, 24 VDC or as required by the Authority Having Jurisdiction.

D. Water Flow Switch per UL 346: Vane type switch for mounting horizontal or vertical, with two contacts; rated to match fire alarm panel by others.

E. Fire Department Connections per UL 405:

1. Outlets: of type and model subject to the "first responder" fire department, with hardware; threaded dust cap and chain of matching material and finish as subject to same wall mounted or free standing, as required by the fire department with signage designating what is supplied (Auto Sprinkler System, Standpipes, Dry Standpipes Only, etc.). Lockable caps and signage required by Fire Code shall be provided.

2. Drain: 3/4 inch automatic drip, outside.

3. Drain: 3/4 inch automatic drip, in gravel base at foot of 90 degree elbow below fire department connection.

4. Label: "Sprinkler - Fire Department Connection".

5. Refer to drawings for proposed location of fire department's connection. Gain approval of fire department officials for location of fire department connection prior to commencing installation. Department connection must be within 100 ft of a fire hydrant by state code and may be required to be located even closer in some jurisdictions.

F. Supervisory Switches per UL 753: As manufactured by Potter Model OSYSV-2 or approved equal.

G. Room Temperature Supervisory Switches: As manufactured by approved supplier.

H. Water Flow Switches per UL 346: As manufactured by Potter Model VSR-F2 or approved equal.

I. 24 VDC Electric 8" alarm bell mounted at 9 ft elevation on exterior wall near riser unless other such means of notification are required by the local fire authority, whether mechanical, horn/strobe, or otherwise..

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's instructions.

C. Install buried shut-off valves in valve box. Provide post indicator for each Lead In.

D. Provide approved backflow preventer assembly at sprinkler system water source connection. Reduced pressure backflow preventer equipment and installation shall conform to the requirements of the city of Rogers, Arkansas Backflow Prevention and Cross Connection Control Program.

E. Locate remote fire department connection, as indicated on plans, with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.

F. Locate outside alarm notification device (bell, horn,strobe, or gong) on building wall.

G. Place pipe runs to minimize obstruction to other work. Coordinate with electrical and other mechanical trades. Refer to site utility plans.

H. Place piping in concealed spaces above finished ceilings. In areas where there is a combination of exposed areas and finished ceiling spaces, piping shall be routed above the finished ceiling spaces. All piping shall be concealed wherever possible throughout entire project.

I. Center sprinklers in two directions in ceiling tile and provide piping offsets as required or locate concealed type sprinklers centered in tiles in one direction and not less than 6" off ceiling grids in any direction.

J. Apply masking tape, or paper cover, or plastic caps to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

K. Install and connect to fire pump system per NFPA 13 as required.

L. Flush entire piping system of foreign matter per NFPA standard.

M. Install guards on sprinklers as required to prevent damage or injury.

N. Hydrostatically test entire system. Furnish completed test results signed by all required authorities and furnish a Contractor’s Material Test Certificate per State Rules and Regulations and NFPA 13.

O. Test to be witnessed by the Authority Having Jurisdiction and/or fire official unless the Authority Having Jurisdiction waives the right to witness and thus defaults the responsibility solely to the Owner's representative. In such a case, the waiver shall be included in the closeout documents. In all cases, the signed test certificate shall be provided in the closeout documents.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

B. All fire sprinkler system components required to interface with the fire alarm system to be supplied and installed by the Fire Sprinkler Contractor. The Fire Alarm Contractor shall coordinate these components with the Fire Sprinkler Contractor and provide necessary equipment and wiring for connection of these components to the fire alarm system.

3.3 LABELING AND IDENTIFICATION

A. Install in accordance with Section 21 05 53.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Leak Testing: All systems to be hydrostatically tested for the greater of 200 psi OR 50 psi above the maximum anticipated normal system pressure at 2 hours per NFPA 13. Dry systems to be air tested per NFPA 13.

2. Electronic/Alarm Equipment Testing: All alarm devices, fire pump controls, air compressors, and all such electrical equipment and devices interfaced with the fire sprinkler system to be tested and attested to in Contractor’s Material Test Certificate, noting such tests were coordinated and verified.

3. Fire Pump Testing: Where Diesel fire pumps are required, diesel fuel shall be supplied for testing and for continual operation after testing, and fire pump tests shall be conducted per NFPA 20 and reports shall be included in the Product Manual.

4. Training and Educating: This Contractor shall train and educate the Owner, or his designated representative, by supplying NFPA 25, with highlighted sections corresponding to his responsibilities and information he should need to know, AND instructions shall be given for emergency procedures and general maintenance of the system, and test sheets shall be given for any periodic tests the Owner is responsible for, beyond the supplier’s annual testing.

5. Annual Inspection: Include a 1 year annual inspection to be conducted 1 year after this work is completed and the warranty has expired. Any Work revealed by such inspection that should have been included in the initial installation shall be so referenced in the inspection documents and completed as warranty work within 30 days of the inspection.

END OF SECTION

SECTION 22 01 00

GENERAL PLUMBING PROVISIONS

PART 1 GENERAL

1.1 WORK INCLUDED

A. The work covered by Division 22 sections consist of furnishing all labor, equipment, appliances and material for the heating, air conditioning, piping and plumbing systems in strict accordance with Codes, Specifications and the applicable drawings and subject to the terms and conditions of the contract. Include all appurtenances necessary to the proper operation of the systems and equipment specified.

B. General Contractor shall install all concrete pads and bases required for installing mechanical equipment. Mechanical Contractor is responsible for the exact sizes required, location of anchor bolts, etc.

C. Some equipment may be furnished by other divisions. Mechanical Contractor is responsible to check the drawings and specifications for equipment that will be furnished by others. Furnish the supplies (hot and cold water cut-offs), traps, drains, controls, gas piping, pressure reducing valves, etc., on all equipment furnished by other divisions.

D. General Contractor shall furnish and install all ceiling access panels required to service mechanical equipment, valves and controls above gyp board or hidden spline ceilings.

E. General Contractor shall provide all site drive, sidewalk and other surfaced areas saw cutting and repairs back to preexisting conditions for the required mechanical piping. Mechanical Contractor shall provide the trenching, bedding and backfill required for the pipe installation.

1.2 RELATED SECTIONS

A. The General Conditions and Division 1, General Requirements, as bound in the specification preamble, apply to all work under Division 22. Carefully note its contents in performance of the work.

B. The Architectural, Fire Suppression, Mechanical, Electrical, and Structural plans and Specifications, including Information to Bidders and other pertinent documents issued by the Engineer are a part of this Specifications and the accompanying mechanical plans. Comply with them in every respect. Examine all the above carefully. Failure to comply does not relieve the Contractor of responsibility nor may it be used as a

basis for additional compensation due to omission of architectural, electrical and structural details from the mechanical drawings.

C. All electrical power wiring is specified under Division 26 of the Specifications. Mechanical Contractor shall furnish all motor starters required for the control and protection of all motors furnished for the Division 22.

D. All concrete pads and bases required for installing mechanical equipment are specified in another section of the Specifications. Advise the General Contractor as to the exact sizes required, location of anchor bolts, etc.

E. Paint all mechanical equipment piping, supports and other exposed material. Do not paint equipment supplied with painted finish, such as the main mechanical equipment unless damaged during handling and installation. In such cases, use touch-up paint of the same type and color as original paint. Conform to requirements in other sections of the Specifications and match wall finish to the room in which installed.

1.3 CODES, FEES AND LATERAL COSTS

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

1. 2021 Bentonville, Arkansas City Building Code.
2. 2021 Arkansas State Mechanical Code.
3. 2018Arkansas State Plumbing Code.
4. 2014 Arkansas Energy Code.
5. 2021 IBC - International Building Code.
6. IFC - International Fire Code; latest accepted edition.
7. IGC - International Gas Code; latest accepted edition.
8. IPC - International Plumbing Code; latest accepted edition.
9. IMC - International Mechanical Code; latest accepted edition.
10. IECC - International Energy Conservation Code; latest accepted edition.
11. AMCA - Air Moving & Conditioning Association.
12. ASA - American Standards Association.

13. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers.
14. ASME - American Society of Mechanical Engineers.
15. ASTM - American Society of Testing Materials.
16. AWWA - American Water Works Association.
17. NBS - National Bureau of Standards.
18. NEMA - National Electrical Manufacturers Association.
19. NFPA - National Fire Protection Association.
20. SMACNA - Sheet Metal & Air Conditioning Contractors' National Association.
21. UL - Underwriters' Laboratories, Inc.
22. AGA - American Gas Association.
23. OSHA - Occupational Safety and Hazard Association.
24. AABC - Associated Air Balance Councils.
25. NEBB - National Environmental Balancing Bureau.

B. Comply with State of Arkansas adopted ADA Accessible Guidelines in regard to accessible or handicapped features.

C. In case of difference between building codes, Specifications, state Laws, local ordinances, industry standards and utility company regulations and the Contract Documents, the most stringent governs. Promptly notify the Engineer in writing of any such difference.

D. Remove any work installed that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards, or utility company regulations, correct the deficiencies, and reinstall all work at no cost to the Owner.

E. The mechanical drawings show the general arrangement of all piping, equipment and appurtenances. Follow as closely as actual building construction and the work of other trades will permit. Final layout will be governed by actual field conditions with all measurements verified at the site. Conform to the requirements shown on all of the drawings. General and structural drawings take precedence over mechanical drawings. Because of the small scale of the mechanical drawings, it is not possible to

indicate all offsets, fittings and accessories which may be required. Investigate the existing and finish conditions affecting the work and arrange the work accordingly, providing such fittings, valves and accessories as may be required to meet such conditions. Contractor shall verify that all equipment, ducts, pipes and all other components will fit in the space provided before fabrication or ordering.

F. Obtain any and all required permits in connection with this work under the Contract and pay any and all fees in connection therewith. Arrange with the serving utility companies for the connections to all utilities and pay all charges for same including inspection fees and meters if required. Refundable deposits will be paid by the Owner.

G. Mechanical Contractor shall provide and install, where applicable, seismic restraints for all piping and duct systems per the latest accepted Building Code.

1.4 GUARANTEE

A. Furnish a written certificate guaranteeing all materials, equipment and labor furnished to be free of all defects for a period of one (1) year from and after the date of final acceptance of the work by the Owner and further guarantee to replace such work without charges if any defects appear within the stipulated guaranty period.

1.5 SOIL CONDITIONS

A. The Specifications and the drawings in no way imply the conditions of the soil to be encountered. When excavating may be required in execution of the work, this Contractor agrees that he has informed himself regarding conditions affecting the work.

1.6 INSPECTION OF PREMISES

A. Before submitting a bid, visit the site of the proposed job and determine the conditions relating to this work.

1.7 UTILITIES, LOCATIONS AND ELEVATIONS

A. Locations and elevations of the various utilities included within the scope of this work have been obtained from substantially reliable sources and are offered as a general guide only, without guarantee as to accuracy. Verify the location and elevation of all utilities and their relation to the work before entering into a contract.

B. Identify outdoor underground lines with continuous strip of plastic utility marker tape at regular intervals (maximum of 10 feet) "Caution (state utility) pipe below". Install one foot directly above pipe before backfilling to grade.

1.8 EXISTING BUILDING AND EXISTING MECHANICAL EQUIPMENT

A. Visit the existing building and become thoroughly acquainted with the existing mechanical systems and utilities in order to determine all of the work that will be necessary to carry out the intent of the plans and specifications.

B. If it is necessary, in any way, to interfere with normal operations of the existing utilities in order to carry out the work, give notice and obtain written approval from the Owner before the work is started.

C. The work involved in this project requires the Contractor to work inside of an existing building. Interruption of the regular routine of the building by the Contractor must be kept to a minimum.

1.9 EQUIPMENT NOT SPECIFIED UNDER DIVISION 22

A. Equipment which requires plumbing and other mechanical connections may be specified in another division of this Specification. Under these conditions, provide necessary utilities including waste, water and natural gas.

B. Rough-in work from approved shop drawings only.

PART 2 PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Provide new materials bearing the manufacturer's name, trade name and the UL label in every case where a standard has been established for the particular material. Furnish the standard product of a manufacturer regularly engaged in the production of the required type of equipment. Provide the manufacturer's latest approved design.

B. Deliver equipment and materials to the site and store in original containers, suitably sheltered from the elements, but readily accessible for inspection by the Engineer until installed. Store all items subject to moisture damage (such as controls) in dry, heated spaces.

C. Provide equipment and materials of the same general type and of the same make throughout the work to provide uniform appearance, operation and maintenance.

D. Tightly cover equipment and protect against dirt, water and chemical or mechanical injury and theft. At the completion of the work, clean fixtures, equipment and materials and polish thoroughly. Turn over to the Owner in a condition satisfactory to the Engineer. Repair damage or defects developing before acceptance of the work at no expense to the Owner.

E. Insure that items to be furnished fit the space available. Make necessary field measurements to ascertain space requirements, including those for connections. Furnish and install such sizes and shapes of equipment that the final installation suits the true intent and meaning of the drawings and Specifications.

F. Follow manufacturer's directions completely in the delivery, storage, protection and installation of all equipment and materials. Promptly notify the Engineer in writing of any conflicts between any requirements of the Contract Documents and the manufacturers' directions. Obtain the Engineer's written instruction before proceeding with the work. Replace any work that does not comply with the manufacturers' directions or such written instructions from the Engineer, at no cost to the Owner.

G. Support all products by service organizations with adequate spare parts inventory and personnel located reasonably close to the site.

H. Where multiple units of the same type or class of products are required, provide all units of the same manufacturer.

2.2 EQUIPMENT ACCESSORIES

A. Furnish and install all equipment, accessories, connections and incidental items necessary to fully complete all work, ready for use, occupancy and operation by the Owner.

B. Where equipment requiring different arrangement or connections from those shown is provided, install the equipment to operate properly and in harmony with the intent of the drawings and Specifications.

C. Support, plumb, rigid and true to line, all work and equipment furnished. Study thoroughly all general, structural, electrical and mechanical drawings, shop drawings and catalog data to determine how equipment, fixtures, piping, ductwork, etc., are to be supported, mounted or suspended and provide extra steel bolts, inserts, pipe stands, brackets and accessories for proper supports whether or not shown on the drawings. When directed, submit drawings showing supports.

D. If accessories are required to complete the work and meet the intent of the specification, it is the responsibility of the Contractor to provide such accessories.

2.3 MATERIAL AND EQUIPMENT SCHEDULE

A. Submit to the Engineer as soon as practical, six (6) complete sets of the schedule of materials and equipment proposed for the installation, or electronic submittals as detailed below. Include manufacturers' names, catalog data, diagrams, drawings and other descriptive data and submit under one cover with an index sheet in front.

1. If Electronic files are submitted, a complete set of the schedule of materials and equipment proposed for the installation shall be included. Include manufacturers' names, catalog data, diagrams, drawings and other descriptive data. All information shall be submitted electronically in "pdf" format, and shall be separated into electronic "pdf" files according to the corresponding specification section (i.e. "22 10 06 - Plumbing Specialties.pdf"). Unless incomplete submittals are authorized by the project engineer, all Division 22 submittals shall be electronically sent at one time. Without authorization, incomplete submittals shall be rejected.

B. Provide written certification that shop drawings are in accordance with the specifications and are dimensionally correct with reference to available space.

C. All submittals will be reviewed a maximum of two (2) times. The cost of additional submittal reviews beyond those two specified will be charged to the Contractor.

D. Shop drawings for the Engineer's files are required on the following items:

1. Commercial water heaters.
2. Plumbing fixtures, floor drains, and roof drains.
3. Domestic water heater.
4. Valves/flex connectors and other specialties.
5. Water balance certification.
6. Piping materials including valves.
7. Piping insulation materials.
8. Complete mechanical equipment electrical data and wiring details.

2.4 EQUIPMENT AND MATERIAL SUBSTITUTIONS

A. It is the responsibility of the Contractor to investigate any desired substitutions for specified equipment prior to submission of his bid. The Mechanical Contractor shall be responsible for any changes required in mechanical, electrical, structural or vibration isolation systems and shall bear all cost for those changes whether the substitute equipment is named by manufacturer in the specifications or is submitted to the Architect for "or equal" consideration. All changes shall be accomplished in a manner acceptable to the Architect per Section 01 60 00 at no additional cost to the Owner.

B. In order to obtain prior approval on equipment or material not specified in Division 22 Specifications or Equipment Schedules, Mechanical Contractor MUST submit to the Engineer any proposed equipment or material ten (10) working days prior to the bid date.

C. If ANY substitute equipment is submitted to Engineer for approval, without said equipment having been pre-approved, the entire submittal will be rejected for resubmittal.

D. Any equipment manufacturers which are a subsidiary to the listed acceptable manufacturers are not considered equal. Therefore, it is the responsibility of the Contractor and equipment supplier to obtain prior approval as described in paragraph 2.4, this Section.

2.5 ELECTRICAL MOTORS

A. Provide motors of a recognized manufacturer, wound for the voltage specified, and in conformance to latest standards of the manufacturer and performance of the National Electrical Manufacturers Association and the Institute of Electrical and Electronic Engineers. Provide motors as manufactured by General Electric, Westinghouse, Century or Siemens-Allis, Baldor or approved equal.

B. Provide motors rated for continuous duty at 100% of rated capacity and temperature raise of 40 degrees Centigrade open type; 50 degrees Centigrade drip and splash proof; 55 degrees Centigrade explosion proof and totally enclosed above an ambient of 40 degrees Centigrade.

C. Unless otherwise required, provide integral horsepower, polyphase motors, Class B, general purpose, squirrel cage, open type induction motors, T-frame.

D. Provide single phase fractional horsepower motors of the open capacitor type. Generally, motors under 1/2 horsepower may be split phase type unless otherwise specified. Provide motors rated 1/2 horsepower or less with integral overcurrent protection.

E. Insure the insulation resistance between stator conductor and frames of motors is not less than 1/2 megohm. Provide shop test of motors including temperature rise, insulation resistance, motor terminal voltage, normal operating line current, RPMs, breaker or switch size with fusing and overload relay sizes.

PART 3 EXECUTION

3.1 COORDINATION OF WORK

A. Compare the mechanical drawings and Specifications with the drawings and Specifications for other trades and report any discrepancies between them to the Engineer and obtain from him written instruction for changes necessary in the mechanical work. Install the mechanical work in cooperation with other trades installing inter-related work. Before installation, make proper provisions to avoid interferences in a manner approved by the Engineer. Make all changes required in the work caused either by neglect or existing field conditions at no cost to the Owner.

B. It is the responsibility of the General Contractor, Mechanical Contractor and Electrical Contractor to coordinate installation of all equipment. Equipment installed prior to proper coordination, which interferes with the harmony and intent of the specifications and drawings, will be removed and reinstalled at the cost of the responsible Contractor.

C. Furnish anchor bolts, sleeves, inserts and supports required for the mechanical work. Locate anchor bolts, sleeves, inserts and supports as directed by the trade requiring them and insure that they are properly installed.

D. Adjust locations of pipes, ducts, equipment fixtures, etc., to accommodate the work and for interferences anticipated and encountered. Determine the exact route and location of each pipe and duct prior to fabrication.

1. New work and remodeled areas are to interface with existing facility services. Contractor to familiarize himself with the extent of the work prior to submitting his bid. Failure to gain familiarity will not be grounds for additional compensation.

2. Provide right-of-way to lines that pitch over those that do not pitch. For example, Plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have the right-of-way over lines whose elevations can be changed.

3. Make offsets, transitions and changes in direction in pipes and ducts as required to maintain proper head room and pitch.

E. Install all mechanical work to permit removal without damage to other parts, to coils, fan shafts and wheels, filters, belt guards, sheaves and drives and all other parts requiring periodic replacement or maintenance. Arrange pipes, ducts and equipment to permit ready access to valves, cocks, traps, starters, motors, control components and to clear the openings of swinging and overhead doors and of access panels.

3.2 CHLORINATION OF DOMESTIC WATER LINES

A. After the hot and cold water systems are complete, all fixtures connected, the system flushed out completely and the shut-off valve to the water main closed, fill the system with a solution containing 50 parts per million of available chlorine. Allow the solution to stand six (6) hours before flushing and returning to service.

B. Then fill the system with a solution containing 100 parts per million of available chlorine. Allow this solution to stand two (2) hours before flushing and returning to service.

C. Notify the Owner twenty-four hours prior to test so his representative can witness test. Obtain chemical analysis of the domestic water lines after chlorination from a Certified Chemist and submit the results of these tests to the Engineer and Owner.

3.3 RECORD DRAWINGS

A. Maintain record drawings showing exact locations and sizes, as actually installed, of piping, drains, cleanouts, ductwork, controls and equipment as specified herein. Deliver to the Owner/Architect upon completion and acceptance of the work, one (1) complete set of contract drawings marked to indicate all deviations from intended installation.

3.4 CUTTING AND PATCHING

A. The General Contractor shall be responsible for all required Building cutting, patching, etc., incidental to this work and shall make all required repairs thereafter to the satisfaction of the Engineer. Do not cut into any major structural element, beam or column without the written approval of the Engineer.

B. The General Contractor shall cut, patch, repair and/or replace pavements, sidewalks, roads and curbs as required to permit the installation of the plumbing work and pay all expenses incurred for this work.

C. Openings in fire or smoke barriers for air handling ductwork or air movement shall be protected in accordance with NFPA 90A and 90B and the Standard Mechanical Code.

D. Pipes, conduits, cables, wires, air ducts, pneumatic tubes and ducts and similar handling service equipment that pass through fire or smoke barriers shall be protected in accordance with NFPA 101 by the plumbing contractor.

E. All fire stopping assemblies must be UL approved assemblies.

3.5 EXCAVATION AND TRENCHING FOR PIPING

A. Excavate to the depths indicated on the Drawings or as required to provide adequate slope and burial depth. Excavated materials not required or suitable for backfill or fill shall be removed from the site. Do such grading as is necessary to prevent surface water from flowing into trenches or other excavations. Water accumulating therein shall be removed by pumping or by other method. Sheeting and shoring shall be installed as may be necessary for protection of the work and for safety of personnel. Excavation shall be by open cut except that short sections of a trench may be tunneled if the pipe can be safely and properly installed and backfill can be properly tamped in such tunnel sections.

B. Trench Excavation: Grade bottom of trenches to provide uniform bearing and support for each section of pipe on undisturbed soil. Where rock is encountered excavate to a minimum overdepth of 4" below trench depths indicated on the Drawings or specified. Overdepth in rock excavation and unauthorized overdepths shall be backfilled. Whenever wet or otherwise unstable soil incapable of properly supporting the pipe is encountered such soil shall be removed and the trench backfilled to proper grade as hereinafter specified.

C. Depth of Cover: Trenches shall be of depth that will provide three feet (3') minimum cover for domestic water, fire lines, sanitary and storm sewers from existing grade or from indicated finish grade, whichever is lower, unless otherwise specifically shown.

D. Utilities Locating: Locate existing utility lines prior to beginning any excavation

E. Protection of Existing Utilities: Existing utility lines to be retained that are shown on the Drawings or the locations of which are made known to the Contractor prior to excavation, as well as all utility lines uncovered during excavation operations, shall be protected from damage during excavation and backfilling, and if damaged, shall be repaired by the Contractor, at his expense.

F. Trenches shall not be backfilled until required pressure and other tests have been performed and until the utilities systems as installed conform to requirements of Drawings and Specifications.

G. Backfill trenches with excavated materials consisting of earth, sandy clay, sand, gravel, soft shale or other approved materials, free from clods of earth or stones 2-1/2" maximum dimension, deposited in 6" layers and compacted to 95% Standard Proctor Compaction Test of the maximum laboratory density determined in accordance with ASTM D698, Moisture-Density Relation of Soils. If fills fail to meet the specified densities, the Contractor shall remove and re-compact the fill until specified densities are achieved. Compaction test shall be performed for each fifty linear feet of trench.

H. Provide a 4-inch thick (minimum) layer of 3/4-inch No. 4 gravel aggregate bedding beneath all buried piping. Bedding shall be compacted and leveled to provide sloping required.

I. Tests for displacement of sewers: After the trench has been backfilled to 2 feet or more above the pipe, if the pipe shows poor alignment, displaced pipe, or any other defects, such defects shall be remedied by the Contractor at his expense.

3.6 EQUIPMENT START-UP AND TESTING

A. Instruct the Owner's operating personnel during start-up and separate operating tests of each major item of equipment. During the operating tests, prove the operation of each item of equipment to the satisfaction of the Engineer. Give at least seven (7) days notice to the Engineer of equipment start-up and operating tests.

3.7 CATALOG DATA FOR OWNER

A. Provide, in looseleaf binders, two (2) sets of a compilation of catalog data of each manufactured item of equipment used in the mechanical work and present this compilation to the Owner/Architect for transmittal to the Owner before final payment is made. Include descriptive data and printed installation, operating and maintenance instructions for each item of equipment. Provide a complete double index as follows:

1. Listing of products alphabetically by name.

2. Listing the names of manufacturers whose products have been incorporated in the work alphabetically together with their addresses and the names and addresses of the local sales representatives.

3. Certificates of Final Inspections.

4. Complete spare parts data with current prices and supply sources.

5. Extended warranties.

B. Deliver to the Owner all special tools, lubricants, extra materials and any other products necessary for the proper operation and maintenance of the mechanical and plumbing systems.

C. Provide project record documents indicating all changes from contract documents made during construction.

D. Submit all Certificates of Final Inspections from the Administrative Authorities.

E. Submit TAB reports on approved forms. Final TAB report submittals shall include all required rebalances if any are required.

F. Submit to the Engineer as soon as practical, electronic closeout documents as detailed below.

1. Include manufacturers' names, catalog data, diagrams, drawings and other descriptive data and submit under one cover with an index sheet in front.All information shall be submitted electronically in "pdf" format, and shall be separated into electronic "pdf" files.

3.8 INSTRUCTION OF OWNER'S REPRESENTATIVE

A. Instruct the representative of the Owner in the proper operation and maintenance of all elements of the mechanical system.

3.9 PROTECTIVE COATINGS

A. Paint exterior surfaces of steel piping run in or through concrete floor fill, under tile floors or underground, and aluminum surfaces in contact with masonry, with one coat of acid resisting bituminous base paint.

3.10 TEST AND ACCEPTANCE

A. Water Piping System: Test with water at 100 psi for one (1) hour or with available city water pressure for twenty-four (24) hours to prove tight and free from leaks.

B. Plumbing and Drainage System: Test the new system humidity and drain piping with water and prove tight. Test system with 10 feet of water for 24 hour period. Air test is not permitted.

C. Storm Drainage System: Test storm drainage system with 10 feet of water for a 24-hour period. If approved by the administrative authority and there is proof that no site water is available, an air test of 5 pounds for 24 hours without introduction of additional air may be used. The air test shall be conducted with a three-inch gage with a maximum scale of 100 psig. This test applies to new storm drains connecting to existing storm drain system. Any failures to the existing storm drain system shall be brought to the attention of the administrative authority prior to the completion of the installation.

3.11 NOISE CONTROL

A. It is intended that the mechanical systems as installed under this contract be free from objectionable noise when the system is operating. The system shall operate at noise levels below criteria recommended for the application by ASHRAE. Provide vibration isolation accessories and isolate equipment, pipeline, ductwork, etc., as required so as to insure an acceptable noise level in all of the mechanical systems.

3.12 CLEANING AND ADJUSTING

A. Do not allow waste material and rubbish to accumulate in or above the premises. After completion of this work, remove rubbish, tools, scaffolding and surplus materials from and about the building and leave all work clean and ready for use. Clean all equipment, pipes, valves and fittings of grease, metal cuttings and sludge. Repair any stoppage, discoloration or other damage to parts of the building, its finish or furnishings due to failure to properly clean the mechanical systems, without additional cost to the Owner. Adjust all automatic control devices for proper operation.

3.13 SYSTEM OPERATING TESTS

A. After the successful completion of all equipment start-up and test requirements, perform the following tests on the complete mechanical systems:

1. First Operating Test by Contractor: Prove the operation of the mechanical systems and of each individual item in the systems. Give at least 10 days prior notice to the Engineer of such tests. Adjust and set proper quantities to all items and equipment. Should any item of the systems fail to perform in an approved manner, repeat this test until approved by the Engineer. During this test, balance circulation of heating and cooling water to balancing cocks, valves, thermostats and similar Items to insure that the mechanical systems perform as intended.

2. Checking by Owner and Engineer: Following the successful completion of first operating tests by the Contractor, the Owner and the Engineer have the privilege of making such tests as they may desire during a period of three weeks to ascertain in detail if any corrections are to be made to the system. At the end of the testing by the Owner and the Engineer, the Engineer may direct the Contractor in writing to make such corrections to the systems as are within the scope of the contract.

3. Contractor's Corrections to Systems: Make all required corrections to the systems and notify the Engineer in wiring that the corrections outlined have been completed. Give at least seven (7) days notice of a final three-day operating test.

4. Three-Day Operating Test: Perform an operating test to the satisfaction of the Engineer for a period of three (3) days. Should any element of the systems not perform properly, make all required corrections and repeat the test until successfully performed.

    a. Submit the Form of Record proposed by the Contractor for the recording of all measurements to the Engineer for approval at least two weeks before the

approved form will be required by the Contractor.

b. Measurements: Make the following measurements at two-hour intervals (5 measurements per 8-hour day) during the three-day operating test.

1) Electrical: Running amperes and voltage of each motor 3/4 horsepower or larger.

2) Air temperatures in each heated or air conditioned space and outdoor temperatures.

c. Instruments: Provide all instruments, materials and labor to perform the tests and to obtain and record the measurements specified herein, including the furnishing of all required record forms as approved by the Engineer. Submit for the Engineer's approval, complete shop drawings or catalog data for all instruments to be used for the three day operating test and obtain approval at least two weeks before the instruments will be required for test measurements.

d. Report: Submit four (4) copies of a written report of the three-day operating test on the approved Form of Record to the Engineer for approval and subsequent transmittal to the Owner.

3.14 MOTOR CONTROL

A. General: Provide each motor 1/8 horsepower or larger with a suitable controller and devices that will perform the functions as specified for the respective motors, together with manual reset thermal overload, protection in each undergrounded conductor. Provide the controller either integral with circuit protective device or mounted in separate enclosure. Starters shall be Allen-Bradley, G.E., Westinghouse, Square D or approved equal.

B. Control: Automatic control devices such as thermostats, float or pressure switches may control the starting and stopping of motor directly, provided the device used is designated for that purpose and has an adequate horsepower rating. When automatic control device does not have such a rating, use a magnetic starter with the automatic control device actuating the pilot control circuit. When combination manual and automatic control is specified and the control device operates the motor directly, provide a manual motor starter and selector switch. When combination manual and automatic control is specified and the automatic control device actuates the pilot control circuit, a magnetic control device actuates the pilot control provided. Provide all magnetic starters with push buttons or selector switches in the covers. Provide connections to the selector switch such that only the normal automatic regulating

control devices will be bypassed when the switch is in the manual position. Connect all safety control devices, such as low or high pressure cutouts, high temperature cutouts and motor overload protective devices in the motor control circuit in both the manual and automatic positions of the selector switch control circuit. Make connections to any selector switch or to more than one (1) automatic regulatory control device in accordance with wiring diagrams recommended by the manufacturer and approved by the Engineer. Where required for manual control, provide push-button stations consisting of two (2) momentary contact operators, 600 volts, 10 amperes installed and wired for three wire control to provide under-voltage relays, auxiliary contacts or other devices required for a complete system.

C. Location: Where the controller is located within sight of the motor driven equipment (fifty feet or less), the controller and circuit protective device shall be capable of being locked in the open position. Where the controller is located out of sight of the motor driven equipment (more than fifty feet) provide a non-fused safety disconnect, suitable for the service, and which opens all ungrounded conductors simultaneously, at or on the motor driven equipment.

D. Enclosure: Enclosure to be general purpose, NEMA Type 1 unless noted otherwise (NEMA Type 1 gasketed). The circuit breaker shall be operable by hand from outside the enclosure and shall be so interlocked with the door or doors that it must be returned to the "OFF" position before the door can be opened.

E. Push-buttons: Provide maintained contact, standard duty type in a general purpose, NEMA Type 1 enclosure for surface mounting rated for 10 amperes continuous at 600 volts or less.

3.15 ACCESS PANELS

A. Provide access panels as required in all walls, ceilings and ductwork to service and have access to all valves, and other operating parts. For all ceiling and wall access doors that are required in gypsum board and plaster, provide minimum 24" x 24", unless due to structural restraints the access door can be reduced to a minimum of 18" x18", Milcor type appropriate for the construction involved.

3.16 DEMOLITION

A. There are areas in the existing building in which demolition will have to be performed due to the requirements for remodeling. The demolition work involved is not fully described herein; however, the information given on the electrical and mechanical drawings and the information set out in the specifications will substantially serve to inform the mechanical Contractor as to the full extent of the demolition required.

B. Contractor should visit job site to verify extent of demolition required to complete project.

C. It is the intent of this Specification that all required demolition work be fully and completely performed and all work be accomplished in a neat and workmanlike manner.

D. Remove all existing piping, fittings, heating, cooling, ventilation equipment that is required to accomplish the remodel work. All existing utilities that are disconnected shall be capped recessed in walls and floors. Contractor shall be responsible for visiting building and determining the extent of the demolition work. Contractor shall provide any necessary temporary piping required to keep existing building utilities (water, gas and sewer) in operation until new construction is completed to the extent that the new utilities can be reconnected.

E. All rubbish, debris and expendable items resulting from demolition work shall be removed from the premises as it accumulates and disposed of at an off-site location by the Contractor.

3.17 SALVAGE

A. Except as otherwise specified herein, or noted on drawings, the Contractor shall receive title to all building materials indicated to be demolished or removed which are not specifically designated as being retained by the Owner, said title to vest in the Contractor immediately upon receipt of Work Order. All salvage materials removed shall be taken from the premises promptly, as the storage of salvage materials on the site will not be permitted. Bidders shall take into account the salvage value to them of materials removed and such value shall be reflected in the bids.

B. All items of usable equipment shall remain the property of the Owner. All such items of equipment which are to be removed and which are not to be reused shall be stored on the premises by the Contractor as directed by the Owner.

C. Usable items shall be determined by the Owner and shall include existing heating and cooling pumps and other equipment so designated as "usable" by the Owner.

3.18 FINALLY

A. It is the intention that this specification shall provide a complete installation except as herein before specifically excepted. All accessory construction and apparatus necessary or advantageous in the operation and testing of the work shall be included. The omission of specific reference to any part of the work necessary for such complete installation shall not be interpreted as relieving this Contractor from furnishing and installing such parts.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe Markers.

E. Ceiling tacks.

1.2 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2007.

B. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

C. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2013.

1.3 SUBMITTALS

A. See Section 22 01 00 - General Plumbing Provisions for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number. Valve locations with tag numbers shall also be indicated on "as-built" drawings.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.1 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

A. Pipe Markers: 3/4 inch diameter and higher.

2.2 IDENTIFICATION APPLICATIONS

A. Instrumentation: Tags.

B. Piping: Pipe markers.

C. Pumps: Nameplates.

D. Small-sized Equipment: Tags.

E. Tanks: Nameplates.

F. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.3 NAMEPLATES

A. Manufacturers:

1. Kolbi Pipe Marker Co.

2. Seton Identification Products.

3. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.

2. Letter Height: 1/4 inch.

3. Background Color: Black.

4. Plastic: Conform to ASTM D709.

2.4 TAGS

A. Manufacturers:

1. Advanced Graphic Engraving.

2. Brady Corporation.

3. Kolbi Pipe Marker Co.

4. Seton Identification Products.

5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame. Valve tag chart should should indicate valve size, valve model and valve location. Valve locations with tag numbers shall also be indicated on "as-built" drawings.

2.5 STENCILS

A. Manufacturers:

1. Brady Corporation.

2. Kolbi Pipe Marker Co.

3. Seton Identification Products.

4. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Stencils: With clean cut symbols and letters of following size:

1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.

2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.

3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.

C. Stencil Paint: Semi-gloss enamel, colors conforming to ASME A13.1.

2.6 PIPE MARKERS

A. Manufacturers:

1. Brady Corporation.

2. Kolbi Pipe Marker Co.

3. MIFAB, Inc.

4. Seton Identification Products.

5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

F. Color code as follows:

1. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.

2. Fire Quenching Fluids: Red with white letters.

3. Combustible Fluids: Brown with white letters.

2.7 CEILING TACKS

A. Manufacturers:

1. Craftmark.

2. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Color code as follows:

1. Plumbing Valves: Green.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

E. Apply ASME A13.1 Pipe Marking Rules:

1. Place pipe marker adjacent to changes in direction.

2. Place pipe marker adjacent each valve port and flange end.

3. Place pipe marker at both sides of floor and wall penetrations.

4. Place pipe marker every 25 to 50 feet interval of straight run.

F. Install metallic detection tape located approximately 12 inches above pipe, where in ground utility lines are buried outside building footprint. Tape shall be continuous and be marked, indicating utility type (ie. water, sewer, gas, electric, etc).

G. Use tags on piping 3/4 inch diameter and smaller.

1. Identify service, flow direction, and pressure.

2. Install in clear view and align with axis of piping.

3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

H. Locate ceiling tacks to locate valves above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 22 07 19

PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flexible elastomeric cellular insulation.

B. Piping insulation.

C. Weather barrier coatings.

D. Jackets and accessories.

1.2 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

1.3 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).

E. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2019).

F. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

G. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2017 (Reapproved 2023).

H. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

I. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

K. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

L. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

1.4 SUBMITTALS

A. See Section 22 01 00 - General Plumbing Provisions, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than five years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum five years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

B. Deliver material to job site in original non-broken factory packaging, labeled with manufacturer's density and thickness.

1.7 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

C. Perform work at ambient and equipment temperature as recommended by the adhesive manufacturer.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.2 GLASS FIBER

A. Manufacturers:

1. Knauf Insulation.
2. Johns Manville Corporation.
3. Owens Corning Corp.
4. CertainTeed Corporation.
5. Armstrong World Industries, Inc.
6. Rubatex Corp.
7. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Insulation: ASTM C547 ; semi-rigid, noncombustible, end grain adhered to jacket.

1. 'K' value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum service temperature: 650 degrees F.
3. Maximum moisture absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive:

1. Compatible with insulation.

F. Insulating Cement/Mastic:

1. ASTM C195; hydraulic setting on mineral wool.

G. Fibrous Glass Fabric:

1. Cloth: Untreated; 9 oz/sq yd weight.
2. Blanket: 1.0 lb/cu ft density.
3. Weave: 5x5.

H. Indoor Vapor Barrier Finish:

1. Cloth: Untreated; 9 oz/sq yd weight.
2. Vinyl emulsion type acrylic, compatible with insulation, white color.

I. Outdoor Vapor Barrier Mastic:

1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

J. Outdoor Breather Mastic:

1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

K. Insulating Cement:

1. ASTM C449/C449M.

2.3 CELLULAR GLASS

A. Manufacturers:

1. Pittsburgh Corning Corporation.
2. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Insulation: ASTM C 552.

1. 'K' value: 0.37 at 100 degrees F.
2. Service Temperature: Up to 900 degrees F.
3. Water Vapor Permeability: 0.005 perm inch.
4. Water Absorption: 0.2 percent by volume, maximum.

2.4 HYDROUS CALCIUM SILICATE

A. Manufacturers:

1. Johns Manville Corporation.
2. PABCO.

3. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Insulation: ASTM C533 and ASTM C795; rigid molded, asbestos free, gold color.

1. K Value: ASTM C177 and ASTM C518 0.40 at 300 degrees F, when tested in accordance with ASTM C177 or ASTM C518.

2. Maximum service temperature: 1200 degrees F.

3. Density: 15 lb/cu ft.

C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

D. Insulating Cement:

1. ASTM C449/C449M.

2.5 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:

1. Armacell International.

2. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534 Grade 2; use molded tubular material wherever possible.

1. 'K' value: ASTM C 177; 0.27 at 75 degrees F.

2. Minimum Service Temperature: -40 degrees F.

3. Maximum Service Temperature: 220 degrees F.

4. Maximum Moisture Absorption - Pipe Insulation: 3.5 percent, by weight, when tested in accordance with ASTM D 1056.

5. Maximum Moisture Absorption - Sheets: 6.0 percent, by weight, when tested in accordance with ASTM D 1056.

6. Water Vapor Permeability: 0.20 perm-inches, when tested in accordance with ASTM E 96.

7. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

1. Air dried, contact adhesive, compatible with insulation.

2.6 WEATHER BARRIER COATINGS

2.7 JACKETS

A. PVC Plastic.

1. Manufacturers:

a. Johns Manville Corporation.

b. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

2. Jacket: One piece molded type fitting covers and sheet material, off-white color.

a. Minimum Service Temperature: 0 degrees F.

b. Maximum Service Temperature: 150 degrees F.

c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.

d. Thickness: 15 mil.

e. Connections: Pressure sensitive color matching vinyl tape.

3. Covering Adhesive Mastic:

a. Compatible with insulation.

B. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.

1. Lagging Adhesive:

a. Compatible with insulation.

C. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.

1. Thickness: 0.016 inch sheet.

2. Finish: Embossed.

3. Joining: Longitudinal slip joints and 2 inch laps.

4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.

5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

C. Repair all insulation that is damaged during construction using the same materials.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:

1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.

2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. Inserts and Shields:

1. Application: Piping 1 inch diameter or larger.

2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.

3. Insert location: Between support shield and piping and under the finish jacket.

4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.

5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

I. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers.

J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

K. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

L. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

3.3 SCHEDULES

A. Plumbing Systems:

1. Domestic Hot Water Supply:

a. Glass Fiber Insulation:

1) Pipe Size Range: 2 inch and under: 1 inch thickness.

2) Pipe Size Range: 2-1/2 inch and larger: 1-1/2 inch thickness.

3) Thickness: 1/2 inch (in interior walls).

2. Domestic Cold Water Supply:

a. Glass Fiber Insulation:

1) Pipe Size Range: 2 inch and under: 1 inch thickness.

2) Pipe Size Range: 2-1/2 inch and larger: 1 inch thickness.

3) Thickness: 1/2 inch (in interior walls).

3. Roof Drainage Above Grade:

a. Glass Fiber Insulation:

1) Pipe Size Range: all sizes.

2) Thickness: 1 inch.

4. Domestic Hot Water Recirculation:

a. Glass Fiber Insulation:

1) Pipe Size Range: All sizes.

2) Thickness: 1 inch.

5. Sanitary Piping Above Ceilings:

a. Glass Fiber Insulation:

1) Pipe Size Range: all sizes.

2) Thickness: 1 inch.

B. Heating Systems:

1. Heating Water Supply and Return:

a. Pipe Size Range: 2 inch and under: 1 inch thickness; glass fiber insulation.

b. Pipe Size Range: 2-1/2 inch and larger: 1-1/2 inch thickness; glass fiber insulation.

C. Cooling Systems:

1. Condensate Drains from Cooling Coils: 1/2 inch thickness; cellular insulation.

2. Refrigerant Suction: 3/4 inch thickness; cellular insulation.

3. Refrigerant Hot Gas: 3/4 inch thickness; cellular insulation.

D. Other Systems:

1. Piping Exposed to Freezing with Heat Tracing: 1-1/2 inch thickness; glass fiber insulation

END OF SECTION

SECTION 22 10 05

PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for piping systems.

1. Sanitary sewer.

2. Domestic water.

3. Storm water.

4. Gas.

5. Flanges, unions, and couplings.

6. Valves.

7. Flow controls.

8. Strainers.

1.2 RELATED REQUIREMENTS

A. Section 22 01 00 - General Plumbing Provisions.

B. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

C. Section 22 07 19 - Piping Insulation.

1.3 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems; 2015 (Reaffirmed 2020).

B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

C. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2021.

D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

E. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

F. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2024.

G. ASME B31.9 - Building Services Piping; 2020.

H. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2023, with Errata (2024).

I. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

J. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2021.

K. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.

L. ASTM B32 - Standard Specification for Solder Metal; 2020.

M. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2020.

N. ASTM B68/B68M - Standard Specification for Seamless Copper Tube, Bright Annealed; 2019.

O. ASTM B75/B75M - Standard Specification for Seamless Copper Tube; 2011.

P. ASTM C4 - Standard Specification for Clay Drain Tile and Perforated Clay Drain Tile; 2004 (Reapproved 2014).

Q. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe; 2015.

R. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.

S. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; latest accepted edition.

T. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings; 2020.

U. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020.

V. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2020.

W. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping; 2020.

X. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2020.

Y. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems; 2019a.

Z. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020.

AA. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2023.

BB. ASTM D3517 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe; 2019.

CC. ASTM F437 - Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2021.

DD. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2008).

EE. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.

FF. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.

GG. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2023.

HH. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 3/4 In. (19 mm) Through 3 In. (76 mm), for Water Service; 2020.

II. AWWA C950 - Fiberglass Pressure Pipe; 2020.

JJ. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2021.

KK. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2020.

LL. MSS SP-67 - Butterfly Valves; 2022.

MM. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.

NN. MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends; 2011.

OO. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.

PP. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

QQ. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 2012.

1.4 SUBMITTALS

A. See Section 22 01 00 - General Plumbing Provisions, for submittal procedures.

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

C. Project Record Documents: Record actual locations of valves.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Perform Work in accordance with Arkansas, city of Bentonville, Arkansas standards.

C. Valves: Manufacturer's name and pressure rating marked on valve body.

D. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.

E. Welder Qualifications: Certified in accordance with ASME (BPV IX).

F. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.6 REGULATORY REQUIREMENTS

A. Perform Work in accordance with State of Arkansas, and city of Bentonville, Arkansas plumbing code.

B. Conform to city of Bentonville, Arkansas code for installation of backflow prevention devices.

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

1.7 DELIVERY, STORAGE, AND HANDLING

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

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

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

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.8 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.1 SANITARY SEWER PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.

1. Fittings: Cast iron.

2. Joint Seals: ASTM C 564 neoprene gaskets.

B. PVC Pipe: ASTM D2665 or ASTM D3034.

1. Fittings: PVC.

2. Joints: Pipe sizes 4 inches or less: Solvent welded, with ASTM D 2564 solvent cement.

3. Joints: Pipe sizes greater than 4 inch: Push-on, using ASTM F477 elastomeric gaskets.

2.2 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.

1. Fittings: Cast iron.

2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C 564 neoprene gaskets.

B. Cast Iron Pipe: CISPI 301, hubless.

1. Fittings: Cast iron.

2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

C. PVC Pipe: ASTM D2665 or ASTM D3034.

1. Fittings: PVC.

2. Joints: Pipe sizes 4 inch and smaller: Solvent welded, with ASTM D 2564 solvent cement.

3. Joints: Pipe sizes greater than 4 inch: Push-on, using ASTM F477 elastomeric gaskets.

2.3 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight.

1. Fittings: Cast iron.

2. Joint Seals: ASTM C 564 neoprene gaskets.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.

1. Fittings: Cast iron.

2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

C. PVC Pipe: ASTM D2665.

1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D2564 solvent cement.

D. In Fire-rated Walls:

1. Cast iron.

a. Fittings: Cast iron.

E. In Plenum-rated Areas:

1. Cast iron.

a. Fittings: Cast iron.

2.4 WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Ductile Iron Pipe: AWWA C151/A21.51.

1. Fittings: AWWA C110, ductile or gray iron, standard thickness.

2. Joints: AWWA C111/A21.11, rubber gasket with 3/4 inch diameter rods.

B. Copper Pipe: ASTM B42, hard drawn.

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.

2. Joints: ASTM B 32, alloy Sn95 solder.

C. PVC SDR 21: pipe shall be manufactured from a Type I, Grade I Polyvinyl Chloride (PVC) compound with a Cell Classification of 12454 per ASTM D1784.

1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D 2564 solvent cement.

2.5 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Pipe: ASTM B42, hard drawn Type "K".

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.

2. Joints: AWS A5.8M/A5.8, BCuP copper/silver braze.

2.6 WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.

2. Joints: ASTM B32, alloy Sn95 solder or mechanical press-fit couplings.

2.7 STORM WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.

1. Fittings: Cast iron.

2. Joint Seals: ASTM C 564 neoprene gaskets.

B. PVC Pipe: ASTM D 2729.

1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D 2564 solvent cement.

2.8 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.

1. Fittings: Cast iron.

2. Joint Seals: ASTM C 564 neoprene gaskets.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.

1. Fittings: Cast iron.

2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

C. PVC Pipe: ASTM D 2729.

1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D 2564 solvent cement.

2.9 STORM WATER PIPING, ABOVE GRADE

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

1. Fittings: Cast iron.

2. Joint Seals: ASTM C 564 neoprene gaskets.

B. Cast Iron Pipe Where Noted: CISPI 301, hubless, service weight.

1. Fittings: Cast iron.

2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

C. PVC Pipe: ASTM D2665 or ASTM D3034.

1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D2564 solvent cement.

D. In Fire-rated Walls:

1. Cast iron.

a. Fittings: Cast iron.

E. In Plenum-rated Areas:

1. Cast iron.

a. Fittings: Cast iron.

2.10 NATURAL GAS PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.

1. Fittings: ASTM A234/A234M, wrought steel welding type, with AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2. Joints: ASME B31.1, welded.

B. Polyethylene Pipe: ASTM D2513, SDR 11.

1. Fittings: ASTM D2683 or ASTM D2513 socket type.

2. Joints: Fusion welded.

2.11 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.

1. Fittings: ASTM A 234/A 234M, forged steel welding type.

2. Joints: ASME B31.1, welded.

3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2.12 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.

2. Fittings: ASME B16.3, malleable iron, or ASTM A 234/A 234M, forged steel welding type.

3. Joints: NFPA 54, threaded or welded to ASME B31.1.

2.13 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:

1. Ferrous pipe: Class 150 malleable iron threaded unions.

2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch:

1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.

2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Grooved and Shouldered Pipe End Couplings:

1. Housing: Malleable iron clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; steel bolts, nuts, and washers; galvanized for galvanized pipe.

2. Sealing gasket: "C" shape composition sealing gasket.

D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

E. Victaulic Devices:

1. Couplings shall consist of a one or more piece ductile or malleable iron cast housing, a synthetic rubber gasket of a central cavity pressure-responsive design, with nuts, bolts, locking toggle or luggs to secure unit together.

   a. Coupling housings shall be cast of ductile iron conforming to ASTM A-536 (Grade 65-45-12) or malleable iron conforming to ASTM A-47 (Grade 32510), hot dip galvanized to ASTM A-153, or zinc electroplated to ASTM B-633, as manufactured by Victaulic Company of America. Refer to Victaulic product specifications for other materials.

   b. Coatings shall consist of an alkyd enamel paint, or hot-dip galvanizing to ASTM A-153, or zinc electroplating to ASTM B-633, as specified.

2. Couplings for grooved end steel pipe shall be Victaulic couplings for grooved end steel pipe.

   a. Line, fittings and valve joints shall be Victaulic flexible (styles 75, 77, 78, or 791) or rigid (styles 005, 07 or HP-70).

   b. Rigid joints shall be Victaulic style 07 "Zero-Flex", style HP-70 or style 005 "FireLock" couplings.

   c. Pin assembled joints shall be Victaulic style 791 "Vic-Boltless" couplings.

d. Reducing joints shall be Victaulic style 750 Reducing Couplings for pipe to pipe joints or to create reducing fittings using straight fitting configurations.

e. Outlets: All joints designated Outlet Couplings, or where feasible to replace reducing outlet tees, shall be Victaulic style 72 Outlet Couplings (specify grooved, female or male threaded outlet).

f. Flanged Connections shall be Victaulic style 741 (2-24") "Vic-Flange" adapters, engaging directly into grooved pipe and bolting directly to ANSI Class 125 cast iron and Class 150 steel flanged components or style 743 (2-12") for ANSI Class 300 flanged components; installer to supply standard flange bolts.

g. Quick disconnects shall be Victaulic style 78 "Snap-Joint" Couplings or style 780/781 for double grooved pipe.

3. Gasket shall be molded of synthetic rubber in a central cavity, pressure-responsive configuration conforming to the pipe outside diameter and coupling housing, of elastomers having properties as designated in ASTM D-2000. Reference shall always be made to the latest published Selection Guide for Victaulic Gaskets for proper gasket selection for the intended service.

   a. Water service: Gasket supplied for water services from -30 degrees F to +230 degrees F, shall be a Grade "E" EPDM compound, with green color code, molded of materials conforming to ASTM D-2000, designation 2CA615A25B24F17Z, recommended for hot water service within the specified temperature range, plus a variety of dilute acids, oil-free air, and many chemical services. Not recommended for petroleum services.

4. Bolts and nuts shall be heat treated carbon steel, track head, conforming to physical properties of ASTM A-183 minimum tensile 110,000 psi, black, or zinc electroplated to ASTM B-633, as supplied or specified.

5. Fittings shall be Victaulic full flow cast fittings, steel fittings or segmentally welded fittings with grooves or shoulders designed to accept Victaulic grooved end couplings.

   a. Standard fittings shall be cast of ductile iron conforming to ASTM A-536 (Grade 65-45-12), or malleable iron conforming to ASTM A-47, Grade 32510, painted with alkyd enamel or hot-dip galvanized to ASTM A-153 or zinc electroplated to ASTM B-633 or cadmium plated to ASTM A-165 as required.

b. Standard steel fittings including large size elbows (16-24") shall be forged steel conforming to ASTM A-234 Grade WPB (0.375" wall), painted with alkyd enamel or hot-dip galvanized to ASTM A-153.

6. Branch outlets for hole cut steel pipe shall be Victaulic hole cut products.

7. Branch outlets shall be made with Victaulic style 920, 921 or 929 "Mechanical-T" branch connections with locating collar or foot engaging into hole. (Specify outlet/branch connection type - grooved, female threaded or FIT, as available.)

8. Gauge, meter outlets for hole cut steel pipe shall be Victaulic strapless mechanical outlet products style 923 "Vic-Let" or 924 "Vic-O-Well" and shall provide a pipe outlet without a need for a strap or lower housing to wrap around the pipe.

9. Flow indicators for hole cut steel pipe shall be Victaulic style 736 Waterflow Indicators for wet sprinkler systems, to sense water flow to 10 GPM or greater.

10. Fittings for plain end steel pipe shall be Victaulic FIT fittings (sizes 1", 1 1/4", 1 1/2" and 2") with internal pipe stop for uniform takeout dimensions, 1/4-turn positive locking lugs of heat treated carbon steel conforming to AISI C-1022, cadmium plated, with externally locked-position indicator for inspection or connection of plain end steel pipe. FIT fittings shall have self-contained, pressure responsive gaskets: for water service (-30 degrees to +230 degrees F) Grade "E"; FIT silicone Grade "L" (-30 degrees to +160 degrees F) are recommended for fire protection dry systems, all systems operating below 0 degrees F, plus dry heat, air without hydrocarbons, certain chemical services and water to +160 degrees F. FIT Nitrile gaskets Grade "T" (0 degrees to +180 degrees F) are recommended for petroleum products, hydrocarbons, air without hydrocarbons, except hot dry air over +140 degrees F, vegetable and mineral oils within the specified temperature range. Not recommended for hot water services.

11. Reducing outlet tees shall be Victaulic FIT style 96 with female threaded outlet (specify 1/2, 3/4 or 1" outlet) for direct sprinkler head, sprig or drop nipple connections.

12. 90 degree elbows shall be Victaulic FIT style 969.

13. FIT Outlet/Mechanical-T shall be Victaulic FIT style 929 with FIT locking lug branch outlet (specify 1 1/4, 1 1/2 or 2" outlet) for direct branch connections.

14. Straight tees shall be Victaulic FIT style 963.

15. Straight couplings shall be Victaulic FIT style 960.

16. Reducing elbows shall be Victaulic FIT style 966 with female threaded outlet (specify 1/2, 3/4, or 1" outlet) for direct sprinkler head, sprig or drop nipple connections.

2.14 MECHANICALLY FORMED TEE FITTINGS

A. Mechanically extracted outlets shall have a height not less than three times the thickness of the branch tube wall.

B. Branch tubes shall not restrict the flow in the main tube. Mechanical Contractor shall insure the branch tube penetration into the collar is of the correct depth.

C. Mechanically formed tee fittings shall be cleaned and brazed with filler material conforming to AWS A5.8.

2.15 PRESS FITTINGS

A. Fittings shall comply with NSF 61, CSA, UPC and be approved by the local jurisdiction. Wrot copper press fittings shall be made from commercially pure copper mill products per ASTM B 75 Alloy C12200. Cast copper alloy press fittings shall be made from materials with a minimum of 78% copper and a maximum of 15% zinc. The press fittings connections shall be compatible with seamless K, L or M copper tube made to ASTM B 88. Fittings shall have a maximum non-shock working pressure of 200 PSI between the temperatures of -20°F and +250°F. Elastomeric seals shall be made of EPDM material, and the fittings shall be manufactured with an inboard bead design. All fittings shall be installed in accordance with the manufacturer's installation instructions and according to local plumbing and mechanical codes. The press-to-connect joint shall be made with pressing tools and jaw sets recommended and authorized by press fitting manufacturer.

2.16 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

B. Plumbing Piping - Drain, Waste, and Vent:

1. Conform to ASME B31.9.

2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Carbon steel, adjustable swivel, split ring.

3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

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

6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.

7. Vertical Support: Steel riser clamp.

8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Plumbing Piping - Water:

1. Conform to ASME B31.9.

2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Carbon steel, adjustable swivel, split ring.

3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

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

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

6. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.

7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded supports or spacers and hanger rods, cast iron roll.

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

9. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.

10. Vertical Support: Steel riser clamp.

11. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

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

13. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.17 GATE VALVES

A. Manufacturers:

1. Conbraco Industries.
2. Nibco, Inc.
3. Milwaukee Valve Company.
4. Crane Co.
5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Up To and Including 2 1/2 Inches:

1. MSS SP-80, Class 125, bronze body, bronze trim, rising stem, handwheel, inside screw, solid wedge disc, solder or threaded ends.

C. 3 Inches and Larger:

1. MSS SP-70, Class 125, iron body, bronze trim, outside screw and yoke, handwheel, solid wedge disc, flanged ends. Provide chain wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.18 GLOBE VALVES

A. Manufacturers:

1. Conbraco Industries.
2. Nibco, Inc.
3. Milwaukee Valve Company.
4. Crane Co.
5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Up To and Including 2 1/2 Inches:

1. MSS SP-80, Class 125, bronze body, bronze trim, handwheel, bronze disc, solder or threaded ends.

C. 3 Inches and Larger:

1. MSS SP-85, Class 125, iron body, bronze trim, handwheel, outside screw and yoke, renewable bronze plug-type disc, renewable seat, flanged ends. Provide

chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.19 BALL VALVES

A. Manufacturers:

1. Conbraco Industries.

2. Nibco, Inc.

3. Milwaukee Valve Company.

4. Crane Co.

B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, threaded ends with union.

2.20 PLUG VALVES

A. Manufacturers:

1. Conbraco Industries.

2. Nibco, Inc.

3. Milwaukee Valve Company.

4. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Construction 2-1/2 Inches and Larger: 1, 250 psi CWP, cast iron body and plug, pressure lubricated, teflon or Buna N packing, flanged or grooved ends. Provide lever operator with set screw.

2.21 BUTTERFLY VALVES

A. Manufacturers:

1. Hammond Valve.

2. Crane Co.

3. Milwaukee Valve Company.

4. Stockham.

5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Construction 1-1/2 Inches and Larger: MSS SP-67, 200 psi CWP, cast or ductile iron body, elastomer coated ductile iron disc, resilient replaceable EPDM seat, wafer ends, extended neck, 10 position lever handle.

C. Provide gear operators for valves 6 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.

2.22 FLOW CONTROLS

A. Manufacturers:

1. ITT Bell & Gossett.

2. Griswold Controls.

3. Taco, Inc.

4. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet , blowdown/backflush drain.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi psi.

2.23 SWING CHECK VALVES

A. Manufacturers:

1. Hammond Valve.

2. Nibco, Inc.

3. Milwaukee Valve Company.

4. Crane Co.

5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Up to 2 Inches:

1. 1, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder or threaded ends.

C. Over 2 Inches:

1. 1, Class 125, iron body, bronze swing disc, renewable disc seal and seat, flanged or grooved ends.

2.24 SPRING LOADED CHECK VALVES

A. Manufacturers:

1. Hammond Valve.

2. Crane Co.

3. Milwaukee Valve Company.

4. Stockham.

5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Class 125, iron body, bronze trim, stainless steel springs, bronze disc, Buna N seals, wafer style ends.

2.25 WATER PRESSURE REDUCING VALVES

A. Manufacturers:

1. Amtrol Inc.

2. Cla-Val Co.

3. Watts Regulator Company.

4. Spence Engineering Co.

5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Up to 2 Inches:

1. MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.

C. Over 2 Inches:

1. MSS SP-85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.26 RELIEF VALVES

A. Pressure Relief:

1. Manufacturers:

    a. Cla-Val Co.

    b. Henry Technologies.

    c. Watts Regulator Company.

    d. Spence Engineering Co.

    e. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

2. AGA Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME (BPV IV) certified and labelled.

B. Temperature and Pressure Relief:

1. Manufacturers:

    a. Cla-Val Co.

    b. Henry Technologies.

    c. Watts Regulator Company.

    d. Spence Engineering Co.

    e. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

2. AGA Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME (BPV IV) certified and labelled.

2.27 STRAINERS

A. Manufacturers:

1. Armstrong International, Inc.

2. Green Country Filtration.

3. WEAMCO.

4. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Size 1-1/2 inch to 4 inch:

1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

C. Size 5 inch and Larger:

1. Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

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

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

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

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

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

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

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

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 19.

H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.

I. Establish elevations of buried piping outside the building to ensure not less than 3 ft of cover.

J. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

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

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

M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.

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

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

P. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

Q. Install water piping to ASME B31.9.

R. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

S. Sleeve pipes passing through partitions, walls and floors.

T. Inserts:

1. Provide inserts for placement in concrete formwork.

2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

U. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.

2. Support horizontal piping as scheduled.

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

4. Place hangers within 12 inches of each horizontal elbow.

5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.

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

8. Provide copper plated hangers and supports for copper piping.

9. Provide hangers adjacent to motor driven equipment with vibration isolation.

10. Support cast iron drainage piping at every joint.

V. Where water pressure within the building exceeds 75 psi static, install an approved water-pressure reducing valve conforming to ASSE 1003 with strainer to reduce the building pressure to 75 psi static or less.

3.4 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

B. Install unions downstream of valves and at equipment or apparatus connections.

C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

E. Install ball valves for throttling, bypass, or manual flow control services.

F. Provide lug end butterfly valves adjacent to equipment when provided to isolate equipment.

G. Provide spring loaded check valves on discharge of water pumps.

H. Provide ball valves in natural gas systems for shut-off service.

I. Provide flow controls in water recirculating systems where indicated.

J. All sanitary waste and vent pipe installed above grade in fire-rated walls, fire-rated plenum spaces or return air plenums shall be cast iron.

3.5 TOLERANCES

A. Drainage Piping: Maintain invert elevations within 1/4 inch vertically of location indicated on drawings. Slope to drain at minimum of 1/4 inch per foot slope for pipes 3 inch and smaller and 1/8 inch per foot slope for pipes larger than 3 inch.

B. Contractor must maintain inverts as indicated on the drawings. The contractor shall employ the latest precision technology available to insure the accuracy of the installation. If the contractor is unable to maintain, the contractor should notify the engineer IMMEDIATELY to obtain direction.

C. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system in accordance with Arkansas state and local codes.

B. Prior to starting work, verify system is complete, flushed and clean.

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

D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

E. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

F. Maintain disinfectant in system for 24 hours.

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

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

I. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.7 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be

properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.

1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.

2. Provide 18 gage galvanized sheet metal sleeve around service main to 6 inch above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.

C. Connections to existing manholes shall be made at the locations shown on the plans. An opening shall be cut in the wall of the manhole and shall be of sufficient size to permit installation of the pipe at the designated elevation. The invert of the existing manhole shall be removed and a new invert constructed. The end of the pipe shall be flush with the inside wall of the manhole and shall be sealed in the wall with mortar to provide a water tight joint.

D. Manholes installed on existing lines shall be constructed in a manner which will not disturb the alignment and grade of the existing pipe except for required alterations. Existing pipe within the manhole shall be removed as required to permit construction of the manhole invert. When authorized by the Engineer, the manhole may be constructed with the sewer pipe in place and the upper half of the pipe removed after the invert has been placed. Temporary plugging of lines and bypassing of sewage shall be required when replacement of the invert is necessary.

E. Connection of dissimilar pipe materials shall be made with the specified adapter couplings.

F. Sewers shall be encased or cradled in concrete where shown on the plans or as directed by the Engineer. Unless otherwise noted on the plans, concrete encasement shall encircle the pipe and shall be a minimum thickness of four inches.

G. Provide new gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure of 5 psi. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

H. Contractor shall connect to existing gas service in accordance with the requirements of local gas service official and all applicable municipal and state regulations. All gas piping shall conform to and be tested in accordance with the local gas company and the Standard Gas Code. Gas piping shall have cathodic protection and all piping

subject to natural gas pressure over 15 ounces must be welded. Any charge made by the gas company for placing the valves, piping, and connection to service main shall be borne by this contractor. See plans for extent of piping.

I. This Contractor shall extend the system of gas piping, to the various outlets as indicated on plans, complete with stop ball valves, drip pockets, valves and other accessories that may be required to give proper and adequate service.

J. Provide gas ball valves in final connection to all equipment. Unions will not be permitted, except in final connections to equipment. Proper reducing fittings shall be used. Bushings will not be accepted. Gas piping in building shall be standard weight schedule 40 black steel pipe with malleable fittings, unless contractor wishes to weld all joints. Welded rod shall be of same material as piping. No. 22 bronze welding will be permitted.

K. All underground gas service exterior to the building (5 psi or less) shall be a polyethylene plastic pipe manufactured in accordance with ASTM No. D-2517 or D-2513 and shall be indicated on the pipe. Gas piping shall be laid at least 36" below grade at all points. Provide a #12 THN copper wire in trench with pipe and leave both ends exposed for future accessibility.

L. All gas piping in ground, including service, shall be checked with a "Holiday" detector to assure that the coating is free of holes, voids, contamination, cracks, etc. This test shall be performed after the completion of joint and finish coating and touch-up. This test shall be conducted in the presence of the Owner's inspector and performed by experienced personnel.

M. For corrosion protection, all underground and exposed exterior steel pipe and fittings must be coated and wrapped.

N. Test all gas piping operating at 6 oz. with air pump and mercury gauge to pressure that will maintain 25 psig for 20 minutes and inspected by gas service official.

O. All gas piping operating at more than 1 psig shall be tested at 100 psig for steel and 50 psig for plastic, for a minimum of 15 minutes and inspected by gas service official.

P. The pressure regulator at the building shall be sized, and approved by gas service official.

Q. All above ground piping shall be rigid steel pipe designated for natural gas use. Pipe shall be painted with a rust inhibiting primer and a final coat the color of which shall be determined by governing regulations or as directed by the Engineer if no governing regulations exist regarding finish color.

R. All gas piping systems within a building and other above ground gas piping shall be electrically continuous and bonded to a grounded electrode as defined in NFPA 70.

S. Medium and high pressure gas regulators installed in the medium and high pressure gas lines (2 psi or greater) shall comply with the following provisions:

1. Shall be suitable for the inlet and outlet gas pressure.

2. Shall comply with Code and gas official requirements.

3. Shall be accessible for servicing.

4. Shall be vented to outdoors when located indoors.

5. Shall be installed in the gas piping system so that it cannot be concealed by building construction.

T. Provide a listed shut off valve immediately ahead of and immediately behind each medium pressure regulator.

U. Underground gas piping shall be installed in a separate ditch.

3.8 SCHEDULES

A. Pipe Hanger Spacing:

1. Metal Piping:

a. Pipe size: 1/2 inches to 1-1/4 inches:

1) Maximum hanger spacing: 8 ft.

2) Hanger rod diameter: 1/4 inch.

b. Pipe size: 1-1/2 inches to 2 inches:

1) Maximum hanger spacing: 8 ft.

2) Hanger rod diameter: 1/4 inch.

c. Pipe size: 2-1/2 inches to 3 inches:

1) Maximum hanger spacing: 8 ft.

2) Hanger rod diameter: 3/8 inch.

d. Pipe size: 4 inches to 6 inches:

1) Maximum hanger spacing: 8 ft.

2) Hanger rod diameter: 3/8 inch.

e. Pipe size: 8 inches to 12 inches:

1) Maximum hanger spacing: 10 ft.

2) Hanger rod diameter: 1/2 inch.

f. Pipe size: 14 inches and Over:

1) Maximum hanger spacing: 10 ft.

2) Hanger rod diameter: 7/8 inch..

2. Plastic Piping:

a. All sizes:

1) Maximum hanger spacing: 6 ft.

2) Hanger rod diameter: 3/8 inch.

3. Roof Supports:

a. Provide gas piping roof supports as indicated on the plans.

b. Provide condensate piping roof supports as indicated on the plans.

4. Roof Piping Supports:

a. All sizes:

1) Maximum linear pipe spacing: 10 ft.

2) At all changes in direction.

END OF SECTION

SECTION 22 10 06

PLUMBING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof and Floor drains

B. Floor Sink.

C. Cleanouts.

D. Hose bibbs.

E. Hydrants.

F. Washing machine boxes and valves.

G. Refrigerator valve and recessed box.

H. Backwater valves.

I. Backflow preventers.

J. Water hammer arrestors.

K. Thermostatic mixing valves.

1.2 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping.

B. Section 22 30 00 - Plumbing Equipment.

C. Section 22 40 00 - Plumbing Fixtures.

1.3 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor Drains; 2022.

B. ASME A112.6.4 - Roof, Deck, and Balcony Drains; 2022.

C. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent; 2021.

D. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2023.

E. NSF 61 - Drinking Water System Components - Health Effects; 2024.

F. PDI-WH 201 - Water Hammer Arresters; 2017.

1.4 SUBMITTALS

A. See Section 22 01 00 - General Plumbing Provisions, for submittal procedures.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

D. Certificates: Certify that grease interceptors meet or exceed City of Bentonville, Arkansas requirements .

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

F. Project Record Documents: Record actual locations of equipment and cleanouts ____.

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

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

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Loose Keys for Outside Hose Bibbs: Four.

J. Product Data: Manufacturer’s standard data sheets describing components including materials, dimensions, relationship to adjacent construction, and attachments.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than five years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 DRAINS

A. Manufacturers:

1. Josam Company.
2. Jay R. Smith Manufacturing Company.
3. Zurn Industries, Inc.
4. Wade Tyler Pipe.
5. MIFAB, Inc.
6. Watts Water Technologies.
7. Striem, Edwardsville, KS USA
8. Schier Products Company, Edwardsville, KS USA
9. Substitutions: See Section 22 10 00 - General Plumbing Provisions.

B. Roof Drains:

1. Assembly: ASME A112.6.4.
2. Body: Lacquered cast iron with sump.
3. Strainer: Removable cast iron dome with vandal proof screws.
4. Accessories: Coordinate with roofing type, refer to roof section. ____
    a. Membrane flange and membrane clamp with integral gravel stop.
    b. Adjustable under deck clamp.
    c. Roof sump receiver.
    d. Waterproofing flange.
    e. Controlled flow weir.
    f. Leveling frame.
    g. Adjustable extension sleeve for roof insulation.
    h. Perforated or slotted ballast guard extension for inverted roof.

C. Roof Overflow Drains:

1. Assembly: ASME A112.6.4.
2. Body: Lacquered cast iron with sump.

3. Strainer: Removable cast iron dome with vandal proof screws.

4. Accessories: Coordinate with roofing type, refer to roof section. ____

    a. Membrane flange and membrane clamp with integral gravel stop.

    b. Adjustable under deck clamp.

    c. Roof sump receiver.

    d. Waterproofing flange.

    e. Controlled flow weir.

    f. Leveling frame.

    g. Adjustable extension sleeve for roof insulation.

    h. Perforated or slotted ballast guard extension for inverted roof.

    i. Perforated stainless steel ballast guard extension.

D. Downspout Nozzles and Boots:

1. ASME A112.6.4, Round cast iron, bronze downspout nozzle with threaded outlet and perforated screen.

2. Bell reducer with cap. Size bell reducer as required to fit downspout. Cut cap to match size of downspout and seal around downspout watertight.

E. Floor Drain:

1. ASME A112.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable round nickel bronze strainer with removable perforated sediment bucket.

F. Institutional Ligature-Resistant Floor Drains:

1. ASME A112.6.3; ligature-resistant cast iron with upper and lower bodies and anchor flanges, vandal resistant screws, cast iron no hub drain body, reversible clamping collar, and round, adjustable round nickel bronze strainer with removable perforated sediment bucket.

G. Floor Sink:

1. Square lacquered cast iron body with integral seepage pan, epoxy coated interior, aluminum dome strainer, clamp collar, sediment bucket; and nickel bronze frame;

half grate.

2.2 CLEANOUTS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company.
2. Josam Company.
3. Ward Manufacturing, Inc.
4. Zurn Industries, Inc.
5. Wade Tyler Pipe.
6. Watts Water Technologies.
7. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Cleanouts at Exterior Surfaced Areas:

1. Round cast nickel bronze access frame and non-skid cover.

C. Cleanouts at Exterior Unsurfaced Areas:

1. Line type with lacquered cast iron body and round epoxy coated gasketed tractor-type cover.

D. Cleanouts at Interior Finished Wall Areas:

1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

E. Cleanouts at Interior Unfinished Accessible Areas: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.3 HOSE BIBBS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company.
2. Watts Regulator Company.
3. Zurn Industries, Inc.
4. Wade Tyler Pipe.

5. Woodford Manufacturing.

6. Acorn.

7. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Interior Hose Bibbs:

1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with lockshield and removable key, integral vacuum breaker in conformance with ASSE 1011.

2. One piece cast iron construction, stainless steel hose box with recessed cam latch in door. Cast bronze valve and stop body, exposed chome-plated and removable wheel handle on wheel. Vaccuum breakers are atmospheric type and conform to the requirements of ASSE Standards 1011.

2.4 HYDRANTS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company.

2. Zurn Industries, Inc.

3. Wade Tyler Pipe.

4. Woodford.

5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Wall Hydrants:

1. ASSE 1019; freeze resistant, self-draining type with chrome plated lockable recessed box hose thread spout, lockshield and removable key, and integral vacuum breaker.

C. Roof Hydrants:

1. Hydrant shall be freeze proof, backflow protected, Woodford Model SRH-MS, or equal.

2. Hydrant shall meet ASSE 1057

3. The hydrant shall not require a drain line. Venturi action shall draw water out of the internal reservoir and discharge out the backflow preventer.

4. Provide backflow preventer.

5. Provide mounting system.

2.5 WASHING MACHINE BOXES AND VALVES

A. Box Manufacturers:

1. Guy Gray Manufacturing.

2. IPS Corporation/Water-Tite.

3. Oatey.

4. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Valve Manufacturers:

1. Guy Gray Manufacturing.

2. IPS Corporation/Water-Tite.

3. Zurn Industries, Inc.

4. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

C. Description: Painted metal preformed rough-in box with brass long shank valves with wheel handles, socket for 2 inch waste, slip in finishing cover.

2.6 REFRIGERATOR VALVE AND RECESSED BOX

A. Box Manufacturers:

1. Guy Gray Manufacturing.

2. IPS Corporation/Water-Tite.

3. Oatey.

4. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Valve Manufacturers:

1. Guy Gray Manufacturing.

2. IPS Corporation/Water-Tite.

3. Zurn Industries, Inc.

4. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

C. Description: Painted metal preformed rough-in box with brass valves with wheel handle, slip in finishing cover.

2.7 BACK WATER VALVES

A. Manufacturers:

1. Jay R. Smith Manufacturing Company; Model _____: www.jayrsmith.com/#sle.

2. Savko Plastic Pipe & Fittings, Inc; Model _____: www.savko.com/#sle.

3. Zurn Industries, Inc; Model _____: www.zurn.com/#sle.

4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Cast Iron Back Water Valves: ANSI A112.21.2M; lacquered cast iron body and cover, brass valve, extension sleeve, and access cover.

C. Plastic Back Water Valves: ABS body and valve, extension sleeve, and access cover.

2.8 BACKFLOW PREVENTERS

A. Manufacturers:

1. Conbraco Industries.

2. Valve Solutions, Inc.

3. Watts Regulator Company.

4. Zurn Industries, Inc.

5. FEBCO.

6. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Reduced Pressure Backflow Preventers:

1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

2.9 WATER HAMMER ARRESTORS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company.
2. Watts Regulator Company.
3. Zurn Industries, Inc.
4. Wade Tyler Pipe.
5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Water Hammer Arrestors:

1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range -100 to 300 degrees F and maximum 250 psi working pressure.

2.10 INTERCEPTORS

A. Manufacturers:

1. ACO International.
2. Jay R. Smith Manufacturing Company.
3. Zurn Industries, Inc.
4. Wade Tyler Pipe.
5. Peterson Concrete Tank Co.
6. Schier Products.
7. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Indoor/Outdoor Hydromechanical Grease Interceptor

1. Indoor/Outdoor Hydromechanical Grease Interceptor

a. Description: Grease interceptor shall be lifetime guaranteed and made in USA of seamless, rotationally-molded polyethylene with minimum 3/8" uniform wall thickness. Interceptor shall be furnished for above or below grade installation with built in cover adapter, built-in flow control. Interceptor shall be built in accordance to ASME A112.14.3 (Type D) and CSA B481.1. Cover shall provide water/gas tight seal.

b. Capacities:

1) Liquid: 125 gallons.

2) Solids: 31 gallons.

3) Grease: 861 lbs., (118gallons) @ 75 gpm.

2.

2.11 MIXING VALVES

A. Thermostatic Mixing Valves:

1. Manufacturers:

a. ESBE.

b. Leonard Valve Company.

c. Honeywell Water Controls.

d. Powers Process Controls.

e. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

2. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.

3. Accessories:

a. Check valve on inlets.

b. Volume control shut-off valve on outlet.

c. Stem thermometer on outlet.

d. Strainer stop checks on inlets.

4. Cabinet: 16 gage stainless steel, for surface mounting with keyed lock.

B. Pressure Balanced Mixing Valves:

1. Manufacturers:

a. Delta Faucet Company.

b. H.G. Specialties.

c. Powers Process Controls.

d. Taconova.

e. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

2. Valve: Chrome plated cast brass body, stainless steel cylinder, integral temperature adjustment.

3. Accessories:

a. Volume control shut-off valve on outlet.

b. Stem thermometer on outlet.

c. Strainer stop checks on inlets.

d. Cabinet: 16 gage stainless steel, for surface mounting with keyed lock.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

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

C. Encase exterior cleanouts in concrete flush with grade. Refer to plans for detail.

D. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; janitor rooms, flush valves, interior and exterior hose bibbs.

E. Pipe relief from backflow preventer to nearest floor drain or floor sink.

F. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatories,sinks, washing machine outlets and water closets.

G. Install city approved backwater valve on all building sewers at the exterior of the building and prior to connection to the public sewer system.

H. Install components in accordance with manufacture's instructions and approved product data submittals.

END OF SECTION

SECTION 22 10 08

PLUMBING SOLDER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Lead-free plumbing solder.

1.2 RELATED SECTIONS

A. Section 22 10 05 - Plumbing Piping.

B. Section 22 40 00 - Plumbing Fixtures.

C. Section 22 30 00 - Plumbing Equipment.

1.3 REFERENCES

A. ASTM B 32 - Standard Specification for Solder Metal; 1996.

B. NSF 61 - Drinking Water System Components - Health Effects; 2002 (ANSI/NSF 61).

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: The Harris Products Group

B. Substitutions: See Section 22 01 00 - General Plumbing Provisions for equipment and material substitutions.

C. Provide all plumbing solder from a single manufacturer.

2.2 MATERIALS

A. Plumbing Solder: Sterling® solder or equal, ASTM B 32, Alloy Grade TC; 95 percent tin, 4.85 percent copper, 0.15 percent selenium.

1. Certified to comply with NSF 61.

2. Melting Temperature: 410 degrees F.

3. Tensile Strength: 7,130 psi.

4. Shear Strength: 5,979 psi.

5. Elongation Percent: 19.1.

6. Brinell Hardness: 15.1.

7. Burst Strength: 5,800 psi.

8. Pressure/Temperature Test Data on Copper Tube Assemblies comprised of 3 inch, 2 inch, 1 inch, 3/4 inch, and 1/2 inch Tubing with a Reducing Tee:

   a. No leaks at 70 degrees F., 200 psi, held for 2 minutes.

   b. No leaks at 180 degrees F., 200 psi, held for 2 minutes.

   c. No leaks at 70 degrees F., 2,000 psi, held for 5 minutes.

B. No lead in plumbing solder.

PART 3 EXECUTION

3.1 INSTALLATION

A. Apply plumbing solder in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 22 30 00

PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water heaters.

B. Pumps.

1. Circulators.

1.2 RELATED REQUIREMENTS

A. Division 26 - Equipment wiring; electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. Comply with State of Arkansas adopted ADA Accessible Guidelines in regard to accessible or handicapped features.

B. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023, with Errata (2024).

C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

D. UL 174 - Standard for Household Electric Storage Tank Water Heaters; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 22 01 00 - General Plumbing Provisions, for submittals procedures.

B. Product Data:

1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.

2. Indicate pump type, capacity, power requirements.

3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

4. Provide electrical characteristics and connection requirements.

C. Shop Drawings:

1. Indicate heat exchanger dimensions, size of tappings, and performance data.

2. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum five years of documented experience.

B. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

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

1. National Sanitation Foundation (NSF).

2. American Society of Mechanical Engineers (ASME).

3. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).

4. National Electrical Manufacturers' Association (NEMA).

5. Underwriters Laboratories (UL).

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

1.6 CERTIFICATIONS

A. Water Heaters: NSF approved.

B. Electric Water Heaters: UL listed and labeled to UL 174.

C. Conform to AGA requirements for water heaters.

D. Pressure Vessels for Heat Exchangers: ASME labeled, to ASME (BPV VIII, 1).

E. Conform to ASME (BPV VIII 1) for tanks.

F. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 WARRANTY

A. Provide five year manufacturer warranty for domestic water heaters.

B. All warranties to begin at Date of Substantial Completion as accepted by the Owner.

PART 2 PRODUCTS

2.1 WATER HEATER MANUFACTURERS

A. Tank Type Water Heater Manufacturers

1. A.O. Smith Water Products Co.

2. State Industries.

3. Rheem Manufacturing Company.

4. Bock Water Heaters, Inc.

5. Lochinvar, LLC.

6. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

2.2 COMMERCIAL ELECTRIC WATER HEATERS

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

B. Performance:

1. As specified in drawing schedule.

C. Electrical Characteristics:

1. As specified in drawing schedule.

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

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

F. Accessories: Provide:

1. Water connections: Brass.

2. Dip tube.

3. Drain Valve.

4. Anode: Magnesium.

5. Temperature and Pressure Relief Valve: ASME labelled.

6. Provide approved manufacturer's drain pan or shop fabricated 24 gage galvanized steel drain pan.

2.3 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Manufacturers:

1. Amtrol Inc.

2. ITT Bell & Gossett.

3. Taco, Inc.

4. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

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

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

D. Size: Refer to plans or as required to match system volume.

2.4 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:

1. Armstrong Pumps Inc.

2. ITT Bell & Gossett.

3. Sterling Fluid Systems.

4. Grundfos.

5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Casing: Bronze, rated for 150 psig working pressure, with stainless steel rotor assembly.

C. Impeller: Bronze.

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

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

F. Performance:

1. As scheduled on drawings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Install water heaters in accordance with manufacturer's instructions and to AGA or UL requirements.

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

D. Pumps:

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

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

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

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

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

3.2 SCHEDULES

A. Water Heaters:

1. Refer to plan schedule.

B. Recirculating Pumps:

1. Refer to plan schedule.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water closets.

B. Urinals.

C. Lavatories.

D. Sinks.

E. Service sinks.

F. Institutional ligature-resistant showers.

G. Showers.

1.2 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping.

B. Section 22 10 06 - Plumbing Specialties.

C. Section 22 30 00 - Plumbing Equipment.

D. Division 26 - Equipment wiring, electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. Comply with State of Arkansas adopted ADA Accessible Guidelines in regard to accessible or handicapped features.

B. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2008 (Reaffirmed 2013).

C. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).

D. ASME A112.18.1 - Plumbing Supply Fittings; 2024.

E. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2024.

F. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2022.

G. NSF 61 - Drinking Water System Components - Health Effects; 2024.

H. NSF 372 - Drinking Water System Components - Lead Content; 2024.

1.4 SUBMITTALS

A. Section 22 01 00 - General Plumbing Provisions: Procedures for submittals.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Manufacturer's Instructions: Indicate installation methods and procedures.

D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum five years of documented experience.

1.6 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.8 WARRANTY

A. Provide five year manufacturer warranty for electric water cooler.

B. All warranties to begin at Date of Substantial Completion as accepted by the Owner.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 FLUSH VALVE WATER CLOSETS

A. Water Closets: Vitreous china, ASME A112.19.2, floor mounted, siphon jet flush action, china bolt caps.

1. Bowl: Height as indicated on plans, with elongated rim.

2. Flush Volume: 1.6 gallon, maximum.

3. Flush Valve: Exposed (top spud).

a. Dual-Filtered Bypass.

4. Flush Operation: Manual, oscillating handle.

5. Manufacturers:

a. American Standard Inc.

b. Kohler Company.

c. Zurn Industries, Inc.

d. Wiloughby

e. Sloan.

f. Acorn

g. Bradley

h. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Flush Valves: ASME A112.18.1, diaphragm type, dual-filtered bypass, complete with vacuum breaker stops and accessories.

1. Sensor-Operated Type: Solenoid operator, low voltage hard-wired, infrared sensor and over-ride push button.

a. Valve shall be equal to Sloan Royal #111 ES-S.

2. Manufacturers:

a. Sloan Valve Company.

b. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

3. Manual Operated:

a. Type: ASME A112.18.1 or ASME A112.19.5; diaphragm type complete with vacuum breaker stops, and accessories.

b. Supplied Volume Capacity: 1.5 gal per flush.

4. Exposed Type: Chrome-plated, escutcheon, integral screwdriver stop.

C. Seats:

1. Manufacturers:

a. Beneke Magnolia.

b. Bemis Manufacturing Company.

c. Church Seat Company.

d. Olsonite.

e. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

2. Solid white plastic, open front, self-sustaining hinge, brass bolts, without cover.

2.3 WALL HUNG URINALS

A. Wall Hung Urinal Manufacturers:

1. American Standard Inc.

2. Kohler Company.

3. Zurn Industries, Inc.

4. Sloan.

5. Wiloughby

6. Acorn

7. Bradley

8. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Urinals: Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.

1. Flush Volume: 1 gallon, maximum.

2. Flush Style: Siphon jet.

3. Flush Valve: Exposed (top spud).

4. Flush Operation: Manual, oscillating handle.

5. Trap: Integral.

6. Removable stainless steel strainer.

7. Supply Size: 3/4 inch.

8. Outlet Size: 2 inches.

C. Flush Valves: ASME A112.18.1, diaphragm type, complete with dual filtered bypass, vacuum breaker stops and accessories.

1. Exposed Type: Chrome plated, escutcheon, dual-filtered bypass, integral screwdriver stop.

a. Valve shall be equal to Sloan Valve Company, model Sloan #186-DFB.

D. Flush Valve Manufacturers:

1. Sloan Valve Company.

2. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

E. Manual Operated:

1. Type: ASME A112.18.1 or ASME A112.19.5; diaphragm type, complete with vacuum breaker stops, and accessories.

2. Supplied Volume Capacity: 1.5 gal per flush.

F. Concealed Type: Rough brass, exposed parts chrome-plated, wall escutcheon, wheel handle stop.

G. Carriers:

1. Manufacturers:

a. JOSAM Company.

b. Sloan Valve Company.

c. Zurn Industries, Inc.

d. Wade Tyler Pipe.

e. Watts Water Technologies.

f. MIFAB.

g. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

2.4 LAVATORIES

A. Lavatory Manufacturers:

1. American Standard Inc.

2. Zurn Industries, Inc.

3. Kohler Company.

4. Sloan.

5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Vitreous China Wall Hung Basin:

1. ASME A112.19.2; vitreous china wall hung lavatory, with 4 inch high back, rectangular basin with front overflow.

a. Drilling Centers: 4 inch.

C. Supply Faucet Manufacturers:

1. Sloan Valve Company.

2. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

D. Supply Faucet: ASME A112.18.1; chrome plated combination supply fitting with open grid strainer, water economy aerator with maximum flow of 0.5 gallon per minute (low-flow), single lever handle.

E. Accessories:

1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.

2. Offset waste with plug and strainer where required.

3. Wheel handle stops.

4. Rigid supplies.

5. Carrier:

a. Manufacturers:

1) JOSAM Company.

2) Sloan Valve Company.

3) Zurn Industries, Inc.

4) Watts Water Technologies.

5) MIFAB.

6) Substitutions: See Section 22 01 00 - General Plumbing Provisions.

b. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports, bearing plate and studs.

F. All lavatory faucets shall be listed to ASSE 1070 for temperature and pressure protection with a maximum control flow of 0.5 gpm (2.2 lpm). Faucet shall feature a single cartridge design for ease of repair and maintenance and shall provide an approach temperature of no greater than 5ºF (3°C). Faucet shall include integral check valves to prevent cross flow and shall be in compliance with the American with Disabilities Act (ADA). Faucet shall feature ceramic disc mixing and shall be constructed using Lead Free material.

2.5 SINKS

A. Sink Manufacturers:

1. American Standard Inc.

2. Elkay.

3. Kohler Company.

4. Just.

5. Bradley.

6. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Single Compartment Bowl:

1. ASME A112.19.3; See schedule outside dimensions, 20 gauge thick, Type 304 stainless steel, self-rimming and undercoated, with ledge back drilled for trim.

2. Drain Size: 3-1/2"

3. Drain Location: Center.

C. Trim: ASME A112.18.1; chrome plated brass supply with high rise swing spout, water economy aerator with maximum 1.5 gpm flow, wrist blades .

D. Accessories: Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon, wheel handle stop, rigid supplies.

E. ADA Compliant.

2.6 WALL MOUNT INSTITUTIONAL LIGATURE-RESISTANT SHOWERS WITH FRONT ACCESS

A. Manufacturers:

1. Willoughby.

2. Acorn.

3. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Description: 14 gauge, type 304 stainless steel with removable front access. . Provide with wall sleeves as required. Upper and bottom conical showerheads, soap dish and neccessary fasteners.

C. Electronic Controls:

1. Ligature resistant hemispherical pushbutton.

D. Flow Rate: 2.0 GPM

2.7 ELECTRIC WATER COOLERS

A. Electric Water Cooler Manufacturers:

1. Tri Palm International/Oasis.

2. Elkay Manufacturing Company.

3. Haws Corporation.

4. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Water Cooler: ARI 1010; split level handicapped mounted electric water cooler with stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket, refrigerated with integral air cooled condenser and stainless steel grille.

1. Include bottle filling station. Unit shall include an electronic sensor for touchless activation with auto 20-second shut-off timer. Filler shall provide 1.1-1.5 gpm flow rate with laminar slow to minimize splashing.

C. Capacity: 8 gpm of 50 degree F water with inlet at 80 degree F and room temperature of 90 degree F, when tested in accordance with ASHRAE Std 18.

D. Electrical: Maximum 1/5 hp compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.

2.8 SERVICE SINKS

A. Service Sink Manufacturers:

1. Elkay Manufacturing Company.

2. American Standard. Inc..

3. Williams.

4. Crane-Fiat.

5. Florestone.

6. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Bowl:

1. 24 x 24 x 12 inch high white terrazzo, floor mounted, shoulders not less 4" high inside and not less than 1-3/4" wide, vinyl bumper guard, stainless steel strainer.

C. Trim:

1. ASME A112.18.1 exposed wall type supply with cross handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps, hot and cold water supply check valves, and

adjustable threaded wall flanges.

D. Accessories:

1. 5 feet of 1/2 inch diameter plain end reinforced rubber hose.

2. Hose clamp hanger.

3. Mop hanger.

4. 20 ga. stainless steel splash catcher panels for all adjacent walls.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

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

3.2 PREPARATION

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

3.3 INSTALLATION

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

B. Provide chrome plated rigid supplies to fixtures with hand wheel stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall carriers and bolts.

E. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

F. Install handicap valve handles to the accessible side.

G. Provide HandiLav or approved equal molded trap and supply insulation kit for all exposed drain and supply handicap lavatories.

H. Install a check valve in the hot and cold water supply lines at every service sink.

3.4 INTERFACE WITH WORK OF OTHER SECTIONS

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

3.5 ADJUSTING

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

3.6 CLEANING

A. Clean plumbing fixtures and equipment.

3.7 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace damaged products before Date of Substantial Completion.

3.8 SCHEDULES

A. Fixture Heights: Install fixtures to heights above finished floor as indicated.

1. Water Closet Flush Valves:

a. Standard: 11 inches min. above bowl rim.

2. Lavatory:

a. Standard: 31 inches to top of basin rim.

b. Accessible: 34 inches maximum to top of basin rim.

B. Minimum fixture rough-in sizes or as required for particular fixtures.

1. Water Closet (Flush Valve Type):

a. Cold Water: 1 Inch.

b. Waste: 4 Inch.

c. Vent: 2 Inch.

2. Lavatory:

a. Hot Water: 1/2 Inch.

b. Cold Water: 1/2 Inch.

c. Waste: 1-1/2 Inch.

d. Vent: 1-1/4 Inch.

3. Sink:

a. Hot Water: 1/2 Inch.

b. Cold Water: 1/2 Inch.

c. Waste: 1-1/2 Inch.

d. Vent: 1-1/4 Inch.

4. Service Sink:

a. Hot Water: 1/2 Inch.

b. Cold Water: 1/2 Inch.

c. Waste: 3 Inch.

d. Vent: 2 Inch.

5. Shower:

a. Hot Water: 1/2 Inch.

b. Cold Water: 1/2 Inch.

c. Waste: 2 Inch.

d. Vent: 2 Inch.

END OF SECTION

SECTION 23 01 00

GENERAL HVAC PROVISIONS

PART 1 GENERAL

1.1 WORK INCLUDED

A. The work covered by Division 23 sections consist of furnishing all labor, equipment, appliances and material for the heating, air conditioning, piping and plumbing systems in strict accordance with Codes, Specifications and the applicable drawings and subject to the terms and conditions of the contract. Include all appurtenances necessary to the proper operation of the systems and equipment specified.

B. General Contractor shall install all concrete pads and bases required for installing mechanical equipment. Mechanical Contractor is responsible for the exact sizes required, location of anchor bolts, etc.

C. Mechanical Contractor shall furnish and install roof-mounted air handler and exhaust fan bases and shall be the manufacturer's base.

D. Some equipment may be furnished by other divisions. Mechanical Contractor is responsible to check the drawings and specifications for equipment that will be furnished by the Owner. Furnish the duct, insulation, controls, etc., on all equipment furnished by other divisions.

E. General Contractor shall furnish and install all ceiling access panels required to service mechanical equipment, valves and controls above gyp board or hidden spline ceilings.

1.2 RELATED SECTIONS

A. The General Conditions and Division 1, General Requirements, as bound in the specification preamble, apply to all work under Division 23. Carefully note its contents in performance of the work.

B. The Architectural, Fire Suppression, Plumbing, Electrical, and Structural plans and Specifications, including Information to Bidders and other pertinent documents issued by the Engineer are a part of this Specifications and the accompanying mechanical plans. Comply with them in every respect. Examine all the above carefully. Failure to comply does not relieve the Contractor of responsibility nor may it be used as a basis for additional compensation due to omission of architectural, electrical and structural details from the mechanical drawings.

C. All electrical power wiring is specified under Division 26 of the Specifications. Mechanical Contractor shall furnish all motor starters required for the control and protection of all motors furnished for the Division 23. Provide and install all automatic temperature and interlock wiring required for controlling mechanical equipment furnished under Division 23, in compliance with Division 26 of the Project Manual.

D. All concrete pads and bases required for installing mechanical equipment are specified in another section of the Specifications. Advise the General Contractor as to the exact sizes required, location of anchor bolts, etc.

E. Paint all roof top mechanical equipment ducts, supports and other exposed material. Do not paint indoor equipment supplied with painted finish, such as the main mechanical equipment unless damaged during handling and installation. In such cases, use touch-up paint of the same type and color as original paint. Conform to requirements in other sections of the Specifications and match wall finish to the room in which installed.

1.3 CODES, FEES AND LATERAL COSTS

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

1. 2021 Bentonville, Arkansas City Building Code.
2. 2021 Arkansas State Mechanical Code; latest accepted edition.
3. 2018 Arkansas State Plumbing Code; latest accepted edition.
4. 2014 Arkansas Energy Code; latest accepted edition.
5. IBC - International Building Code; latest accepted edition.
6. IFC - International Fire Code; latest accepted edition.
7. IGC - International Gas Code; latest accepted edition.
8. IMC - International Mechanical Code; latest accepted edition.
9. IPC - International Plumbing Code; latest accepted edition.
10. IECC - International Energy Conservation Code
11. AMCA - Air Moving & Conditioning Association.

12. ASA - American Standards Association.

13. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers.

14. ASME - American Society of Mechanical Engineers.

15. ASTM - American Society of Testing Materials.

16. AWWA - American Water Works Association.

17. NBS - National Bureau of Standards.

18. NEMA - National Electrical Manufacturers Association.

19. NFPA - National Fire Protection Association.

20. SMACNA - Sheet Metal & Air Conditioning Contractors' National Association.

21. UL - Underwriters' Laboratories, Inc.

22. AGA - American Gas Association.

23. OSHA - Occupational Safety and Hazard Association.

24. AABC - Associated Air Balance Councils

25. NEBB - National Environmental Balancing Bureau

B. Comply with State of Arkansas adopted ADA Accessible Guidelines in regard to accessible or handicapped features.

C. In case of difference between building codes, Specifications, state Laws, local ordinances, industry standards and utility company regulations and the Contract Documents, the most stringent governs. Promptly notify the Engineer in writing of any such difference.

D. Remove any work installed that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards, or utility company regulations, correct the deficiencies, and reinstall all work at no cost to the Owner.

E. The mechanical drawings show the general arrangement of all piping, equipment and appurtenances. Follow as closely as actual building construction and the work of other trades will permit. Final layout will be governed by actual field conditions with all measurements verified at the site. Conform to the requirements shown on all of the drawings. General and structural drawings take precedence over mechanical

drawings. Because of the small scale of the mechanical drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. Investigate the existing and finish conditions affecting the work and arrange the work accordingly, providing such fittings, valves and accessories as may be required to meet such conditions. Contractor shall verify that all equipment, ducts, pipes and all other components will fit in the space provided before fabrication or ordering.

F. Obtain any and all required permits in connection with this work under the Contract and pay any and all fees in connection therewith. Arrange with the serving utility companies for the connections to all utilities and pay all charges for same including inspection fees and meters if required. Refundable deposits will be paid by the Owner.

1.4 GUARANTEE

A. Furnish a written certificate guaranteeing all materials, equipment and labor furnished to be free of all defects for a period of one (1) year from and after the date of final acceptance of the work by the Owner and further guarantee to replace such work without charges if any defects appear within the stipulated guaranty period.

1.5 SOIL CONDITIONS

A. The Specifications and the drawings in no way imply the conditions of the soil to be encountered. When excavating may be required in execution of the work, this Contractor agrees that he has informed himself regarding conditions affecting the work.

1.6 INSPECTION OF PREMISES

A. Before submitting a bid, visit the site of the proposed job and determine the conditions relating to this work.

1.7 UTILITIES, LOCATIONS AND ELEVATIONS

A. Locations and elevations of the various utilities included within the scope of this work have been obtained from substantially reliable sources and are offered as a general guide only, without guarantee as to accuracy. Verify the location and elevation of all utilities and their relation to the work before entering into a contract.

1.8 EXISTING BUILDING AND EXISTING MECHANICAL EQUIPMENT

A. Visit the existing building and become thoroughly acquainted with the existing physical plant, mechanical systems and utilities in order to determine all of the work that will be necessary to carry out the intent of the plans and specifications.

B. If it is necessary, in any way, to interfere with normal operations of the existing utilities in order to carry out the work, give notice and obtain written approval from the Owner before the work is started.

1.9 EQUIPMENT NOT SPECIFIED UNDER DIVISION 23

A. Equipment which requires plumbing and other mechanical connections may be specified in another division of this Specification. Under these conditions, provide necessary utilities including waste, water, natural gas, duct, insulation and controls.

B. Rough-in work from approved shop drawings only.

PART 2 PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Provide new materials bearing the manufacturer's name, trade name and the UL label in every case where a standard has been established for the particular material. Furnish the standard product of a manufacturer regularly engaged in the production of the required type of equipment. Provide the manufacturer's latest approved design.

B. Deliver equipment and materials to the site and store in original containers, suitably sheltered from the elements, but readily accessible for inspection by the Engineer until installed. Store all items subject to moisture damage (such as controls) in dry, heated spaces.

C. Provide equipment and materials of the same general type and of the same make throughout the work to provide uniform appearance, operation and maintenance.

D. Tightly cover equipment and protect against dirt, water and chemical or mechanical injury and theft. At the completion of the work, clean fixtures, equipment and materials and polish thoroughly. Turn over to the Owner in a condition satisfactory to the Engineer. Repair damage or defects developing before acceptance of the work at no expense to the Owner.

E. Insure that items to be furnished fit the space available. Make necessary field measurements to ascertain space requirements, including those for connections. Furnish and install such sizes and shapes of equipment that the final installation suits the true intent and meaning of the drawings and Specifications.

F. Follow manufacturer's directions completely in the delivery, storage, protection and installation of all equipment and materials. Promptly notify the Engineer in writing of any conflicts between any requirements of the Contract Documents and the manufacturers' directions. Obtain the Engineer's written instruction before proceeding

with the work. Replace any work that does not comply with the manufacturers' directions or such written instructions from the Engineer, at no cost to the Owner.

G. Support all products by service organizations with adequate spare parts inventory and personnel located reasonably close to the site.

H. Where multiple units of the same type or class of products are required, provide all units of the same manufacturer.

2.2 EQUIPMENT ACCESSORIES

A. Furnish and install all equipment, accessories, connections and incidental items necessary to fully complete all work, ready for use, occupancy and operation by the Owner.

B. Where equipment requiring different arrangement or connections from those shown is provided, install the equipment to operate properly and in harmony with the intent of the drawings and Specifications.

C. Support, plumb, rigid and true to line, all work and equipment furnished. Study thoroughly all general, structural, electrical, fire suppression and mechanical drawings, shop drawings and catalog data to determine how equipment, fixtures, piping, ductwork, etc., are to be supported, mounted or suspended and provide extra steel bolts, inserts, pipe stands, brackets and accessories for proper supports whether or not shown on the drawings. When directed, submit drawings showing supports.

D. If accessories are required to complete the work and meet the intent of the specification, it is the responsibility of the Contractor to provide such accessories.

2.3 MATERIAL AND EQUIPMENT SCHEDULE

A. Submit to the Engineer as soon as practical, six (6) complete sets of the schedule of materials and equipment proposed for the installation, or electronic submittals as detailed below. Include manufacturers' names, catalog data, diagrams, drawings and other descriptive data and submit under one cover with an index sheet in front.

1. If Electronic files are submitted, a complete set of the schedule of materials and equipment proposed for the installation shall be included. Include manufacturers' names, catalog data, diagrams, drawings and other descriptive data. All information shall be submitted electronically in "pdf" format, and shall be separated into electronic "pdf" files according to the corresponding specification section (i.e. "23 40 00 - Air Cleaning Devices.pdf"). Unless incomplete submittals are authorized by the project engineer, all Division 23 submittals shall be electronically sent at one time. Without authorization, incomplete submittals shall be rejected.

B. Provide written certification that shop drawings are in accordance with the specifications and are dimensionally correct with reference to available space.

C. All submittals will be reviewed a maximum of two (2) times. The cost of additional submittal reviews beyond those two specified will be charged to the Contractor.

D. Shop drawings for the Engineer's files are required on the following items:

1. Roof Top Air Handling Units.
2. Supply Fan.
3. Electric Heaters.
4. Filters.
5. Exhaust Fans.
6. Make-up Air Units.
7. Valves/Circulation Pumps/Flex Connectors and other Specialties.
8. Air Curtain.
9. Grilles and Registers.
10. Starters.
11. Variable Air Damper Boxes.
12. Controls and Instrumentation.
13. Air Balance Certification.
14. Ductwork Materials Including Duct Accessories.
15. Duct Insulation Materials.
16. Complete Mechanical Equipment Electrical Data and Wiring Details.
17. Controls - Including Sequences of Operation specific to the job.

2.4 EQUIPMENT AND MATERIAL SUBSTITUTIONS

A. It is the responsibility of the Contractor to investigate any desired substitutions for specified equipment prior to submission of his bid. The Mechanical Contractor shall be responsible for any changes required in mechanical, electrical, structural or vibration isolation systems and shall bear all cost for those changes whether the

substitute equipment is named by manufacturer in the specifications or is submitted to the Architect for "or equal" consideration. All changes shall be accomplished in a manner acceptable to the Architect per Section 01 60 00 at no additional cost to the Owner.

B. In order to obtain prior approval on equipment or material not specified in Division 23 Specifications or Equipment Schedules, Mechanical Contractor MUST submit to the Engineer any proposed equipment or material ten (10) working days prior to the bid date.

C. If ANY substitute equipment is submitted to Engineer for approval, without said equipment having been pre-approved, the entire submittal will be rejected for resubmittal.

D. Any equipment manufacturers which are a subsidiary to the listed acceptable manufacturers are not considered equal. Therefore, it is the responsibility of the Contractor and equipment supplier to obtain prior approval as described in paragraph 2.4, this Section.

2.5 ELECTRICAL MOTORS

A. Provide motors of a recognized manufacturer, wound for the voltage specified, and in conformance to latest standards of the manufacturer and performance of the National Electrical Manufacturers Association and the Institute of Electrical and Electronic Engineers. Provide motors as manufactured by General Electric, Westinghouse, Century or Siemens-Allis, Baldor or approved equal.

B. Provide motors rated for continuous duty at 100% of rated capacity and temperature raise of 40 degrees Centigrade open type; 50 degrees Centigrade drip and splash proof; 55 degrees Centigrade explosion proof and totally enclosed above an ambient of 40 degrees Centigrade.

C. Unless otherwise required, provide integral horsepower, polyphase motors, Class B, general purpose, squirrel cage, open type induction motors, T-frame.

D. Provide single phase fractional horsepower motors of the open capacitor type. Generally, motors under 1/2 horsepower may be split phase type unless otherwise specified. Provide motors rated 1/2 horsepower or less with integral overcurrent protection.

E. Insure the insulation resistance between stator conductor and frames of motors is not less than 1/2 megohm. Provide shop test of motors including temperature rise, insulation resistance, motor terminal voltage, normal operating line current, RPMs, breaker or switch size with fusing and overload relay sizes.

PART 3 EXECUTION

3.1 COORDINATION OF WORK

A. Compare the mechanical drawings and Specifications with the drawings and Specifications for other trades and report any discrepancies between them to the Engineer and obtain from him written instruction for changes necessary in the mechanical work. Install the mechanical work in cooperation with other trades installing inter-related work. Before installation, make proper provisions to avoid interferences in a manner approved by the Engineer. Make all changes required in the work caused either by neglect or existing field conditions at no cost to the Owner.

B. It is the responsibility of the General Contractor, Plumbing Contractor, Mechanical Contractor and Electrical Contractor, and Sprinkler Contractor to coordinate installation of all equipment. Equipment installed prior to proper coordination, which interferes with the harmony and intent of the specifications and drawings, will be removed and reinstalled at the cost of the responsible Contractor.

C. Furnish anchor bolts, sleeves, inserts and supports required for the mechanical work. Locate anchor bolts, sleeves, inserts and supports as directed by the trade requiring them and insure that they are properly installed.

D. Slots, chases, openings and recesses in existing structure shall be cut, patched and repaired by the Contractor.

E. Adjust locations of pipes, ducts, equipment fixtures, etc., to accommodate the work and for interferences anticipated and encountered. Determine the exact route and location of each pipe and duct prior to fabrication.

1. Provide right-of-way to lines that pitch over those that do not pitch. For example, Plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have the right-of-way over lines whose elevations can be changed.

2. Make offsets, transitions and changes in direction in pipes and ducts as required to maintain proper head room and pitch.

F. Install all mechanical work to permit removal without damage to other parts, to coils, fan shafts and wheels, filters, belt guards, sheaves and drives and all other parts requiring periodic replacement or maintenance. Arrange pipes, ducts and equipment to permit ready access to valves, cocks, traps, starters, motors, control components and to clear the openings of swinging and overhead doors and of access panels.

G. Change the cross sectional dimensions of ductwork when required to meet job conditions, but maintain at least the same equivalent cross sectional area. Secure the

approval of the Engineer prior to fabrication of ductwork requiring such changes. Sizes shown on the plans are clear dimensions; add for internal insulation if specified.

3.2 RECORD DRAWINGS

A. Maintain record drawings showing exact locations and sizes, as actually installed, of piping, drains, cleanouts, ductwork, controls and equipment as specified herein. Deliver to the Owner/Architect upon completion and acceptance of the work, one (1) complete set of contract drawings marked to indicate all deviations from intended installation.

B. Record drawings shall be provide in hard copy form, as well as, on a DVD in PDF form.

3.3 CUTTING AND PATCHING

A. The General Contractor shall be responsible for all required cutting, patching, etc., incidental to this work and shall make all required repairs thereafter to the satisfaction of the Engineer. Do not cut into any major structural element, beam or column without the written approval of the Engineer.

B. Openings in fire or smoke barriers for air handling ductwork or air movement shall be protected in accordance with NFPA 90A and 90B and the Mechanical Code.

C. Pipes, conduits, cables, wires, air ducts, pneumatic tubes and ducts and similar handling service equipment that pass through fire or smoke barriers shall be protected in accordance with NFPA 101.

D. All fire stopping assemblies must be UL approved assemblies.

3.4 EQUIPMENT START-UP AND TESTING

A. Instruct the Owner's operating personnel during start-up and separate operating tests of each major item of equipment. During the operating tests, prove the operation of each item of equipment to the satisfaction of the Engineer. Give at least seven (7) days notice to the Engineer of equipment start-up and operating tests.

3.5 CATALOG DATA FOR OWNER

A. Provide, in looseleaf binders, two (2) sets of a compilation of catalog data of each manufactured item of equipment used in the mechanical work and present this compilation to the Owner/Architect for transmittal to the Owner before final payment is made. Include descriptive data and printed installation, operating and maintenance instructions for each item of equipment. Provide a complete double index as follows:

1. Listing of products alphabetically by name.

2. Listing the names of manufacturers whose products have been incorporated in the work alphabetically together with their addresses and the names and addresses of the local sales representatives.

3. Certificates of Final Inspections.

4. Complete spare parts data with current prices and supply sources.

5. Extended warranties.

B. Deliver to the Owner all special tools, lubricants, extra materials and any other products necessary for the proper operation and maintenance of the mechanical and plumbing systems.

C. Provide project record documents indicating all changes from contract documents made during construction.

D. Submit all Certificates of Final Inspections from the Administrative Authorities.

E. Submit TAB reports on approved forms. Final TAB report submittals shall include all required rebalances if any are required.

3.6 INSTRUCTION OF OWNER'S REPRESENTATIVE

A. Instruct the representative of the Owner in the proper operation and maintenance of all elements of the mechanical system. Spend not less than five (5) days in such formal instruction and additional time as directed by the Engineer to fully prepare the Owner to operate and maintain the mechanical equipment.

B. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated. Provide the following training as required to fully qualify the Owner's designated personnel. All training must be video taped to a CD and a copy included in each operation and maintenance closeout manual.

1. Air Handling Units: ____ hours.

2. Return Fan/Relief Fan.

3. Mini-Split HVAC Units.

3.7 PROTECTIVE COATINGS

A. Paint exterior surfaces of steel piping run in or through concrete floor fill, under tile floors or underground, and aluminum surfaces in contact with masonry, with one coat of acid resisting bituminous base paint.

B. Paint all exposed galvanized ducts behind grilles flat black.

3.8 NOISE CONTROL

A. It is intended that the mechanical systems as installed under this contract be free from objectionable noise when the system is operating. The system shall operate at noise levels below criteria recommended for the application by ASHRAE. Provide vibration isolation accessories and isolate equipment, pipeline, ductwork, etc., as required so as to insure an acceptable noise level in all of the mechanical systems.

3.9 CLEANING AND ADJUSTING

A. Do not allow waste material and rubbish to accumulate in or above the premises. After completion of this work, remove rubbish, tools, scaffolding and surplus materials from and about the building and leave all work clean and ready for use. Clean all equipment, pipes, valves and fittings of grease, metal cuttings and sludge. Repair any stoppage, discoloration or other damage to parts of the building, its finish or furnishings due to failure to properly clean the mechanical systems, without additional cost to the Owner. Adjust all automatic control devices for proper operation.

3.10 SYSTEM OPERATING TESTS

A. After the successful completion of all equipment start-up and test requirements, perform the following tests on the complete mechanical systems:

1. First Operating Test by Contractor: Prove the operation of the mechanical systems and of each individual item in the systems. Give at least 10 day prior notice to the Engineer of such tests. Adjust and set proper quantities to all items and equipment. Should any item of the systems fail to perform in an approved manner, repeat this test until approved by the Engineer. During this test, balance circulation of heating and cooling water to balancing cocks, valves, thermostats and similar Items to insure that the mechanical systems perform as intended.

2. Checking by Owner and Engineer: Following the successful completion of first operating tests by the Contractor, the Owner and the Engineer have the privilege of making such tests as they may desire during a period of three weeks to ascertain in detail if any corrections are to be made to the system. At the end of

the testing by the Owner and the Engineer, the Engineer may direct the Contractor in writing to make such corrections to the systems as are within the scope of the contract.

3. Contractor's Corrections to Systems: Make all required corrections to the systems and notify the Engineer in wiring that the corrections outlined have been completed. Give at least seven (7) days notice of a final three-day operating test.

4. Three-Day Operating Test: Perform an operating test to the satisfaction of the Engineer for a period of three (3) days. Should any element of the systems not perform properly, make all required corrections and repeat the test until successfully performed.

    a. Submit the Form of Record proposed by the Contractor for the recording of all measurements to the Engineer for approval at least two weeks before the approved form will be required by the Contractor.

    b. Measurements: Make the following measurements at two-hour intervals (5 measurements per 8-hour day) during the three-day operating test.

        1) Electrical: Running amperes and voltage of each motor 3/4 horsepower or larger.

        2) Air temperatures in each heated or air conditioned space and outdoor temperatures.

    c. Instruments: Provide all instruments, materials and labor to perform the tests and to obtain and record the measurements specified herein, including the furnishing of all required record forms as approved by the Engineer. Submit for the Engineer's approval, complete shop drawings or catalog data for all instruments to be used for the three day operating test and obtain approval at least two weeks before the instruments will be required for test measurements.

    d. Report: Submit four (4) copies of a written report of the three-day operating test on the approved Form of Record to the Engineer for approval and subsequent transmittal to the Owner.

3.11 MOTOR CONTROL

A. General: Provide each motor 1/8 horsepower or larger with a suitable controller and devices that will perform the functions as specified for the respective motors, together with manual reset thermal overload, protection in each undergrounded conductor. Provide the controller either integral with circuit protective device or mounted in

separate enclosure. Starters shall be Allen-Bradley, G.E., Westinghouse, Square D or approved equal.

B. Control: Automatic control devices such as thermostats, float or pressure switches may control the starting and stopping of motor directly, provided the device used is designated for that purpose and has an adequate horsepower rating. When automatic control device does not have such a rating, use a magnetic starter with the automatic control device actuating the pilot control circuit. When combination manual and automatic control is specified and the control device operates the motor directly, provide a manual motor starter and selector switch. When combination manual and automatic control is specified and the automatic control device actuates the pilot control circuit, a magnetic control device actuates the pilot control provided. Provide all magnetic starters with push buttons or selector switches in the covers. Provide connections to the selector switch such that only the normal automatic regulating control devices will be bypassed when the switch is in the manual position. Connect all safety control devices, such as low or high pressure cutouts, high temperature cutouts and motor overload protective devices in the motor control circuit in both the manual and automatic positions of the selector switch control circuit. Make connections to any selector switch or to more than one (1) automatic regulatory control device in accordance with wiring diagrams recommended by the manufacturer and approved by the Engineer. Where required for manual control, provide push-button stations consisting of two (2) momentary contact operators, 600 volts, 10 amperes installed and wired for three wire control to provide under-voltage relays, auxiliary contacts or other devices required for a complete system.

C. Location: Where the controller is located within sight of the motor driven equipment (fifty feet or less), the controller and circuit protective device shall be capable of being locked in the open position. Where the controller is located out of sight of the motor driven equipment (more than fifty feet) provide a non-fused safety disconnect, suitable for the service, and which opens all ungrounded conductors simultaneously, at or on the motor driven equipment.

D. Enclosure: Enclosure to be general purpose, NEMA Type 1 unless noted otherwise (NEMA Type 1 gasketed). The circuit breaker shall be operable by hand from outside the enclosure and shall be so interlocked with the door or doors that it must be returned to the "OFF" position before the door can be opened.

E. Push-buttons: Provide maintained contact, standard duty type in a general purpose, NEMA Type 1 enclosure for surface mounting rated for 10 amperes continuous at 600 volts or less.

3.12 ACCESS PANELS

A. Provide access panels as required in all walls, ceilings and ductwork to service and have access to all valves, operating parts and duct mounted fire dampers. For all ceiling and wall access doors that are required in gypsum board and plaster, provide minimum 24" x 24", unless due to structural restraints the access door can be reduced to a minimum of 18" x18", Milcor type appropriate for the construction involved.

3.13 TEMPORARY HEATING AND COOLING

A. Permanent heating and cooling systems may be used to provide temporary heating and cooling to the building during construction, if the following requirements are met:

1. Provide filters in equipment filter racks.

2. Provide filter material at entrance to all return air ducts or over permanent return air grilles. All return air ductwork is to be protected from construction dust and debris. If return air duct work is not protected prior to equipment startup for temporary use, the Contractor will pay to have the entire ductwork system of the affected equipment thoroughly cleaned prior to Owner occupancy.

3. Contractor shall provide and pay for operation, maintenance, regular replacement of filters and worn or consumed parts.

4. Shall replace any equipment that is damaged during temporary usage with new equipment.

5. All warranty periods shall not begin until Certificate of Substantial Completion is issued.

6. Verify with engineer that the installation is ready and approved for operation.

B. Just prior to turning the building or portions of the building over to the Owner, Contractor will replace all filters on equipment used for temporary ventilation, heat or cooling during construction.

C. Do not turn water into the system until the systems have been thoroughly cleaned and approved by the Engineer.

3.14 DEMOLITION

A. There are areas in the existing building in which demolition will have to be performed due to the requirements for remodeling. The demolition work involved is not fully described herein; however, the information given on the electrical and mechanical drawings and the information set out in the specifications will substantially serve to

inform the mechanical Contractor as to the full extent of the demolition required.

B. Contractor should visit job site to verify extent of demolition required to complete project.

C. It is the intent of this Specification that all required demolition work be fully and completely performed and all work be accomplished in a neat and workmanlike manner.

D. Remove all existing piping, fittings, heating, cooling, ventilation equipment that is required to accomplish the remodel work. All existing utilities that are disconnected shall be capped recessed in walls and floors. Contractor shall be responsible for visiting building and determining the extent of the demolition work. Contractor shall provide any necessary temporary piping required to keep existing building utilities (water, gas and sewer) in operation until new construction is completed to the extent that the new utilities can be reconnected.

E. All rubbish, debris and expendable items resulting from demolition work shall be removed from the premises as it accumulates and disposed of at an off-site location by the Contractor.

3.15 SALVAGE

A. Except as otherwise specified herein, or noted on drawings, the Contractor shall receive title to all building materials indicated to be demolished or removed which are not specifically designated as being retained by the Owner, said title to vest in the Contractor immediately upon receipt of Work Order. All salvage materials removed shall be taken from the premises promptly, as the storage of salvage materials on the site will not be permitted. Bidders shall take into account the salvage value to them of materials removed and such value shall be reflected in the bids.

B. All items of usable equipment shall remain the property of the Owner. All such items of equipment which are to be removed and which are not to be reused shall be stored on the premises by the Contractor as directed by the Owner.

C. Usable items shall be determined by the Owner and shall include existing heating and cooling pumps and other equipment so designated as "usable" by the Owner.

3.16 FINALLY

A. It is the intention that this specification shall provide a complete installation except as herein before specifically excepted. All accessory construction and apparatus necessary or advantageous in the operation and testing of the work shall be included. The omission of specific reference to any part of the work necessary for such

complete installation shall not be interpreted as relieving this Contractor from furnishing and installing such parts.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Ceiling tacks.

1.2 REFERENCE STANDARDS

1.3 SUBMITTALS

A. See Section 23 01 00 - General HVAC Provisions, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number. Valve locations with tag numbers shall also be indicated on "as-built" drawings.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Dampers: Ceiling tacks, where located above lay-in ceiling.

B. Ductwork: Stencilled painting.

C. Instrumentation: Tags.

D. Relays: Tags.

E. Small-sized Equipment: Tags.

F. Thermostats: Nameplates.

G. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.2 NAMEPLATES

A. Manufacturers:

1. Advanced Graphic Engraving.
2. Kolbi Pipe Marker Co.
3. Seton Identification Products.
4. Substitutions: See Section 23 01 00 - General HVAC Provisions.

B. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.
2. Letter Height: 1/2 inch.
3. Background Color: Black.
4. Plastic: Conform to ASTM D709.

2.3 TAGS

A. Manufacturers:

1. Advanced Graphic Engraving.
2. Brady Corporation.
3. Kolbi Pipe Marker Co.
4. Seton Identification Products.
5. Substitutions: See Section 23 01 00 - General HVAC Provisions.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame. Valve tag chart should should indicate valve size, valve model and valve location. Valve

locations with tag numbers shall also be indicated on "as-built" drawings.

2.4 STENCILS

A. Manufacturers:

1. Brady Corporation.

2. Kolbi Pipe Marker Co.

3. Seton Identification Products.

4. Substitutions: See Section 23 01 00 - General HVAC Provisions.

B. Stencils: With clean cut symbols and letters of following size:

1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.

2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.

3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.

4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24 inch long color field, 2-1/2 inch high letters.

5. Over 10 inch Outside Diameter of Insulation or Pipe: 32 inch long color field, 3-1/2 inch high letters.

6. Ductwork and Equipment: 2-1/2 inch high letters.

2.5 CEILING TACKS

A. Manufacturers:

1. Craftmark.

2. Substitutions: See Section 23 01 00 - General HVAC Provisions.

B. Description: Steel with 3/4 inch diameter color coded head.

C. Color code as follows:

1. Yellow - HVAC equipment.

2. Red - Fire dampers/smoke dampers.

3. Blue - Heating/cooling valves.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 91 00 for stencil painting.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install ductwork with stencilled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

D. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Measurement of final operating condition of HVAC systems.

1.2 REFERENCE STANDARDS

A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.

B. ASHRAE Std 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 1988, with 1997 Errata.

C. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; National Environmental Balancing Bureau; 2005, Seventh Edition.

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting, and Balancing; Sheet Metal and Air Conditioning Contractors' National Association; 2002.

1.3 SUBMITTALS

A. See Section 23 01 00 - General HVAC Provisions, for submittal procedures.

B. Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.

1. Submit to Architect.

2. Submit six weeks prior to starting the testing, adjusting, and balancing work.

3. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.

4. Include at least the following in the plan:

    a. Preface: An explanation of the intended use of the control system.

    b. List of all air flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.

    c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.

    d. Identification and types of measurement instruments to be used and their most recent calibration date.

    e. Discussion of what notations and markings will be made on the duct and piping drawings during the process.

    f. Final test report forms to be used.

    g. Detailed step-by-step procedures for TAB work for each system and issue, including:

        1) Terminal flow calibration (for each terminal type).

        2) Diffuser proportioning.

        3) Branch/submain proportioning.

        4) Rechecking.

        5) Diversity issues.

    h. Expected problems and solutions, etc.

    i. Criteria for using air flow straighteners or relocating flow stations and sensors .

    j. Details of how TOTAL flow will be determined; for example:

        1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.

    k. Specific procedures that will ensure that air side is operating at the lowest possible pressures and methods to verify this.

l. Confirmation of understanding of the outside air ventilation criteria under all conditions.

m. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).

n. Method of checking building static and exhaust fan and/or relief damper capacity.

o. Methods for making coil or other system plant capacity measurements, if specified.

p. Time schedule for TAB work to be done in phases (by floor, etc.).

q. Description of TAB work for areas to be built out later, if any.

r. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.

s. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).

t. Procedures for formal progress reports, including scope and frequency.

u. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Field Logs: Submit at least once a week to Construction Manager and Engineer. Field logs should be submitted with weekly progress reports and include a record of all discrepancies and issues encountered during the period covered.

E. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

F. Progress Reports.

G. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1. Submit to the Construction Manager, HVAC controls contractor, and Engineer within two weeks after completion of testing, adjusting, and balancing.

2. Revise TAB plan to reflect actual procedures and submit as part of final report.

3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.

4. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.

6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.

7. Units of Measure: Report data in I-P (inch-pound) units only.

8. Include the following on the title page of each report:

    a. Name of Testing, Adjusting, and Balancing Agency.

    b. Address of Testing, Adjusting, and Balancing Agency.

    c. Telephone number of Testing, Adjusting, and Balancing Agency.

    d. Project name.

    e. Project location.

    f. Project Architect.

    g. Project Engineer.

    h. Project Contractor.

    i. Project altitude.

    j. Report date.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:

1. AABC MN-1, AABC National Standards for Total System Balance.

2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.

3. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.

4. SMACNA HVAC Systems Testing, Adjusting, and Balancing.

5. Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.

2. Having minimum of two years documented experience.

3. Certified by one of the following agencies or methods:

a. AABC, Associated Air Balance Council: www.aabchq.com; upon completion submit AABC National Performance Guaranty.

b. NEBB, National Environmental Balancing Bureau: www.nebb.org.

c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org.

d. Test and Balance under direct supervision of a Professional Engineer registered in the State of Arkansas.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

F. Acceptable TAB Agencies:

1. NEBB.

2. AABC.

3. SMACNA.

4. TABB.

5. Substitutions: Not permitted.

3.2 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.

2. Temperature control systems are installed complete and operable.

3. Proper thermal overload protection is in place for electrical equipment.

4. Final filters are clean and in place. If required, install temporary media in addition to final filters.

5. Duct systems are clean of debris.

6. Fans are rotating correctly.

7. Fire and volume dampers are in place and open.

8. Air coil fins are cleaned and combed.

9. Access doors are closed and duct end caps are in place.

10. Air outlets are installed and connected.

11. Duct system leakage is minimized.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions. Since work will occur in phases, provide listing of system deficiencies for systems to be balanced during the specified phases.

3.3 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.

1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

C. Provide additional balancing devices as required.

3.4 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply and outside air systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.5 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:

1. Running log of events and issues.

2. Discrepancies, deficient or uncompleted work by others.

3. Contract interpretation requests.

4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on the drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

H. Check and adjust systems approximately six months after final acceptance and submit report.

I. After all adjustments and corrections have been performed to balance system as designed, additional readjustment shall be performed to satisfy desired temperature.

3.6 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities . Test and balance all air handlers for the three design positions i.e. minimum (5% adjustable) outside air, design outside air and economizer operation.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions.

L. Measure building static pressure and adjust supply, return, barometric relief dampers, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

M. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.

N. Measure and record supply, return, outside and exhaust air cfm, fan rpm, motor amps, coil entering and leaving air, temperatures (both wet and dry bulb temperatures), outside air (wet and dry bulb temperatures) for cooling and heating operations, system static pressures shall be measured at the required conditions at the minimum and maximum fan speeds.

O. Measure and record the following air handling and distribution systems.

1. Supply, return, outside air and exhaust when system is in the economizer operation. Measure and record supply air and outside air temperatures (both wet and dry bulb).

3.7 SCOPE

A. Test, adjust, and balance the following:

1. Packaged Roof Top Heating/Cooling Units
2. Fans.
3. Air Filters.
4. Air Inlets and Outlets.

3.8 MINIMUM DATA TO BE REPORTED

A. Electric Motors:

1. Manufacturer
2. Model/Frame
3. HP/BHP
4. Phase, voltage, amperage; nameplate, actual, no load
5. RPM
6. Service factor
7. Starter size, rating, heater elements
8. Sheave Make/Size/Bore

B. V-Belt Drives:

1. Identification/location

2. Required driven RPM
3. Driven sheave, diameter and RPM
4. Belt, size and quantity
5. Motor sheave diameter and RPM
6. Center to center distance, maximum, minimum, and actual

C. Combustion Equipment:

1. Boiler manufacturer
2. Model number
3. Serial number
4. Firing rate
5. Overfire draft
6. Gas meter timing dial size
7. Gas meter time per revolution
8. Gas pressure at meter outlet
9. Gas flow rate
10. Heat input
11. Burner manifold gas pressure
12. Percent carbon monoxide (CO)
13. Percent carbon dioxide (CO2)
14. Percent oxygen (O2)
15. Percent excess air
16. Flue gas temperature at outlet
17. Ambient temperature
18. Net stack temperature
19. Percent stack loss

20. Percent combustion efficiency

21. Heat output

D. Air Cooled Condensers:

1. Identification/number

2. Location

3. Manufacturer

4. Model number

5. Serial number

6. Entering DB air temperature, design and actual

7. Leaving DB air temperature, design and actual

8. Number of compressors

E. Air Moving Equipment:

1. Location

2. Manufacturer

3. Model number

4. Serial number

5. Arrangement/Class/Discharge

6. Air flow, specified and actual

7. Return air flow, specified and actual

8. Outside air flow, specified and actual

9. Total static pressure (total external), specified and actual

10. Inlet pressure

11. Discharge pressure

12. Sheave Make/Size/Bore

13. Number of Belts/Make/Size

14. Fan RPM

F. Return Air/Outside Air:

1. Identification/location
2. Design air flow
3. Actual air flow
4. Design return air flow
5. Actual return air flow
6. Design outside air flow
7. Actual outside air flow
8. Return air temperature
9. Outside air temperature
10. Required mixed air temperature
11. Actual mixed air temperature
12. Design outside/return air ratio
13. Actual outside/return air ratio

G. Exhaust Fans:

1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Air flow, specified and actual
6. Total static pressure (total external), specified and actual
7. Inlet pressure
8. Discharge pressure
9. Sheave Make/Size/Bore

10. Number of Belts/Make/Size

11. Fan RPM

H. Duct Traverses:

1. System zone/branch

2. Duct size

3. Area

4. Design velocity

5. Design air flow

6. Test velocity

7. Test air flow

8. Duct static pressure

9. Air temperature

10. Air correction factor

I. Flow Measuring Stations:

1. Identification/number

2. Location

3. Size

4. Manufacturer

5. Model number

6. Serial number

7. Design Flow rate

8. Design pressure drop

9. Actual/final pressure drop

10. Actual/final flow rate

11. Station calibrated setting

J. Terminal Unit Data:

1. Manufacturer
2. Type, constant, variable, single, dual duct
3. Identification/number
4. Location
5. Model number
6. Size
7. Minimum static pressure
8. Minimum design air flow
9. Maximum design air flow
10. Maximum actual air flow
11. Inlet static pressure

K. Air Distribution Tests:

1. Air terminal number
2. Room number/location
3. Terminal type
4. Terminal size
5. Area factor
6. Design velocity
7. Design air flow
8. Test (final) velocity
9. Test (final) air flow
10. Percent of design air flow

END OF SECTION

SECTION 23 07 13

DUCT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duct insulation.

B. Duct Liner.

C. Insulation jackets.

D. Adhesive, tie wires, tape

1.2 RELATED REQUIREMENTS

A. Section 23 01 00 - General HVAC Provisions.

B. Section 23 05 53 - Identification for HVAC Piping and Equipment.

C. Section 23 31 00 - Ducts: Glass fiber ducts.

1.3 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

E. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2020.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

G. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

H. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

I. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

J. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 23 01 00 - General HVAC Provisions, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than five years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with a minimum five years of documented experience and approved by manufacturer.

C. Perform work at ambient and equivalent temperatures as recommended by the adhesive manufacturer. Work shall be performed only by mechanics who regularly perform this type of work only.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

B. Adhesives to be waterproof.

C. Recovering jackets 6 ounce per square yard canvas attached with a lagging fire retardant adhesive. Install on exposed ductwork insulation. Cover thoroughly with several coats of sizing.

2.2 GLASS FIBER, FLEXIBLE

A. Manufacturer:

1. Knauf Insulation.

2. Johns Manville Corporation.

3. Owens Corning Corp.

4. CertainTeed Corporation.

5. Substitutions: See Section 23 01 00 - General HVAC Provisions.

B. Insulation: ASTM C553; flexible, noncombustible blanket.

1. 'K' value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.

2. Maximum Service Temperature: 450 degrees F.

3. Maximum Water Vapor Sorption: 5.0 percent by weight.

4. Maximum Moisture Absorption: 0.20 percent by volume.

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.

2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E 96/E 96M.

3. Moisture Vapor Transmission: ASTM E 96; 0.02 perm.

4. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Outdoor Vapor Barrier Mastic:

1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

F. Tie Wire: Annealed steel, 16 gage.

2.3 GLASS FIBER, RIGID

A. Manufacturer:

1. Knauf Insulation.

2. Johns Manville Corporation.

3. Owens Corning Corp.

4. CertainTeed Corporation.

5. Substitutions: See Section 23 01 00 - General HVAC Provisions.

B. Insulation: ASTM C612; rigid, noncombustible blanket.

1. 'K' value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.

2. Maximum service temperature: 450 degrees F.

3. Maximum Water Vapor Sorption: 5.0 percent.

4. Maximum Moisture Absorption: 0.20 percent by volume.

5. Maximum Density: 8.0 lb/cu ft.

6. Density: 3.0 lb/cu ft.

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.

2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E 96/E 96M.

3. Moisture vapor transmission: ASTM E 96; 0.04 perm.

4. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Indoor Vapor Barrier Finish:

1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.

2. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.4 JACKETS

A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.

1. Lagging Adhesive:

a. Compatible with insulation.

B. Mineral Fiber (Outdoor) Jacket: Asphalt impregnated and coated sheet, 50 lb/square.

C. Aluminum Jacket: ASTM B209 (ASTM B209M).

1. Thickness: 0.016 inch sheet.

2. Finish: Embossed.

3. Joining: Longitudinal slip joints and 2 inch laps.

4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.

5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

2.5 DUCT LINER

A. Manufacturers:

1. Knauf Insulation.

2. Johns Manville Corporation.

3. Owens Corning Corp.

4. CertainTeed Corporation.

B. Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; semi-rigid duct liner; impregnated surface and edges coated with poly vinyl acetate polymer, acrylic polymer, or black composite.

1. Fungi Resistance: ASTM G21.

2. Substitutions: See Section 23 01 00 - General HVAC Provisions.

3. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.

4. Service Temperature: Up to 250 degrees F.

5. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.

6. Minimum Noise Reduction Coefficients:

a. 1/2 inch Thickness: 0.30.

b. 1 inch Thickness: 0.45.

c. 1-1/2 inches Thickness: 0.60.

d. 2 inch Thickness: 0.70.

C. Adhesive: Waterproof, fire-retardant type, ASTM C916.

D. Liner Fasteners: Galvanized steel, welded with press-on head.

2.6 MATERIALS

A. External Insulation

1. Concealed Round Ducts: Flexible glass fiber insulation, minimum installed R-value of R-6, with factory applied reinforced aluminum foil vapor barrier for systems conveying air at less than room temperature.

B. Internal Insulation

1. Rectangular Ducts and Plenums: Internal duct insulation shall be semi-rigid duct liner board manufactured from glass fibers bonded with a thermosetting resin. Insulation shall be coated on one side with a fire resistant black coating and shall have a minimum installed R-value of R-6. Duct liner shall be installed by cutting side pieces of insulation to lap both top and bottom sections for maximum support. Install side pieces first. Side pieces and bottom piece shall be attached with 4" strips of adhesive at one foot intervals. Top section of insulation shall be attached with Stick-Klip fasteners secured by Miracle adhesive spaced one fastener per two square feet of insulation. Edges of insulation shall be butted with

adhesive to insure a tight joint and provide a smooth surface.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

C. Finish with system at ambient conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated ducts conveying air below ambient temperature:

1. Provide insulation with vapor barrier jackets.

2. Finish with tape and vapor barrier jacket.

3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated ducts conveying air above ambient temperature:

1. Provide with or without standard vapor barrier jacket.

2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces : Finish with canvas jacket sized for finish painting.

F. External Duct Insulation Application:

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

2. Secure insulation without vapor barrier with staples, tape, or wires.

3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert

spacers.

4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.

5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

G. Duct and Plenum Liner Application:

1. Adhere insulation with adhesive for 100 percent coverage.

2. Secure insulation with welded mechanical liner fasteners. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible and NAIMA Fibrous Glass Duct Liner Standards (latest edition) for spacing.

3. Seal and smooth joints. Seal and coat transverse joints.

4. Seal liner surface penetrations with adhesive.

5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.3 SCHEDULES

A. Exhaust Ducts: Externally wrap.

B. Outside Air Intake Ducts:

1. Round: Externally insulate with 2- inch thick insulation.

2. Rectangular: Internally insulate with 1-inch thick semi-rigid duct liner with adhesive and welded mechanical fasteners.

C. Concealed Supply Ducts:

1. Round Duct: Externally insulate with 2- inch thick insulation.

2. Rectangular: Internally insulate with 1-inch thick, semi-rigid duct liner..

D. Concealed Return Air Ducts and Plenums:

1. Round: Externally insulate with 2-inch thick insulation.

2. Rectangular: Internally insulate with 1-inch thick.

END OF SECTION

SECTION 23 09 23

DDC CONTROLS SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. System shall be an extension of existing control system.

B. Furnish a complete system of temperature and ventilation controls in accordance with this specification section. Items of work included are as follows.

1. Provide all necessary hardware and software to meet the specified functional requirements as put forth in the specification and sequence of operation, as defined on drawings.

2. Prepare individual hardware layouts, interconnection drawings and control loop configuration data from project design data.

3. Implement the detailed design for all system input/output points, distributed control and system data bases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.

4. Design all equipment cabinets, panels, and the data communication network cables including all associated hardware.

5. Provide and install all cabinets, panels, and data communication network cables including all associated hardware.

6. Provide and install all interconnecting cables between supplied cabinets, controllers, input devices and output devices.

7. Provide and install all interconnecting cables between all operator terminals and peripheral devices (such as printers, etc.) supplied under this section.

8. Provide complete specifications for all items supplied by others (such as printers, instruments, etc.).

9. Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, start-up and commissioning.

10. Provide a comprehensive operator and technician training program as described herein.

11. Provide as-built documentation, software, and any control logic and all associated support documentation on approved media which accurately represents the final system.

C. Control equipment.

D. Software.

1.2 RELATED SECTIONS

A. Section 23 74 13 - Packaged Rooftop Air Conditioning.

B. Section 23 36 06 - Air Terminal Units - Variable Volume.

C. Section 23 05 93 - Testing, and Balancing.

D. Division 26 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2005.

B. UL 916 - Underwriters Laboratories Standard for Energy Management Equipment

C. SBCCI - Southern Code Congress International

D. City, county, state, and federal regulations and codes in effect as of date of contract.

1.4 SYSTEM DESCRIPTION

A. General Requirements (BacNet)

1. A distributed logic control system complete with Direct Digital Control (DDC) and Direct Analog Control (DAC) software shall be provided. System shall be totally based on ANSI/ASHRAE Standard 135-1995, BACnet. This system is to control all mechanical equipment, including all unitary equipment such as VAV boxes, heat pumps, fan-coils, AC units, etc. and all air handlers, boilers, chillers, and any other listed equipment using native BACnet-compliant components.

2. The entire processing system shall be in complete compliance with the BACnet standard: ANSI/ASHRAE 135-1995. The system shall use BACnet protocols and LAN types throughout and exclusively. Non-BACnet-compliant or proprietary equipment or systems (including gateways) shall not be acceptable and are specifically prohibited.

3. All logic controllers for terminal units, air handlers, central mechanical equipment, and Microsoft Windows-based operator's terminal(s) shall

communicate and share data, utilizing only BACnet communication protocols.

4. All logic controllers shall be fully programmable. That is, programmable controllers for every terminal unit, air handler, all central plant equipment, and any other piece of controlled equipment shall be provided. Programming tools shall be provided as part of operator workstation for every controller supplied for the project.

B. General Requirements

1. Provide an engineered system of controls to accomplish the sequence of operations. This system is to control all specified equipment directly, without intervening conventional controls.

2. All Controllers for terminal units, air handlers, central mechanical equipment, and Windows based operators' terminal(s) shall communicate with each other and share information.

3. The controls contractor shall assume complete responsibility for the entire controls system as a single source and shall certify that he has on staff under his direct employ on a day to day basis, factory trained technical personnel, qualified to engineer, program, debug, and service all portions of the control system, including central system operators terminal, global controllers, terminal unit controllers, and all other portions of the control system.

C. Basic System Features:

1. Zone by zone control of space temperature, usage scheduling, optimum starting, equipment failure reporting, and override timers for off-hours usage. A zone is the area served by one HVAC unit .

2. Operator Terminal software shall be a Windows 98 or later application program. Software shall be multitasking, capable of executing and displaying multiple instances in individual windows while running concurrently with other Windows programs such as word processors or database programs. Software shall completely support Windows 98 or Window NT Dynamic Data Exchange (DDE) interface. Software shall strictly follow Microsoft Windows API guidelines. Systems using proprietary software or Windows formats other than above are strictly prohibited. Operation of the terminal software shall be simple and intuitive.

3. Complete energy management firmware, including self adjusting optimum start, demand limiting, global control strategies and logging routines for use with total control systems. All energy management firmware shall be resident in field

hardware and not dependent on the Operators Terminal for operation. Operators terminal software is to be used for access to field based energy management control firmware only.

4. Priority password security systems to prevent unauthorized use. Each user shall have an individual password. Each user shall be assigned which control functions they have access to.

5. Equipment monitoring and alarm function including information for diagnosing equipment problems.

6. The complete system including, but not limited to terminal unit controllers, Global controllers and Operator terminals shall Auto-restart, without operator intervention, on resumption of power after a power failure. Database stored in Global Controller memory shall be battery backed up for a minimum of 29 days. Unitary controllers shall utilize EEPROM for all variable data storage. Batteries on unitary controllers shall not be allowed.

7. Modular system design of proven reliability.

8. Each field panel capable of independent control.

9. All software and/or firmware interface equipment for connection to remote monitoring station from field hardware or the Operators Terminal.

10. Equipment runtime totalization of fans, heaters, boilers, etc., capable of alarm generation and alarm dial out to remote sites.

11. Room sensors with digital readout that allow the user to view room temperature, view outside air temperature, adjust the room setpoint within preset limits and set desired override time. User shall also be able to shut unit off from sensor.

12. Field control devices such as terminal unit controllers shall have optically isolated communication lines. Controllers not optically isolated and utilizing a ground referenced communication technique are specifically prohibited.

13. Communication wiring for field control devices shall not be dependent on daisy chaining of communication wiring. Communication wire may be run in star patterns, daisy chained or combination of either, allowing units to be added to a communication line easily in the future.

14. All hardware and software shall be designed and manufactured by U.S. corporations. All hardware shall be U.L. listed with integral labels showing rating.

1.5 SUBMITTALS

A. See Section 23 01 00 - General HVAC Provisions, for submittal procedures.

B. Product Data: Provide data for each system component and software module.

C. Shop Drawings:

1. Within four weeks after award of contract, the supplier shall submit review drawings, installation and operation instruction and a recommended spare parts list.

2. Drawings shall be standard sizes (8.5 inches x 11 inches) or (11 inches x 17 inches).

3. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.

4. List connected data points, including connected control unit and input device.

5. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration diskette containing graphics.

6. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.

7. Indicate description and sequence of operation of operating, user, and application software.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

E. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.

1. Revise shop drawings to reflect actual installation and operating sequences.

2. Include submittals data in final "Record Documents" form.

F. Operation and Maintenance Data:

1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.

2. Input/Output point and alarm point summary listing.

3. Electrical drawings showing all system internal and external connection points, terminal block layouts and terminal identification.

4. Manufacturer's instructions and drawings for installation, maintenance and operation of all purchased items.

5. Include keyboard illustrations and step-by-step procedures indexed for each operator function.

6. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

7. Overall system operation and maintenance instructions, including preventive maintenance and troubleshooting instructions.

8. Complete recommended spare parts list.

G. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

H. Provide ten (10) copies of submittal drawings.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 70.

B. Responsibility: The supplier of the system shall be responsible for inspection and Quality Assurance (QA) for all materials and workmanship furnished by him.

C. Design system software under direct supervision of a Professional Engineer experienced in design of this Work and licensed at Design-Builder.

D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

E. Installer Qualifications: Company specializing in performing the work of this section with minimum five years experience approved by manufacturer with an office located within fifty (50) miles of constructions site.

F. Component Testing: Maximum reliability shall be achieved through extensive use of high-quality, pre-tested components. Each and every controller, sensor, and all other components shall be individually tested by the manufacturer prior to shipment.

G. Tools, Testing and Calibration Equipment: Provide all tools, testing and calibration equipment necessary to ensure reliability and accuracy of the system.

H. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 PRE-CONSTRUCTION MEETING

A. Convene one week before starting work of this Section.

B. Require attendance of parties directly affecting the work of this Section.

1.8 WARRANTY

A. Warranty shall cover all costs for parts, labor, and associated travel, and expenses for a period of one year from completion of system demonstration.

B. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the Vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours.

C. This warranty shall apply equally to both hardware and software.

D. Correct defective Work within a five year period after Substantial Completion.

E. Provide one year manufacturer's warranty for field programmable micro-processor based units.

F. All warranties to begin at Date of Substantial Completion as accepted by the Owner.

1.9 PROTECTION OF SOFTWARE RIGHTS

A. Prior to delivery of software, the Owner and the party providing the software will enter into a software license agreement with provisions for the following:

1. Limiting use of software to equipment provided under these specifications.

2. Limiting copying.

3. Preserving confidentiality.

4. Prohibiting transfer to a third party.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Trane, Inc.

B. Substitutions: Not Permitted.

2.2 OPERATOR STATION

A. Work Station:

1. Configuration: IBM-compatible pentium based microcomputer system or better.
2. Minimum memory: 32 Mb RAM.
3. Memory clock speed: 450 MHz.
4. Display: Super video color graphics adapter (SVGA), 17 inch non-interlaced color monitor, maximum 0.28 mm dot pitch.
5. Floppy disk drive: 1.44Mb.
6. Hard disk drive: 1 Gb or larger.
7. Mouse: Software supported mouse with support software including self building menus and displays of system operations and functions.
8. Modem: Internal type modem or proprietary data modem with cables and communication interfaces required to provide the specified functions, minimum 56.6 kbps rate.
9. Printer: Support color printer. Equal to Hewlett Packard 930 Series.
10. Operating System: Windows 98.

B. Displays

1. Operator Terminal shall display all data associated with project as called out on drawings and/or point list supplied. System shall be capable of displaying graphic file, text and dynamic point data together on each display. Information shall be labeled with descriptors and shall be shown with the appropriate engineering units. All information on any display shall be dynamically updated every second without any action by the user. Terminal shall allow user to change all field resident EMS functions associated with the project such as set points, time schedules, holiday schedules, etc. from any screen no matter if that screen shows all text or a complete graphic display. This shall be done without any reference to point addresses or other numeric/mnemonic indications.
2. All displays shall be generated and customized in such a manner by the local system supplier that they fit the project as specified. Canned displays shall not be acceptable. Displays shall use Standard English (or specified language) for labeling and readout. Systems requiring factory programming for displays or logic are specifically prohibited. All displays and programming shall be

supported locally by the installing contractor without factory dependency or assistance.

3. Digital points shall be displayed as On/Off or with customized text. Text shall be justified Left, Right or Center as selected by the user. System must allow operator to change display assignment and also create new and original displays on line. System shall be supplied with a library of standard displays which may be used unaltered or be modified by the operator. Systems that do not allow customization or creation of new displays by the operator shall not be allowed.

4. Analog points shall be displayed with operator modifiable units. Analog Input points may also be displayed as individual objects on the display screen as an overlay to the system display. Analog Output points, when selected with the mouse, shall be displayed as a prompted dialog box. Selection for display type shall be individual for each point.

5. A Customized Menu Label shall be used for display selection. Menu items on a display shall allow penetration to lower level displays or additional menus. Dynamic point information and menu items may be mixed on the same display to allow sub displays to exist for each item. Each display may be protected from viewing unless operator has appropriate security level. A separate display security level may be assigned to each display and system point.

6. All dynamic point information shall be updated on the Operators terminal display once every 1 second. Any changes by the operator shall be acted on by devices in the field within 2 seconds maximum.

7. Displays may be modified on site or via remote communications.

8. System must have central controller to access system. System display to be at least 4 line X 20 character LED display.

9. Entire system shall operate without dependency on the central terminal.

C. Security System

1. Provide security system that prevents unauthorized use unless operator is logged on. Access shall be limited to operator terminal's functions unless user is logged on. This includes displays as outlined above.

2. Each Operators Terminal shall provide security for 20 users minimum. Each user shall have an individual password. Password shall be up to 4 alpha numeric characters, case sensitive. Each User shall be individually assigned which control functions and menu items the user has access to. All passwords, user names and

access assignments shall be adjustable on-line, at the operators terminal. Each user shall also have a set security level that defines access to displays and also defines what individual points the user can control.

D. Display of Scheduling Information

1. Display of Weekly schedules shall show all information in easy to read 7 day (week) format for each schedule. This includes all on/off times for each day along with all optimum start information.

2. Holiday schedules shall show all dates that are to be holidays. Holidays shall be shown on the terminal in a graphical calendar format showing all scheduled days for a given month. User shall be able to easily scroll through the months for each year for up to 20 years into the future as a minimum. Each day assigned as a holiday shall display as "All Off" or show "Scheduled" for that day.

3. Event schedules shall be shown in the same graphical calendar format and manner as Holiday schedules. Event schedules allow for scheduling of special events up to 20 years into the future. After event has elapsed, control returns to normal schedule.

4. Operator shall be able to change all information for a given Weekly, Holiday or Event schedule if logged on with the appropriate security access. This includes all information that has to do with optimum start including assignments such as sensors to use and heating/cooling factors.

E. Alarm Indication

1. System Terminal shall provide visual and printed means of alarm indication. Printout of alarms shall be sent to the assigned terminal and port.

2. Provide log of alarm messages. Alarm log shall be archived to the hard disk of the system terminal. Each entry shall include point descriptor and address, time and date of alarm occurrence, point value at time of alarm, time and date of point return to normal condition, time and date of alarm acknowledge.

3. Alarm messages shall be in plain English (or specified language) and shall be user definable on site or via remote communication. System shall provide a minimum of 20 user definable messages for each zone controlled.

F. Trend Log Information

1. System shall periodically gather samples of point data stored in the field equipment and archive the information on the Operator terminals hard disk.

Archive files shall be appended with new sample data, allowing samples to be accumulated over several years. Systems that write over archived data shall not be allowed. Samples may be viewed at the operators terminal in a Trend Log. Trend log displays shall be in spreadsheet format. Provide capability for operator to scroll through all trend log data. System shall automatically open archive files as needed to display archived data when operator scrolls through the data vertically. Display all trend log information in standard engineering units.

2. Operator shall be able to change trend log setup information as well. This includes information to be trend logged as well as interval at which information is to be logged. All points in the system may be logged. All operations shall be password protected.

3. Provide means for operator to export to a comma delimited file format all trend log data for use by other spread sheet programs. Operation of system shall not be affected by this operation. In other words, the system shall stay 100% on-line

G. Controller Status

1. Provide means for operator to view communication status of all controllers connected to the system. Display shall include controller, status and error count. Status will show if controller is communicating or not. Error count shall show actual count of communication errors between system and controllers in the field.

2. Provide means for operator to reset error count for all controllers to zero.

3. Provide capability to select alarm indication for each controller.

H. Configuration/Setup

1. Provide means for operator to display and change system configuration. This shall include but not be limited to system time, day of the week, date of day light savings set forward setback, printer type and port addresses, modem port and speed, etc. Items shall be modified utilizing easy to understand terminology using simple mouse/cursor key movements.

2.3 GLOBAL CONTROLLER

A. General

1. Global controller shall provide battery backed real time clock functions. It shall also provide system communications to programmable and application specific controllers as noted in section 2.3 in the field. Global controller shall interface with Operator terminal(s) for information display. Global controllers shall share

information in a Peer-to-Peer manner utilizing a high speed LAN communication network.

2. Global controller shall decide global strategies for system based on information from any points in the system regardless if the point is directly monitored by the controller. Program that implements these strategies shall be completely flexible and user definable. Any system utilizing factory pre-programmed global strategies that cannot be modified by field personnel on site or downloaded via remote communications are not acceptable. Changing global strategies via firmware changes is also unacceptable. Program executed speed shall be once per second as a minimum.

3. Programming shall be object oriented using control program blocks. Provide documentation in flow chart form for all programming as part of the final system As-Built documentation. Include samples of flow chart documentation in submittals. All flow charts shall be generated with CAD system and automatically downloaded to controller. No reentry of data base shall be necessary.

4. Provide means to view inputs and outputs to each program block in real time as program is executing. This function may be done via the Operators Terminal, field computer, or via modem.

5. Controller shall have a minimum of 1 Mb battery backed Static RAM, expandable to 4 Mb, along with 256 Kb of EPROM. Battery shall retain static RAM memory and clock functions for a minimum of 30 days. Battery shall be a field replaceable lithium type. Battery shall automatically re-charge on resumption of local power.

6. Communication to field devices shall be via four individual two wire communication trunks. Communication baud rate of each trunk shall be 9600 baud. All field devices shall automatically search and detect the communication rate to match the Global controller. All field devices on the communication trunk shall be optically isolated. Ground referenced communications to field devices is prohibited. Routing of communication trunk may be daisy chained, run in star patterns or any other configuration that makes wiring easiest. Global controller shall be capable of communication to all field controllers that manufacturer has made in the past to allow backward compatibility.

7. Controller shall have at a minimum, one (1) additional communication ports in addition to the LAN port. The port shall be RS-232, one for communication to portable field computer and one for a modem for remote communications. The other two ports shall be RS-485 for connection to a permanent panel mounted

display device (see section 2.4 for description), and for future connection to other devices.

B. Remote Communications

1. Provide all functions that will allow remote communications via modem to off-site locations. Include modem along with all cabling necessary for installation.

2. Global Controller shall have capability to call out alarm conditions automatically if desired. Alarm message and site description shall be sent to off site computer or serial printer. If desired, controller may also send encoded message to digital pager. All Global controllers connected to the local LAN shall be capable of calling out alarm messages through one shared modem connected to one or more of the Global controllers on the local LAN.

3. Controller shall have capability to call 20 different phone numbers each as a minimum. Numbers called may be controlled by type of alarm, time schedule, holiday schedule or other selectable program parameters.

4. Owner shall provide standard voice grade phone line for remote communication function.

5. Global controller and supplied modem shall be capable of modem-to-modem baud rates of 14.4K baud minimum over standard voice grade phone lines. Lower baud rates shall be selectable for areas where local phone company conditions require lower baud rates.

C. Schedules

1. Schedules shall be arranged in a three tiered hierarchy as follows:

   a. Highest level: Event Schedules

   b. Middle level: Holiday Schedules

   c. Lowest level: Weekly Schedules

2. Each Global Controller shall have at a minimum:

   a. 100 Weekly time schedules (7 day)

   b. 100 Holiday schedules (400 programmable days each)

   c. 20 Event schedules (400 programmable days each) with 8 schedule entries per day

3. Each schedule may be assigned to any point, controller, or program in the system.

4. Each schedule (Weekly, Holiday and Event) shall be capable of performing an optimum start. Optimum start calculation shall be based on outside air temperature, zone air temperature deviation from zones daytime heating and cooling set points, and individual zone adaptive heating and cooling coefficients that are adjusted each day based on performance parameters of the individual zone. Each schedule may use identical or individual sensors in its calculations.

5. Holiday schedule shall be provided to allow operation of system based on different schedule on specified holidays. Display of Holiday schedule shall be via a monthly calendar format. Operator shall be able to scroll through months and years.

6. Event schedules shall be identical to Holiday schedule format. However, event schedule shall be a one time action that once that time period is passed, the event schedule shall be erased for that particular day. Events may be scheduled up to one year in advance.

7. Operator may define and setup all schedule information from system terminal, via portable computer on site or via remote communications. This includes all times, dates and optimum start parameters. These functions shall be password protected.

D. Logging Capabilities

1. Each Global Controller shall log as a minimum 150 user selectable points with a minimum of 100 samples per point with standard memory configuration. Logging shall be expandable, user defined, with additional memory in global controller. Sample time interval shall be from 1 to 1000 seconds. Sample initiation may be by any of the following conditions:

   a. Selectable begin and end date and time

   b. Point COS (Any system point)

   c. Point Alarm Status (Any system point)

   d. Schedule ON status (Weekly, Holiday or Event schedules)

2. Any point in the system whether it is real or calculated may be logged.

3. Logs may be viewed both on site or off-site via remote communication.

4. Global controller shall periodically upload trended data to Operator terminal for long term archiving if desired.

E. Alarm Generation

1. Alarms may be generated for any condition of the system. This includes things such as analog point high/low alarm limits, digital point COS, communication failure to terminal unit controllers, etc. Controller shall have a minimum of 6 alarm types with 7 categories for each type.

2. Each alarm may be dialed out as noted above.

3. Provide alarm log for viewing of alarms. Log may be viewed on site at the system terminal or off-site via remote communications.

F. Demand Limiting

1. System shall be capable of monitoring energy demand. Energy demand may be from any type of energy source such as electrical or gas. Provide a Demand Limiting routine which shall shed assigned points or zones in the system to prevent the demand from exceeding preset limits. Demand limiting routine shall be a priority shed type allowing automatic override of zone or point shed when assigned temperature sensor exceeds operator set limits. Routine shall be able to change between 4 sets of demand limit and restore set points based on time of day or operator command.

2. Zone shed method shall be by either preventing operation of heating and cooling, or by shifting the zones heating and cooling set points.

3. All parameters of the Demand Limiting routine shall be modifiable from the Operators Terminal or via remote communications.

G. Energy Logging

1. Each global controller shall provide for a minimum of 10 Energy Logs. Each log shall monitor an energy meter and record or calculate the following information for each Day, Month and Year:

   a. Energy consumption

   b. Demand peak value and time of peak

   c. Outside air temperature minimum, maximum and average value

   d. Heating and Cooling degree day calculation

2. Energy meter input may be from any type of energy source such as electric, BTU or gas. Input type shall be dry contact pulse for electric or gas meters.

H. Field Interface/Display Terminal

1. Provide interface capability to display terminals. Interface shall support up to 8 field terminals on each global controller. Field Terminal(s) shall connect to the Global controller via a two conductor RS-485 cable in a star or tee tap configuration allowing easy addition of terminals in the future.

2. Field Terminals shall be capable of displaying and commanding any and all points in the system including those points on other global controllers utilizing customizable menus and data displays. Field Terminal data displays shall be independent of Operator Terminal displays. Field Terminal operation shall not be dependent on Operator terminal operation. See section 2.4 for field terminal description.

I. Memory Modules

1. Global Controller data storage memory shall be modular, allowing additional memory to be added in the field (two modules minimum). Additional memory may be allocated by the operator to increase the storage capability of any or all routines requiring memory for storage of data. Modules shall be battery backed static RAM in Single In-line Modules (SIMM) or other easily insertable package.

2.4 CONTROL UNITS

A. General

1. Provide programmable and application specific Terminal Unit Controller as needed to comply with sequence of operation, point list and drawings. All Terminal Unit Controller units shall be completely stand-alone with no loss of control if communication with global controller is interrupted. All control parameters, programs and local variables such as setpoint information shall be stored in EEPROM on board each Terminal Unit Controller allowing the operator to change information as desired. Controllers that utilize a battery to backup control parameters, etc., shall not be allowed.

2. Programmable Terminal Unit Controllers shall be used in custom applications such as central plant, built up air handlers, fume hoods or when application specific controllers sequence of operation is not applicable.

3. Communication from Global controller to Terminal Unit Controllers shall be via two wire communication trunk as specified for Global Controllers above. Any type of Terminal Unit Controller shall communicate on the same communication trunk. System shall communicate to one Terminal Unit Controller regardless of whether other Terminal Unit Controllers on the same communication line are

powered and connected. Ground referenced communications is prohibited.

4. Global controller shall communicate to all field controllers manufacturer has made in the past as well as currently.

B. Programmable Terminal Unit Controllers

1. Each programmable Terminal Unit Controller shall be completely programmable from the system terminal, via field computer or via remote communications. Program execution rate shall be ten times per second minimum (once every 100 milliseconds).

2. This controller shall be programmed to perform custom strategies for system based on information from all points in the field. Program that implements these strategies shall be completely flexible and user definable. Any controllers utilizing factory programmed strategies that cannot be modified by field personnel on site, require factory assistance, or cannot be downloaded via remote communications are not acceptable. Changing strategies via firmware changes is also unacceptable.

3. Programming shall be object oriented using program blocks familiar to control specialists for all program strategies. Provide documentation in flow chart form for all programming. Include samples of flow chart documentation in submittals. All flow charts shall be generated with CAD system and automatically downloaded to controller. No re-entry of data base shall be necessary. As-Built documentation of all software shall be provided to end user in flow chart form at completion of project.

4. Program and program parameters such as set points shall be stored in EEPROM. Battery backed RAM shall not be accepted for this level of controller.

5. All inputs shall be universal in that they accept analog and digital information. Inputs shall be capable of detecting a 0.1 second momentary closure. Analog inputs shall be capable of accepting thermistor inputs, 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA inputs. No external hardware shall need to be added for Terminal Unit Controller to accept these different types of inputs. All inputs shall utilize a minimum of 10 bit analog to digital conversion.

6. Every digital output shall have local status indication. Outputs shall have minimum control resolution of 0.1 seconds On or Off.

7. Each of the analog outputs shall be independently switch selectable to output 0 to 10 VDC or 4 to 20 mA. Unit shall be programmable to output a sub range of voltage or current to match the device controlled. Analog outputs shall use 8 bit

digital to analog conversion.

8. Terminal Unit Controller may be programmed to control what is displayed on zone sensor display. See section 2.5. Terminal Unit Controller may be programmed to show alpha numeric values on zone sensor display in response to program changes or button presses on the zone sensor.

9. Each Terminal Unit Controller shall provide 24 VDC at 250 mA as a source of power for current transducer sensors in the field.

C. Application Specific Terminal Unit Controllers

1. Application Specific Terminal Unit Controllers shall be completely stand-alone controllers for unitary type controls such as VAV terminal boxes, heat pumps, AC units, unit ventilators, etc. All programs shall be resident in controller for complete stand-alone operation.

2. EEPROM technology shall be used for storage of program parameters such as set points, limits, etc., controllers utilizing a battery for backup of program parameters shall not be allowed.

3. All application specific Terminal Unit Controller units shall have capability to use Digital display zone sensor, or thermistor type zone sensor .

2.5 OPERATOR FIELD INTERFACE DEVICE

A. Hardware

1. Operator field interface shall communicate to global controller via RS-485 at 38.4K baud minimum. RS-232 port shall be available for reprogramming displays. This port shall be accessible without removing any covers from unit.

2. Provide minimum of 128K of nonvolatile RAM for display storage and 32K of EPROM. Battery shall retain memory for 30 days minimum.

3. Operator interface device shall be housed in plastic enclosure suitable for mounting in office area. Device shall be separate unit from global controller and mount on standard double wide box.

B. Displays

1. Operator Terminal shall display all data associated with project as called out on drawings and/or point list supplied. Information shall be labeled with English description on display and shall be shown in engineering units as labeled (i.e. temperature shall be displayed in degrees F, 72.3F.) Terminal shall allow user to

change all EMS functions associated with the project such as set points, time schedules, holiday schedules, etc. with single button push. This shall be done without any reference to point addresses or other numeric/mnemonic indications.

2. All displays shall be generated and customized in such a manner by local system supplier that they fit the project as specified. No canned displays that are modifiable only by factory personnel shall be acceptable. Displays shall use Standard English for labeling and readout.

3. Menu system shall be used for display selection. Menu items on display shall allow penetration to lower level displays. Dynamic point information and menu items may be mixed on the same display to allow sub displays to exist for each item. Each display may be protected from viewing unless operator has appropriate security level. Display security level may be assigned to each display.

4. All dynamic point information shall be updated every 1 second. Any changes by the operator shall be acted on by devices in the field within 1 second.

5. Cursor keys shall be used to move cursor to desired item for selection of new display or to allow the operator to make changes. Entry of name to view or change data shall not be necessary.

6. Displays may be modified on site or via remote communications.

C. Security System

1. Provide security system that prevents unauthorized use unless operator is logged on. Access shall be limited to operator terminal's functions unless user is logged on. This includes displays as outlined above.

2. Operator's Terminal shall access passwords from global controller that are user definable. Each password may have one of 10 security levels that define extent of access for operator once logged on with that password.

2.6 TEMPERATURE SENSORS

A. General

1. All temperature sensors to be solid state electronic, factory calibrated to within one-half degree F, totally interchangeable. Wall sensors to be housed in enclosure appropriate for application. Duct and well sensors to be electronically identical with housing appropriate for application. Provide appropriate wells for installation by others.

2. Provide Digital display zone sensors for all wall sensors as indicated on drawings.

B. Digital Display Zone Temperature Sensor

1. Sensor shall contain digital display and user function keys along with temperature sensor. Sensor shall function as occupant control unit. It shall allow occupant to raise and lower setpoint and activate terminal unit for night override use all within limits as programmed by building operator. Sensor shall also allow service technician access to terminal unit controller functions for use as system setup and test and service tool. Sensor shall display and allow modification of Terminal unit controller parameters such as VAV Minimum and Maximum CFM set points, Night heating and cooling set points, Minimum and Maximum setpoint limits. Systems that require a Hand held field service tool shall not be allowed.

2. Provide means for occupant to view room setpoint, room temperature and outside air temperature at each controller. Override time may be set and viewed in 0.1 hour increments. Override time count down shall be automatic, but may be reset to zero using function keys on unit. Display shall be blank in unoccupied mode unless a function button is pressed.

3. Display shall also be used for status and alarm indication as described in the sequence of operation.

2.7 OTHER SENSORS

A. Building Pressure Sensor:

1. Building pressure sensor shall be adjustable for both positive or negative area pressure and accurate to ± 5% of setting.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.

B. Notify the Owners Representative in writing of conditions detrimental to the proper and timely completion of the work.

C. Do not begin work until all unsatisfactory conditions are resolved.

D. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide all miscellaneous devices, hardware, software, interconnections installation and programming required to insure a complete operating system in accordance with the sequences of operation and point schedules.

C. The controls contractor shall furnish and install all control components and necessary hardware, computing equipment, and software as defined in this specification.

D. Control wiring and terminations for the building automation system shall be provided by the controls contractor. In addition, all 24 VAC electrical work specified herein shall be the responsibility of the controls contractor. The controls contractor must accept responsibility for total system operation.

1. Wiring shall be installed in accordance with the requirements for low voltage controls as specified in the electrical specifications. Local codes shall have jurisdiction

E. All material and equipment used shall be standard components, regularly manufactured and available and not custom designed especially for this project. All systems and components, except site-specific software, shall have previously been thoroughly tested and proved in actual use prior to installation on this project.

F. The system architecture shall be fully modular, permitting expansion of application software, system peripherals, and field hardware.

G. The system, upon completion of installation and prior to acceptance of the project, shall perform all operating functions as detailed in this specification.

H. Locate and install components for easy accessibility; in general, mount 60 inches above floor with minimum 3'-0" clear access space in front of units. Obtain Owner Representative's approval on locations prior to installation. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

I. All instruments, switches, transmitters, etc., shall be suitably wired and mounted to protect them from vibration and high temperatures.

J. Provide conduit and electrical wiring in accordance with Division 26. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

K. Identify all equipment and panels. Provide permanently mounted engraved tags to all panels.

3.3 INTERLOCKING AND CONTROL WIRING

A. Provide all 24 VAC interlock and control wiring. All wiring shall be installed in a neat and professional manner in accordance with Division 16 and all state and local electrical codes.

B. Provide all low voltage (24 VAC or below) wiring as required by functions as specified and as recommended by equipment manufacturers, to serve specified control functions.

C. Low voltage control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the Owner's Representative prior to rough-in.

D. Low voltage communication wiring shall not be located within 6 feet of lighting ballast unless it is run inside conduit.

E. Provide auxiliary pilot duty relays on motor starters as required for control function.

F. Provide power for all control components from nearest electrical control panel or as indicated on the electrical drawings; coordinate all high voltage (120 VAC and above) with electrical contractor.

G. All control wiring installed in mechanical, electrical, telephone and boiler rooms to be installed in conduit or raceways provided and installed by the control contractor. All other wiring to be installed in a neat and inconspicuous manner per local code requirements.

3.4 MANUFACTURER'S FIELD SERVICES

A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

B. Provide service engineer to instruct Owner's representative in operation of systems plant and equipment for 3 day period.

C. Provide basic operator training for two (2) persons on data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Include a minimum of 24 hours dedicated instructor time. Provide training on site.

D. Provide the capability for off-site monitoring at Control Contractor's local and main office. At a minimum, off site facility shall be capable of system diagnostics and software download. Owner shall provide phone line for this service.

E. Provide Owner's Representative with spare parts list. Identify equipment critical to maintaining the integrity of the operating system.

3.5 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate complete and operating system to Owner.

B. Provide systems demonstration under provisions of Section 23 01 00.

C. Provide certificate stating that control system has been tested and adjusted for proper operation.

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPING AND SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

E. Strainers.

F. Check valves.

G. Filter-driers.

H. Solenoid valves.

I. Expansion valves.

1.2 RELATED REQUIREMENTS

A. Division 26 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. AHRI 710 - Performance Rating of Liquid-Line Driers; 2009.

B. AHRI 750 - Thermostatic Refrigerant Expansion Valves; 2007.

C. AHRI 760 - Performance Rating of Solenoid Valves for Use With Volatile Refrigerants; 2007.

D. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2024, with Errata (2025).

E. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants; 2024.

F. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023, with Errata (2024).

G. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023, with Errata (2024).

H. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2024.

I. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2022.

J. ASME B31.9 - Building Services Piping; 2020.

K. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

L. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.

M. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

1.4 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

C. Liquid Indicators:

1. Use line size liquid indicators in main liquid line leaving condenser.

2. If receiver is provided, install in liquid line leaving receiver.

3. Use line size on leaving side of liquid solenoid valves.

D. Valves:

1. Use service valves on suction and discharge of compressors.

2. Use gage taps at compressor inlet and outlet.

3. Use gage taps at hot gas bypass regulators, inlet and outlet.

4. Use check valves on compressor discharge.

5. Use check valves on condenser liquid lines on multiple condenser systems.

E. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.

F. Strainers:

1. Use line size strainer upstream of each automatic valve.

2. Where multiple expansion valves with integral strainers are used, use single main liquid line strainer.

3. On steel piping systems, use strainer in suction line.

4. Use shut-off valve on each side of strainer.

G. Filter-Driers:

1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

2. Use a filter-drier on suction line just ahead of compressor.

3. Use sealed filter-driers in lines smaller than 1/2 inch outside diameter.

4. Use sealed filter-driers in low temperature systems.

5. Use sealed filter-driers in systems utilizing hermetic compressors.

6. Use replaceable core filter-driers in lines of 3/4 inch outside diameter or greater.

7. Use filter-driers for each solenoid valve.

H. Solenoid Valves:

1. Use in liquid line of systems operating with single pump-out or pump-down compressor control.

2. Use in liquid line of single or multiple evaporator systems.

3. Use in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when system shuts down.

1.5 SUBMITTALS

A. See Section 23 01 00 - General HVAC Provisions, for submittal procedures.

B. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

C. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.

D. Design Data: Submit design data indicating pipe sizing. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Test Reports: Indicate results of leak test, acid test.

F. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.

G. Project Record Documents: Record exact locations of equipment and refrigeration accessories on record drawings.

H. Maintenance Data: Include instructions for changing cartridges, assembly views, spare parts lists.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

B. Design piping system under direct supervision of a licensed hvac company experienced in design of this type of work and licensed in the state where the Project is located.

1.7 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 for installation of piping system.

B. Welding Materials and Procedures: Conform to ASME (BPV IX) .

C. Welders Certification: In accordance with ASME (BPV IX).

D. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.1 PIPING

A. Copper Tube to 7/8 inch OD: ASTM B88 (ASTM B88M), Type K (A), annealed.

1. Fittings: ASME B16.26 cast copper.

2. Joints: Flared.

B. Pipe Supports and Anchors:

1. Conform to ASME B31.5.

2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Carbon steel adjustable swivel, split ring.

3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

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

6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.

7. Vertical Support: Steel riser clamp.

8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

10. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

11. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.2 REFRIGERANT

A. Refrigerant: As defined in ASHRAE Std 34.

1. R-32.

2. R-454B.

2.3 MOISTURE AND LIQUID INDICATORS

A. Manufacturers:

1. Henry Technologies.

2. Parker Hannifin/Refrigeration and Air Conditioning.

3. Sporlan Valve Company.

4. Substitutions: See Section 23 01 00 - General HVAC Provisions.

B. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 460 psi.

2.4 VALVES

A. Manufacturers:

1. Hansen Technologies Corporation.

2. Henry Technologies.

3. Danfoss Automatic Controls.

4. Substitutions: See Section 23 01 00 - General HVAC Provisions.

B. Diaphragm Packless Valves:

1. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

C. Packed Angle Valves:

1. Forged brass , forged brass seal caps with copper gasket, rising stem and seat , molded stem packing, solder or flared ends; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

D. Ball Valves:

1. Two piece forged brass body with teflon ball seals and copper tube extensions, brass seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 325 degrees F.

E. Service Valves:

1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

2.5 STRAINERS

A. Straight Line or Angle Line Type:

1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

B. Straight Line, Non-Cleanable Type:

1. Steel shell, copper plated fittings, stainless steel wire screen, for maximum working pressure of 500 psi.

2.6 CHECK VALVES

A. Manufacturers:

1. Hansen Technologies Corporation.

2. Parker Hannifin/Refrigeration and Air Conditioning.

3. Sporlan Valve Company.

4. Substitutions: See Section 01 60 00 - Product Requirements.

5. Substitutions: See Section 23 01 00 - General HVAC Provisions.

B. Globe Type:

1. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum temperature of 300 degrees F and maximum working pressure of 425 psi.

C. Straight Through Type:

1. Brass body and disc, phosphor-bronze or stainless steel spring, neoprene seat; for maximum working pressure of 500 psi and maximum temperature of 250 degrees F.

2.7 FILTER-DRIERS

A. Manufacturers:

1. Flow Controls Division Emerson Electric Co.
2. Parker Hannifin/Refrigeration and Air Conditioning.
3. Sporlan Valve Company.
4. Substitutions: See Section 23 01 00 - General HVAC Provisions.

B. Performance:

1. Flow Capacity - Liquid Line: As indicated in schedule, minimum, rated in accordance with AHRI 710.
2. Flow Capacity - Suction Line: As indicated in schedule, minimum, rated in accordance with AHRI 730 (I-P).
3. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
4. Design Working Pressure: 500 psi, minimum.

C. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, and filtration to 40 microns; of construction that will not pass into refrigerant lines.

D. Construction: UL listed.

1. Replaceable Core Type: Steel shell with removable cap.
2. Sealed Type: Copper shell.
3. Connections: As specified for applicable pipe type.

2.8 SOLENOID VALVES

A. Manufacturers:

1. Flow Controls Division of Emerson Electric.
2. Parker Hannifin/Refrigeration and Air Conditioning.

3. Sporlan Valve Company.

4. Substitutions: See Section 23 01 00 - General HVAC Provisions.

B. Valve: AHRI 760, pilot operated, copper or brass body and internal parts, synthetic seat, stainless steel stem and plunger assembly (permitting manual operation in case of coil failure), integral strainer, with flared, solder, or threaded ends; for maximum working pressure of 500 psi.

C. Coil Assembly: UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box.

2.9 EXPANSION VALVES

A. Manufacturers:

1. Flow Controls Division of Emerson Electric.

2. Parker Hannifin/Refrigeration and Air Conditioning.

3. Sporlan Valve Company.

4. Substitutions: See Section 23 01 00 - General HVAC Provisions.

B. Angle or Straight Through Type: AHRI 750; design suitable for refrigerant, brass body, internal or external equalizer, mechanical pressure limit (maximum operating pressure MOP feature), adjustable superheat setting, replaceable inlet strainer, with replaceable capillary tube and remote sensing bulb.

C. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10 degrees F superheat. Select to avoid being undersized at full load and excessively oversized at part load.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

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

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

3.2 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

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

F. Inserts:

1. Provide inserts for placement in concrete formwork.

2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

G. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.5.

2. Support horizontal piping as scheduled.

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

4. Place hangers within 12 inches of each horizontal elbow.

5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

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

7. Provide copper plated hangers and supports for copper piping.

H. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

I. Provide clearance for installation of insulation and access to valves and fittings.

J. Provide access to concealed valves and fittings.

K. Flood piping system with nitrogen when brazing.

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

M. Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting.

N. Insulate piping and equipment; refer to Section and Section 23 07 16.

O. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

P. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

Q. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

R. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

S. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

T. Fully charge completed system with refrigerant after testing.

U. Provide electrical connection to solenoid valves. Refer to Division 26.

3.3 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

B. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using electronic leak detector. Test to no leakage.

3.4 SCHEDULES

A. Hanger Spacing for Copper Tubing.

1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. 1-3/8 inch OD: Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. 1-5/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. 2-1/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. 2-5/8 inch OD: Maximum span, 9 feet; minimum rod size, 3/8 inch.
7. 3-1/8 inch OD: Maximum span, 10 feet; minimum rod size, 3/8 inch.
8. 3-5/8 inch OD: Maximum span, 11 feet; minimum rod size, 1/2 inch.
9. 4-1/8 inch OD: Maximum span, 12 feet; minimum rod size, 1/2 inch.

END OF SECTION

SECTION 23 31 00

DUCTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ductwork.

B. Duct cleaning.

1.2 RELATED REQUIREMENTS

A. Section 23 07 13 - Duct Insulation: External insulation and duct liner.

B. Section 23 33 00 - Duct Accessories.

C. Section 23 33 30 - Air Duct Sealants.

D. Section 23 37 00 - Air Outlets and Inlets.

E. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

1.3 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2015b.

D. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2015.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

F. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

G. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

H. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

I. ASTM C14M - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe (Metric); 2020.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

K. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2018, with Editorial Revision (2020).

L. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry; 2018, with Editorial Revision (2020).

M. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).

N. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

O. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2015.

P. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

Q. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2012, 2nd Edition.

R. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.4 DEFINITIONS

A. Duct Sizes: Duct sizes indicated on drawings are inside clear dimensions.

B. Low Pressure: Static pressure in duct less than 1" WG and velocities less than 2000 fpm (10 meters/second).

C. Medium Pressure: Static pressure between 1 and 6 inches WG and velocities between 1500 and 3000 fpm.

1.5 SUBMITTALS

A. See Section 23 01 00 - General HVAC Provisions, for submittal procedures.

B. Product Data: Provide data for duct materials, duct liner, and duct connections.

C. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for all systems.

D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual.

E. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

F. Confirm ductwork has been fabricated and installed in accordance with recommendations and SMACNA standards.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum five years of documented experience.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum five years of documented experience.

1.7 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A, NFPA 90B, and NFPA 96, standards.

1.8 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.1 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

B. Aluminum for Ducts: ASTM B209 (ASTM B209M); aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T651 or of equivalent strength.

C. Stainless Steel for Ducts: ASTM A 240/A 240M, Type 316.

D. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.

2. VOC Content: Not more than 250 g/L, excluding water.

3. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E84.

4. For Use With Flexible Ducts: UL labeled.

5. Products:

a. Seal all joints and seams on sheet metal supply, return, makeup air and exhaust ductwork with "Hardcast" type DT sealing tape and type FTA adhesive or "Hardcast" iron grip 601 duct sealant installed in strict accordance with manufacturer's instructions. Clean all dirt, oil, moisture, etc., before applying adhesive. Duct tape, UL listed or not, is not acceptable.

b. Substitutions: See Section 23 01 00 - General HVAC Provisions.

E. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

F. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:

1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.

2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.

3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.

4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.

5. Other Types: As required.

2.2 DUCT ASSEMBLIES

A. All Ducts: Galvanized steel, unless otherwise indicated.

B. Low Pressure Supply (Heating Systems): 1 inch w.g. pressure class, galvanized steel.

C. Return and Relief: 1 inch w.g. pressure class, galvanized steel.

D. General Exhaust: 1 inch w.g. pressure class, galvanized steel.

2.3 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

B. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE Handbook - Fundamentals.

C. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

D. Provide air foil turning vanes when rectangular elbows must be used.

E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

F. Fabricate continuously welded round duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

G. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

H. Lap metal duct in direction of air flow. Hammer down edges and slips to leave smooth duct interior.

I. Size round ducts installed in place of rectangular ducts from ASHRAE Table of Equivalent Rectangular and Round Ducts. No variation of duct configuration or sizes permitted except by written permission.

J. Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breathe, rattle, vibrate or sag. Caulk duct joints and connections with sealant as ducts are being assembled.

2.4 MANUFACTURED DUCTWORK AND FITTINGS

A. Flexible Ducts: Two ply vinyl film supported by helically wound spring steel wire.

1. Insulation: Fiberglass insulation with aluminized fiberglass scrim vapor barrier film.

2. Pressure Rating: 6 inches WG positive and 1.0 inches WG negative.

3. Maximum Velocity: 5000 fpm.

4. Temperature Range: -10 degrees F to 160 degrees F.

5. R-6.0 Formaldehyde free insulation.

6. UL -181 (UL listed).

7. Manufacturers:

a. Hart & Cooley.

b. Flex Master.

c. Substitutions: See Section 23 01 00 - General HVAC Provisions.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Flexible Ducts: Connect to metal ducts with draw bands.

E. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

F. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

H. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

I. Use double nuts and lock washers on threaded rod supports.

J. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

K. Connect flexible ducts to metal ducts per manufacturer's recommendations.

L. All round and rectangular duct installed in exposed areas shall be paint lock duct.

3.2 CLEANING

A. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

B. If determined by the Architect and/or Engineer, that during construction the duct systems were not adequately protected and dirt/debris was allowed to enter the installed ductwork, then it will be required by the HVAC contractor for the duct system to be cleaned. If required, clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

END OF SECTION

SECTION 23 33 00

DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air turning devices/extractors.

B. Backdraft dampers - metal.

C. Duct access doors.

D. Duct test holes.

E. Fire dampers.

F. Flexible duct connections.

G. Smoke dampers.

H. Volume control dampers.

1.2 RELATED REQUIREMENTS

A. Section 23 31 00 - Ducts.

B. Division 26 - Electrical: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

C. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.

D. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 23 01 00 - General HVAC Provisions, for submittal procedures.

B. Project Record Drawings: Record actual locations of access doors, volume dampers, test holes, and fire dampers.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Fusible Links: Two of each type and size.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum five years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

C. Demonstrate resetting of fire dampers to authorities having jurisdiction and Owner's Representative.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.1 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:

1. Krueger.

2. PCI Industries, Inc; Pottorff Brand.

3. Ruskin Company.

4. Titus.

5. Substitutions: See Section 23 01 00 - General HVAC Provisions.

B. Multi-blade device with blades aligned in short dimension; steel or aluminum construction; with individually adjustable blades, mounting straps.

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

2.2 BACKDRAFT DAMPERS - METAL

A. Manufacturers:

1. Louvers & Dampers, Inc.

2. Nailor Industries Inc.

3. PCI Industries, Inc; Pottorff Brand.

4. Ruskin Company.

5. Substitutions: See Section 23 01 00 - General HVAC Provisions.

B. Gravity Backdraft Dampers, Size 18 x 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

C. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.3 DUCT ACCESS DOORS

A. Manufacturers:

1. Nailor Industries Inc.

2. Ruskin Company.

3. Greenheck Fan Corporation.

4. SEMCO Incorporated.

5. Substitutions: See Section 23 01 00 - General HVAC Provisions.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.

1. Less Than 12 inches Square: Secure with sash locks.

2. Up to 18 inches Square: Provide two hinges and two sash locks.

3. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.

4. Larger Sizes: Provide an additional hinge.

D. Access doors with sheet metal screw fasteners are not acceptable.

2.4 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.5 FIRE DAMPERS

A. Manufacturers:

1. Louvers & Dampers, Inc.

2. Nailor Industries Inc.

3. Ruskin Company.

4. Greenheck Fan Corporation.

5. Substitutions: See Section 23 01 00 - General HVAC Provisions.

B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

C. Ceiling Dampers: Galvanized steel, 22 gage frame and 16 gage flap, two layers 0.125 inch ceramic fiber on top side and one layer on bottom side for round flaps, with locking clip.

D. Horizontal Dampers: Galvanized steel, 22 gage frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

E. Multiple Blade Dampers: 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

F. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide dynamic style dampers with stainless steel closure springs and latches for closure under air flow conditions. Configure with blades out of air stream.

G. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.6 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers:

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Connector: Fabric crimped into metal edging strip.

1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.

a. Net Fabric Width: Approximately 3 inches wide.

2. Metal: 3 inches wide, 24 gage thick galvanized steel.

2.7 VOLUME CONTROL DAMPERS

A. Manufacturers:

1. Louvers & Dampers, Inc.

2. Nailor Industries Inc.

3. Ruskin Company.

4. Greenheck Fan Company.

5. Jer-Air Manufacturing.

6. United Enertech.

7. Substitutions: See Section 23 01 00 - General HVAC Provisions.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.

1. Fabricate for duct sizes up to 6 x 30 inch.

2. Blade: 24 gage, minimum.

D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

1. Blade: 18 gage, minimum.

E. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings_____.

F. Quadrants:

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.

2. On insulated ducts mount quadrant regulators on minimum 2-inch stand-off mounting brackets, bases, or adapters.

3. Where rod lengths exceed 30 inches provide regulator at both ends.

2.8 MISCELLANEOUS PRODUCTS

A. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.

1. Thickness: 2 mils.

2. High tack water based adhesive.

3. UV stable light blue color.

4. Elongation Before Break: 325 percent, minimum.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

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

E. Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Install fire dampers in accordance with NFPA 92.

G. Demonstrate re-setting of fire dampers to Owner's representative.

H. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

I. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

END OF SECTION

SECTION 23 33 30

AIR DUCT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air duct sealants for permanently sealing fabricated joints and seams of HVAC air ducts and thermal insulation.

B. Reinforcing membrane for sealants.

1.2 RELATED SECTIONS

A. Section 23 07 13 - Duct Insulation.

B. Section 23 31 00 - HVAC Ducts and Casings.

C. Section 23 33 00 - Duct Accessories.

1.3 REFERENCES

A. ASTM D 1668 - Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing; 1995.

B. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2005.

C. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.

D. UL 181A - Closure Systems for Use with Rigid Air Ducts and Air Connectors; Underwriters Laboratories Inc.; 2005.

E. UL 181B - Closure Systems for Use with Flexible Air Ducts and Air Connectors; Underwriters Laboratories Inc.; 2005.

1.4 SUBMITTALS

A. See Section 23 01 00 - General HVAC Provisions, for submittal procedures.

B. Product Data: Manufacturer's product data, including physical properties and application instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

B. Store materials in accordance with manufacturer's instructions. Protect from freezing.

1. Storage Temperature: 40 to 100 degrees F.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not apply below 35 degrees F. or above 120 degrees F.

B. Avoid high humidity.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer:

1. Hardcast, Inc.

2. RCD Corporation.

B. Substitutions: See Section 23 01 00 - General HVAC Provisions.

C. Supply all products specified in this section from a single manufacturer.

2.2 AIR DUCT SEALANTS

A. Low to High Velocity Air Duct Sealant: Non-toxic, water-based, fiber-reinforced adhesive-sealant; for permanently sealing fabricated joints and seams of sheet metal air ducts, UL 181 listed rigid fiberglass air ducts, UL 181 listed flexible air ducts, and thermal insulation; for repairing damaged and leaking air ducts; for sealing conditioned spaces from air infiltration.

1. Type: Elastomeric terpolymer emulsion.

2. Underwriters Laboratories Listed: UL 181A-M and UL 181B-M.

3. Solids by Weight: 67 percent, plus or minus 2 percent.

4. Weight per Gallon: 10.5 pounds, plus or minus 0.20 pounds.

5. Wet Film Coverage: 100 linear feet per gallon at 1/16 inch thick by 3 inches wide.

6. Consistency: Thixotropic, non-sagging.

7. Adhesive Cure: 72 hours at 50 percent humidity and 70 degrees F.

8. Service Temperature Limits: Minus 10 degrees to 180 degrees F.

9. Water Vapor Transmission Rate: 0.6157 perms in accordance with ASTM E 96.

10. Flame Spread Index: Not greater than 5, when tested in accordance with ASTM E 84.

11. Smoke Developed Index: Zero, when tested in accordance with ASTM E 84.

B. Low to High Velocity Air Duct Sealant: Hardcast Iron Grip 601 non-toxic, water-based, adhesive-sealant; for permanently sealing fabricated joints and seams of sheet metal air ducts, UL 181 listed rigid fiberglass air ducts, UL 181 listed flexible air ducts, and thermal insulation; for repairing damaged and leaking air ducts; for sealing conditioned spaces from air infiltration.

1. Type: Elastomeric terpolymer emulsion.

2. Underwriters Laboratories Listed: UL 181A-M and UL 181B-M.

3. Solids by Weight: 70 percent, plus or minus 2 percent.

4. Wet Film Coverage: 320 linear feet per gallon at 20 mil thick by 3 inches wide.

5. Consistency: Thixotropic, non-sagging.

6. Adhesive Cure: 48 hours at 50 percent humidity and 70 degrees F.

7. Flame Spread Index: Not greater than 5, when tested in accordance with UL-723.

8. Smoke Developed Index: Zero, when tested in accordance with UL-723.

C. Reinforcing Membrane: RCD "Glasscoat" inorganic woven fiberglass reinforcing membrane; conforming to irregular surfaces for sealing and coating thermal insulation, air ducts, return air plenums, equipment, vessels, pipes, and fittings.

1. ASTM D 1668, Type III.

2. Nominal Dry Weight: 1.2 to 2.0 ounces per square yard.

3. Saturated Weight: 1.6 to 2.6 ounces per square yard.

4. Nominal Thread Count: 10 by 20.

5. Breaking Strength, Saturated: 75 warp, 75 fill minimum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive air duct sealants.

B. Notify Architect of conditions that would adversely affect application of sealants. Do not proceed with application until unsatisfactory conditions are corrected.

3.2 SURFACE PREPARATION

A. Prepare surfaces in accordance with manufacturer's instructions.

B. Remove water, dirt, oil, grease, and corrosion from surfaces to receive air duct sealants.

3.3 APPLICATION

A. Apply air duct sealants in accordance with manufacturer's instructions.

B. Apply to sheet metal air ducts, UL 181 listed rigid fiberglass air ducts, UL 181 listed flexible air ducts, thermal insulation, and other surfaces where indicated.

C. Do not thin or mix.

D. Apply tack coat at rate of 2 gallons per 100 square feet.

E. Embed reinforcing membrane into tack coat.

F. Apply finish coat at rate of 2 gallons per 100 square feet.

G. Allow drying time as follows:

1. Minimum 6 hours when used outdoors if wet weather is imminent.

2. Minimum 24 hours before using air duct system.

3. Additional time as required by air temperature and humidity conditions.

END OF SECTION

SECTION 23 34 23

POWER VENTILATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof exhausters.

B. Kitchen hood upblast roof exhausters.

1.2 RELATED REQUIREMENTS

A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

B. Section 23 31 00 - Ducts.

C. Section 23 33 00 - Duct Accessories: Backdraft dampers.

D. Division 26 - Electrical: Equipment Wiring.

1.3 REFERENCE STANDARDS

A. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016, with Errata (2018).

B. AMCA 261 - Directory of Products Licensed to Use the AMCA Certified Ratings Seal; Air Movement and Control Association International, Inc.; http://www.amca.org/licenses/search.aspx.

C. AMCA 300 - Reverberation Room Methods of Sound Testing of Fans; 2024.

D. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.

E. NEMA MG 1 - Motors and Generators; 2024.

1.4 SUBMITTALS

A. See Section 23 01 00 - General HVAC Provisions, for submittal procedures.

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum five years of documented experience.

B. Equivalent fan selections shall not increase or decrease motor horsepower, increase top speed by more than 10%, or increase inlet air velocity by more than 20% from that specified.

C. Provide fans capable of accommodating static pressure variations of plus or minus 10%.

D. Provide balanced variable for motors 15 horsepower and under.

E. Statically and dynamically balance fans to eliminate vibration or noise transmission to occupied areas of the building.

F. Provide belt guards on belt driven fans.

G. Provide safety screen where inlet or outlet is exposed.

H. Prime coat fan wheels and housing factory inside and outside. Prime coating on aluminum parts is not required.

1.6 FIELD CONDITIONS

A. Permanent ventilators may be used for ventilation during construction only after ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acme.

B. Captive Aire.

C. Greenheck.

D. Loren Cook Company.

E. Substitutions: See Section 23 01 00 - General HVAC Provisions.

2.2 POWER VENTILATORS - GENERAL

A. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300, and bearing AMCA Certified Sound Rating Seal.

C. Fabrication: Conform to AMCA 99.

D. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

F. Kitchen Range Hood Exhaust Fans: Comply with requirements of NFPA 96.

2.3 ROOF EXHAUSTERS

A. Roof Curb: 14 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips.

B. Kitchen Exhaust Roof Curb: Provide hinged, 14 inch high self-flashing of galvanized steel with continuously welded seams, insulation and curb bottom, ventilated double wall, and hinged curb adapter.

C. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.

D. Performance Ratings: As indicated on drawings.

2.4 DOWNBLAST ROOF EXHAUSTERS

A. Direct Drive Fan:

1. Fan Wheel:

a. Type: Non-overloading, backward inclined centrifugal.

b. Material: Spun Aluminum

2. Housing:

a. The spun aluminum structural components shall be constructed of minimum of 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure.

B. Drive Assembly:

1. Motor pulley adjustable for final system balancing.

2. Readily accessible for maintenance.

C. Disconnect Switches:

1. Factory mounted and wired.

D. Roof Curb: 14 inch high self-flashing of galvanized steel with continuously welded seams, factory installed nailer strip.

E. Options/Accessories:

1. Birdscreen:

a. Provide galvanized steel construction.

2. Dampers: Provide gravity type.

3. Hinge Kit:

a. Aluminum hinges.

b. Hinges and restraint cables mounted to base (sleeve).

2.5 KITCHEN HOOD UPBLAST ROOF EXHAUSTERS

A. Direct Drive Fan:

1. Fan Wheel:

a. Type: Non-overloading, backward inclined centrifugal.

b. Material: Aluminum statically and dynamically balanced.

2. Motors:

a. Open drip-proof (ODP).

b. Heavy duty ball bearing type.

c. Mount on vibration isolators or resilient cradle mounts, out of air stream.

3. Housing:

a. Construct of heavy gauge aluminum including curb cap, windband, and motor compartment.

b. Rigid internal support structure.

c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.

d. Construct drive frame assembly of heavy gauge steel, mounted on vibration isolators.

e. Provide breather tube for fresh air motor cooling and wiring.

B. Shafts and Bearings:

1. Fan Shaft:

a. Ground and polished steel with anti-corrosive coating.

b. First critical speed at least 25 percent over maximum cataloged operating speed.

2. Bearings:

a. Permanently sealed or pillow block type.

b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.

c. 100 percent factory tested.

C. Drive Assembly:

1. Belts: Static free and oil resistant.

2. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.

3. Motor pulley adjustable for final system balancing.

4. Readily accessible for maintenance.

D. Disconnect Switches:

1. Factory mounted and wired.

E. Roof Curb: 14 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, curb bottom, ventilated double wall, and factory installed nailer strip.

F. Drain Trough: Allows for single-point drainage of water, grease, and other residues.

G. Options/Accessories:

1. Roof Curb Extension: Vented curb extension where required for compliance with minimum clearances required by NFPA 96.

2. Grease Trap:

a. Aluminum.

b. Built-in drain connection.

c. Container system to collect grease residue.

3. Hinge Kit:

a. Aluminum hinges.

b. Hinges and restraint cables mounted to base sleeve.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.

C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

D. Hung Cabinet Fans:

1. Install flexible connections specified in Section 23 33 00 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

E. Provide sheaves required for final air balance.

F. Install backdraft dampers on inlet to roof and wall exhausters.

G. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

3.2 SCHEDULES

A. Drawing Code: See plan Schedule.

B. Air Flow Capacity: See plan Schedule.

C. Static Pressure: See plan Schedule.

D. Motor hp:

1. Electrical Characteristics: See plan Schedule.

E. Accessories:

1. See plan Schedule.

END OF SECTION

SECTION 23 34 33

AIR CURTAINS

PART 1 -GENERAL

1.1 SUMMARY:

A. Air curtains.

1.2 DEFINITIONS:

A. For convenience purposes a few definitions are indicated herein. All capacities, ratings and other specified and scheduled air curtain criteria are based on these definitions.

1. Air Curtain: An air moving device which produces a directionally-controlled airstream, moving across the entire height and width of an opening.

2. Unit Airflow Rate: The airflow volume which leaves the discharge nozzle, at standard air conditions, and reported in CFM.

3. Average Outlet Velocity: The airflow rate produced by the air curtain divided by the cross sectional area of the discharge nozzle plane at free-air delivery, and reported in FPM.

4. Outlet Air Velocity Uniformity: An indicator of the consistency of air velocities across the air curtain width, expressed as a percentage.

5. Air Discharge Angle: The angle between the plane of the protected opening and the direction in which the air stream leaves the discharge.

1.3 SYSTEM DESCRIPTION:

A. An air curtain is an air moving device which produces a directionally-controlled airstream, moving across the entire height and width of an opening.

1.4 SUBMITTALS:

A. Submittals are required to show full compliance with the contract documents.

B. Indicate each air curtain tag/mark number on the submittal as applicable.

C. Product Data:

1. Product Data must have the specific Contract Document air curtain mark/tag on each submittal with all information associated with each unit clearly identified.

Where information does not apply to the product being provided then such information must be marked off on the submittal.

2. Rated capacities showing compliance with Contract Document requirements scheduled on drawings. Capacities including but not limited to: Airflow (CFM), discharge velocity (FPM), noise rating (dBA), motor quantity and horsepower, electrical ratings (FLA, volts/phase/hertz), outlet velocity uniformity (%), unit assembly weight (lbs).

3. Mechanical Drawings.

4. Wiring Diagrams.

5. Standard product features.

6. Optional product features and accessories.

1.5 SHOP DRAWINGS:

A. Provide drawings showing air curtain assembly and parts.

B. Wiring Diagrams: Power, signal, and control wiring. The wiring diagram must indicate a clear distinction between manufacturer's factory furnished and installed wiring, and contractor furnished and installed wiring for all power, signal and control wiring and accessories.

C. Installation Instructions: Manufacturer's installation instructions with diagrams, instructions and manufacturer's contact information.

D. Operation and Maintenance Data: Complete documentation of manufacturer's recommended operation and maintenance procedures for the air curtain including commissioning procedures.

E. Manufacturer's Warranty statement for products and parts.

F. Contractor's Warranty statement for repair and replacement of products and parts.

1.6 QUALITY ASSURANCE:

A. The Contract Document Drawings and Specifications indicate the "basis-of-design" manufacturer, model, size, profiles, and dimensional requirements of air curtains.

B. Comply with NFPA 70 - National Electrical Code.

C. Hot Water/Steam coils certified to ARI standard 410.

D. ETL Listed (Tested in accordance with UL 1995, 4th Edition, dated October 14, 2011 including revisions through October 3, 2014 and CSA C22.2 No. 236-11, 4th Edition, dated October 14, 2011 including revisions through October 3, 2014).

1. Comply with all applicable ordinances, codes and standards as required by the authorities having jurisdiction.

2. All units tested in accordance with ANSI/AMCA 220. Unheated units shall bear AMCA Seal for Performance.

1.7 COORDINATION:

A. Coordinate layout and installation of air curtains, mounting system and all components associated with the air curtains with other construction.

B. Notify the architect/engineer of any coordination conflicts prior to installation of the air curtain or other associated parts and accessories so that the installation can be coordinated prior to installation. Any installation that is commenced or completed without coordination is subject to rejection of the work and must be redone as required to meet the intent of the contract documents.

1.8 WARRANTY:

A. Provide manufacturer's standard warranty for replacement of parts for a period of (24 months for unheated units and 18 months for heated units) from the time of shipment from the manufacturer. The warranty must cover all parts, components, accessories, etc. provided with the air curtain whether or not the parts, components or accessories are the direct product manufactured by the air curtain manufacturer.

PART 2 -PRODUCTS

2.1 MANUFACTURERS:

A. Aire.

B. Substitutions: See Section 23 01 00 - General HV AC Provisions.

2.2 EQUIPMENT BASIC DESCRIPTION – BASIS-OF-DESIGN

A. A. Each unit consists of a factory assembled casing, centrifugal fans, slotted grill, discharge nozzle, motor(s), and access panels for motor and fan assembly. Additional accessories as specified. The air curtain provides a specific CFM and a uniform outlet velocity across the entire length of the discharge nozzle area. A remote or unit mounted Nema 12 control panel will be provided.

2.3 CASING:

A. Housing Materials: Bottom intake slotted grill shall be painted steel. Other casing shall be galvanized steel.

B. Unit Support: Integral to the unit frame or casing. All weight bearing structural support shall be formed galvanized steel. Units shall be furnished in single increments of sufficient structural strength to be supported from the top per manufacturer's instructions.

2.4 AIR DISCHARGE NOZZLE

A. Discharge nozzle shall be high efficiency discharge plenum. Air curtain creates a positive air seal with directional air foil vane. The vane shall facilitate a deflection of the air stream by +/- 20 degrees.

2.5 FANS

A. Wheels: Galvanized forward curved centrifugal type, double inlet design, with zinc plated hubs.

B. Drives: Direct Drive. Belt Drive Not Acceptable.

2.6 MOTORS:

A. Type: Open Drip Proof (ODP), resiliently mounted, continuous duty, air over with integral thermal-overload protection.

B. Bearings: Heavy duty type permanently lubricated, shielded ball bearings of equal size.

2.7 ELECTRIC HEAT:

A. Description: Factory mounted electric heating elements. The heater shall consist of factory wired heating coil.

1. Heating elements shall be mounted inside the air curtain plenum on the discharge side of the blowers.

B. Heating Element: Helical coil with point suspension of elements.

C. Power Supply: Single point [multi-point] power connection and control wiring to the air curtain.

D. Heater Casing: Galvanized steel.

E. Protection: Automatic reset thermal overloads and contactor interlock.

F. Electric Heater Controls: See ACCESSORIES

2.8 STEAM HEAT

A. Description: Factory mounted steam coil. The coil shall be mounted to the intake of air curtain.

B. Steam and Condensate Piping Connections: Threaded

C. Tubes: Copper, complying with ASTM B 75.

D. Tube Diameter: 0.625 inch. O.D.

E. Fin and Tube Joint: Mechanical bond

F. Headers: Seamless copper tube with brazed joints.

G. Ratings: According to ARI standard 410.

H. Working-Pressure Ratings: 200 psig, 325 degrees Fahrenheit.

I. Source Quality Control: Coils shall be tested at 550 psig using dry nitrogen, submerged under water. Dual-operator verification shall determine that all coils are leak-free.

J. Coil Connections: [Left Hand Supply, Right Hand Supply, Left Hand Return, Right Hand Return]

K. Valves and Valve Controls by contractor.

2.9 FILTERS

A. A. Filter Type: ½" thick cleanable.

B. ACCESSORIES

1. (Optional Features-If desired please include on schedule) (The air curtain must be interlocked with the door, this could be by a door switch, through a dry contact in the door controller or by other means.)

2. Automatic Door Switch: Remotely installed in the door area to activate the unit each time the door opens and deactivate the unit each time the door closes. [Roller/plunger, Magnetic]

3. Disconnect: panel mounted, non-fused.

4. Adjustable Time Delay: Integral part of the unit, only used with an automatic door switch. Air curtain to operate until specified time (adjustable 1 to 100 seconds) after the door closes.

5. Hand/Off/Auto Switch: Acts as an override to the automatic door switch. In Hand position the air curtain is on, in Off position the air curtain is off, and in Auto position the air curtain runs via the automatic door switch. [panel mounted, remote mounted]

6. Thermostat: Controls electric heaters. [line voltage, low voltage], [panel mounted, remote mounted]

7. Heat On/Off Switch: Controls electric heaters. [panel mounted, remote mounted]

PART 3 -EXECUTION

3.1 EXAMINATION:

A. Examine the installation location where each air curtain will be installed to confirm that the installation location is in accordance with the Contract Documents and the Manufacturer's Installation Instructions.

B. If there are any concerns regarding the installation location with respect to any aspect of the installation or performance of the air curtain notify the architect/engineer in order to resolve the concern.

3.2 INSTALLATION:

A. Install each air curtain in accordance with the Installation Instructions provided by the manufacturer of the air curtain.

3.3 SYSTEM STARTUP

A. Startup each air curtain in accordance with the manufacturer's Operations and Maintenance Manual and Installation Instructions.

3.4 FIELD QUALITY CONTROL:

A. Perform the following field tests and inspections and prepare test reports:

1. After installing air curtains completely, perform visual and mechanical check of individual components.

2. After electrical circuitry has been energized, start unit to confirm motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Repair or replace malfunctioning units and retest as specified above.

3.5 ADJUSTING:

A. Adjust air-directional vanes.

3.6 CLEANING:

A. Clean the outside of each air curtain of any dirt, debris, grease, grime or other material.

B. Clean the inside of each air curtain of any dirt, debris, grease, grime or other material as necessary to ensure proper operation. Remove any loose debris that may be of harm to the air curtain operation.

C. Remove, clean and reinstall the cleanable air filters, if provided.

3.7 DEMONSTRATION:

A. Contractor to instruct the Owner's maintenance personnel on how to adjust, operate, and maintain air curtains.

END OF SECTION

SECTION 23 36 06

AIR TERMINAL UNITS - VARIABLE VOLUME

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Variable air volume (VAV) terminal units.

B. Bypass variable air volume terminal units.

C. Integral damper motor operators.

D. Terminal unit controller.

E. Central network controller.

F. Zone thermostat.

1.2 RELATED SECTIONS

A. Section 23 05 93: Testing, Adjusting, and Balancing.

B. Division 26: Equipment wiring systems. Electrical supply to units.

1.3 SYSTEM DESCRIPTION

A. This Section Provided for Reference Only. Equipment is to be provided directly by owner through a national buying agreement.

B. The changeover/bypass VAV system shall provide temperature control of multiple comfort zones through the use of a constant volume single-zone HVAC unit. Variable air volume control shall be provided for each zone to maintain zone temperature within the heating/cooling setpoints. The system shall monitor the temperature and setpoints of the zones and automatically change the heat/cool mode of the HVAC unit to satisfy zone requirements. The system shall maintain airflow through HVAC unit by bypassing air from the supply to the return duct. Bypass air is modulated based upon system monitoring of supply air velocity.

C. The changeover/bypass VAV system shall have all ancillary devices, sensors and operating parameters viewable and editable from a central system panel or from a computer communicating either directly or remotely with the central system panel.

D. The control system shall be designed as indicated on the drawings and described in the specifications.

E. Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of mechanical systems on this project.

1.4 SUBMITTAL

A. Submit unit performance data including: capacity, nominal and operating performance.

B. Submit Mechanical Specifications for unit and accessories describing construction, components and options.

C. Submit shop drawings indicating overall dimensions as well as installation, operation and service clearances. Indicate lift points and recommendations and center of gravity. Indicate unit shipping, installation and operating weights including dimensions.

D. Submit data on electrical requirements and connection points. Include recommended wire and fuse sizes or MCA, sequence of operation, safety and start-up instructions.

1.5 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing VAV products of the type specified in this section with minimum 15 years documented experience.

1.6 SYSTEM RESPONSIBILITY

A. The entire changeover/bypass system, including VAV terminal units, direct digital controls and Building Automation System shall be furnished by a single manufacturer who shall be responsible for the entire system. Acceptable manufacturers may either be the variable air volume terminal unit or temperature control manufacturer, but must bear sole responsibility for the system.

1.7 OPERATION AND MAINTENANCE

A. Include manufacturer's descriptive literature, operating instructions, and maintenance data.

1.8 SYSTEM RESPONSIBILITY

A. The entire changeover/bypass system, including VAV terminal units, direct digital controls and Building Automation System shall be furnished by a single manufacturer who shall be responsible for the entire system. Acceptable manufacturers may either be the variable air volume terminal unit or temperature control manufacturer, but must bear sole responsibility for the system.

1.9 WARRANTY

A. Provide a full parts warranty for one year from start-up.

B. All warranties to begin at Date of Substantial Completion as accepted by the Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Trane.

B. Substitutions: See Section 23 01 00 - General HVAC Provision.

2.2 MANUFACTURED UNITS

A. Zone controls are ceiling mounted variable air volume supply air control terminals for connection to low pressure duct. VAV terminal units shall be networked to a central controller, which, based on the multiple zones comfort requirements, provides a staged "heat" or "cool" decision to be used by the building air conditioning unit. A variable air volume bypass air control terminal shall modulate to maintain a minimum air flow across the air conditioning unit.

B. The systems controls shall be a dedicated direct digital microprocessor based control system with multi-level distributed microprocessing. System controls shall be designed for use exclusive to zone temperature and changeover/bypass control. General purpose or generic controls are not acceptable.

2.3 FABRICATION

A. Casings: Units shall be completely factory-assembled, manufactured of rolled and seam welded 18 gauge galvanized steel. Discharge end shall be crimped to fit standard round ductwork. Casings shall be available in the following inlet and outlet diameter sizes: 6", 8", 10", 12", 14", 16".

2.4 VOLUME DAMPER

A. Damper blade shall be constructed of 22 gauge galvanized steel.

B. Damper blade shall have aerodynamically designed edges to provide seal tight operation at full closure without gasketing and vibration free operation at open positions.

C. Damper blade shall be round and shall modulate a full 90 degrees from open to close.

2.5 WIRING

A. Factory mount and wire VAV terminal unit controls. Mount electrical components in terminal unit control box with removable cover.

B. Provide industry standard 1/4" male spade connectors on terminal unit controller for field wiring of thermostat, communications and power source.

C. All wiring shall comply with local and national electric codes and the manufacturer's published installation manual.

D. Provide terminal strips in central controller for field wiring of air conditioning unit input connections, duct temperature sensor, duct pressure sensor, communications, time clock, bypass damper motor and power wiring.

2.6 CONTROLS

A. Electric damper actuator: 24 VAC with end switches to eliminate actuator motor stall conditions.

B. Zone thermostat

1. Zone thermostat shall be a sensor with thumbwheel setpoint adjustment, night setback override and cancel buttons, and a communications jack.

   a. The zone sensor shall have the capability of manually overriding the unit controller to the continuous unoccupied mode.

   b. The zone sensor shall have the capability of manually overriding the unit controller to the maximum flow position.

2. Zone thermostat shall be simple, and easy to use. If programming or editing of parameters at zone thermostat is required, customer training must be provided.

C. Variable air volume (VAV) terminal unit controller.

1. The VAV terminal unit controller shall be a microprocessor based, direct digital controller and shall contain the control logic required to modulate the flow of primary air through the terminal unit in response to the difference between zone temperature and the appropriate setpoint. The control algorithm shall be proportional integral.

2. All VAV terminal unit controller setpoints and operating parameters shall be stored in non-volatile electronic memory. Battery back-up is not acceptable.

3. All VAV terminal unit controllers will come with factory-programmed setpoints and operating parameters, or have default settings capable of providing typical operating control on power-up.

4. The VAV terminal unit controller shall be field or factory configurable to function as an auto-changeover device, or as an auto changeover device with remote heat control capability.

    a. The auto-changeover terminal unit controller shall control damper position, and therefore primary air flow, in response to the difference between zone temperature and the appropriate set point. The terminal unit controller shall be capable of operating as a cool supply air controller or to "changeover" and operate as a warm supply air controller.

    b. The terminal auto-changeover unit controller configured for remote heat control shall control damper position, and therefore primary air flow, in response to the difference between zone temperature and the appropriate set point. The terminal unit controller shall be capable of operating as a cool supply air controller or to "changeover" and operate as a warm supply air controller. Additionally, the terminal unit controller shall be capable of controlling local heat, remote from the air conditioning unit heat, in response to a difference between zone temperature and the appropriate setpoint.

    c. The terminal unit controller configured to control remote heat shall be capable of allowing simultaneous remote heat and HVAC unit heat, or disabling remote heat when HVAC unit heat is being provided.

    d. The terminal unit controller shall be equipped with 24 VAC triac output(s) to energize remote heat. The triacs shall be configurable to function as normally open or normally closed outputs. If only a contact closure is available to enable remote heat, additional relay power wiring must be provided.

    e. The terminal unit controller shall be configurable to control various types of remote heat. These types of remote heat are to include 1-3 stages electric heater control.

D. Central Controller

1. The central controller shall exchange information with each terminal unit controller. The information shall be electronically encoded and serially transmitted on single twisted pair communication link.

2. The central controller shall send setpoints and override instructions to the terminal unit controller. The terminal unit controller shall send operating status and configuration information to the central controller.

3. The central controller shall be capable of communicating and operating with any configuration of manufacturer's DDC VAV terminal unit product, including fan powered reheat and pressure independently controlled units.

4. The central controller shall communicate with up to 16 terminal unit controllers.

5. The central controller shall scan the terminal unit controllers to determine deviations from temperature setpoint, time of deviation, time from last changeover and number of terminal unit controllers requiring heating or cooling. Based upon this information, the system heat/cool mode and stage of capacity shall be determined.

6. The central controller shall be capable of excluding a zones request for cooling or heating if that zone remains more than 3 degrees from setpoint for a period of 60 minutes.

7. The central controller shall monitor the system supply air temperature to ensure that high and low temperature limits are maintained. The temperature limits shall be editable values.

8. The central controller shall modulate the position of the bypass damper based on a supply air duct pressure input, to maintain a minimum air flow rate through the air conditioning unit. Bypass damper position and setpoints shall be available for monitoring and editing at the central controller. If bypass damper information is not available at central controller, additional equipment must be provided which will allow monitoring and editing bypass damper parameters at central controller.

    a. The duct pressure sensor shall be field convertible to sense supply duct velocity or static pressure. The central controller shall be capable of modulating the position of the bypass damper based on a supply duct velocity or static pressure input as installed.

9. All central controller setpoints and operating parameters shall be stored in non-volatile electronic memory within the central controller or transmitted to each terminal unit controller for storage in non-volatile electronic memory. Battery back-up is not acceptable.

10. The central controller shall be capable of accepting time clock input to determine occupied or unoccupied setpoint mode of operation.

11. Central controller shall be configurable as either an air conditioning unit controller or a heat pump controller.

12. The central controller shall be capable of local or remote interface via RS-232 port for an electronic display and keyboard terminal. Electronic display and keyboard terminal shall allow monitoring and editing of all central controller setpoint and operating parameters and terminal unit controller setpoint and operating parameters.

13. The central controller shall not require electronic display and keyboard terminal for system start-up and normal operation.

14. The central controller shall be capable of issuing override commands to the terminal unit controller. Override commands shall be used by the terminal unit controller to change the criteria by which the actuator and the terminal unit heat outputs are controlled. The central controller shall be capable of issuing the following override commands:

    a. Drive terminal unit damper to maximum position.

    b. Drive terminal unit damper to minimum position.

    c. Drive terminal unit damper to fully closed.

    d. Drive terminal unit damper to fully open.

    e. Disable terminal unit remote heat.

15. The central controller shall be capable of resetting the terminal unit minimum position setpoint for purposes of increasing ventilation to the space whenever the HVAC unit has no heating or cooling stages energized.

16. The central controller shall be capable of assigning terminal unit controllers into groups. Grouping shall allow for acquiring group status information and executing override commands to all unit controllers within a group at one time.

17. The central controller shall be capable of monitoring and editing the following setpoints which reside in the terminal unit controller:

    a. Occupied cooling setpoint (45-95 F).

    b. Occupied heating setpoint (45-95 F).

    c. Unoccupied cooling setpoint (45-95 F).

    d. Unoccupied heating setpoint (45-95 F).

e. Minimum position setpoint (0-100%).

f. Maximum position setpoint (0-100%).

g. Minimum heating position setpoint (0-100%).

18. The central controller shall be capable of reporting the following terminal unit controller status information:

    a. Active cooling temperature setpoint.

    b. Active heating temperature setpoint.

    c. Current terminal unit damper position.

    d. Current zone temperature.

    e. Terminal unit remote heat status.

    f. Occupied/Unoccupied mode.

19. The central controller shall be capable of monitoring and editing the following terminal unit controller configuration information:

    a. Unit identification.

    b. Enable/disable zone thermostat setpoint thumbwheel.

    c. Set high/low limits on zone thermostat setpoint thumbwheel.

    d. Set zone thermostat setpoint thumbwheel deadband from 2-10 degrees.

    e. Enable/disable zone request for heating or cooling.

    f. Calibration (-10 to +10 degrees) of zone thermostat temperature sensor, zone thermostat setpoint thumbwheel, and auxiliary temperature inputs.

20. The central controller shall be capable of reporting the following system status information:

    a. System type (air conditioning unit or heat pump).

    b. Mode of operation (occupied or unoccupied).

    c. Operating status (heat or cool).

    d. Supply air temperature.

e. Supply air duct static pressure in inches W.C.

f. Position of bypass damper.

g. System fan status (on or off).

h. Stages of cooling (on or off).

i. Stages of heating (on or off).

21. The central controller shall be capable of monitoring and editing the following system configuration information:

    a. System identification.

    b. Supply air high temperature limit.

    c. Supply air low temperature limit.

    d. Supply air minimum flow or static pressure setpoint.

    e. Required heat/cool calls required for changeover.

    f. Energy saver mode of operation.

    g. Ventilation mode of operation.

    h. Unoccupied terminal unit damper position.

22. Central controller shall be capable of interface via serial communications link with higher end building automation system.

E.

Remote Operators Panel: The central controller shall have a digital operators panel to provide monitoring and control of terminal unit controllers from one location. Multiple central controllers can be linked to one operators panel.

1. The operators panel shall have an LCD display screen to display system information, and an integral keypad for system control.

2. The panel shall allow the operator to enter the occupied and unoccupied heating and cooling setpoints for each terminal unit controller connected to the system. Setpoints shall be stored in non-volatile memory and maintained during a power outage without the use of batteries.

3. The operators panel shall have time-of-day scheduling capability. Scheduling shall be two on/off periods per day for each of the seven week days, plus exception and holiday schedules. Schedules shall be stored in non-volatile memory and maintained during a power outage without the use of batteries. The terminal unit controllers shall be scheduled by group.

4. The operators panel shall have:

    a. Automatic implementation of daylight saving time and leap year.

    b. 24 holiday dates.

    c. Timed override capability for groups of terminal unit controllers.

    d. Optimal start.

    e. The ability to display temperature and system failure alarms.

    f. An alarm log of the last 32 alarm events.

    g. Password protection.

    h. Auto log-off.

5. The operators panel shall have an internal modem. All system status and operating parameters shall be accessible via modem communication from a remote location. The operators panel shall have the ability to automatically dial out alarm status information to a remote modem device.

6. The central controller shall have the capability of directly controlling the operation a packaged rooftop unit with a factory installed microprocessor control board. The central controller and the roof top control board shall be capable of sharing data and control modes over a single pair of wires via a communications board mounted in the unit. The central controller shall automatically recognize and communicate with the roof top unit on the communications link.

F. Failure modes of operation

1. The central controller shall accommodate the following failure conditions:

    a. Supply air velocity sensor failure: The central controller shall drive the bypass damper to 25 percent open position (editable), and allow the terminal units to function normally. The failure shall be reported at the central controller status display.

b. Supply air temperature sensor failure: The central controller shall disable the supply fan and all stages of heating and cooling. The bypass damper shall be driven to 50 percent open, and terminal unit dampers shall be driven to maximum position. The failure shall be reported at the central controller status display.

c. Communication failure: The central controller shall disable all stages of heating and cooling and the supply fan, and drive the bypass damper to 50 percent open if the central controller receives no response from the terminal unit controllers.

2.7 TESTS

A. Velocity sensor component, pressure transducer, must pass a voltage stability test, executed over a period of time of four days to assure accuracy and repeatability of voltage output to 1% of operational range.

B. Manufacturer shall download all setpoints at factory for unit control.

C. Manufacturer shall 100% functionally test unit controller at factory when fabrication of equipment is complete. The test shall assure successful operation of damper stroke, sensor inputs and communications.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturers instructions.

B. Support units individually from structure. Do not support from adjacent ductwork.

PART 4 SEQUENCE OF OPERATION

4.1 VARITRAC (CHANGEOVER-BYPASS VAV ZONING)

A. UCM Control

1. The microprocessor-based UCM continuously monitors zone temperature, damper position, and zone setpoints. A proportional plus integral (PI) control loop maintains heating and cooling setpoints by positioning the damper for the proper airflow to meet load requirements. Maximum and minimum position setpoints limit airflow.

2. Heat/Cool Mode Decision for UCM

a. The heat/cool control action is determined by the central control panel and sent to the unit control module. System supply air is compared to individual zone temperatures and setpoints.

3. Heat/Cool Mode of Operation

   a. If the supply air temperature is less than or equal to the zone temperature, the control mode is Cool. If the supply air temperature is greater than or equal to the zone temperature +10°F, the control mode is Heat. If the supply air temperature is between the zone temperature and the zone temperature +10°F, the control action is selected that drives the damper to the lowest position.

4. Local Heat Control

   a. There are three local-heat outputs available to control duct or perimeter heat. Local heat type selection determines the heating control algorithm. Choices are:

      1) None: No local heat is being controlled.

      2) 1-3 Stages electric: Up to three stages of local electric heat are controlled by space demand.

      3) Slow pulse-width modulation: Pulse-width modulation energizes and electric heat output for some portion of a 3-minute time window.

      4) Proportional hot water and auxiliary output: Two flowing outputs position a proportional hot water valve for local heat. A second on/off hot water stage is available if necessary.

      5) 1-3 Stages hot water/perimeter: Up to three stages of local hot water heat are controlled by space demand.

   b. The heating action of the unit when the central control panel is in the heating mode and the local heat is configured as one of four local heat types is as follows.

      1) 1-3 Stages electric: Heat is disabled.

      2) Slow pulse width modulations: Heat is disabled.

      3) Proportional hot water and auxiliary output: Heat remains enabled.

      4) 1-3 Stages hot water/perimeter: Heat remains enabled.

c. Priority Local Heat

1) If priority local heat is edited:

(a) YES: The UCM controls the local heat to the appropriate heating setpoint with local heat first. If the space temperature falls 1°F below the zone heating setpoint, a call for heat is generated.

(b) NO: The UCM first calls for heat from the air-handling unit. If the space temperature drops 1°F below the heating setpoint, the UCM controls to setpoint with local heat.

(c) Priority local heat is enabled via occupied priority local heat and unoccupied priority local heat in the PC Software.

5. Occupied/Unoccupied Mode

a. During occupied operation, damper unit controller controls to the zone sensor setpoint knob or its internal programmed setpoints. The zone sensor setpoint knob indicates the cooling setpoint. The heating setpoint is offset below the cooling setpoint by 2°F. This value may be edited from 2 to 10°F in the PC software. If the zone sensor setpoint knob is disabled or failed, the UCM controls to its internal programmed occupied setpoints. The factory defaults of 74°F cooling and 70°F heating may be edited from the operator display and PC software. During unoccupied operation, the UCM controls to the programmed unoccupied setpoints. The factory defaults of 85°F cooling and 60°F heating, may be edited from the operator display and PC software.

6. Drive to MAX

a. A UCM may be overridden to maximum position from the zone sensor, operator display, and PC software. The factory default of 100% may be edited from the operator display and PC software.

7. Override to Unoccupied

a. A UCM can be overridden to continuous unoccupied from the zone sensor, operator display, and PC software.

4.2 CHANGEOVER-BYPASS VAV FUNCTIONS

A. Priority Shutdown

1. The VAV system controller has priority shutdown capability. A building automation system command, external contact closure, discharge air temperature

sensor failure, or communication failure (no UCM's communicating) initiates priority shutdown. Priority shutdown initiates the following control actions:

a. All states of heating and cooling are disabled (minimum ON time not enforced).

b. The main supply air fan is turned OFF (minimum ON time not enforced).

c. All damper unit control local heat is disabled.

d. All damper unit control dampers are driven to MAX.

e. The system returns to normal operation when the priority shutdown condition is corrected.

B. Demand Ventilation Control

1. The central control panel may perform demand ventilation. The outdoor air damper position is reset in response to a demand ventilation (CO2 concentration) signal supplied by a sensor connected to the UCMs. The signal is the highest reported zone demand signal or any one specific zone demand signal. Outdoor air dampers are reset in a proportional manner.

C. Group Functions

1. The central control panel allows UCM unit callers to be grouped. The following functions are supported:

a. Group Timed Override: If the timed override button on a sensor is pressed, all UCMs of that group go to occupy mode.

b. Group Overrides: The central control panel has the ability to override several UCM functions as a group. The following group commands are issued:

1) Occupied/Unoccupied: The group can be set to Auto which follows the time-of-day schedule, or overridden to Continuous Occupied or Continuous Unoccupied mode.

2) Flow Control: The group can be set to Auto, which follow temperature vs. setpoint demand or overridden to Continuous Open, Closed, Minimum, or Maximum.

3) Local Heat: Local zone heat may be set enabled or disabled.

4) Enforce Minimum while Unoccupied: Selecting Yes enforces damper unit controller minimum positions during unoccupied mode. Selecting

No allows the dampers to close completely during unoccupied mode.

5) Energy Saver Model: Energy saved mode allows damper unit controllers to close below their minimums if a zone is in the cooling mode and has a zone temperature lower than the active heating setpoint, or in the heating mode and has a zone temperature greater than the active cooling setpoint.

6) Ventilation Mode: This mode allows damper unit controller dampers to open for greater ventilation when the group is occupied and the air conditioning system is in a zero energy state (no stages of heating or cooling are energized) for more than four minutes. Ventilation mode multiplies the active minimum damper position setpoint by four.

END OF SECTION

SECTION 23 37 00

AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sqaure ceiling diffusers.

B. Security Grilles.

C. Registers/grilles.

1. Ceiling-mounted, egg crate exhaust and return register/grilles.

1.2 REFERENCE STANDARDS

A. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2017 (Reaffirmed 2023).

B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets; 2023.

1.3 SUBMITTALS

A. See Section 23 01 00 - General HVAC Provisions, for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. Project Record Documents: Record actual locations of air outlets and inlets.

1.4 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum five years of documented experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Air Devices, Inc.

B. Carnes Company HVAC.

C. Krueger.

D. Nailor.

E. Price Industries.

F. Ruskin.

G. Titus.

H. Tuttle-Bailey.

I. Substitutions: See Section 23 01 00 - General HVAC Provisions.

2.2 SQAURE CEILING DIFFUSERS

A. Type: Provide high performance 3-cone diffuser diffuser to discharge air in 360 degree pattern .

B. Frame: Surface mount, inverted T-Bar type. In plaster ceilings, provide plaster frame and ceiling frame.

C. Fabrication: Steel or aluminum as indicated on drawings with baked enamel finish.

D. Color: As shown on drawings.

E. See Air Distribution Schedule on drawings for details and accessories.

2.3 SECURITY SUPPLY CEILING DIFFUSERS

A. Type: Provide minimum security diffuser to provide fixed, horizontal discharge pattern .

B. Frame: Tamper proof scews.

C. Fabrication: Steel or aluminum as indicated on drawings with baked enamel finish.

D. Color: As shown on drawings.

E. Accessories: Opposed blade volume damper shall be constructed of heavy gauge steel. Damper must be operable from the face of the diffuser by removing the spring loaded inner core assembly.

F. See Air Distribution Schedule on drawings for details and accessories.

2.4 CEILING RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 1/2 inch minimum depth, 1/2 inch maximum spacing, with blades set at 45 degrees, horizontal face.

B. Frame: Surface mount, inverted T-Bar type. In plaster ceilings, provide plaster frame and ceiling frame.

C. Fabrication: Steel or aluminum as indicated on drawings with baked enamel finish.

D. Color: As shown on the drawings.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans, where indicated on plans.

F. See Air Distribution Schedule on drawings for details and accessories.

2.5 SECURITY RETURN/EXHAUST CEILING DIFFUSERS

A. Type: Provide minimum security diffuser with 13/16" inch sqaure holes on 1-inch centers. .

B. Frame: Tamper proof scews.

C. Fabrication: Steel or aluminum as indicated on drawings with baked enamel finish.

D. Color: As shown on drawings.

E. See Air Distribution Schedule on drawings for details and accessories.

2.6 CEILING GRID CORE EXHAUST REGISTERS/GRILLES

A. Type: Fixed grilles of 1/2 x 1/2 x 1/2 inch louvers.

B. Fabrication: Aluminum with factory baked enamel finish.

C. Frame: Channel lay-in frame for suspended grid ceilings.

D. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face, where indicated on plans.

E. See Air Distribution Schedule on drawings for details and accessories.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black.

F. Provide minimum 6" deep plenum box on back of all return and exhaust grilles.

3.2 SCHEDULES

A. Air Outlet and Inlet Schedule

1. Drawing Code: Refer to plan schedule.

2. Manufacturer: As scheduled on drawings.

3. Model: As scheduled on drawings.

4. Description: As scheduled on drawings.

5. Finish: As scheduled on drawings.

6. Service: As scheduled on drawings.

7. Mounting: As scheduled on drawings.

8. Accessories: As scheduled on drawings.

END OF SECTION

SECTION 23 38 12

COMMERCIAL-KITCHEN HOODS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Kitchen ventilation hood.

1.2 RELATED SECTIONS

A. Section 23 07 13 - Duct Insulation.

B. Section 21 13 02 - Fire Suppression Equipment - Kitchen Hood.

C. Section 23 31 00 - Ducts.

D. Section 23 34 23 - HVAC Power Ventilators.

1.3 REFERENCES

A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

B. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2003.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems

E. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems

F. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; National Fire Protection Association; 2008.

1.4 SYSTEM DESCRIPTION

A. Hood:

1. Provide Captive-Aire model ND with PSP Accessory or equal compensating ventilator.

2. Kitchen ventilation hood(s) shall be of the Type I, full compensating canopy wall mounted group with the capability to replace 80% of the exhausted air with fresh outside air. Air shall be supplied through perforated panels in a manner that does

not interfere with the cooking operations beneath the hood(s). Perforated panels shall be located on the bottom of the plenum to ensure precise volume control and shall limit the throw to within several feet of the hood.

3. The hood(s) casing shall be constructed of a minimum of 18 ga. type 304 stainless steel. The hood(s) shall be constructed using the standing seam method for optimum strength. End panels shall have stamped vertical ribs, evenly spaced, to add additional strength and rigidity. All seams shall be welded liquid tight and all exposed internal welds shall be ground and polished to match the original surface of the metal. Lighter material gauges, alternate material types and finishes (400 series stainless steel, cold rolled steel, etc.) and non liquid tight welds (tack weld, spot weld, etc.) are not acceptable. All unexposed interior surfaces shall be constructed of a minimum 18 ga. corrosion resistant steel including, but not limited to ducts, plenum, and brackets.

4. The hood(s) shall include a filter housing constructed of the same material as the hood. The filters shall be aluminum (stainless steel or Teflon coated) baffle type, U. L. 1046 Classified, and in sufficient number and sizes to ensure optimum performance as specified by the filter manufacturer. The filter housing shall terminate in a pitched, full length grease trough which shall drain into a removable grease container.

5. Vaporproof, U. L. Listed incandescent (recessed incandescent, recessed fluorescent) light fixtures shall be prewired to a junction box situated at the top of the hood for field connection. Wiring shall conform to the requirements of the National Electrical Code (NFPA #70- Latest Edition).

6. They shall be U. L. Listed with fire damper with fusible link rating not to exceed 286 degrees F. They shall be built in accordance with National Fire Protection Association (NFPA) Bulletin #96, International Conference of Building Officials (ICBO), Southern Building Code Congress International (SBCCI), and bear the National Sanitation Foundation (NSF) Seal of Approval. The hood manufacturer shall provide, on request, the necessary data that confirms compliance with the code authorities listed above (NER report required). The hood volume shall be calculated utilizing a computerized thermal updraft velocity method.

7. Hood manufacturer shall supply complete computer generated submittal drawings including hood sections views(s) and hood plan view(s). These drawings must be available to the engineer and owner for their use in construction, operation and maintenance.

1.5 SUBMITTALS

A. See Section 23 01 00 - General HVAC Provisions, for submittal procedures.

B. Provide shop drawings of hood showing materials, weights, dimensions, connections, accessories and hanging information.

C. Certificates: Certify that products of this section meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

A. Perform in accordance with NFPA 96 standard, city of Neosho, Missouri.

1. Maintain one copy on project site.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of experience.

D. Products Requiring Electrical Connection: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.7 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

1.8 PROJECT CONDITIONS

A. Coordinate hood installation with size, location and installation of service utilities.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.9 WARRANTY

A. Correct defective Work within a one year period after Date of Substantial Completion.

B. Provide five year manufacturer warranty for hood.

C. All warranties to begin at Date of Substantial Completion as accepted by the Owner.

1.10 EXTRA MATERIALS

A. Supply one extra hood filter for Owner's use in maintenance of project.

1.11 MAINTENANCE SERVICE

A. Provide service and maintenance of hood for twelve months from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Captive-Aire Systems, Inc.

B. Greenheck.

C. Accurex.

D. Substitutions: See Section 23 01 00 - General HVAC Provisions.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that installation area is ready to receive hood and associated hardware.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with plans and specifications.

3.3 STARTING EQUIPMENT

A. Provide manufacturer's field representative to prepare and start equipment.

B. Adjust for proper operation within manufacturer's published tolerances.

C. Demonstrate proper operation of equipment to Owner's designated representative.

3.4 SCHEDULES

A. See Kitchen Ventilation Hood Information on drawings.

3.5 SPECIAL TESTING

A. Provide any special testing as required by local AHJ.

END OF SECTION

SECTION 23 40 00

AIR CLEANING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Disposable, extended area panel filters.

1.2 RELATED REQUIREMENTS

A. Division 26 - Electrical: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. AHRI 850 (I-P) - Performance Rating of Commercial and Industrial Air Filter Equipment; 2013 (Reaffirmed 2023).

B. ASHRAE Std 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.[CHOICE TEXT]

C. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017, with Addendum (2022).

1.4 PERFORMANCE REQUIREMENTS

A. Conform to Section 7.4.

1. Dust Spot Efficiency: Plus or minus 5 percent.

1.5 SUBMITTALS

A. See Section 23 01 00 - General HVAC Provisions, for submittal procedures.

B. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions and connection requirements.

C. Shop Drawings: Indicate filter assembly and filter frames, dimensions and connection requirements.

D. Manufacturer's Installation Instructions: Indicate assembly and change-out procedures.

E. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Filters: One additional set of each type and size of disposable panel filters to be installed at the time the building is conveyed to the Owner.

1.6 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 FILTER MANUFACTURERS

A. American Filtration Inc.

B. AAF International/American Air Filter.

C. Camfil Farr Company.

D. Substitutions: See Section 23 01 00 - General HVAC Provisions.

2.2 DISPOSABLE, EXTENDED AREA PANEL FILTERS

A. Media: UL 900 Class 1, pleated, lofted, non-woven, reinforced cotton and synthetic fabric; supported and bonded to welded wire grid by corrugated aluminum separators.

1. Frame: Cardboard.

2. Nominal size: to match equipment filter size requirements.

3. Nominal thickness: 2 inches.

B. Rating, per ASHRAE Std 52.1:

1. Dust spot efficiency: MERV 8.

2. Initial resistance at 500 FPM face velocity: 0.30 inch WG.

3. Recommended final resistance: 0.9 inch WG.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install air cleaning devices in accordance with manufacturer's instructions.

B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.

3.2 SCHEDULES

A. Air Filter Schedule

1. Refer to plan Equipment Schedule.

END OF SECTION

SECTION 23 55 34

ELECTRIC WALL HEATERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electric wall heaters.

1.2 RELATED REQUIREMENTS

A. Division 26 - Electrical.

1.3 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2002.

B. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association; 2006.

C. UL - Underwriters Laboratories Inc.

1.4 SUBMITTALS

A. See Section 23 01 00 - General HVAC Provisions, for submittal procedures.

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

C. Shop Drawings: Indicate assembly, required clearances, and locations and sizes of field connections.

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

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listing.

F. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.6 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 WARRANTY

A. All warranties to begin at Date of Substantial Completion as accepted by the Owner.

PART 2 PRODUCTS

2.1 UNIT HEATER MANUFACTURERS

A. Modine Manufacturing Company.

B. Sterling HVAC/Mestek Technology, Inc.

C. Reznor/Thomas & Betts Corporation.

D. Markel.

E. Indeeco.

F. Substitutions: See Section 23 01 00 - General HVAC Provisions.

2.2 ELECTRIC WALL HEATERS

A. Contractor shall supply and install heavy duty wall mounted forced air electric heaters of the wattage, voltage and phase as specified on the drawings. The heater shall so be designed to provide an even distribution of heated air to the space to be heated by drawing return air in the peripheral area of the heater across and through the element which shall then be discharged from the center section of the heater by means of an electric motor and axial flow fan blade

B. Heaters shall be surface mounted to extend no more than 5 3/4" from the finished wall.

C. Heater front shall withstand 10.8 ft. lbs. (324 poundals) impact and 400 lbs. static force applied to an 8 sq. in. area at center grille location with less than 1/16" permanent distortion. The combination return and supply grille assembly shall be constructed of 1/16" x 3/8" rounded edge horizontal steel louvers which shall be spaced for maximum opening of 1/4". Louvers shall be welded at every intersection to three evenly spaced 1/16" diameter vertical members and completely framed in a heavy gauge natural anodized Aluminum extrusion. Front assembly shall be attached to the chassis by hidden tamper-resistant (Allen-head) machine screws. All other parts shall be 16 Gauge steel Zinc coated, both sides finished in a high gloss or bronze colored baked powder coat finish.

D. Motor shall be a permanently lubricated unit bearing, totally enclosed shaded pole type with impedance protection. Motors shall operate at no more than 1400 RPM and shall be same voltage as the heater. A protective shield shall surround the motor to separate return air from heated air.

E. Heater shall have a rating as indicated on the drawings.

F. Element assemblies shall consist of two or three corrosion resistant steel sheathed type elements mechanically bonded to common corrosion resistant steel fins. Each sheathed element shall consist of helically coiled Nickel Chromium alloy resistant wire completely embedded in and surrounded by Magnesium Oxide, enclosed and wedged into corrosion resistant steel sheaths. Elements shall have 2" cold conductor pins extending into the sheath and shall have a density of no more than 60 Watts per inch.

G. Heaters shall be equipped with a "manual reset" thermal overload which disconnects elements and motor in the event normal operating temperatures are exceeded. For safety, if opened due to abnormal temperature, thermal overload shall remain open until manually reset. Automatic reset thermal overloads which allow the element to continue to cycle under abnormal conditions will not be accepted.

H. Heaters shall be ETL Listed.

2.3 ROOM THERMOSTATS

A. Manufacturers:

1. Honeywell.

2. Johnson Controls, Inc.

3. Siemens Building Technologies, Inc.

4. Substitutions: See Section 15010 - General Provisions.

B. Adjustable Room Thermostat: Low voltage, to control burner operation, and supply fan to maintain temperature setting. Include system selector switch (heat-off-cool) and fan control switch (auto-on).

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Verify that proper power supply is available.

3.2 INSTALLATION

A. Install in accordance with NFPA 90A and NFPA 90B.

B. Provide vent connections in accordance with NFPA 211.

C. Provide connection to electrical power systems.

3.3 SCHEDULES

A. Electrical Unit Heaters

1. Refer to plan Schedule.

END OF SECTION

SECTION 23 74 13

PACKAGED ROOFTOP AIR CONDITIONING UNIT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Packaged Rooftop Air Conditioning Units.

1.2 REFERENCES

A. UL 60335-2-40 - Standard for Safety, Household and Similar Electrical Appliances - Safety - Part 2-40.

B. AHRI 210 / 240 - Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment

C. AHRI 340 / 360 - Performance Rating of Commercial and Industrial Unitary Air-conditioning and Heat pump Equipment

D. ASHRAE 90.1 - Energy Standard for New Buildings Except Low-Rise Residential Buildings

E. California Administrative Code - Title 24

F. AHRI 270 (SI/I-P) or 370 Sound Rating of Outdoor Refrigeration and Air Conditioning Equipment, as applicable.

G. Gas-fired heaters shall comply with ANSI Z21.47 and 10 CFR Part 431 for Commercial Warm Air furnaces.

1.3 SUBMITTALS

A. Submit drawings indicating components, dimensions, weights and loadings, required clearances, and location and size of field connections.

B. Submit product data indicating rated capacities, weights, accessories, service clearances and electrical requirements.

C. Submit manufacturer's installation instructions.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data.

B. Include manufacturer's descriptive literature, start-up and operating instructions, installation instructions, and maintenance procedures.

1.5 HANDLING

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

B. Protect units from physical damage. Leave factory shipping covers in place until installation.

1.6 WARRANTY

A. Provide a full parts warranty for one year from start-up or 18 months from shipment, whichever occurs first (ALL EQUIPMENT).

B. OEM provides several Extended Warranty options to include:

1. Whole Units Parts Warranty (Year 2 plus)

2. Compressor Parts or Gas Heater Exchanger Parts Option

3. Whole Unit Labor Warranty (Year 1 plus)

4. Compressor Warranty Option

5. Refrigerant Warranty Option

1.7 MAINTENANCE SERVICE

A. All work on units shall be accomplished by OEM factory trained and authorized servicing technicians.

1.8 SUMMARY

A. The contractor shall furnish and install packaged rooftop air conditioning unit(s) as shown and as scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the conditions specified, scheduled or as shown on the contract drawings.

PART 2 PRODUCTS - GENERAL

2.1 MANUFACTURERS:

A. Trane.

B. Rheem Manufacturing Company/RUUD.

C. Daikin.

D. Carrier.

E. Substitutions: See Section 23 01 00 - General HVAC Provision.

2.2 CASING

A. Unit casing shall be zinc coated, heavy gauge, galvanized steel.

B. Weather resistant painted metal with galvanized substrate.

C. Meets ASTM B117, 672 hour salt spray test.

D. Removable single side maintenance access panels.

E. Exposed vertical panels and top covers in the indoor air section insulated with a cleanable foil-faced, fire-retardant permanent, odorless glass fiber material.

1. Base pan with no penetrations within the perimeter of the curb other than the raised 1-inch downflow supply/return openings to provide an added water integrity precaution, if the condensate drain backs up.

F. Base of the unit insulated with 1/8-inch, foil-faced, closed-cell insulation.

G. Unit base provisions for forklift and/or crane lifting on three sides of unit.

2.3 MICROCHANNEL COILS

A. Optimal heat transfer performance due to flat, streamlined tubes with small ports, and metallurgical tube to fin bond.

1. Reduce system refrigerant charge by up to 50 precent leading for better compressor reliability.

2. All-aluminum construction minimizes galvanic corrosion.

B. Strong aluminum brazed structure provides better fin protection.

1. Flat streamlined tubes more dust resistant and easy to clean.

C. Coils leak tested at the factory to verify the pressure integrity.

2.4 COIL GUARDS

A. Provides condenser coil protection.

2.5 COMPRESSORS

A. All units have direct-drive, hermetic, scroll type compressors with centrifugal type oil pumps.

B. Suction gas-cooled motor with voltage utilization range of plus or minus 10 percent of unit nameplate voltage.

1. Internal overloads shall be standard with scroll compressors.

C. Crankcase heaters shall be standard on all compressors.

D. 3-5 ton standard efficiency units shall have 1 stage of cooling. 3-5T high efficiency units shall have 2 stages of cooling. All 6-17.5 ton unit shall have 3 stages of cooling. All 20-25 ton units shall have 4 stages of cooling.

2.6 FILTERS

A. Standard 2-inch filters.

B. Optional 2-inch MERV 8 and MERV 13 filters.

2.7 FROSTAT™

A. Frostat shall be standard on all units.

2.8 GAS HEATING SECTION

A. Gas heating section includes a tubular heat exchanger in low, medium and high heat capacities and shall be made of corrosion-resistant aluminized steel tubes and burners.

B. Burner system shall have an induced draft combustion blower.

C. Heater uses a direct spark ignition (DSI) system and a flame sensor.

D. Units are designed for use with natural gas or propane (field-installed propane conversion kit).

2.9 INDOOR FAN

A. 3-5T standard eff and 3T high efficiency units shall have direct drive forward curve fan.

B. Where 3-5T includes variable speed compressors, supply fans shall be direct drive plenum with ECM motors.

1. All other models shall have direct drive plenum fans with ECM motors. Plenum fan shall be backward-curved fan wheel along with an external rotor direct drive variable speed indoor motor.

2. Plenum fan design – backward-curved fan wheel along with an external rotor direct drive variable speed indoor motor.

3. Supply fan speed adjustments can be made using the unit controller or using a manufacturer supplied app. The connection between the unit control and the app shall be Bluetooth.

C. Motors are electronically protected.

2.10 POWERED OR UNPOWERED CONVENIENCE OUTLET

A. Powered GFCI, 120V/15A, 2 plug, convenience outlet or unpowered GFCI, 120V/20A, 2 plug, convenience outlet shall be available.

B. Powered outlets must include a service receptacle disconnect. This outlet shall be powered from the line side of the disconnect or circuit breaker, and will remain powered when the disconnect or circuit breaker is in the open position.

2.11 STAINLESS STEEL DRAIN PAN

A. Optional factory installed, 304 stainless steel drain pan shall be available.

2.12 THROUGH-THE-BASE ELECTRICAL WITH DISCONNECT SWITCH

A. Optional 3-pole, molded case, disconnect switch with provisions for through-the-base electrical connections shall be available.

B. Disconnect switch installed within unit and shall be protected from outdoor elements.

C. Wiring shall be provided from the switch to the unit high voltage terminal block.

D. Switch shall be cULus recognized.

E. Provided disconnect switch does not satisfy the need for overcurrent protection. When disconnect switch is factory provided, overcurrent protection shall be provided by others.

2.13 ECONOMIZER

A. Economizer shall be available with or without barometric relief. It shall be fully modulating from 0 to 100 percent and shall include provision for a minimum position setting. Assembly also includes, preset linkage, wiring harness with plug, and spring

return actuator.

B. Barometric relief provides a pressure-operated, gravity-closing damper.

C. Barometric relief prevents entrance of outside air during the equipment off cycle.

D. Control options include dry bulb, differential dry bulb, reference enthalpy, or comparative enthalpy.

E. A standard discharge air sensor shall be included on all units with economizers.

2.14 VENTILATION OVERRIDE OPERATION

A. Unit can be set to transition up to 3 different pre-programmed sequences for smoke purge, pressurization, and exhaust.

2.15 LEAK DETECTION SENSORS

A. Unit shall be furnished with a leak detection system from the factory when a circuit refrigerant charge exceeds 3.91 lbs. The leak detection system shall consist of one or more refrigerant detection sensors. When the system detects a leak, the unit controller shall initiate mitigation actions.

PART 3 ACCESSORIES

3.1 ROOF MOUNTING CURB

A. Roof mounting curb shall be heavy gauge zinc coated steel with nominal two-inch by four-inch nailer setup. Supply/return air opening gasketing shall be provided. Curb shall ship knocked down for easy assembly. Channel shall be provided to allow for adjustment of return air opening location. Curb shall be manufactured to National Roofing Contractors Association guidelines.

3.2 ELECTRONIC ZONE SENSORS

A. Remote Sensor shall be available to be used for remote zone temperature sensing capabilities when zone sensors are used as Remote panels

B. Integrated Comfort System sensors shall be available with sensor only, sensor with timed override, and sensor with local temperature setpoint adjustment with timed override.

C. Humidity Sensor - Monitors the humidity levels in the space for 1) Humidification and/or 2) Modulating Hot Gas Reheat.

END OF SECTION

SECTION 23 74 38

PACKAGED ROOFTOP DIRECT FIRED KITCHEN HOOD MAKE-UP AIR UNIT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Kitchen hood make-up air unit.

1.2 RELATED SECTIONS

A. Section 23 07 13 - Duct Insulation: Duct Liner.

B. Division 26 - Equipment Wiring Systems: Electrical supply to units.

1.3 REFERENCES

A. ANSI/Z223.1 (NFPA 54) - National Fuel Gas Code.

B. ANSI Z 83.8 - Gas Unit Heaters.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.4 SUBMITTALS

A. See Section 23 01 00 - General HVAC Requirements, for submittal procedures.

B. Product Data: Submit schedule of equipment typically indicating sizes and number of units, including capacity data.

C. Shop Drawings: Submit drawings indicating components, assembly, dimensions, weights, required clearances, location and size of field connections.

D. Design Data: Submit product data indicating capacities, weights, specialties and accessories, electrical requirements and wiring diagram.

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

F. Submit operation and maintenance data.

1. Include manufacturer's descriptive literature, operating instructions, maintenance instruction and unit parts.

G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of documented experience and approved by manufacturer.

1.6 PROJECT CONDITIONS

A. Coordinate unit installation with size, location and installation of service utilities.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.7 WARRANTY

A. Correct defective Work within a one year period after Date of Substantial Completion.

B. Provide one year manufacturer's parts warranty.

C. Provide a 10-year non-prorated parts warranty on the heat exchanger, burners and draft hood assembly. Parts only.

D. All warranties to begin at Date of Substantial Completion as accepted by the Owner.

PART 2 PRODUCTS

2.1 PACKAGED ROOF TOP GAS AIR HANDLER

A. Manufacturers:

1. Accurex.

2. Reznor.

3. CaptiveAire.

4. Greenheck.

5. Econ-Air.

B. Substitutions: See Section 23 01 00 - General HVAC Provisions.

C. A direct-fired gas heating and ventilating unit(s), as indicated on the drawings shall be furnished. Unit(s) shall be tested in accordance with ANSI Standard Z83.4a-2001/CSA 3.7a-2001, and shall bear the ETL label. Orientation shall be horizontal, down or side discharge. Unit(s) shall be factory assembled, tested and shipped as a

complete packaged assembly, for indoor or outdoor mounting, consisting of the following:

1. Gas burner.
2. Centrifugal blower (forward-curved double width/double inlet).
3. Motor starter with thermal overload protection.
4. Motor and drive assembly.
5. Fuel burning and safety equipment.
6. Temperature control system.
7. Gas piping.

D. Housing: Unit housing shall be constructed of 20 gauge G-90 galvanized steel. The wall panels and roof panels shall be fabricated by forming double-standing, self-locking seams that require no additional support. The floor and wall panels shall be caulked air tight with a silicone caulk. All casing panels shall be attached with sheet metal screws or rivets, which can be removed to field service large components. The unit base shall be suitable for curb or flat mount. Housing construction should be suitable for outdoor or indoor installation. An observation port shall be located on the exterior of the unit for observation of the main flame and pilot flame. All controls, gas valves, modulating controls and electrical components shall be mounted within the burner vestibule. The burner vestibule shall be an integral part of the unit and not extend outside the exterior casing of the unit and not exposed to the main air stream. The vestibule full-size door shall provide easy access to controls and gas-train components. Blower door shall provide easy access to blower, motor and drives. Access doors shall be provided on both front and backside of unit providing full access to every part of the unit. Internal ridged board 1" x 1.5" foil face installation shall be installed on roof, walls and base of casing.

E. Base: The base shall be constructed of galvanized steel for improved rigidity. Base shall be structurally reinforced to accommodate the blower assembly and burner.

F. Blower: Blower(s) shall be forward-curved, centrifugal, Class I or II (depending on application requirements), double width, double inlet, constructed G-90 galvanized steel. Unit shall have a heavy-duty, solid-steel shaft. Wheels shall be balanced in two planes and done in accordance with AMCA standard 204-96, Balance Quality and Vibration Levels for Fans. The wheel blades shall be aerodynamically designed to minimize turbulence, increase efficiency and reduce noise. The wheel blades shall be securely attached to the wheel inlet ring. The wheel shall be firmly attached to the fan

shaft with setscrews and keys. The blower assembly shall be isolated from the fan structure with vibration isolators.

G. Motor and Motor Compartment: Motors shall be heavy-duty ball bearing type and furnished at the specified voltage, phase and enclosure. Motor mounting plate shall be constructed of heavy gauge galvanized steel and shall be designed to provide easy adjustment of the belt tension.

H. Shaft and Bearings: Shafts shall be precision ground and polished. Heavy duty, pre-lubricated bearings shall be selected for a minimum (L50) life in excess of 200,000 hours of operation at maximum cataloged operating speed. They shall be designed for, and individually tested, specifically for us in air handling applications.

I. Belts and Drives: Belts shall be oil and heat resistant, non-static, grip-notch type. Drives shall be cast type, precision machined and keyed, and secured attached to the fan and motor shafts. Fan operating speed shall be factory set using adjustable pitch motor pulleys. Blower drives shall be fully adjustable. All drives shall be a minimum of 2 grooves and 2 HP.

J. Burner: The gas burner shall be a direct-fired, draw-through type, sized to provide an output as indicated on the plans using natural gas. The burner shall burn over its entire length at all times when the system is in operation. The burner shall have non-clogging, 4302B stainless-steel combustion baffles attached to a ductile cast-iron gas-supply section with no moving parts to wear out or fail. The burner shall be capable of 92% combustion efficiency with a maximum turndown ratio of 30 to 1. The gas burner shall be furnished with a pilot package arranged so that the pilot flame lights the burner with instantaneous ignition. Pilot assembly includes a flame rod, spark rod and pilot, which is automatically ignited by a 6,000 volt ignition transformer. A flame-rod rectification system shall be used to prove pilot and main flame. Rear access doors or a removable lid will provide complete access to burner and pilot assembly. Burner profile plates shall be self-adjusting to operate across the complete CFM range of each model heater. Every unit shall be designed for Variable Air Volume capabilities.

K. All gas equipment should conform to local code requirements. All gas manifold components shall be piped and wired at the factory. Components include: pilot gas shut-off valve, pilot gas regulator, pilot gas valve, main gas shut-off valve, main gas regulator, two solenoid valves, modulating gas valve, burner and high gas pressure regulator.

L. Line and manifold pressure gauges come standard on the unit and are installed at the factory before shipment. The line pressure gauge will ensure proper pressure from the incoming gas line and is capable of measuring from 0 to 35" w.c. The manifold

pressure gauge is installed after the combination gas valve to ensure proper pressure into the burner and is capable of measuring -5 to 15" w.c. During startup, the manifold pressure gauge will also help to set high and low fire on the unit.

M. Standard Components: Include motor starter with adjustable overloads, air-flow safety switch, electronic flame-safety relay, high-temperature limit switch, main gas regulator, two solenoid valves, modulating gas valve, burner, adjustable burner ON/OFF inlet air duct-stat to shut off burner when inlet air is sufficiently warm to maintain space temperature and non-fused disconnect and casing insulation shall be 1" x 1.5" density with a foil face.

N. Optional Components: Include high gas pressure switch to open circuit to electronic flame safety relay, if gas pressure is too high, low gas pressure switch to open circuit to electronic flame safety relay, if gas pressure is too low, adjustable low temperature blower safety control with bypass timer to shut down unit if discharge temperature drops below setting, and proof of closure switch to energize the main burner circuit only if the motorized gas valve is in a closed position.

O. Temperature controls for building exhaust air replacement to maintain a constant discharge temperature of supply air. The burner flame modulates to compensate for outdoor temperatures. The optional manual Summer-OFF/Winter selector switch and exhaust system interlock controls the heater-blower operation. Supplied with optional remote control panel with temperature selector dial and Summer-OFF/Winter selector.

P. Accessories

1. Inlet Dampers: Manufacturer shall provide and install on unit, when possible, a two-position motor-operated damper with internal end switch to energize the blower-starter circuit, when damper is 80% open. Blades shall be a maximum of 6" wide 16-gauge G-90 galvanized steel and shall be made to guarantee the absence of noticeable vibration at design air velocities. Damper blades are to be mounted on friction-free synthetic bearings. Damper edges shall have PVC coated polyester fabric mechanically locked into blade edge. Jamb seals used are flexible metal, compression type.

2. Filters: The filters shall be 2" thick, aluminum mesh, coated with super-filter adhesive. Aluminum-mesh filters shall have aluminum frames with media to be layers of slit and expanded aluminum, caring in pattern to obtain maximum depth loading. Washable 2" filters shall be enclosed in two-piece, die-cut frame with diagonal supports. Frame shall be constructed of heavy-duty beverage board. Filter media is supported on the air leaving side by a metal grid.

3. Filter section shall be either insulated or non-insulated constructed of G-90 galvanized steel with filters supported by internal slides and with removable access panels. Filters shall be provided in a v-bank arrangement.

4. Fresh-air inlet hood shall be constructed of G-90 galvanized steel with bird screen.

5. Curb shall be 20", constructed of 18-gauge G-90 galvanized steel as a completed welded assembly.

6. Variable Frequency Drives (VFD) on the supply and exhaust fan where indicated on the drawings.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Verify that proper power supply is available.

C. Verify that proper fuel supply and pressure are available for connection.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

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

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

1. Provide vent connections to ANSI/NFPA 211.

2. Install devices furnished by manufacturer but not factory mounted. Furnish copy of manufacturers wiring diagram.

D. Mechanical Contractor shall be responsible for all required communication between make-up air unit(s) and exhaust fan(s) with VFDs.

3.3 STARTING EQUIPMENT

A. Provide manufacturer's field representative to prepare and start equipment.

B. Adjust for proper operation within manufacturer's published tolerances.

C. Demonstrate proper operation of equipment to Owner's designated representative.

3.4 PROTECTION

A. Protect installed equipment from subsequent construction operations.

END OF SECTION

SECTION 26 00 10

GENERAL ELECTRICAL PROVISIONS

PART 1 GENERAL

1.1 WORK INCLUDED

A. Furnish and install all electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings. Specifications and drawings are complimentary except that, in case of conflict, the most stringent will govern.

B. Judgment shall be exercised to install electrical work in a practical manner to function properly, simplify future maintenance, and to fit building construction and finish. Items not shown or specified which are required to produce a complete, operative and finished system shall be provided.

C. The electrical plans are a guide to the Contractor to show general arrangement of conduit and wiring and equipment required. If any error omissions or obscurities appear therein, which are questionable, do not conform to good practice, or appear contrary to the purpose and intent of the work, the Contractor shall promptly notify the Architect and Engineer and apply for directions before construction. The exact location of conduit runs and lengths shall be determined by the Contractor in the field.

D. The drawings may be superseded by later revised or detailed drawings or specification addenda prepared by the Architect. The Contractor shall conform to all reasonable change without extra cost to the Owner. All items not specifically mentioned in the specifications or noted on the drawings, but which are obviously necessary to make a complete working installation, shall be included.

E. Examine the premises in accordance with Division 1 and Division 2 of the specifications.

F. The Owner may furnish some equipment. Electrical Contractor is responsible to check the drawings and specifications for equipment that will be furnished by the Owner. Furnish the electrical connections, etc., on all Owner furnished equipment.

G. Should the particular equipment which any bidder proposes to install, require other space conditions than those indicated on the drawings, arrange for such space with the Engineer before submitting a bid. Should changes become necessary because of failure to comply with this clause, install the changes without additional expense.

H. Where electrical equipment is installed that causes electrical noise interference with other electrical systems installed under this contract, equip the offending equipment

with isolating transformers, filters, shielding or any other means as required for the satisfactory suppression of the interference as determined by the Engineer.

I. Comply with National Electric Code, NFPA, appropriate Building Code, and all local, state, and national ordinances.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. The General Conditions and Supplementary General Conditions of the contract are an integral part of Division 26 of the Specifications. Carefully note its contents in performance of the work.

B. The General Requirements as included in Division 1 of the Specifications are an integral part of Division 26. Carefully note its contents in performance of the work.

C. Examine all of the contract drawings and specifications, field verify existing conditions, or otherwise determine the extent of related work in other divisions before submitting a quotation for the work in this division. Coordinate the work in this division with work in other divisions through the Electrical Contractor. No extra payment will be made for additional work required by failure to coordinate the work. Should drastic changes from original drawings be necessary, the Contractor shall notify the Architect and secure written approval and agreement from the Architect on necessary adjustments.

D. The architectural, mechanical and structural plans and specifications, including Information to Bidders and other pertinent documents issued by the Architect or Engineer are a part of this Specification and the accompanying electrical plans. Comply with them in every respect. Examine all the above carefully.

1. Failure to comply does not relieve the Contractor of responsibility nor may it be used as a basis for additional compensation due to omission of architectural, mechanical and structural details from the electrical drawings.

E. Related work in other divisions requiring cooperation and coordination with this division includes, but is not limited to, the following:

1. Power arranged under Division 1.

2. Perform all cutting and patching as required under Division 1.

3. Furnish all sleeves, inserts, anchors and supports required by this work to be installed in concrete or masonry and coordinate with the respective trades under Division 3 and 4 for proper locations and installation.

4. Flash and seal roof penetrations in accordance with Division 7. Furnish locations and sizes and coordinate the installation with the respective trade.

5. Perform painting of electrical equipment and materials in finished areas as required under Division 9. Touch up or prime any surfaces required in this division in accordance with Division 9. Provide factory finishes as specified in other sections of this division.

6. Install branch circuits and make final connections to any equipment requiring electric power that is furnished and installed by the Contractor or by the Owner. Perform the electrical work according to approved shop drawings.

7. Install empty raceways and outlet boxes or branch circuits for equipment to be furnished by others and installed after completion of the contract.

8. Install and connect motor starters furnished under Division 23 where starters are not an integral part of the equipment. Insure that starters generally conform to the requirements of this division.

9. 120 volt control wiring is furnished and installed by the Electrical Contractor in accordance with the requirements of Division 23.

10. Mechanical equipment control conduit system furnished and installed by the Mechanical Contractor.

11. Motors are furnished and installed generally as an integral part of equipment specified under Division 23 and must conform to the requirements of this division.

1.3 FEES, PERMITS AND INSPECTIONS

A. Obtain any and all required permits in connection with this work under the Contract and pay any and all fees in connection therewith to include fees by the utility companies.

B. Under this section of work the Contractor shall, upon completion of the work, furnish a certificate of final inspection to the Architect from the inspection department having jurisdiction.

1.4 CODES AND STANDARDS

A. All work shall be done in a good workmanlike manner. Materials and workmanship shall comply with all applicable local state and federal codes including, but not limited to, the following:

1. National Electrical Code, Latest Edition (NEC).
2. Underwriters' Laboratories, Inc. (UL).
3. Institute of Electrical and Electronic Engineers (IEEE).
4. Insulated Power Cable Engineers' Association (IPCEA).
5. National Electrical Manufacturers' Association (NEMA).
6. American Standards Association (ASA).
7. American Society for Testing Materials (ASTM).
8. State Fire Prevention Code.
9. Occupational Safety and Health Act (OSHA).
10. National Fire Protection Association (NFPA).
11. International Building Code (IBC).

B. Comply with all State and Federal ADA Accessible Guidelines in regard to accessible or handicapped features.

C. The latest specifications and standards available shall be used for the above.

D. In case of discrepancy between the applicable codes, plans and specifications, the most stringent shall govern.

E. Should the Contractor perform any work that does not comply with requirements of the applicable authorities, he shall bear all cost arising in correcting the deficiencies.

F. Equipment and materials which are not covered by UL standard will be accepted provided equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory.

1.5 DEMOLITION

A. Coordinate all demolition with the General Contractor. All existing wiring is to be removed as necessary. Reuse existing circuits for relocated devices and light fixtures.

PART 2 PRODUCTS

2.1 QUALIFICATION (PRODUCTS AND SERVICES)

A. Approvals are required of products or services of proposed manufacturers, suppliers and installers and will be based upon submission by Contractor of certification.

B. Manufacturer's Qualifications, provide submittal information with the following: Manufacturer regularly and presently manufactures as one of the manufacturer's principal products the following items and has manufactured these items for at least five (5) years.

1. Wire and Cable - all types.
2. Light Fixtures.
3. Lighting Switches and Receptacles.
4. Dimmers.
5. Molded Case Circuit Breakers.
6. Fuses.
7. Conduit.
8. Wiring Devices.
9. Low Voltage Fusible and Non-Fusible Switches.
10. Fire Alarm Systems and Equipment.
11. Conduit Supports and Fittings.
12. Panelboards.
13. Fire Sealant.

C. Manufacturer's product submitted must have been in satisfactory operation on three (3) installations similar to this project for approximately five (5) years.

D. There must be a permanent service organization maintained or trained by manufacturer which will render satisfactory service to this installation within eight (8) hours of receipt of notification that service is needed.

E. Installer must have the technical qualifications, experiences, trained personnel and facilities to install specified items including at least three (3) years of successful installation of electrical work similar to that required on this project. Approval will not be given where the experience record is one of unsatisfactory performance.

F. The lighting wholesale supplier shall have an office and a stocking warehouse within 100 miles of the project site. The distributor/manufacturer's representative shall have an office within 100 miles of the project site, and shall have on staff a full time lighting designer as well as personnel who are available to service the project after

completion.

2.2 MANUFACTURED PRODUCTS

A. Insure that materials and equipment furnished is of current production by manufacturers regularly engaged in the manufacture of such items for which replacement parts should be available.

1. Items not meeting this requirement but which otherwise meet technical specifications and merits of which can be established through reliable test reports or physical examination of representative samples will be considered.

B. Provide products of a single manufacturer when more than one (1) unit of the same product is needed.

C. Equipment Assemblies and Components:

1. All components of an assembled unit need not be products of the same manufacturer.

2. Manufacturers of equipment assemblies which include components made by others must assume complete responsibility for the final assembled unit.

3. Components must be compatible with each other and with the total assembly for the intended service.

4. Constituent parts which are similar must be the product of a single manufacturer.

5. Moving parts of any element of equipment of the units normally requiring lubrication must have means provided for such lubrication and must be adequately lubricated at factory prior to delivery.

D. Identify all factory wiring on the equipment being furnished and on all wiring diagrams.

E. Equipment and materials shall be new and shall bear the manufacturer's name, trade name and the UL label in every case where a standard has been established for the particular material.

F. Equipment and materials of the same general type shall be of the same make throughout the work to provide uniform appearance, operation and maintenance.

G. Dimensions: It shall be the responsibility of the Contractor to insure that items furnished fit the space available. He shall make necessary field measurements to ascertain space requirements, including those for connections, and shall furnish and install such sizes and shapes of equipment that the final installation shall suit the true

intent and meaning of the drawings and specifications. Dimensions are to be taken from the architectural drawings.

H. Manufacturer's directions shall be followed completely in the delivery, storage, protection and installation of equipment and materials. Notify the Architect of any conflict between any requirement of the contract documents and the manufacturer's directions and obtain the Architect's written instruction before preceding with the work. Should the Contractor perform any work that does not comply with the manufacturer's directions or such written instructions from the Architect, he shall bear all costs arising in correcting the deficiencies.

I. The Contractor shall provide and install all accessories, and incidental items to complete the work, ready to use and fully operational.

2.3 EQUIPMENT RATINGS AND APPROVAL OF "EQUAL" EQUIPMENT

A. Equipment voltage ratings must be in accordance with the requirements indicated on the drawings or as specified.

B. Obtain written approval for any equipment which differs from the requirements of the drawings and specifications.

1. Furnish drawings showing all installation details, shop drawings, technical data and other pertinent information as required.

2. Approval by the Engineer of the equal equipment does not relieve the Contractor of the responsibility of furnishing and installing the equipment at no additional cost.

3. Furnish and install any other items required for the satisfactory installation of the equal equipment at no additional cost. This includes, but is not limited to, changes in branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels, and correlation with other work, subject to the jurisdiction and approval of the Engineer.

C. Equipment and materials specified herein are named to establish a standard of quality. Other material of equal quality may be substituted per Section 01 60 00 and with approval by the Architect.

D. It is the responsibility of the Contractor to investigate any desired substitutions for specified equipment prior to submission of his bid. The contractor shall be responsible for any changes required in mechanical, electrical or structural systems resulting from equipment substitutions and shall bear all costs for those changes whether the substitute equipment is named by Architect for "equal" consideration or

not. All changes shall be accomplished in a manner acceptable to the Architect at no additional cost to the Owner.

E. In order to obtain prior approval on equipment or material not specified in Division 26, 27 and 28 Specifications or Equipment Schedules, Contractor MUST submit to the Engineer any proposed equipment or material ten (10) working days prior to the bid date.

2.4 EQUIPMENT PROTECTION

A. Store all materials and equipment to be installed in the work so as to insure the preservation of their quality, workability, and fitness for the work intended. Provide storage provisions for protection from the elements, rust and physical damage. Place stored materials on clean, hard surfaces above ground and keep covered at all times to insure protection from paint, plaster, dust, water and other construction debris or operations. Install heaters under the protective cover where the equipment may be damaged due to moisture and weather conditions. Keep conduit ends plugged or capped and all covers closed on boxes, panels, switches, fixtures, etc., until installation of each item. Store all plastic conduit or duct out of direct sunlight in shaded areas. Located stored materials and equipment to facilitate prompt inspection. All boxes and packaging must remain intact.

B. Protect during installation, all equipment, controls, controllers, circuit protective devices, etc., against entry of foreign matter on the inside and be vacuum clean both inside and outside before testing, operating and painting.

C. Replace damaged equipment, as determined by the Engineer, in first class operating condition or return to source of supply for repair or replacement.

D. Protect painted surfaces with removable heavy Kraft paper, sheet vinyl or equal, installed at the factory and removed prior to final inspection.

E. Repair damaged paint on equipment and materials. Finish with same quality of paint and workmanship as used by manufacturer so repaired areas are not obvious.

F. All lighting fixtures are to be stored on the project in their original factory cartons.

2.5 EQUIPMENT ACCESSORIES

A. Furnish and install all equipment, accessories, connections and incidental items necessary to fully complete all work, ready for use, occupancy and operation by the Owner.

B. Where equipment requiring different arrangement or connections from those shown is provided, install the equipment to operate properly and in harmony with the intent of the drawings and specifications.

C. Support, plumb, rigid and true to line all work and equipment included. Study thoroughly all general, structural, electrical and mechanical drawings, shop drawings and catalog data to determine how equipment is to be supported, mounted or suspended and provide extra steel bolts, inserts, pipe stands, brackets and accessories for proper supports whether or not shown on the drawings. When directed, submit drawings showing supports.

PART 3 EXECUTION

3.1 WORK PERFORMANCE

A. Furnish and install a temporary electrical distribution system of adequate feeder sizes to prevent excessive voltage drop. Install all temporary work in a neat and safe manner. Provide temporary lighting as necessary to furnish 2.5 footcandles on all work surfaces.

B. Field coordinate with other trades in ample time to build all chases and openings, set all sleeves, inserts and concealed materials, and provide clearances that may be required to accommodate materials and equipment. Lay out electrical work so that in case of interference with other items the layout may be altered to suit conditions encountered.

C. Cutting and Patching:

1. The Electrical Contractor shall be responsible for all required cutting, patching, etc., incidental to this work and shall make all required repairs thereafter to the satisfaction of the Engineer. Do not cut into any structural element, beam or column without the written approval of the Engineer.

2. Pipes, conduits, cables, wires, wire ducts and similar equipment that pass through fire or smoke barriers shall be protected in accordance with NFPA 101.

D. Wall Penetrations: When conduit, wireways, bus duct and other electrical raceways pass through fire partitions, fire walls, or walls and floors, install a firestop that provides an effective barrier against the spread of fire, smoke and gases. Firestop material must be packed tight and completely fill clearances between raceways and openings. Use firestop material conforming to the following:

1. All wall penetrations shall be caulked and sealed. Provide fire barrier pillows to protect the interior of conduits/sleeves passing through fire rated walls.

2. The Contractor shall furnish and install all necessary sleeves and chases for all work passing through and attaching to walls, ceilings or the roof.

3. Provide UL listed, fire rated poke through devices for floor penetrations as required by the Standard Building Code, National Fire Code and Life Safety Code.

4. Provide UL approved fire rated chases and fire sealing as required to maintain fire rating for all penetrations in fire rated walls.

5. Firestopping material must be of the latest type as supplied by leading manufacturers such as "3M".

6. Floor, exterior wall and roof seals must be watertight. Sleeve walls and floors which are cored for installation of conduit with steel tubing, grouted and the space between the conduit and sleeve filled as specified herein. Where conduits pierce the roof, refer to architectural specifications and drawings for details. Provide pourable sealant as specified by the Roofing Contractor.

E. Do not use electrical hangers and other supports for other than electrical equipment and materials. Provide not less than a safety factor of five (5) and conform with any specific requirements as shown on the drawings or in the specifications.

F. Do not deviate from the plans and specifications without the full knowledge and consent of the Engineer. Should, at any time during the progress of the work, a new or existing condition be found which makes desirable a modification of the requirements of any particular item, report such item promptly to the Engineer for his decision and instruction.

G. Notify all other contractors of any deviations or special conditions. Resolve interferences between the work of the various contractors prior to installation. Remove, if necessary, work installed which is not in compliance with the plans and specifications as specified above, and properly reinstall without additional cost to the Owner.

H. This Contractor shall furnish all necessary scaffolding, cranes, tackle, tools and appurtenances of all kinds, and all labor required for the safe and expeditious execution of his contract.

3.2 EQUIPMENT INSTALLATION AND EQUIPMENT

A. Installation:

1. "Provide" and "Install" as used on the drawings and in the specifications means furnish, install, connect, adjust and test except where otherwise specified.

2. Install coordinated electrical systems, equipment and materials complete with auxiliaries and accessories installed.

B. Equipment Location: As close as practical to locations shown on drawings.

C. Working Spaces: Not less than specified in the National Electrical Code for all voltages specified.

D. Inaccessible Equipment:

1. Where the Engineer determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, remove and reinstall equipment as directed at no additional cost.

2. "Conveniently Accessible" is defined as being capable of being reached without the use of ladders or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping and ductwork.

E. Equipment and Materials:

1. Install new equipment and materials unless otherwise specified.

2. Insure that equipment and materials are designed to provide satisfactory operation and operating life for environmental conditions where being installed. NEC and other code requirements applied to the installation and other code requirements apply to the installation in areas requiring special protection such as explosion proof, vapor-proof, water tight and weather-proof construction.

3.3 EQUIPMENT IDENTIFICATION

A. In addition to the requirements of the National Electrical Code, install identification signage which will clearly indicate information required for use and maintenance of items such as panelboards, cabinets, motor controllers (starters), safety switches, time clocks, contactors, separately enclosed circuit breakers, individual breakers, and controllers in switchgear and motor control assemblies, control devices and other significant equipment.

3.4 DRAWINGS AND SPECIFICATIONS

A. The drawings and specifications indicate the requirements for the systems, equipment, materials, operation and quality. They are not to be construed to mean limitation of competition to the products of specific manufacturers.

3.5 SYSTEM VOLTAGES

A. System voltage is 120/208 volts, three-phase, four-wire.

3.6 SUBMITTALS

A. Obtain the Engineer's approval for all equipment and materials before purchasing or delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval is not permitted at the job site. Only equipment and material which have been approved by submittals may be used on this project. Refer to Section 26 00 10, Paragraph 2.3.E for substitutions.

B. Include in all submittals adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Engineer to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval must be legible and clearly identify equipment being submitted.

C. Submit to the Engineer within (30) days after the awarding of the Contract, a complete set of brochures of shop drawings and descriptive data of all material and equipment proposed for the installation. All information shall be submitted electronically in "pdf" format, and shall be separated into electronic "pdf" files in three groups, lighting, switchgear and all others.

D. The submittals must include the following:

1. Information which confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.

2. Elementary and interconnection wiring diagrams for communication and signal systems, control system and equipment assemblies. All terminal points and wiring must be identified on wiring diagrams.

3. Parts list which must include those replacement parts recommended by the equipment manufacturer.

4. Approvals will be based on complete submission only.

E. Furnish shop drawings for the work involved in sufficient time so that no delay or changes will be caused. Thermofax copies are not acceptable - only permanent type prints are allowed.

F. Verify that shop drawings comply in all respects with the item originally specified. It is the Contractor's responsibility to procure the proper sizes, quantities, rearrangements, structural modifications or other modifications in order for the

substituted item to comply with the established requirements.

G. Any shop drawings prepared to illustrate how equipment, conduit, fixtures, etc., can be fitted into available spaces will be examined under the assumption that the Contractor has verified all the conditions. Obtaining approval thereon does not relieve the Contractor of responsibility in the event the material cannot be installed as shown on the drawings.

H. Shop drawings need not cover detailed installation drawings prepared for the Contractor's own use, but be limited, as in the case of raceways, to necessary departures from the plans as prepared by the Engineer.

I. Submit working scale drawings of apparatus and equipment which in any way varies from these specifications and plans, to be reviewed by the Engineer before the work is started. Correct interferences with the structural conditions before the work proceeds.

J. Submit all shop drawings at the same time in a loose-leaf binder with double index as follows:

1. List the products by designated letter or number as indicated on plan sheets.

2. List the name and manufacturers whose products have been incorporated in the work alphabetically together with their addresses and the name and addresses of the local sales representative.

3. Provide indexes with sheet numbers and quantities of the products listed.

3.7 TESTS AND DEMONSTRATION

A. As equipment and materials are being installed and connected, test the installation for the following:

1. Short circuits and ground faults.

2. Insulation resistance at 500 volts DC.

3. Grounding continuity.

B. After tests are completed and necessary corrections are made, put each system into operation and demonstrate its performance to the satisfaction of the Owner's authorized representative.

C. Provide written documentation of tests and performance as requested by the Owner's authorized representative. The results are to be made part of the Closeout Documents.

D. Furnish all instruments, test equipment and personnel that are required for the particular test. Certify that equipment and gauges are in good working order. Remove equipment subject to damage during test from line before test is applied.

E. After installation is complete the Contractor shall conduct operating test of all electrical systems for approval by the Architect. Test shall include verification of direction of rotation for all motors. The equipment shall be demonstrated to operate in accordance with the requirements of the plans and specifications. The test shall be performed in the presence of the Architect or Engineer.

F. Provide certified test of the grounding electrode system. It shall test to 5 ohms or less.

3.8 COMPLETION AND ACCEPTANCE

A. Upon completion of the work and before final acceptance, perform the duties and provide the documents as follows in accordance with the General Conditions, Supplementary Conditions and Division 1 of Contract.

B. Remove all rubbish, tools and surplus materials accumulated during the execution of the work in this Division.

C. Touch up any equipment or finishes damaged during delivery or installation from the work in this Division.

D. Provide a written one-year guarantee of materials and work except for items that are specified to have a longer warranty. Items that have a published or normal life expectancy of less than one year, such as incandescent lamps are to be covered by the manufacturer's guarantee.

E. Provide systems and equipment installation, operating and maintenance instructions and catalog data for transmittal to the Owner. Place the data in a loose-leaf binder which contains an index of the products listed alphabetically by name and a separate index listing the manufacturers alphabetically by name and including the manufacturer's address and the name and address of their local representative.

F. Instruct the Owner's representative in the proper operation and maintenance of the systems and their elements as required or directed to familiarize the Owner in the operation and maintenance of the systems.

3.9 RECORD DRAWINGS

A. The Contractor shall keep a neat and accurate record of field changes made during construction. Changes shall be penciled in on a separate set of drawings used only for recording changes. At completion of the project the Contractor shall deliver this set to

the Architect for preparation of record drawings.

B. Record drawings shall include corrected panel schedules and riser diagram as well as all plan sheets.

3.10 FINALLY

A. It is the intention that this specifications shall provide a complete installation. All accessories and apparatus necessary for complete operational systems shall be included. The omission of specific reference to any part of the work necessary for such complete installation shall not be interpreted as relieving this Contractor from furnishing and installing such parts.

END OF SECTION

SECTION 26 05 19

WIRES AND CABLES

PART 1 GENERAL

1.1 WORK INCLUDED

A. Wires and cables.

1.2 RELATED WORK

A. Section 26 05 53: Identification.

PART 2 PRODUCTS

2.1 MATERIALS

A. Wire and cable shall be new, shall have size, grade of insulation, voltage and manufacturer name, permanently marked on outer covering at regular intervals.

B. Building Wiring: 95% conductivity, soft drawn conforming to requirements of the NEC and relevant ASTM specifications, copper, 600 volt insulation, dual rated THHN-THWN.

C. Branch Circuit Wiring: Conductors smaller than No. 12 AWG not permitted; No. 8 AWG and larger, stranded construction; smaller than No. 8, either solid or stranded.

D. Fire Alarm System Wiring: UL Listed plenum-rated cable for conductors installed in plenum rated spaces. Coordinate with Authority Having Jurisdiction.

E. Exterior Wiring: Bare stranded for ground, THWN-THHN for all other.

F. Use pre-insulated pressure connectors such as Scotchlock on stranded conductors No. 10 and smaller. Use approved high-pressure crimp sleeve connectors on No. 8 and larger conductors.

G. Where allowed by local inspecting authorities, type "MC" cable shall be allowed for fixture whips. It shall be installed using proper fittings and installation tools per NEC.

H. Low voltage cable is to be installed in conduit in areas with no ceiling or inaccessible hard ceiling.

PART 3 EXECUTION

3.1 INSTALLATION

A. Make conductor length for parallel feeders identical.

B. Lace or clip groups of conductors at panelboards, pull boxes and wireways.

C. Provide copper grounding conductors and straps.

D. Install wire and cable in code conforming raceway.

E. Use wire pulling lubricant for pulling No. 4 AWG and larger wire.

F. Install wire in conduit runs after concrete and masonry work is complete and after moisture is swabbed from conduits.

G. Splice only in accessible junction or outlet boxes. Install splices and taps which have mechanical strength and insulation rating equivalent-or-better than conductor and are compatible with conductor material.

H. Color code conductors to designate neutral conductor and phase as follows: 120/208V (phases) black, red, blue, (neutral) white, (ground) green; 277/480V (phases) orange, brown, yellow, (neutral) white with color stripe, (ground) green.

I. All 20 amp circuits are 2-#12, 1-#12 ground unless noted. Use #10 AWG conductors on 20 amp branch circuits which exceed 75 feet to the first outlet.

J. Install home runs as indicated on the panel schedules. Circuits may be grouped into 3-Phase home runs but in no case are more than 3 phase conductors allowed.

K. Sharing of neutrals is not allowed, to include lighting and power circuits.

L. Where conduit and wire are installed on the roof, refer to NEC Section 310.15.(B.)(2)(C) for derating/correcting factors for the distance installed from the roof.

M. No low-voltage wiring is to be visible in open ceiling areas; install in conduit.

3.2 MARKING

A. Identify circuits using wire markers at the following locations:

1. All power and lighting branch circuits and feeders at pull boxes, fixtures, outlets, motors, etc., indicating panel and circuit number at which each circuit or feeder originates.

2. All branch circuits in the panelboard gutters indicating corresponding branch circuit numbers.

3. All signal and control wires at all termination points such as cabinets, terminal boxes, equipment racks, control panels, consoles, etc. Install in accordance with approved schedules prepared by the equipment manufacturer or by the Contractor.

4. Mark both ends of all pull wires with tag reading "PULL WIRE" and numbered to refer to the same pull wire.

END OF SECTION

SECTION 26 05 26

GROUNDING

PART 1 GENERAL

1.1 WORK INCLUDED

A. Power system grounding.

B. Communication system grounding.

C. Building ground system.

1.2 RELATED WORK

A. Section 26 05 19: Wires and Cables.

B. Section 26 05 34: Conduit.

1.3 REGULATORY REQUIREMENTS

A. Install complete grounding system for the building(s) and all electrical equipment in accordance with National Electrical Code, Section 250.

PART 2 PRODUCTS

2.1 GROUNDING

A. Provide copper grounding conductors for grounding connections sized according to NEC.

PART 3 EXECUTION

3.1 POWER SYSTEM GROUNDING

A. Install NEC sized ground conductor, #12 AWG minimum, in all branch circuit and equipment conduits.

B. Bonding Jumpers: Provide green insulated wire, size correlated with over-current device protecting the wire. Connect to neutral only at service neutral bar.

C. Bonding Wires: Install bonding wire in flexible conduit connected at each end to a grounding bushing.

D. No strap type grounding clamps shall be used. All connections shall be made only after surfaces have been cleaned or ground to exposed metal.

E. The building structural steel shall be grounded as follows:

1. All locations noted on the plans or if not shown, at approximately 75 foot intervals where structural columns are located.

2. All grounding locations are to be made with 1/0 bare copper wire with exothermic welds or Burndy "HyGround" to the column, to in-footing rebar, and to a 3/4" x 8' copper ground rod. Include "Eupher" grounds at all locations shown with grounding symbol.

F. Provide one 1-1/0 bare copper ground wire from the electrical service, and from nearest branch panel, grounding electrode, in 1 1/4" conduit, to the location of each telephone terminal board and Data Room. Provide "Intersystem Bonding Termination" bars at these locations and at the electrical meter where applicable. Termination bars in data or telephone rooms are to be equal to Chatsworth Products, Inc; Model 40153-020. Ground all equipment and metal parts using #6 bare copper ground from this terminal bar.

G. Bond the neutral (grounded conductor) to ground at one location only once per building at the building's main service disconnect. Bond per NEC Article 250.

H. Ground cable trays per N.E.C.

END OF SECTION

SECTION 26 05 29

SUPPORTING DEVICES

PART 1 GENERAL

1.1 WORK INCLUDED

A. Conduit supports.

PART 2 PRODUCTS

2.1 CONDUIT SUPPORTS

A. Single Runs: Galvanized conduit straps or ring bolt type hangers with specialty spring clips. All "Caddy" and "B-Line" hangers are approved.

B. Multiple conduits running horizontally at the same grade and elevation may be supported by trapezes of channels suspended on rods. All support components shall be adequate size for loaded weights being supported. Provide conduit racks with 25% spare capacity.

C. Perforated strap iron or wire shall not be used for supporting conduits or equipment.

D. Where large conduits are supported beneath bar joist, hanger rods shall be secured to angle irons of adequate size. Each angle shall span two or more joist to distribute the weight properly.

E. Supports shall be installed within three (3) feet of each coupling or connector.

F. Vertical Runs: Channel support with conduit fittings, clamp type supports where conduits penetrate floors.

2.2 ANCHOR METHODS

A. Hollow Masonry: Toggle bolts or spider type expansion anchors.

B. Solid Masonry: Lead expansion anchors or preset inserts.

C. Metal Surfaces: Machine screws, bolts or welded studs.

D. Wood Surfaces: Wood screws.

E. Concrete Surfaces: Self drilling anchors or power driven studs.

2.3 METAL FRAMING SYSTEMS

A. Provide metal framing systems for electrical equipment and conduits as required for proper support spacing and approved for the purpose. Powerstrut, Unistrut, Kindorf or equal.

2.4 CABLE SUPPORTING SYSTEMS

A. Along each corridor on one side of the corridor, install cable supports, above the ceiling, supported by the wall studs. They shall be four tier, two-inch galvanized steel, equal to B-Line # BCH 32-4S. Install at four-foot intervals.

PART 3 EXECUTION

3.1 INSTALLATION

A. Layout to maintain headroom, neat mechanical appearance, and to support equipment loads required.

B. Install horizontal supports at eight feet (8') on centers, at fittings and corners, and as required for proper support.

C. Provide a complete installation with all channels, accessories, screws, nuts, washers, inserts, springs, clamps, hangers, clips, fittings, brackets framing fittings, post bases and brackets to provide a structural rigid support or mounting system.

D. On the roof, provide B-Line DB series roof top support bases. Provide two supports per 10' length of conduit. Conduit to be 24" off the roof, minimum. Provide 1/2" rubber pads under the B-Line support blocks. Coordinate to be higher than other trades' piping on the roof. Install conduit in the ceiling space below where possible.

END OF SECTION

SECTION 26 05 34

CONDUIT

PART 1 GENERAL

1.1 WORK INCLUDED

A. Conduit and couplings.

B. Flexible conduit.

1.2 RELATED WORK

A. Section 26 05 53: Identification.

PART 2 PRODUCTS

2.1 MATERIALS

A. Conduit/Elbows: Rigid steel threaded ANSI C80.1; electrical metallic tubing ANSI C80.3, Schedule 40 PVC.

B. Couplings/Connectors: Threaded; liquid-tight; compression gland. Set screw type products are not allowed.

C. Flexible Conduit: Aluminum or steel armor, plastic jacketed type with liquid-tight connectors used only at motor/equipment terminations. Connectors are to be metal.

D. Metal Clad Cable: Type "MC" cable may be used where allowed by local codes for fixture whips only.

E. PVC or High Density Polyethylene Conduit: HDPE or PVC conduit is acceptable for underground and innerduct applications.

2.2 TYPE

A. Utilize rigid steel conduit (3/4" minimum) in the following locations:

1. In concrete.

2. In exterior locations.

3. Areas subject mechanical abuse.

B. Utilize electrical metallic tubing in other locations, 3/4" minimum. Only E.M.T. is allowed in walls. E.M.T. may be Steel or Aluminum.

C. Make connections to motors and equipment with PVC jacketed flexible conduit and liquid-tight connectors. Minimum size 1/2" for motor connections. Use 3/8" Greenfield flexible conduit only for fixture wiring. Provide sufficient length of flexible conduit to avoid transmission of vibration. Install straps per NEC.

D. PVC conduit may be used for underground service entrance conduits and all low voltage under-slab applications. It is not to be installed exposed. Elbows for service conduits and panel feeders are to be galvanized rigid.

E. Flexible conduit is not allowed within walls.

F. Conduit on the roof is rigid aluminum.

2.3 MARKING

A. All empty conduit shall be left with a pull string for future use, and shall be permanently marked on each end with like numbers.

B. Mark the conduits and boxes mentioned in this Section paragraph 2.2F as to circuits included and on the record drawings.

PART 3 EXECUTION

3.1 INSTALLATION

A. All wiring systems shall be installed in raceways consisting of galvanized steel tubing, PVC conduit, HDPE conduit, rigid galvanized steel, flexible steel conduit or neoprene covered flexible steel conduit.

B. Water tight junction boxes, fittings, expansion joints, compression fittings (for use with all electrical tubing), conduit hubs, etc., shall be provided, for all electrical systems wherever construction dictates, including, but not limited to, outdoor locations.

C. Flexible conduit used in outdoor locations or indoor locations where exposed to continuous or intermittent moisture shall be liquid tight, neoprene covered and UL listed. All fittings for such applications shall be liquid tight, nylon insulated throat type as manufactured by Thomas and Betts, Series 5331, or approved equal.

D. Sufficient slack shall be provided in all flexible conduit connections to reduce the effects of vibration.

E. Insulated bushings shall be used where rigid conduit is installed in any enclosure or junction box. In addition, insulated bushings shall be used on all conduits 1 1/4-inch and larger.

F. All conduit bends shall have a radius greater than or equal to that stipulated by the NEC.

G. Install conduit concealed in all areas excluding mechanical and electrical rooms and conduit to fixtures in rooms without ceilings.

H. For exposed runs, attach surface mounted conduit with clamps.

I. Coordinate installation of conduit in masonry work.

J. Install conduit free from dents and bruises. Plug ends to prevent entry of dirt or moisture.

K. All conduit systems shall be installed complete and shall be cleaned out before installation of conductors.

L. Alter conduit routing to avoid structural obstructions, minimizing crossovers.

M. Seal conduit with glass fiber where conduits leave heated area and enter unheated area.

N. Provide flashing and pitch pockets making watertight joints where conduits pass through roof or waterproofing membranes. Provide pourable sealant as approved by the Roofing Contractor.

O. Install UL approved expansion fittings complete with grounding jumpers where conduits cross building expansion joints (review architectural and structural drawings and coordinate with General Contractor to determine expansion joint locations). Provide bends or offsets in conduit adjacent to building expansion joints where conduit is installed above suspended ceilings.

P. Avoid routing conduit through public spaces with exposed structure where possible.

Q. Route all exposed conduits parallel or perpendicular to building lines. Coordinate all exposed conduit locations with the Architect prior to rough-in.

R. In exposed ceiling areas stub conduits feeding devices in walls out of the wall as high as possible at bottom of structure or bond beam, whichever is higher.

S. Allow minimum of 6-inch clearance at flues, steam pipes and heat sources. Allow 12-inch clearance at telephone conduits. Where possible, install horizontal raceway runs above water and steam piping.

T. Install conduit system from cabinets to boxes, boxes to outlet and outlet to outlet in such a manner as to be electrically continuous throughout.

U. Make bends or offsets with approved bender or hickey.

V. Where conduits are stubbed up for low voltage cabling or future use, do so neatly; furnish with nylon pull string, conduit caps and labeling on each end.

W. Securely support conduits from the structure using approved type clamps, hangers and assemblies. Space supports according to manufacturer's recommendations and accepted practice. Do not support conduits from ceiling suspension system. In no case exceed support spacing per NEC maximum.

X. Avoid installing conduit on the roof. Where necessary, support conduits via B-Line type DB supports and the appropriate strut straps. Support twice per 10' length of conduit. Use supports which hold conduit 24 inches above roof. Conduit on the roof is rigid aluminum. Provide 1/2" rubber pads under the conduit supports.

Y. Leave a nylon pull string in all empty conduits. Terminate empty conduit stubouts with bushing manufactured for that purpose.

Z. Install properly sized grounding conductor in all conduit.

AA. Elbows for service and panel feeders are to be galvanized rigid conduit.

BB. No conduit may be installed in slab. Conduit for stub-ups and panel feeders are to be installed with the top of the conduit at a minimum of four inches under the slab. Bed with one-half inch washed rock. Conduit for floor boxes is to be installed coming out of the bottom of the floor box and installed under slab.

CC. Provide conduit for all low voltage cable installed in areas which have no ceiling or hard ceilings.

DD. All data/telephone conduits are to be "home-run" to an area above an accessible ceiling. No "Daisy Chaining" allowed.

EE. No "Daisy Chaining" of fixtures is allowed.

FF. Seal conduits where they transition from underground distribution system to the interior of a building or structure, refer to N.E.C. 225.27.

GG. Where conduit penetrates walk-in coolers or freezers it shall be non-metallic. All fittings, conduit, and boxes touching the wall of the coolers or freezers shall be non-metallic. On the non-conditioned side of the penetration provide a “seal-off” fitting and pour it with the recommended sealant after the installation of wiring. All spaces around the penetrations shall be sealed with the appropriate type sealant as recommended by the equipment manufacturer. This shall apply to low voltage wiring as well as line voltage wiring.

END OF SECTION

SECTION 26 05 37

OUTLET AND PULL BOXES

PART 1 GENERAL

1.1 WORK INCLUDED

A. Outlet boxes.

B. Pull and junction boxes.

1.2 RELATED WORK

A. Section 26 05 53: Identification.

B. Section 26 27 26: Wall Switches, Receptacles and Plate Covers.

C. Section 27 10 05: Conduit for Telephone/Data and TV Raceway System.

PART 2 PRODUCTS

2.1 MATERIALS

A. Boxes: Hot dip galvanized, 1.25 oz/sq.ft. or cadmium plated, conforming to UL requirements.

B. Interior Boxes: Pressed sheet steel blanked for conduit.

C. Exterior Boxes: Corrosion-resistant cast, deep type, with face plate gasket and corrosion-resistant fasteners.

D. For Ceiling: 4" square boxes for receiving three or less 3/4" conduits.

E. For Flush Mounting in Walls: 4" square boxes with matching plaster cover for single or two gang outlets. For larger boxes, use solid type or special units, with flush plates.

F. Surface Mounted: 4" square.

G. Pull Boxes and Junction Boxes: Metal construction, conforming to National Electrical Code, with screw-on or hinged cover.

H. Flush Mounted Pull Boxes: Provide overlapping covers with flush head cover retaining screws, prime coated.

I. For floor boxes, refer to the electrical legend on the plans.

PART 3 EXECUTION

3.1 INSTALLATION

A. Mount outlet boxes flush in areas other than mechanical rooms, electrical rooms, above removable ceilings, and on exposed structure in rooms without ceilings.

B. Do not install boxes back-to-back in same wall, allow 6" minimum horizontal spacing between boxes.

C. Do not use sectional or handy boxes unless specifically requested.

D. For boxes mounted in exterior walls, make sure that there is insulation behind outlet boxes to prevent condensation in boxes.

E. For outlets mounted above counters, benches and splashbacks, coordinate location and mounting heights with built-in units. Adjust outlet mounting height to agree with required location for equipment served.

F. Securely mount each outlet box to metal studs with outlet box mounting supports. Secure to at least two studs or install box stabilizers as manufactured by "B-Line" and "Caddy".

G. Do not install more than three 3/4" conduits into one 4" outlet box. Do not use more than one extension ring on a box.

H. For heights of outlets above the finished floor in permanent partitions, use the following unless otherwise noted: To Center of Device:

1. Convenience Receptacles: 18" or as directed.

2. Brackets: As directed.

3. Switches: 46" or as directed.

4. Telephone Outlets: 18" or as directed.

5. Other Outlets: As directed or indicated.

6. Over Counters: 6" above countertop, horizontal at windows or where indicated.

7. Fire Alarm Pull stations: Minimum 42” and Max 48” measured vertically, from the floor level to activating handle or lever.

8. Fire Alarm Audio Visual Device: 80” to top of box

I. Locate pull boxes and junction boxes above removable ceiling or in electrical rooms, utility rooms or storage areas.

J. Install pull boxes of the proper size and depth to accommodate the required conduits and wires.

K. When installing outlet boxes in fire rated walls, provide fire blocking material on the back side of the boxes.

L. Coordinate box mounting height with brick courses, where applicable.

M. Study all devices and light fixtures, providing and installing applicable outlet and back boxes as necessary.

N. Boxes for fire alarm systems are to be painted red.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION

PART 1 GENERAL

1.1 WORK INCLUDED

A. Provide and install identification markers.

1.2 RELATED WORK

A. Section 26 05 19: Wires and Cables.

B. Section 26 05 34: Conduit.

C. Section 26 05 37: Outlet and Pull Boxes.

D. Section 26 24 16: Panelboards.

E. Section 26 28 18: Motor and Circuit Disconnects.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide nameplates of laminated phenolic plastic with engraved letters 3/16" high at push-button stations, thermal overload switches, receptacles, wall switches and similar devices where the nameplate is attached to the device plate. At all other locations, make lettering 1/4" high, unless otherwise detailed on the drawings. Securely fasten nameplates to the equipment. Motor nameplates may be non-ferrous metal not less than 0.03" thick, die stamped.

B. Pre-marked, self adhesive, wrap around type markers, manufacturers: Brady, T&B, E-Z Code.

PART 3 EXECUTION

3.1 INSTALLATION

A. General: Equip the following items with nameplates:

1. All motors, motor starters, motor control center, push-button stations, control panels, time switches.

2. Disconnect switches, fused or unfused, switchboards and panelboards, circuit breakers, contactors or relays in separate enclosure.

3. Power receptacles where the nominal voltage between any pair of contacts is greater than 150 volts.

4. Wall switches controlling outlets for lighting fixtures or equipment where the outlets are not located within sight of the controlling switch.

5. Special electrical systems at junction and pull boxes terminal cabinets and equipment racks.

B. Adequately describe the function of or use of the particular equipment involved. Where nameplates are detailed on the drawings, use inscription and size of letters as shown. Include on nameplates for panelboards and switchboards the panel designation, voltage and phase of the supply. The name of the machine or the motor nameplates for a particular machine must be the same as the one used on all motor starter, disconnect and push button station nameplates for that machine.

C. The Contractor shall provide typed panel schedules for all electrical panels. Schedules shall reflect actual wiring incorporating all field changes. Copies of Panel Schedules from the construction drawings are not acceptable.

1. Panel Schedules shall reflect room numbers as depicted by the Owner as well as construction numbers.

D. Label all junction boxes with a black permanent marker indicating circuit number and distribution panel or motor control center feeding the circuits contained therein.

E. At each panel, provide a phenolic plastic plate with 1/4-inch high engraved letters, stating the voltages in the panel, the color code of the wires in the panel, power supply origination, the arc flash hazard, and the date of the installation. Attach to the panel cover with stainless steel bolts, locknuts and nuts or locking nuts. At the main disconnect, provide a label noting the available fault current and date of installation.

F. All breakers within each panel are to be labeled.

G. All underground conduits are to be labeled as to each end.

END OF SECTION

SECTION 26 05 73

OVERCURRENT PROTECTIVE DEVICES

PART 1 GENERAL

1.1 WORK INCLUDED

A. Fuses.

B. Molded-case circuit breakers.

1.2 RELATED WORK

A. Section 26 24 16: Panelboards.

B. Section 26 28 18: Motor and Circuit Disconnects.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Fuses:

1. Bussman.

2. Littlefuse.

B. Breakers and Relays:

1. Eaton.

2. General Electric.

3. Siemens.

4. Square D.

2.2 CIRCUIT BREAKERS

A. General: Except as otherwise indicated, provide circuit breakers and ancillary components, of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard design, materials, components and construction in accordance with published product information and as required for a complete installation.

B. Molded-Case Circuit Breakers: Provide factory assembled molded-case circuit breakers of frame assembled molded-case circuit breakers of frame size voltage and

interrupting ratings as indicated on the drawings. Provide breakers with permanent thermal and instantaneous magnetic trips in each pole and ampere ratings and indicated. Construct with overcenter, trip-free, toggle type operating mechanisms with quick-make, quick break action and positive handle indication. Construct breakers for mounting and operating in any physical position and operating in an ambient temperature of 40 Deg. C. Provide breakers with mechanical screw type removable connector lugs, AL/CU rated.

C. Any overcurrent protection device rated 1200A or higher shall be furnished with an enegy-reducing maintenance switching feature with local status indication. This feature shall be furnished with the overcurrent device by the manufacturer.

D. Tandem circuit breakers are not acceptable.

2.3 FUSES

A. General: Except as otherwise indicated, provide fuses of types, sizes, ratings and average time-current and peak let through current characteristics indicated, which comply with manufacturers' standard design, materials and construction in accordance with published product information and with industry standards and configurations.

B. Class RK1 and Class J Current Limiting Fuses: Provide UL Class RK1 and Class J current limiting fuses rated 200,000 RMS symmetrical interrupting current for protecting motors and equipment, equal to Buss LPN-RK or LPS-RK.

PART 3 EXECUTION

3.1 INSTALLATION OF OVERCURRENT PROTECTIVE DEVICES

A. Install overcurrent protective devices as indicated in accordance with the manufacturer's written instructions and with recognized industry practices to insure that protective devices comply with requirements. Comply with NEC and NEMA standards for installation of overcurrent protective devices.

B. Coordinate with other work, including electrical wiring work as necessary to interface installation of overcurrent protective devices.

C. Fasten circuit breakers without mechanical stresses, twisting or misalignment being exerted by clamps, supports or cabling.

3.2 FIELD QUALITY CONTROL

A. Prior to energization of overcurrent protective devices, test devices for continuity of circuitry and for short circuits. Correct malfunctioning units and then demonstrate compliance with requirements.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.1 WORK INCLUDED

A. Branch circuit panelboards.

1.2 REGULATORY REQUIREMENTS

A. Construct panelboards to UL standards and provide UL labels.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Eaton.

B. General Electric.

C. Siemens.

D. Square D.

2.2 ENCLOSURES

A. Panels: Surface (or flush) mounted complete with hinged trim with outer door lock and metal directory frame.

B. Panel Can: Galvanized, painted to match trim.

C. Keys: Provide two keys for each panel. Make keys interchangeable for panels on this project.

2.3 120/208 AND 277/480 VOLT PANELBOARDS

A. Panelboards: Three phase, 4-wire, solid neutral design with sequence style bussing, full capacity neutral and bare uninsulated grounding bar bolted to enclosure, composed of an assembly of bolt-in-place molded case automatic air circuit breakers with thermal and magnetic trip and trip free position separate from either "ON" or "OFF".

B. Furnish and install power and distribution panelboards, equipped with thermal magnetic molded case circuit breakers of frame, trip ratings and interrupting capacities, as shown on the panelboard schedule, manufactured in accordance with the

latest NEMA standards, listed by Underwriters' Laboratories, Inc. and bearing the UL label.

C. Panelboard Main Bus, Main Lugs and/or Main Breaker: Copper only with current ratings as shown on the panelboard schedule. Current density in accordance with Underwriters' Laboratories requirements. Bus mounting for circuit breakers of the bolted connection type and accommodating any combination of circuit breaker units without further modification, wiring lugs suitable for copper conductors.

D. Circuit Breakers: Quick make and quick break trip free on overload or short circuit; multi-pole breakers with common trip, wiring terminals suitable for the type conductor specified, bolt-on connections to the bus.

E. Steel Box: As specified by Underwriters' Laboratories standards, end walls removable, size of wiring gutters in accordance with Underwriters' Laboratories standards, trim of code-gauge steel with primer and durable enamel finish, trim doors equipped with spring latch and cylinder lock keyed alike. Each individual circuit to be clearly numbered on the face of the panelboard and a directory for circuit identification provided.

F. Where noted on the plans, provide "SPD" units.

1. On main service equipment provide units equal or better than 125 kA per mode, minimum.

2. On sub panels provide units equal to 80 kA per mode, where called for.

3. All units to be built in to the panels called for. Provide with phase indicating lights and disconnecting means.

G. The panelboard wholesale supplier shall have an office and a stocking warehouse within 100 miles of the project site. The distributor/manufacturer's representative shall have an office within 100 miles of the project site, and shall have on staff a full time designer as well as personnel who are available to service the project after completion.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide mounting brackets, busbar drillings and filler pieces for unused spaces.

B. Prepare and affix typewritten directory to inside cover of panelboard indicating loads controlled by each circuit. Label with construction and permanent room numbers.

C. Provide 4-inch housekeeping concrete pads for all floor mounted units which are located inside the building or outdoors.

D. At each panel, provide a phenolic plastic plate with 1/4-inch high engraved letters, stating the voltages in the panel and the color code of the wires in the panel and the available fault current and date of installation. Attach to the panel cover with stainless steel bolts, locknuts and nuts or locking nuts.

E. Arc flash warning labels are to be equal to Brady # 121130 ot Y972346.

END OF SECTION

SECTION 26 27 26

WALL SWITCHES, RECEPTACLES, AND PLATE COVERS

PART 1 GENERAL

1.1 WORK INCLUDED

A. Wall switches.

B. Receptacles.

C. Plate covers.

1.2 RELATED WORK

A. Section 26 05 26: Grounding.

B. Section 26 05 37: Outlet and Pull Boxes.

C. Section 26 05 53: Identification.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Arrow Hart.

B. Bryant.

C. Eagle.

D. General Electric.

E. Hubbell.

F. Leviton.

G. P&S.

H. Substitutions: See Section 26 00 10 - General Electrical Provisions.

2.2 WALL SWITCHES

A. Acceptable Devices

1. Single Pole Switch: Type 1221, or equal.

2. Double Pole Switch: Type 1222, or equal.

3. Three-way Switch: Type 1223, or equal.

4. Four-way Switch: Type 1224, or equal.

5. Dimmers: Lutron "NOVA" Series or equal; size as required per the circuit wattage, 600 watt minimum. Provide type for the fixtures being dimmed.

6. Two-pole switches used to control two loads, like lights and exhaust fans in restrooms, must be "rated" for that duty.

7. Keyed Switches: Provide four keys per switch.

B. Materials

1. 120/277 Volt Switches: Quite slow make, slow break design, toggle handle with totally enclosed case, rated 20 ampere, specification grade. Provide matching two pole, three-way and four-way switches.

2. Color: Coordinate with the Architect.

3. Dimmers: Electronic switching type with toroid filter coil to eliminate RF interference.

4. Two-pole switches used to control two loads, like lights and exhaust fans in restrooms, must be "rated" for that duty.

5. Provide metal barrier between gangs in boxes, where adjacent switches have a potential in excess of 300V between conductors.

2.3 RECEPTACLES

A. Device: Receptacles In General Use Areas of Project: All receptacles shall be commercial grade and shall be "Tamper Resistant."

1. Duplex Receptacle: Type BR20TR, or equal.

2. Duplex Receptacle, GFCI: Type GFTR20, or equal.

3. Single Receptacle: Type 5361, or equal.

4. Special Outlets: See Plans.

5. Isolated Ground Receptacle: Type 5362IG, or equal.

B. Devices

1. Standard Duplex Receptacle: Nema 5-20R. Full gang size, polarized, duplex, parallel blade, U grounding slot, rated at 20 amperes, 125 volts, designed for split feed service.

2. Nameplates: Provide engraved or embossed plastic for receptacles other than standard duplex and standard single receptacles indicating voltage, phase and amperes.

3. Isolated ground outlets to be orange, emergency circuit devices to be red, all other device colors to be coordinated with the Architect.

4. Exterior receptacles are to be "GFI" and rated as "weather resistant".

C. Devices: Receptacles in Detention Areas shall be extra heavy duty.

1. Duplex Receptacle: Type 5362, or equal.

2. Duplex Receptacle, Weather Resistant: Type 5362WR, or equal.

3. Single Receptacle, Weather Resistant: Type 5361WR, or equal.

2.4 PLATE COVERS

A. Materials

1. Stainless Steel: Type 302 or 304, No. 4 finish, 0.040 inches thick, accurately die cut, protected with release paper.

2. Cast Metal: Die cast profile, ribbed or strength, flash removed, primed with grey enamel, furnished complete with four mounting screws.

3. Gaskets: Resilient rubber or closed cell foam urethane.

4. Nylon: High-performance, molded nylon.

5. Stamped Metal: For use on 4" square boxes.

B. Device

1. Flush Mounting Plates: Beveled type with smooth rolled outer edge.

2. Surface Box Plates: Beveled, steel, pressure formed for smooth edge to fit box.

3. Weatherproof Plates: CAST METAL, gasketed; for receptacles, provide the weatherproof "while in use" type.

4. Where two-gang boxes are required for single gang devices, provide special plates with device opening in one gang and second gang blank.

PART 3 EXECUTION

3.1 INSTALLATION

A. Coordinate switch mounting location with architectural detail and heights as noted on plans.

B. Run separate neutral for each lighting circuit.

C. Install switches at 46" to center above finished floor, coordinate with brick layers where applicable.

D. Mount receptacles at mounting heights specified on the plans, 18" to center of the box unless noted otherwise.

E. Connect all devices using pigtails. Do not through-wire on device terminals.

F. Mount outlets for electric water coolers and other similar permanently installed plug connected equipment behind equipment according to approved installation drawing, coordinate with the equipment installer.

G. Install coverplates on wiring devices level and with all four edges in contact with finished surface.

H. Use nylon plates, color to match devices as specified by the Architect, in all interior areas unless noted. Use steel plates in mechanical and utility type areas.

END OF SECTION

SECTION 26 28 18

MOTOR AND CIRCUIT DISCONNECTS

PART 1 GENERAL

1.1 WORK INCLUDED

A. Provide and install motor and circuit disconnects.

1.2 REGULATORY REQUIREMENTS

A. Conform to National Electrical Code and to applicable inspection authority.

1.3 REFERENCES

A. Underwriters' Labs, Inc. Annual Product Directories.

B. Classification of Standard Types of Non-ventilated Enclosures for Electric Controllers, National Electrical Manufacturers Association.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Eaton.

B. General Electric.

C. Hubbell.

D. Leviton.

E. Square D.

2.2 EQUIPMENT

A. Provide motor and circuit disconnects with UL label.

B. Single Phase 120 Volt Disconnect Switches: Double pole toggle switch, Leviton MS302.

C. Provide with lockable covers.

D. Three-Phase Motor Disconnect Switches and Single Phase 240 Volt Disconnect Switches: 2 or 3 pole heavy duty fusible or non-fusible as shown, 250 or 480 volt as required in NEMA Type 1 or 3 enclosures. Provide with lugs for suitable wire range, with ground lug, copper current carrying parts, silver-tungsten contacts, reinforced

fuse clips for type R rejection fuses.

E. Provide NEMA "4/4X" type disconnects within the kitchen area.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install motor and circuit disconnect as recommended by manufacturer and as required by Code.

B. Where required by local authorities, install disconnects for all roof mounted equipment separate from that equipment. Furnish (galvanized) "Unistrut" or angle iron mounting stands with B-Line DB series roof top support base. Coordinate with the equipment supplier and Roofing Contractor.

END OF SECTION

SECTION 26 51 00

INTERIOR BUILDING LIGHTING

PART 1 GENERAL

1.1 WORK INCLUDED

A. Installation of luminaires, supports and accessories.

B. Emergency lighting units.

C. Exit signs.

D. Lamps.

E. Ballasts, drivers, and accessories.

1.2 RELATED WORK

A. Section 26 05 19: Wires and Cables.

B. Section 26 05 29: Supporting Devices.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SUBMITTALS

A. Submit shop drawings and product data in accordance with General Conditions including pertinent physical characteristics and complete photometric data reports from independent testing laboratory.

B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, and performance data.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data: Instructions for each product. Installation manuals are required.

1.5 COORDINATION

A. Confirm compatibility and interface of other materials with luminaire and ceiling system. Report discrepancies to the Engineer/Architect and defer ordering until clarified.

B. Supply plaster frames, trim rings and backboxes to other trades.

C. Coordinate with Division 23 to avoid conflicts between luminaires, supports, fittings and mechanical equipment.

D. Conform to requirements of NFPA 70.

E. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

F. Products: Listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

G. The lighting wholesale supplier shall have an office and a stocking warehouse within 100 miles of the project site. The distributor/manufacturer's representative shall have an office within 100 miles of the project site, and shall have on staff a full time lighting designer as well as personnel who are available to service the project after completion.

H. Any substitutions to the light fixture schedule shall be proven, by the manufacturer at the discretion of the Engineer, to be of equal or superior quality, material, and performance than the specified light fixtures. All requests for substitutions shall be submitted along with fixture specification sheets, photometric calculations and electronic ies files 10 days prior to bid opening date for review. Substitutions shall be requested in writing only, accompanied by the above listed electronic ies files. Substitutions will not be considered if they are indicated or implied in shop drawing submission without previous formal request. Substitutions will not be considered if they require substantial revision of the contract documents. The Contractor shall be responsible for any and all additional costs required by modifications to architectural, structural, mechanical or electrical facilities, devices, systems, etc. resulting from the approved substitution.

I. Light fixtures and ballasts are to comply with the fixture schedule and the Specifications.

PART 2 PRODUCTS

2.1 LUMINAIRES

A. Acceptable Manufacturers

1. Provide products of manufacturers as listed in the lighting fixture schedule or equal, subject to compliance with requirements.

2. Fixtures are to be supplied in manufacturer's standard cartons.

3. Substitutions: See Section 26 00 10 - General Electrical Provisions.

B. Lensed Luminaires

1. Pre-treat housing and finish in high reflectance baked white powder paint on exposed and reflective surfaces giving reflectance of 90% minimum average. Paint shall be applied after fabrication.

2. Reflective end plates may be 20 gauge metal.

3. Provide full 22 gauge steel housing.

4. Provide hinged frames with fully enclosed spring loaded cam latches and T-type hinges, removable for cleaning without tools. Support lay-in lenses on four sides with flip ends on short dimension.

5. Provide gasketing, stops and barriers to form light traps and prevent light leaks.

6. Design luminaire to dissipate ballast and lamp heat.

7. Use formed or ribbed backplates, endplates, reinforcing channels.

8. Provide virgin acrylic diffusers, 0.125" thick nominal, number 12 pattern, 7.8 oz. weight per square foot.

9. Furnish products as indicated in Fixture Schedule, or equal.

C. Recessed Luminaires

1. Supply recessed luminaire complete with trim type required for ceiling system installed. Before ordering, confirm ceiling construction details and architectural finish for each area. Supply with "IC" type housing or gyp board hat over the fixture, where insulation will cover.

2. Fixtures shall be delivered to the job site in factory provided individual cartons.

3. All damaged fixtures are to be replaced

2.2 LAMPS

A. Acceptable Manufacturers

1. General Electric.

2. Osram/Sylvania.

3. Philips.

B. LED Lamps

1. LED Lamps: Manufacturers must have Energy Star/DLC rating or shall offer LM-80 and TM-21 test reports to the public online.

2. LED estimated useful life: Minimum of 50,000 hours at 70% lumen maintenance, calculated based on LM-80 test data.

3. LED fixtures shall be modular and allow for separate replacement of LED lamps and drivers.User serviceable LED lamps and drivers shall be accessible and replaceable from the room side.

4. Light fixture provider shall provide all low voltage control wiring for dimmable fixture.

5. Note lamp color specifications on the fixture schedule, minimum CRI shall be 80.

6. All light fixtures shall be provided with a 5 year warranty on the LED and driver system.

2.3 BALLASTS AND DRIVERS

A. Provide ballasts that meet standards of an electrical testing laboratory and the Certified Ballasts Manufacturers' Association.

B. Acceptable Manufacturers:

1. Universal.

2. Philips/Advance.

3. Osram/Sylvania.

C. LED Drivers

1. LED drivers shall be electic-type, labeled as compliant with radio frequency interference (RFI) requirements of FCC Title 47 Part 15, and comply with NEMA SSL 1 " Electronic Drivers for LED Devices, Arrays, or System". LED drivers shall have a sound rating of "A", have a minimum efficiency of 85%, and be rated for a THD of less than 20 percent at all input voltages.

2. Dimmable LED drivers shall be 0-10V type unless otherwise noted on the schedule. Dimmable LED drivers shall be capable of dimming without LED strobling or flicker across their full drimming range.

3. Emergency LED drivers shall be manufactured by a company with a minimum of five (5) years service. They shall be factory installed and tested, to include red pilot lights. They shall be manufactured by Bodine Mfg. and be rated at 1100 lumens, minimum.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install lamps in accordance with manufacturer's instructions.

B. Provide spare lamps in the amount of 5% of the total count, or 5 each type, whichever is the greater number.

C. All incandescent lamps shall be replaced at the Date of Substantial Completion.

D. Provide ballasts of compatible design to lamps specified.

E. No "Daisy Chaining" of fixtures is allowed.

F. Install fixtures securely, in a neat and workmanlike manner.

G. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

H. Support all luminaires independent of ceiling framing, directly from building structure by rod hangers and inserts or suspension wire, two per fixture.

I. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

J. Install recessed luminaires to permit removal from below.

K. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

L. Install clips to secure recessed grid-supported luminaires in place.

M. Install wall mounted luminaires, emergency lighting units, and exit signs at height as scheduled.

N. Manufactured wiring systems are approved. Provide submittals per Specifications.

3.2 RECESSED LUMINAIRES

A. Perform field inspection, testing, and adjusting in accordance with Section 26 00 10.

B. Install recessed luminaires to permit removal from below to gain access to outlet or pre-wired fixture box.

C. Install an accessible junction box not less than two feet away from the fixture and connect to it by not less than four feet nor more than six feet of flexible conduit, using type of fixture wire approved for this purpose.

D. Mount in suspended ceiling with exposed tee bar grid system, support directly from the building structure by a minimum of two support wires.

E. Hold insulation back from all fixtures by three (3) inches and clear on top.

F. A disconnecting means is required for all ballasted luminaires with double ended lamps. Install per NEC 410.130(G).

3.3 ALIGNMENT

A. Aim and adjust luminaires.

B. Align luminaires, clean diffusers and replace burned out lamps prior to final acceptance.

3.4 FIRE RATED CEILINGS

A. Where recessed fixtures will penetrate either fire-rated ceilings or fire rated gypsum board located above suspended ceilings, the fire-rated ceiling or gypsum board shall be continuous over and around the fixture housing and outlet box. Coordinate the ceiling and fixture installations to insure a continuous fire rated ceiling.

3.5 FINALLY

A. Remove dirt and debris from enclosures.

B. Clean photometric control surfaces as recommended by manufacturer.

C. Clean finishes and touch up damage.

D. Relamp luminaires that have failed lamps at Substantial Completion and all lamps that have been energized during construction for more than 500 hours.

END OF SECTION

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 GENERAL

1.1 WORK INCLUDED

A. Installation of luminaires, supports and accessories.

1.2 RELATED WORK

A. Section 26 05 19: Wires and Cables.

B. Section 26 51 00: Interior Building Lighting.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SUBMITTALS

A. Submit shop drawings and product data in accordance with General Conditions including pertinent physical characteristics and complete photometric data reports from independent testing laboratory.

B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, and performance data.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data: Instructions for each product.

1.5 COORDINATION

A. Confirm compatibility and interface of other materials with luminaire and ceiling system. Report discrepancies to the Engineer/Architect and defer ordering until clarified.

B. Products: Listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide products of manufacturers as listed in the lighting fixture schedule, or equal.

B. LED Lamps

1. LED Lamps: manufacturers must have Energy Star/DLC rating or shall offer LM-80 and TM-21 test reports to the public online.

2. LED estimated useful life: Minimum of 50,000 hours at 70% lumen maintenance, calculated based on LM-80 test data.

3. LED fixtures shall be modular and allow for separate replacment of LED lamps and drivers.

4. Light fixture provider shall provide all low voltage control wiring for dimmable fixture.

5. All light fixtures shall be provided with a 5 year warranty on the LED and driver system.

6. Note lamp color specifications on the fixture schedule, minimum CRI shall be 80.

7. All exterior light fixtures shall be, at a minimum, IP64 rated.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fixtures securely on poles and pole bases as shown on the plans.

B. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

C. Install recessed luminaires to permit removal from below.

D. Install wall mounted luminaires and emergency lighting units at height as scheduled.

3.2 ALIGNMENT

A. Aim and adjust luminaires.

B. Align luminaires, clean diffusers and replace burned out lamps prior to final acceptance.

3.3 FINALLY

A. Remove dirt and debris from enclosures.

B. Clean photometric control surfaces as recommended by manufacturer.

C. Clean finishes and touch up damage.

END OF SECTION

SECTION 27 10 05

CONDUIT FOR TELEPHONE/DATA AND TV RACEWAY SYSTEM

PART 1 GENERAL

1.1 WORK INCLUDED

A. Telephone/Data and TV raceway system.

1.2 RELATED WORK

A. Section 26 05 19: Wires and Cable.

B. Section 26 05 34: Conduit.

C. Section 26 05 37: Outlet and Pull Boxes.

D. Section 26 05 53: Identification.

1.3 SYSTEM DESCRIPTION

A. At TV locations, provide a 4" outlet box and plaster ring with 3/4" raceway to above a drop ceiling in an accessible area. Leave a pull string in each raceway. End each stub up with a 90-degree elbow. Mount as shown on the plans.

B. At all telephone/data locations, provide a 4" outlet box and plaster ring with 1" raceway to an accessible area above a ceiling. Leave a pull string in each raceway. End each stub-up with a 90-degree elbow.

PART 2 PRODUCTS

2.1 MATERIALS

A. Conduit: Refer to Section 26 05 34.

B. Outlet and Pull Boxes: Refer to Section 26 05 37.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide an insulated throat connector or plastic bushing where raceways are stubbed out above the ceiling, including a 90-degree elbow on the end of the conduit.

B. Provide a nylon blank cover plate for any outlet location which is not to be used. Allow for this quantity to be 50% of total data outlets.

C. Provide conduit for all low voltage wiring which is installed in areas which have no ceiling or hard ceiling and shall be painted blue.

D. All device plates are to be nylon.

END OF SECTION

SECTION 28 31 05

FIRE ALARM SYSTEM

PART 1 GENERAL

1.1 SCOPE AND RELATED DOCUMENTS

A. The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials, and performance of all operations in connection with the installation of the Fire Alarm System as shown on the drawings and as herein specified.

B. The requirements of the conditions of the Contract, Supplementary Conditions and General Requirements, apply to the work specified in this section.

C. The complete installation is to conform to the applicable sections of NFPA-72, Local Code Requirements and National Electrical Code with particular attention to Article 760 and all other applicable regulatory requirements.

D. The work covered by this section of the specifications is to be coordinated with the related work as specified elsewhere under the project specifications.

1.2 REGULATORY REQUIREMENTS

A. The system and all associated operations shall be installed in accordance with the following:

1. Guidelines of the following Building Code: IBC.

2. NFPA 72, National Fire Alarm Code.

3. NFPA 70, National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

4. Other applicable NFPA standards.

5. Local Jurisdictional Adopted Codes and Standards.

6. ADA Accessibility Guidelines.

B. Equipment: All devices, combinations of devices, notification appliances, and equipment, shall be listed for the purpose for which they are used and shall be installed in compliance with applicable codes and standards.

C. Type of System: The control panel shall be listed for power-limited applications per NEC 760 and for compliance with the National Fire Protection Association Standard NFPA 72 for Protected Premises, Public Reporting, and/or Supervising Station fire alarm systems.

D. Type of Service: The control panel shall be listed for the applicable types of service.

E. Type of Signaling: The control panel shall be listed for the applicable types of signaling methods used, i.e. Temporal Coded, Zone Coded, Non-Coded, March Time and/or Digital Alarm Communicator (DACT) Signaling.

1.3 SYSTEM DESCRIPTION

A. Fire Alarm System:

1. Provide a complete, supervised, power-limited, fire detection and evacuation system.

a. All equipment herein specified is that of and depicts the type and quality of the equipment to be furnished.

B. System Supervision:

1. The fire alarm system shall be an electrically supervised system, which shall monitor the integrity of circuit conductors and power supplies. Performance of fire alarm system circuits shall be in accordance with Class B (Style B) operation for Initiating Device Circuits, and Class B (Style Y) operation for Notification Appliance Circuits.

2. Remote annunciator LEDs and associated wiring and remote emergency control wiring shall be supervised such that an open condition in the circuit shall cause a trouble indication at the control panel.

C. LED Indicators:

1. The control panel shall have a red LED display that shall automatically scroll to chronologically display the IDC zone number of all alarm and supervisory conditions. Supervisory conditions shall be clearly differentiated from fire alarm conditions by using the decimal point of the display and shall also be indicated by pulsing a separate dedicated yellow LED.

2. The control panel shall have a yellow LED display that shall automatically scroll to chronologically display distinct trouble conditions. Manual operation of the scrolling shall be provided to control the scroll rate. The following trouble conditions shall be capable of being displayed:

a. IDC Zones, identified by zone number.

b. IDC Auxiliary Output Trouble, identified by zone number.

c. Auxiliary Alarm Output Trouble, identified by zone number.

d. Low Battery Trouble.

e. City Circuit Trouble.

f. Configuration Trouble.

g. Depleted or Disconnected Battery Trouble.

h. NAC 1 Trouble.

i. Walk Test Enabled (System is in Walk Test "Trouble").

j. Program Trouble.

k. Power Supply Trouble.

l. Ground Fault Trouble.

3. Separate LED indicators shall be provided for:

a. Indication of supervisory conditions by yellow LED.

b. Indication that alarm conditions have been manually silenced by yellow LED.

c. AC power normal indicated by illuminating a green LED.

D. Alarm Sequence of Operation:

1. Activation of an alarm Initiating Device shall:

a. Cause the red LED display to display the number of the zone in alarm. In the event that multiple zones are in alarm, the zone numbers shall be scrolled in chronological order.

b. Activate the panel tone-alert audible indicator.

c. Cause the audible alarm Notification Appliances to sound in a Temporal Code General Alarm pattern throughout the entire facility.

d. Cause the common Auxiliary Alarm output to activate.

e. Cause the IDC Auxiliary output to activate.

f. Cause the Visual Notification Appliances to operate.

g. Cause the remote tone-alert audible signal and associated red zone LED on the remote annunciator to flash.

h. Cause a signal to be sent to the building elevator controls.

i. Release all door hold-open devices.

E. Alarm Acknowledge:

1. Activating the Acknowledge switch shall cause the local panel audible tone-alert to silence.

2. Subsequent alarms shall resound the local panel tone-alert.

3. Activating the Alarm Silence switch shall silence all NACs programmed for on-until-silence and shall illuminate the dedicated yellow alarm silenced LED.

F. Alarm Reset:

1. Restoring the alarm initiating devices to normal and activating the System Reset switch shall restore all alarm circuits to their normal condition.

G. Trouble Condition Sequence of Operation:

1. The occurrence of a single open or a single ground condition shall: activate an audible signal, flash a distinct indication at the yellow trouble LED display, and activate the common trouble output in accordance with the requirements of the applicable codes and standards so that all means of interconnecting equipment, devices, notification appliances and power supplies shall be monitored for the integrity of the interconnecting conductors, or equivalent.

2. Actuating the Trouble Silence switch shall silence the audible trouble signal and cause the trouble LED to chronologically scroll the received trouble indicators.

H. Supervisory Condition Sequence of Operation:

1. The occurrence of a supervisory condition shall be annunciated by: flashing the dedicated yellow supervisory LED, activating the audible tone-alert, and activating the common supervisory output. The red, seven-segment fire alarm LED display shall be capable of indicating the zone number of the IDC in supervisory condition. The seven-segment display shall clearly differentiate between alarm zone numbers and supervisory zone numbers.

I. Indicator Test:

1. The control panel shall incorporate an Indicator Test procedure for manually testing of the local audible tone device, zone alarm and supervisory display, zone trouble display, and individual operator panel LED indicators.

J. Provide one year of off-site monitoring along with a quote for two more years.

1.4 QUALIFICATIONS

A. Manufacturer: The manufacturer shall be a nationally recognized company specializing in detection and alarm systems. The manufacturer and service organization shall have a minimum of 10 years experience in the fire detection and alarm systems industry.

B. Installer: The installation organization shall be a company specializing in the installation of detection and alarm systems. This organization shall have a minimum of 10 years experience with installation of fire detection and alarm systems. The fire alarm system shall be installed by NICET certified installers. This organization shall employ factory trained and NICET certified technicians, and shall maintain a service organization within 100 miles of this project location. At least one employee shall be NICET level III certified or be a licensed professional engineer trained in fire detection and alarm systems.

1.5 SUBMITTALS

A. Submit manufacturer's product data sheets for all proposed devices and equipment.

B. Provide wiring diagrams, equipment ratings, dimensions, and finishes for all proposed devices and equipment.

C. If submittals, upon review by the Owner and/or the Owner's Representative, are found not to conform with the performance, type and quality of products as well as all other requirements of these specifications, the Contractor shall be required to resubmit. The Contractor shall be responsible for the Owner's extra expenses for subsequent review(s) of rejected submittals. Such extra fees shall be deducted from payments by the Owner to the Contractor. Approval of the submittals by the Owner shall, in no case, relieve the Contractor of the responsibility to meet the requirements of this specification.

D. Shop Drawings: A complete set of shop drawings shall be supplied. The shop drawings shall be reproduced electronically in digital format. This package shall include but not be limited to:

1. Control panel wiring and interconnection schematics.

2. Complete point to point wiring diagrams.

3. Riser diagrams.

4. Complete floor plan drawing locating all system devices and 1/4' = 1'0 scale plan and elevation of all equipment in the Fire Command Station. Including showing the placement of each individual item of fire alarm, security, and access control equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.

5. Include voltage drop calculations for notification and initiation appliance circuits.

    a. Starting Supply Voltage to be calculated at lowest end of -10% voltage variance: ie 21.6V for 24V system.

    b. Current per device to be calculated at devices minimal allowed voltage.

    c. Distance between devices must include up/down distance from concealed ceiling to equipment mounting height.

    d. Voltage at final device on a line shall be no less than 10% above minimum operating voltage of device. Ex: For a device with voltage range of 16-33V, the lowest allowed voltage is 17.6V at final device.

6. Include battery size calculations.

1.6 PROJECT RECORD (AS-BUILT) DRAWINGS

A. The Contractor shall provide and maintain on the site an up-to-date record set of approved shop drawings.

B. Record drawings shall include location of end-of-line device locations.

C. Upon completion of the work, and final acceptance by the local authority, the Contractor shall submit record drawings to the Owner and the Engineer.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit manufacturer's data sheets for all equipment installed.

B. Include operating, installation, and routine maintenance instructions.

C. Include manufacturer's letter stating the date of installation on which the system is operational.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: The equipment and service described in this specification represent the base bid for the equipment.

1. Subject to compliance with requirements, preapproved manufacturer is Simplex Grinnell. New Fire Alarm System must be compatible with and connect to the existing Simplex 4100ES panel.

B. Being listed as an acceptable Manufacturer in no way relieves the Contractors obligation to provide all equipment and features in accordance with these specifications.

2.2 SUBSTITUTIONS

A. Other equipment may be substituted as long as the level of quality and performance of operation is equal to, or greater than, that which is specified. The Owner and/or Owners Representative shall make the determination as to whether or not the substitute equipment is acceptable.

2.3 FIRE DETECTION AND CONTROL PANEL

A. Where shown on the plans, provide and install a fire alarm control panel sized for this project plus projected expansion. Construction shall be modular with solid state, microprocessor based electronics. The control panel shall be addressable utilizing the latest technologies.

B. The fire alarm control panel cabinet shall provide the following features:

1. The printed circuit board assemblies of the control panel shall be mounted such that removal of a common, single piece mounting chassis shall provide access for installing the cabinet and for pulling wires into the cabinet.

2. Provisions for semi-flush mounting between standard 16-inch center stud wall construction without altering the standard construction dimensions.

3. Cabinet color shall be red.

4. To facilitate installation, the cabinet shall provide:

a. Built-in depth gauges for 1/2-inch thick drywall installation.

b. Built-in knockouts for nail holes and wiring conduit entrance.

c. A built-in trim band to allow semi-flush mounting into rough-cut wall openings.

5. A label mounted to the inside of the cabinet door shall be clearly visible and contain information for the following:

   a. Summarized installation instructions including location of standard, optional, and expansion modules.

   b. Operating instructions to include a readily available list to interpret LED display indications.

   c. Summarized programming instructions.

6. A separate label shall be provided to allow on-site documentation of the specific location of the individual IDC zones.

C. The Fire Alarm Control Panel shall contain:

1. Operator interface switches for status acknowledge, alarm silence, and system reset.

2. Discrete LED indicators to annunciate the following: presence of AC power, status of alarm silenced feature, presence of supervisory conditions.

3. A red, seven segment LED display shall be provided to annunciate the following:

   a. The zone number of an IDC in Alarm

   b. Multiple IDCs in Alarm shall be annunciated by scrolling the number of the zones in chronological order. Scrolling shall be automatic with manual intervention as required to hold and scroll.

   c. The number of an IDC in a supervisory condition with the decimal point of the display illuminated as a supervisory indicator. This shall be accompanied by the illumination of the supervisory LED.

   d. Multiple IDCs in supervisory shall be annunciated by scrolling the number of the zones in chronological order.

4. A yellow LED display shall be provided to distinctly annunciate the trouble conditions. These conditions shall as a minimum include:

   a. The number of an IDC in trouble.

b. Multiple IDCs in trouble shall be annunciated by scrolling the number of the zones in chronological order. Scrolling shall be automatic with manual intervention as required to hold and scroll.

c. NAC 1 trouble.

d. Annunciator interface module trouble.

e. Auxiliary alarm output trouble, indicated by zone.

f. Low battery.

g. Depleted battery.

h. Walk Test system test enabled.

i. Programming trouble.

j. Power supply trouble.

k. Ground fault trouble.

l. City Circuit module trouble.

5. The following features shall be selectable at the control panel without using any separate programming tools or equipment:

a. March time code, temporal code, selective code, zone code, general alarm, time limit cutout, and alarm silence inhibit, for NACs.

b. Agency listed smoke detector Alarm Verification on an individual zone basis, to reduce the possibility of false alarms only in areas that may be prone to periodic high ambient smoke conditions (e.g., elevator lobbies, meeting rooms, etc.).

c. Silence inhibit of the alarm Notification Appliances for 0, 1, 2, 3, 4, or 5 minutes to prevent accidental silencing of the alarm signals.

d. Selectable NAC Silence cutout timer to automatically silence the Notification Appliances after 0, 10, 20, or 30 minutes after the activation of the Initiating Device.

e. System Walk Test operation that shall allow the system to be tested by a single person. When in the Walk Test mode, activating an Initiating Device shall report its individual resident zone with a distinct zone code pattern over the audible Notification Appliances. Upon completion of the zone

identification, the control panel shall automatically reset within 4 seconds. Integrity of the installation conductors of Initiating Device and Notification Appliance Circuits shall be verified by momentarily opening any circuit. This shall cause the operational Notification Appliances to operate steady for 4 seconds. The control panel shall automatically reset upon completion of the audible test signal. Walk Test of ground fault circuit testing shall be verified by operating the Notification Appliances for 4 seconds.

6. Remote Supervising Station output circuits (City Connection circuits), selectable for interface to remote station reverse polarity, or local energy master box.

7. An internally mounted internet dialer Digital Alarm Communication Transmitter (IP-DACT) shall be a UL 864 listed network dialer capable of operating on a VoIP system. Router used for network transmission shall have battery backup. AND Provide dual path commercial fire communicator connected to the IP_DACT capable of providing three selectable reporting paths which include: cellular only, IP only or IP primary/cellular backup.

8. Provisions for interfacing to Emergency Control relays, with dry contact outputs, for control of the HVAC equipment, elevators, door controls and other fire related equipment.

9. Provisions for interfacing to a remote Trouble relay for operation of remote trouble notification appliances.

10. Provisions for interfacing to a remote Supervisory relay for operation of remote supervisory notification appliances.

11. Selective zone disconnect operation shall be provided for each Initiating Device Circuit in the system. The panel shall provide an "Abort Enable" feature that delays the activation of alarm outputs if a zone is re-enabled in the alarm state. This shall allow the operator to "Abort the Enable" prior to unwanted activation of the notification appliances, off-premise reporting, and emergency control relays.

D. The power supply shall provide up to 4 amps of power to serve detectors, alarm notification appliances, remote annunciators, door holders, smoke dampers, relays, and other auxiliary devices as indicated on the plans and specifications. In addition to the 4 amps of power for Notification Appliances and Auxiliary equipment, the panel shall provide adequate power to serve the maximum configuration of control panel modules.

1. Include a secondary emergency power supply with capacity for operating system in standby mode for 24 hours followed by alarm mode for 5 minutes. The control panel shall obtain its primary operating power from a 120 VAC, 60 Hz supply provided with a dedicated and secured disconnect switch. Locate away from any sources of heat.

E. A "Depleted Battery" warning shall be sounded in the event that operation on battery back up exceeds the capacity requirements of the stand-by batteries. Operation shall include activation of the audible tone-alert and a unique indication shall be displayed on the operator control panel.

F. Active Status Reminder

1. Should any Alarm, Supervisory, or Trouble condition be present within the system and the audible signal silenced, the local tone alert shall resound every 8 hours (each change of work shift) to act as a reminder that the fire alarm system is not 100% operational.

2.4 MANUAL PULL STATIONS

A. Description: Double-action type, red LEXAN or metal finished in red, with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units. Provide at each exit door.

B. Protective Shield: Provide a tamperproof, clear LEXAN shield and red frame that easily fit over manual pull stations. When shield is lifted to gain access to the station, a battery powered piercing warning horn shall be activated. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.

2.5 SMOKE DETECTORS

A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:

1. Factory Nameplate: Serial number and type identification.

2. Operating Voltage: 24 VDC, nominal.

3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.

4. Plug-In Arrangement: Detector and associated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug

connection. Base shall provide break-off plastic tab that can be removed to engage the head/base locking mechanism. No special tools shall be required to remove head once it has been locked. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control unit.

5. Environmental Compensation: The detector shall provide a software filtering process that automatically compensates for environmental factors and component aging that affect detector operation.

6. Each detector head shall contain an LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the detector head LED shall be on steady.

7. Each detector base shall contain a magnetically actuated test switch to provide for easy alarm testing at the detector location and for accessing detector status information. Off-normal conditions shall be indicated by specific identifiable detector LED pulse patterns.

B. Smoke Detectors: A maintenance and testing service providing the following shall be included with the base bid:

1. Biannual sensitivity reading and logging for each smoke sensor.

2. Scheduled biannual threshold adjustments to maintain proper sensitivity for each smoke sensor.

3. Threshold adjustment to any smoke sensor that has alarmed the system without the presence of particles of combustion.

4. Scheduled biannual cleaning or replacement of each smoke detector or sensor within the system.

5. Semi-annual functional testing of each smoke detector or sensor using the manufacturer's calibrated test tool.

6. Written documentation of all testing, cleaning, replacing, threshold adjustment, and sensitivity reading for each smoke detector or sensor device within the system.

7. The initial service included in the bid price shall provide the above listed procedures for a period of one year after owner acceptance of the system.

C. Type: Smoke detectors shall be of the photoelectric type. Where acceptable per manufacturer specifications, ionization type detectors may be used.

D. Duct Smoke Detector: Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Provide at each location called for by code regulations.

1. The detector shall provide on-board sensitivity drift compensation and dirt accumulation tracking.

2. A magnetic test function shall initiate an alarm and provide detailed diagnostic information using the detector status LED.

3. The detector shall provide a multi-function status LED indicator that indicates off-normal conditions by specific identifiable detector LED pulse patterns.

4. The duct housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC or an auxiliary alarm relay with two "Form C" contacts rated at 1A@ 28VDC or ½A@ 120 VAC resistive. This auxiliary relay operates when the detector reaches its alarm threshold. Relay shall be mounted within 3 feet of HVAC control circuit.

5. Duct housing shall provide a relay control trouble indicator yellow LED.

6. Compact duct housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.

7. Duct housing shall provide two (2) test ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke detector.

8. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.

9. Each duct detector shall have a Remote Test Station with an alarm LED and test switch.

E. Smoke Detector/Carbon Monoxide (CO) Detector

1. Smoke Detector/Carbon Monoxide Detector shall be listed to UL 268 and UL 2075 for Carbon Monoxide Gas Detection.

2. The Detector shall be photoelectric smoke sensing and electrochemical CO sensing and equipped with a sounder capable of Temp 3 and Temp 4 audible signals.

3. The Detector shall have nominal sensitivity of 2.5% per foot as measured in the UL smoke box.

4. The Detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms.

5. The Detector's base shall be able to mount to a single-gang electrical box or direct (surface mount) to the wall or ceiling.

6. The Detector shall provide LED indication that blinks to indicate normal standby, smoke alram, smoke maintenacne, CO alarm, CO trouble/end-of-life. When the detector is in CO troulbe conditon, it shall send a trouble signal to the panel.

7. The Detector shall provide a means to test CO gas entry into the CO sensing cell. The detector shall provide this with a test mode that accpets CO gas from a test agent and alarms immeditately upon sensing CO entry. The 2-wire model shall include a maintenance signal to indicate the need for maintenance at the alarm control panel and shall provide a loop testing capability to verify the circuit without testing each detector individually.

8. The Detector shall have a replaceable CO cell that can be replaced at end of cell life.

2.6 HEAT DETECTORS

A. Thermal Detector: Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; 135-deg F fixed-temperature setting except as indicated.

B. Thermal detector shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag.

2.7 MAGNETIC DOOR HOLDERS

A. Description: Units shall be listed to UL 228. Units are equipped for wall, chain or arm mounting as necessary and are complete with matching door plate. Unit shall operate from a 120VAC, a 24VAC or a 24VDC source, and develops a minimum of 25 lbs. holding force.

B. Material and Finish: Match door hardware and structural conditions.

C. Provide at all fire wall doors. Coordinate with the Architectural Life Safety Plan.

D. Provide type as appropriate for door style and location.

2.8 STANDARD ALARM NOTIFICATION APPLIANCES

A. Horn: Piezoelectric type horn shall be listed to UL 464. The horn shall have a minimum sound pressure level of 85 dBA @ 24VDC. The horn shall mount directly to a standard single gang, double gang or 4" square electrical box, without the use of special adapter or trim rings.

B. Visible/Only: Strobe shall be listed to UL 1971. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. V/O appliances shall be provided with different minimum flash intensities of 15cd, 75cd and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific Visible/Only appliance.

C. Audible/Visible: Combination Audible/Visible (A/V) Notification Appliances shall be listed to UL 1971 and UL 464. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. Provide a label inside the strobe lens to indicate the listed candela rating of the specific strobe. The horn shall have a minimum sound pressure level of 85 dBA @ 24VDC. The audible/visible enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings.

D. Notification Appliance Circuit provides synchronization of strobes at a rate of 1Hz and operates horns with a Temporal Code Pattern operation. The circuit shall provide the capability to silence the audible signals, while the strobes continue to flash, over a single pair of wires. The capability to synchronize multiple notification appliance circuits shall be provided.

E. Accessories: The contractor shall furnish the necessary accessories.

F. Provide ceiling mounted devices where indicated on the plans.

G. Visual devices shall have field selectable candela ratings of 15, 30, 75, 95, 115, 150, and 177.

2.9 **SYSTEM PRINTER (CAPABILITY ONLY)**

A. Provide capability for system printer. Printer information below included for reference only.

1. The system printer shall be operated from a Printer Modules (PIM-1 which mounts inside the enclosure and PIM-2, which outside the enclosure.

2. The logging printer shall be “UL” listed with the system. This parallel printer shall be supervised for: On/Off line, out of paper, paper jam, power off, and connection the system. The printer shall be a; high speed, 24 dot matrix, wide carriage, and capable of using tractor or friction fed paper. Supervised network connection shall be either Style 4 or 7 as required by local requirements. The printer shall contain diagnostic LED’s for ease in maintenance.

2.10 FIRE ALARM WIRE AND CABLE

A. All wire and cable shall be in strict compliance with local codes and the provisions of NEC Article 760 for Power-limited Fire Alarm Circuits. If required, the installation and control panel may be reclassified as Non Power-limited, per the provisions in NEC 760, providing all the requirements of NEC 760 Circuit Markings and Wiring Methods are met, and all identification of power-limited circuits are removed from the control panel.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Install system components and all associated devices in accordance with applicable NFPA Standards and manufacturer's recommendations.

B. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:

1. Factory trained and certified personnel.

2. National Institute of Certification in Engineering Technologies (NICET) fire alarm level III certified personnel.

3. Personnel licensed or certified by state or local authority.

3.2 EQUIPMENT INSTALLATION

A. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.

B. Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.

C. All necessary devices and wiring which are necessary for a complete, acceptable system shall be supplied regardless whether shown on the plans or not.

D. Provide wire guards to protect all devices installed in gymnasiums and areas subject to physical abuse.

3.3 WIRING INSTALLATION

A. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction (AHJ) and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electric Code (NEC).

B. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.

C. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system conduits, junction boxes and covers red.

D. Wire installed in open ceiling areas shall be installed in conduit.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.

B. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:

1. Factory trained and certified.

2. National Institute for Certification in Engineering Technologies (NICET) fire alarm certified, NICET level III minimum.

3. Certified by a state or local authority.

4. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.

C. Pretesting: Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.

D. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.

E. Minimum System Tests: Test the system according to the procedures outlined in NFPA 72.

F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log.

H. Final Test, Certificate of Completion, and Certificate of Occupancy:

1. Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy.

3.5 CLEANING AND ADJUSTING

A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Clean unit internally using methods and materials recommended by manufacturer.

B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.6 TRAINING

A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.

1. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of four hours training.

2. Schedule training with the Owner at least seven days in advance.

3.7 FINALLY

A. Prior to the start of the installation of the fire alarm system, the Fire Alarm Contractor shall submit proposed drawings depicting device locations and system description to the local Authority Having Jurisdiction.

B. Final system design shall include all changes or variations necessary to comply with national, state and local authorities, to include all calculations necessary.

C. No additional costs, other than the bid price, shall be allowed.

D. The Fire Alarm Contractor shall be capable of certifying and signing the final plans as required by the Authority Having Jurisdiction.

E. Provide a plan box to be permanently mounted near the fire control panel for the storage of as-built drawings and system documentation, to include fire prevention drawings.

END OF SECTION

SECTION 31 11 00

SITE PREPARATION & CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Removal of miscellaneous existing site appurtenances.
   2. Protection and/or removal of trees and other vegetation.
   3. Topsoil stripping
   4. Clearing, grubbing and mowing

1.2 RELATED REQUIREMENTS
Construction Drawings

1.3 PROTECTION

A. Provide protection necessary to prevent damage to existing improvements, trees, or vegetation, light poles, power poles, fire hydrants, etc., indicated on the Contract Documents are to remain.

B. Protect improvements on adjoining properties and on Owner's property.

C. Restore damaged improvements to original condition as acceptable to parties having jurisdiction.

D. Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction. Streets and roadways shall be thoroughly cleaned and/or swept on a daily basis or more frequently as required by the governing authority.

E. Provide traffic control as required, in accordance with the U.S. Department of Transportation "Manual of Uniform Traffic Control Devices" and the state highway department requirements.

F. Unknown Utility Lines: All known utilities have been shown according to the information available. Contractor is responsible for coordinating with local utility companies and owner to locate and confirm all buried utilities in the construction area. Contractor is to notify Architect immediately if unknown lines, pipes, or other underground objects are encountered.

G. Mow and remove weeds and small undergrowth vegetation in the construction area as defined on the drawings.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION

3.1 GENERAL PROCEDURE

A. Unless otherwise indicated on the drawings, remove trees, shrubs, grass, other vegetation, improvements, or obstructions interfering with installation of new construction. Removal includes digging out stumps and roots. Dispose of off-site in accordance with local regulations. Do not remove items elsewhere on site or premises unless specifically indicated. Notify Architect prior to clearing if any item called for as “removed by Owner" remains upon issuance of Notice to Proceed.

B. Strip topsoil to whatever depths encountered to prevent intermingling with underlying subsoil or other objectionable material. Cut heavy growths of grass from areas before stripping. Topsoil shall consist of sandy clay surfical soil found in depth of not less than 6". Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones and other objects over 2" in diameter, weeds, roots, and other objectionable material.

C. Stockpile topsoil in storage piles where directed. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent windblown dust. Dispose of unsuitable or excess topsoil same as specified for waste material, unless otherwise specified by owner. Excess topsoil beyond amount specified shall be removed from the site by the Contractor unless specifically noted otherwise on the Drawings.

D. Completely remove stumps, roots, and other debris below proposed subgrade elevation. Fill depressions caused by clearing and grubbing operations with satisfactory soil material as per requirements of Section 31 23 00 unless further excavation or earthwork is required.

E. Remove existing above grade and below grade improvements and abandoned underground piping or conduit necessary to permit construction and other work.

F. Retain boxing and protection for items to remain in construction until finish grade is completed. Repair any damage that occurs to these items without expense to the Owner.

END OF SECTION

SECTION 31 13 00

TREE PROTECTION AND TRIMMING

PART 1 GENERAL

1.1 SUMMARY

A. The work of this section pertains to existing trees, along the perimeter of proposed development, that are noted to remain and will be effected by the surrounding work. These trees must be protected in the specified manner from the beginning of the project until Owner acceptance.

B. Trimming of the trees noted to remain is to be completed by nursery personnel trained in tree surgery and having a minimum of 5 years experience in the field. Trees noted to remain and have work occurring within the drip line which will change the existing grades or will result in the removal of a portion of the root system will be professionally trimmed to minimize the effect of the damage. Damage to and/or removal of roots should be kept to a minimum and the tree crown should be trimmed proportionally.

C. The Contractor shall stake the work occurring around trees and have tree roots and crown trimmed before commencing any work .

1.2 SHOP DRAWINGS / SUBMITTALS

None required.

1.3 COORDINATION

A. Coordinate tree trimming work with the project schedule such that access to the trees for trimming is not hindered and such that no other work is endangered by falling limbs. Once tree trimming is complete place tree protection equipment and devices as specified. Field verify with Architect, trees to be protected

PART 2 PRODUCTS

This part not used.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Tree protection measures are to prevent damage to the existing trees and include the roots, trunk and crown. Protection measures should be adequate to minimize the possibility of accidental damage and should remain intact throughout the project construction.

3.2 PROTECTION MEASURES

A. Roots
After trimming (if necessary) has been completed, place metal posts and temporary fencing along the tree line. Fencing should be located at the drip-line of the tree, or at the extent of the root system in the case of a trimmed tree.

B. Trunk
Provide a complete barrier protecting the trunk from the ground to the first major branch. This may consist of 2 x 4's placed vertically and edge-to-edge around the tree and secured with wire or rope.

C. Crown
Physical barriers are generally not feasible at this level, however, care should be exercised in the operation of power equipment in the area of the tree. Extent of construction should be estimated and trees trimmed accordingly so that the tree crown is not damaged.

D. The Contractor shall stake the work occurring around trees and have tree roots and crown trimmed before commencing any work .

3.3 PROCEDURES

A. Comply with the requirements of Article - SAFETY REQUIREMENTS GENERAL CONDITIONS of the specifications. Perform tree trimming in such a manner as to eliminate hazards to persons and property and to minimize interference with use of adjacent areas or structures.

Provide safeguards, including warning signs, barricades, temporary fences, warning lights, etc., that are required for protection of all personnel during operations.

B. Care shall be taken to prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust down to a minimum.

C. Debris shall become the property of the tree trimming subcontractor and shall be disposed of by him off the site unless specifically noted otherwise.

D. On completion of the work of this section and after removal of all debris, site shall be left in clean condition satisfactory to Owner's representative.

END OF SECTION

SECTION 31 22 00

SITE GRADING

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 31 23 00, Excavation and Backfill.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. Do all cutting, filling, compacting, and finish grading required to bring entire project area within the limits of construction shown to indicated grades.

B. Subgrades should be consistent with finish grades shown, allowing for an uniform layer of topsoil, properly graded to drain away from the building. Provide smooth ditches or swales as shown to carry water away from the project area without standing.

C. Contractor shall be responsible for setting all grades and slope stakes; and locating all buildings, drives, parking areas, walks and other site items as shown on drawings.

D. Control grading operations to prevent water from running into excavated areas.

3.2 ENVIRONMENTAL REQUIREMENTS

A. Construct temporary erosion control systems as shown on Construction Drawings or as directed by "Storm Water Pollution Prevention Plan" (SWPPP) to protect adjacent properties and water resources from erosion and sedimentation.

B. In event that site work on this project will disturb 5 or more acres, Contractor shall not begin construction without posting on site the "National Pollution Discharge Elimination System" (NPDES) permit governing discharge of storm water from site for entire construction period. NPDES permit requires SWPPP to be in place during construction.

C. Contractor shall be totally responsible for conducting storm water management practices in accordance with NPDES permit and for enforcement action taken or imposed by Federal or State agencies, including cost of fines, construction delays, and remedial actions resulting from Contractor's failure to comply with provisions of NPDES permit.

D. All grading operations are operations that are to be in strict compliance with the provisions of the Arkansas Water and Air Pollution Control Act Act 472 of 1949 as amended, AR Ann. 8-4-101 et seq.), and the Federal Clean Water Act 33 U.S.C. 1251 et. seq. Contractor shall be responsible for submitting application to state authority and obtaining permits.

E. It shall be the Contractor's responsibility to comply with current OSHA and other local, state, and federal requirements for all excavation and fill operations, and other areas of the work.

F. Contractor to keep dust on site to a minimum the entire duration of construction by means of regular watering. This will include dust created by grading operations, vehicular traffic, and wind.

END OF SECTION

SECTION 31 23 00

EXCAVATION AND BACKFILL

PART 1 GENERAL

1.1 SUMMARY

A. Furnish labor and materials for all work under this section.

1.2 RELATED SECTIONS

A. Section 00 42 13– Proposal for Lump Sum Contract: Unit Prices

B. Section 01 22 13 – Measurement & Payment

C. Section 01 40 00 – Quality Control: Required Special Inspections

D. Section 02 32 00 – Earthwork

E. Section 03 30 00 – Cast-In-Place Concrete

F. Section 31 11 00 - Site Preparation

G. Section 31 22 00 - Site Grading

H. Section 32 11 16 - Crushed Stone Base Course

I. Section 32 92 19 – Seeding

K. Section 32 92 23 – Sodding

1.3 SOILS VERIFICATION

A. The **Contractor** shall be responsible for having GTS, Inc. 1911 North Shiloh Drive, Fayetteville, Arkansas 72704, the registered soils engineer, present on site to examine and conduct tests of soils preparation and construction per IBC required special inspections including filling and grading. The soils engineer shall inspect excavations for foundations, footings, and paving areas perform bearing testing, and will submit a report to general contractor with a copy to the Architect stating conditions observed meet or exceed the limits found in the specifications and are consistent with acceptable construction practices. Construction shall not begin before report is received by the Architect. **Contractor** shall be responsible for any costs for meeting these requirements. **Contractor** shall coordinate inspections, testing, and observation with soils engineer.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 TOPSOIL AND UNSUITABLE SOILS EXCAVATION

A. Strip off topsoil and unsuitable fill material at new building, paving and drive areas. Remove all vegetation, rocks, and any soft soils. Haul away and dispose of unsuitable fill material and excess excavated topsoil material off site. Excavate to minimum thicknesses as follows:
   1. Building Pad: 2'-0"
   2. Paving Areas: 1'-0"

   At footings, excavate as required to provide 12 inches of engineered fill beneath footings.

B. After stripping unsuitable soils as described in soils report to required depth (refer to "Preparation Of Original Earth" section), the entire building area, drives, walks, and all areas to be paved shall be proof-rolled with a loaded rubber-tired tandem-axle dump truck or scraper weighing at least 25 tons, and any soft soils are to be undercut and replaced with properly compacted fill. Soils engineer shall be present when proof rolling is being performed.

C. After proofrolling, scarify to a depth of at least 6" adjusting the moisture content to within 2 percent of optimum moisture content, then compacted to specified density.

D. Retain sufficient topsoil on site to accomplish final grading.

E. Use no topsoil for compacted fill inside building perimeter.

F. Use no on-site excavated material for fill inside building perimeter or below footings.

G. If insufficient topsoil on site, furnish good topsoil, approved by Architect, for finish grading and planting areas.

3.2 EARTH EXCAVATION

A. Excavation for walks, pavements, curbs, gutters, roof drainage, conductors, building volume below grade, underfill below slabs on grade, foundation walls, footings and other items indicated by drawings or otherwise necessary for construction.

B. Excavate to elevations and dimensions indicated, plus minimum, yet sufficient, space to permit erection of forms, shoring, waterproofing, masonry and the inspection of foundations.

C. Bear footings on engineered fill at elevations shown on drawings.

D. Ensure all exterior footing excavations are below frost line at a minimum of 24" below final finish grade.

E. Remove any existing foundations, footings, piers, and other construction found in the area of new construction.

F. Material to be excavated is assumed to be earth and other materials that can be removed with a Caterpillar D-8 Dozer with single tooth ripper (mass grading), a Caterpillar 330B tracked excavator equipped with rock teeth (utility trenches) or equipment of similar power and capability. If unanticipated rock is encountered within limits of excavation, contractor shall immediately notify Architect and not proceed further until instructions are given and measurements made for purpose of establishing volume of rock excavation. Rock is defined as any stone or boulders that cannot be removed with the use of a Caterpillar D-8 Dozer with single tooth ripper (mass grading), a Caterpillar 330B tracked excavator equipped with rock teeth (utility trenches) or equipment of similar power and capability.

G. Only as a last resort, should explosives be used. Should explosives be necessary, work shall be done by experienced powder men using small charges and in strict accordance with all regulations governing this work. Contractor to secure permits required for such work and correct any damage to foundations and/or property caused by improper use of explosives at his expense. Architect to be notified and approval granted before explosives are allowed.

H. Specifically notify Architect to inspect excavations and receive the Architect's approval before placing concrete.

I. Provide unit price for rock excavation on Bid Form. Rock shall be measured per cubic yard for rock in place. This shall include associated costs for quantity verification by soils engineer.

J. Provide unit prices for engineered fill/placement/compaction and existing earth excavation/removal/haul-off in spaces provided on Bid Form. This shall include associated costs for quantity verification by soils engineer. These unit prices are for Owner's information only. Provide all fill and cut in contract as required to meet requirements shown on drawings and specifications.

3.3 PREPARATION OF ORIGINAL EARTH

A. Floor slab areas should be stripped of all surface vegetation, topsoil and unsuitable soil. Any soft or unstable materials should be removed and replaced with engineered fill. The subgrade, exposed after stripping and completing any cuts, should be scarified to a minimum depth of 8 inches and moisture conditioned to level within 2 percent of the materials' optimum moisture content. The subgrade should then be compacted to at least 98 percent of the material's minimum dry density determined in accordance with ASTM D1557

B. Remove all topsoil below areas to receive sidewalks. Bear concrete sidewalks on natural earth or minimum 12" engineered fill as required to meet elevations as shown on grading plan.

3.4 FILL MATERIAL AND GRADING

A. Place imported engineered fill material beneath the slab. Thickness as required to meet subgrade elevations is in addition to granular under slab fill.

B. Place imported engineered fill materials for paving areas to levels indicated on site plan. Compact as specified.

C. Bear concrete sidewalks on natural earth or minimum 12" engineered fill as required to meet elevations as shown on grading plan. Thickness as required to meet subgrade elevations is in addition to 4"granular under slab fill.

D. Footings to bear on minimum 1'-0" thick engineered fill. The over excavation of existing low strength materials should extend a sufficient distance beyond the edge of the building such that the engineered fill placed beneath footings will extend laterally beyond the edge of the footing at least 8 inches for each 12 inches of engineered fill placed beneath the footing.

E. At Contractor's option, the on-site soils could be modified with lime to reduce their plasticity. The actual percentage required is to be determined in the field by a qualified soils engineer as the amount necessary to reduce the plasticity index(PI) of the lean to fat clay soils to less than 18 percent. Refer to proposal form for unit pricing. This is for owner's use only in determining any additional soil modification. If soil modification is selected by contractor as option, it will be priced inclusive in project.

F. Excavations resulting from the removal of existing site features should be cleaned of loose material and properly back filled as recommended in this report.

G. If soils engineer determines less fill material or more is required, it shall be provided or deducted from contract. Refer to proposal form for unit pricing.

H. In general, place no interior or exterior fills less than 3 days after concrete forms for structure have been removed, and then only when approval is received from Architect.

I. Place fill in layers not exceeding 9" in loose thickness, thoroughly compacting with powered tamp. Moisture content of fill material is to be controlled to between 2 percent below and 3 percent above optimum as determined by ASTM D698. Compact fill material to a minimum of 98 percent of the minimum dry density, ASTM D1557

J. All imported engineered fill to consist of approved, low to moderate plasticity silty clay material that is free from organic matter and debris. Engineered fill shall have liquid limits less than 40 and a plasticity index of at least 18. Locally available clayey gravel (hillside) materials could be used but should be approved prior to their use. No rock

greater than 3” shall be allowed in fill material. Submit test results of fill material from borrow pit proposed for use to Architect for approval prior to procurement.

K. Final fill under concrete floor slabs shall consist of 4 inches of granular sub-base material immediately below the concrete floor slab. The sub-base material shall be clean, washed, crushed limestone conforming to ASTM C33, Size 57, or equal spread level to allow for minimum required concrete thickness. The upper portion (approximately 2 inches) to be “choked” off with limestone fines or sand. Tamp tightly into place, prior to placement of termite treatment and vapor barrier.

L. Backfill around foundations and grade beams with debris-free earth having no stones larger than 3" and no frozen materials. Take precautions not to damage waterproofing membrane. Repair any damage to same.

M. Roll, tamp and otherwise compact other site fill.

N. Cut and fill with debris-free earth to bring lawn areas affected by this construction to approximately 4" below finish grades. Grade uniformly between elevations give and "round-out" any abrupt changes in slope during final grading operations.

O. Haul in additional earth required. Should there be an excess of excavated material, haul it to area off site.

P. Haul away and dispose of any surface rubble and debris.

Q. Remove any groundwater accumulated in excavations prior to placement of concrete. Soils Engineer to verify conditions are acceptable and bearing capacity is at or exceeds specified bearing pressure

3.5 TOPSOIL

A. After rough grading is completed and approved, scarify subsoil in areas to be lawns to a depth of 3" and place a layer of topsoil there over, providing additional topsoil required to give thickness specified.

B. Topsoil material: Fertile, natural topsoil, typical of locality, free from stones, debris, clay and weeds.

C. Topsoil minimum thicknesses: 4" seeded and sodded areas, 12” landscaped areas. (Adjust final cut and fill depth as required to accommodate lawn type.)

D. Fill to finish grade indicated, eliminate water pockets and irregularities, ready to receive seed or sod.

E. Finish site grading to be smooth throughout contours. Abrupt changes, uneven, or undulating grading will not be accepted unless shown as such on grading plan.

3.6 EXTENT OF FINISH GRADING

A. Cut, fill and grade to extent of contours and elevations indicated by drawings.

B. At building perimeter, keep finish grades generally 6" below finish floor elevation with exception of areas at drives and walks.

3.7 QUANTITY VERIFICATION

A. Contractor to be responsible for costs incurred by Surveyor Geotechnical Engineer, or other qualified individuals to verify quantity of rock or additional unsuitable soil removed. This shall be included in the unit price costs.

3.8 OBSERVATION AND SPECIAL INSPECTIONS

A. Soils cut and fill operations shall be observed periodically by the Architect/Engineer prior to placing of concrete footings and slabs, and paving. Inspection of soils bearing pressure, verification of soils, and cut/fill operations for conformance to the construction documents and IBC shall be performed by the designated third party Special Inspector.

3.9 TEST REQUIRED

A. Contractor shall coordinate compaction tests on the building and paving areas from a recognized testing laboratory, approved by the Architect, at the following intervals. Contractor is to pay for compaction testing. **Location of each test shall be noted on report.**

B. Minimum three tests per each layer of fill placed, one per each 2,500 sq. ft. of building area.

C. Minimum three tests per each layer of fill placed, one per each 5,000 square feet of pavement area.

D. Density testing of any gravel or crushed stone base course with fines or any over-excavated footing is to be compacted to a minimum of 95 percent of the maximum Standard Proctor dry density, ASTM Specification D-698.

E. If any test results fall below required minimum, the testing company is required to contact Contractor and Architect immediately.

END OF SECTION

SECTION 31 23 16

ROCK REMOVAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Removal of identified and discovered rock during excavation.
B. Use of explosives to assist rock removal.
C. Incorporating removed rock into fills and embankments.

1.2 RELATED SECTIONS

A. Section 00 42 13 – Unit Prices
B. Section 31 23 33 - Excavation, Backfill, and Compaction for Utilities
C. Geotechnical Report for boring locations and findings of subsurface materials and conditions.
D. Construction Drawings

1.3 REFERENCE STANDARDS

A. National Fire Protection Association (NFPA) latest edition
   495 Code For Explosive Materials

1.4 ENVIRONMENTAL REQUIREMENTS

A. Determine environmental effects associated with proposed work and safeguard those concerns as regulated by law and local governing authorities by reasonable and practical methods.

1.5 PROJECT CONDITIONS

A. Discrepancy with Construction Drawings and Specifications regarding amount and type of rock to be removed shall immediately be brought to attention of the Owner or his designated representative. Revised removal plan and schedule shall subsequently be provided and followed.

1.6 QUALIFICATIONS

A. Submit records of documented experience to the Owner or his designated representative prior to removal of rock by blasting.

1.7 QUANTITY VERIFICATION

A. Contractor to be responsible for costs incurred for surveyor Geotechnical Engineer, or other qualified individuals to verify quantity of rock removed. This shall be included in the Unit Price cost.

PART 2 PRODUCTS

2.1 MATERIALS

A. Explosives, detonator/delay device, blast mat materials and accessories shall be as recommended by explosive supplier and shall comply with requirements of applicable governing authorities.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify site conditions and note subsurface conditions affecting work of this section.
B. Establish required lines, grades, and elevations that will determine extent of proposed rock removals.

3.2 ROCK EXCAVATION

A. Rock excavation is defined as igneous, metamorphic, or sedimentary rock that cannot be removed by rippers or other mechanical methods and, therefore requires drilling and blasting. Cut rock to form level bearing at bottom of footing and trench excavations. In utility trenches excavate rock to 6-in. below invert elevation of pipe. Remove shaled layers to provide sound and unshattered base for footings or foundations.
B. Comply with laws, rules, and regulations of Federal, State, and local authorities and insurer which govern storage, use, manufacture, sale, handling, transportation, licensing, or other disposition of explosives. Take special precautions for proper use of explosives to prevent harm to human life and damage to surface structures, utility lines, or other subsurface structures. Do not conduct blasting operations until persons in vicinity have had ample notice and have reached positions of safety.
C. Contractor shall hold harmless the Owner or his designated representative, Architect, and Engineer from claims growing out of use of such explosives. Removal of materials of any nature by blasting shall be done in such manner and at such time as to avoid damage affecting integrity of design and to avoid damage to new or existing structures included in or adjacent to work. It shall be Contractor's responsibility to determine method of operation to ensure desired results and integrity of completed work.
D. Use Controlled Low Strength Material (CLSM) / Flowable Fill or other acceptable materials to replace rock overblast or overexcavation in building area to facilitate placement of utilities and future footings.

END OF SECTION

SECTION 31 23 23

PIPELAYING

PART 1 GENERAL

1.1 SCOPE

A. Section includes the Work necessary to install water, sewer, and storm drainage piping and appurtenances.

1.2 RELATED WORK

A. Trenching, backfill and compacting is specified in Section 31 23 33.

1.3 QUALITY ASSURANCE

A. Provide workmen with skill to ensure embedment of pipe.

B. Methods of Testing
   1. The moisture density relations of materials shall be determined in the laboratory in accordance with AASHTO T-99 or T-180, as specified.
   2. Field density of backfill shall be determined in accordance with ASTM D2922.

1.4 PUBLIC WORK

A. Comply with the City of Bentonville standard water and sewer specifications for public water and sewer lines. If conflict should be found between this section and city standards for Public Utilities, city standards shall be the priority. It shall be the Contractor's responsibility to obtain city standard water and sewer specifications and comply with the minimum requirements.

PART 2 PRODUCTS

2.1 EMBEDMENT

A. Class I material consists of manufactured angular, granular material, 1/4 to 1-1/2 inches (6 to 40 mm) in size.

B. Class II material consists of coarse sands and gravel with maximum particle size of 1-1/2 inches (40 mm), including variously graded sands and gravels containing small percentage of fines, generally granular and non-cohesive, either wet or dry. Soil types GW, GP, SW, and SP are included in this class.

   GW-Well graded gravels and gravel-sand mixtures, little or no fines, 50 percent or more retained on a No.4 sieve, more than 95 percent retained on a No. 200 sieve.

GP-Poorly graded gravels and gravel-sand mixtures, little or no fines. 50 percent or more retained on a No. 4 sieve. More than 95 percent retained on a No. 200 sieve. Clean.

SW-Well-graded sands and gravelly sands, little or no fines. More than 50 percent passes a No.4 sieve. More than 95 percent retained on a No. 200 sieve. Clean.

SP-Poorly graded sands and gravelly sands, little or no fines. More than 50 percent passes a No.4 sieve. More than 95 percent retained on a No.4 sieve. Clean.

2.2 BACKFILL

A. Select materials are defined as good earth, sand, or gravel and shall be free from rocks larger than 1-1/2 inches in diameter or hard lumpy materials. Select materials require hand placement and consolidation.

B. Protection cover shall be defined as backfill from the top of the pipe to a point 12 inches above the top of the pipe and shall consist of select material as defined in paragraph 2.1A.

C. Backfill over the protection cover shall be free from cinders, ashes, refuse, vegetable, or organic material, boulders, rocks or stones having dimension greater than 6 inches, frozen soil, or other material that in the opinion of the Engineer is unsuitable.

PART 3 EXECUTION

A. Examine the pipe and appurtenances for compliance with specifications.

B. Reject pipe and appurtenances not in compliance with specifications.

C. Remove foreign matter from pipe and appurtenances before lowering into excavated area.

D. Pipe bedding
   1. For PVC pipe and fittings, place 6-inch minimum of Class I or Class II material between excavated trench bottom or stabilized trench bottom and bottom of pipe or fitting as embedment. Embedment material shall be tamped by hand or approved mechanical methods so as to provide a uniform and continuous bearing support for the pipe at every point along the pipe barrel. Class I material shall be used for haunching to the spring line of the pipe, and to 6 inches over the top of the pipe. Embedment shall be compacted to a standard proctor density of 85 percent as defined in AASHTO T-99.
   2. For iron pipe and appurtenances, place 4 inch minimum of Class I or Class II material between excavated trench bottom or stabilized trench bottom and bottom of pipe or appurtenance. Embedment material shall be tamped by hand or approved mechanical methods so as to provide a uniform and continuous bearing support for the pipe at every point along the pipe barrel. Class I material shall be used for haunching to the spring line of the pipe, and to 6 inches over the top of the pipe. Embedment shall be compacted to a standard proctor density of 85 percent as defined in AASHTO T-99.

E. Place pipe and appurtenance to planned line and elevation.
   1. Place gravity waste water pipe from low end to high end with pipe bells facing upstream.
   2. Place potable water pipe with bells facing the direction of laying.
   3. Cover open end of laid pipe to prevent rodents and debris from entering pipe.

F. For iron pipe, place Class I material 6 inch maximum layers, compacted to 85 percent maximum density standard proctor, to top of pipe. Ensure that Class I material is compacted against haunch area of pipe.

G. Pipe Covering: Place protection material to a minimum 12 inch depth over top of pipe and fittings. Place in 6 inch maximum layers, compacted to 85 percent standard proctor density.

H. See Section 31 23 33 for remainder of backfill requirements.

I. Existing Utility Crossing: Expose all utilities located between two manholes a minimum of 24 hours before the downstream manhole is constructed. Wherever possible, sewer will be adjusted to provide necessary clearance.

END OF SECTION

SECTION 31 23 33

EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 GENERAL

1.1 SUMMARY

A. This section includes the excavation, bedding, and backfilling of utilities necessary to perform work indicated on Drawings and Contract Documents.

B. Comply with the City of Bentonville standard water and sewer specifications for public water and sewer lines. If conflict should be found between this section and city standards for Public Utilities, city standards shall be the priority. It shall be the Contractor's responsibility to obtain city standard water and sewer specifications and comply with the minimum requirements.

1.2 RELATED REQUIREMENTS

A. Construction Drawings
B. Section 31 11 00 - SITE PREPARATION & CLEARING
C. Section 31 23 23 - PIPELAYING
D. Section 02 32 00 – GEOTECHNICAL SOILS REPORT

1.3 LOCAL REQUIREMENTS

A. Contractor to verify with city officials that this specification meets or exceeds local requirements. Local requirements shall supercede requirements of this specification unless noted otherwise.

1.4 SUBMITTALS

A. Shop Drawings or details pertaining to Site Utilities are not required unless use of materials, methods, equipment, or procedures contrary to Drawings or these specifications are proposed or as requested by Bentonville Water Utilities. Do not perform work until required shop drawings have been accepted by Owner.

B. The Contractor shall contact all utility companies and determine if additional easements will be required to complete the project. Contractor shall provide written confirmation of the status of all easements to the Architect at the time of the preconstruction conference.

PART 2 PRODUCTS

2.1 BEDDING MATERIAL

A. Processed sand and gravel free from clay lumps, organic, or other deleterious material, and complying with following gradation requirements:

U.S. Sieve Size	Percent Passing (by weight)
1 Inch	100
3/4 Inch	90-100
3/8 Inch	20-55
No. 4	0-10
No. 8	0-5

B. Steel Casing Pipe: Comply with AWWA C-201 or C-202, minimum grade B, size and wall thickness as indicated on Drawings.

2.2 DETECTION TAPE

A. Provide metallic detection tape located approximately 12” above pipe or conduit, where in ground utility lines are buried outside building footprint. Tape shall be continuous and be marked, indicating utility type (i.e. water, sewer, gas electric, etc.)

PART 3 EXECUTION

3.1 SUMMARY

A. Set all lines, elevations, and grades for utility and drainage system work and control system for duration of work, including careful maintenance of benchmarks, property corners, monuments, or other reference points.
B. Maintain in operating condition existing utilities, active utilities, and drainage systems encountered in utility installation. Repair any surface or subsurface improvements shown on Drawings.
C. Verify location, size, elevation, and other pertinent data required to make connections to existing utilities and drainage systems as indicated on Drawings. Contractor shall comply with local codes and regulations.

3.2 EXCAVATION, TRENCHING, AND BACKFILLING

A. Perform excavation as indicated for specified depths. During excavation, pile materials suitable for backfilling in orderly manner far enough from bank of trench to avoid overloading, slides, or cave- ins.

B. Remove excavated materials not required or not suitable for backfill or embankments and waste as specified. Any structures discovered during excavation(s) shall be disposed of as specified.

C. Prevent surface water from flowing into trenches or other excavations by temporary grading or other methods, as required. Remove accumulated water in trenches or other excavations by pumping or other acceptable methods.

D. Open cut excavation with trenching machine or backhoe. Where machines other than ladder or wheel-type trenching machines are used, do not use clods for backfill. Dispose of unsuitable material and provide other suitable material at no additional cost to Owner.

3.3 TRENCH EXCAVATION

A. The local utility companies shall be contacted before excavation shall begin. Dig trench at proper width and depth for laying pipe, conduit, or cable. Cut trench banks as nearly vertical as practical and remove stones as necessary to avoid point-bearing. Over excavate wet or unstable soil, if encountered, from trench bottom as necessary to provide suitable base for continuous and uniform bedding.

B. All trench excavation side walls greater than 5 feet in depth shall be sloped, shored, sheeted, braced or otherwise supported by means of the sufficient strength to protect the workmen within them in accordance with the applicable rules and regulations established for construction by the Department of Labor, Occupational Safety and Health Administration (OSHA), and by local ordinances. Lateral travel distance to an exit ladder or steps shall not be greater than 25 feet in trenches 4 feet or deeper.

C. Accurately grade trench bottom to provide uniform bearing and support for each section of pipe on bedding material at every point along entire length, except where necessary to excavate for bell holes, proper sealing of pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make joint connection properly.

D. Trench width requirements below the top of the pipe shall not be less than 12" nor more than 18" wider than outside surface of any pipe or conduit that is to be installed to designated elevations and grades. All other trench width requirements for pipe, conduit, or cable shall be least practical width that will allow for proper compaction of trench backfill.

E. Trench depth requirements measured from finished grade or paved surface shall meet the following requirements or applicable codes and ordinances:
   1. Water Mains: 48" to top of pipe barrel or 6" below the frost line (established by the local building official), whichever is deeper.
   2. Sanitary Sewer: Depths, elevations, and grades as indicated on Drawings.
   3. Storm Sewer: Depths, elevations, and grades as shown on Drawings.
   4. Electrical Conduits: 24" minimum to top of conduit or as required by NEC 300-5, NEC 710-36, codes, or the local utility company requirements, whichever is deeper.
   5. TV Conduits: 18" minimum to top of conduit or as required by the local utility company, whichever is deeper.
   6. Telephone Conduits: 18" minimum to top of conduit, or as required by the local utility company, whichever is deeper.

7. Gas Mains and Service: 30" minimum to top of pipe, or as required by the local utility company, whichever is deeper.

F. Please note that the trench depths listed above are minimum depths. Verify with local authority having jurisdiction for minimum trench depth requirements.

3.4 SHEETING AND BRACING

A. Provide sheeting and bracing, when necessary, in trenches and other excavations where protection of workmen required. Sheeting may be removed after excavation has been backfilled sufficiently to protect against damaging or injurious caving.

3.5 PIPE BEDDING

A. Accurately cut trenches for pipe or conduit that is installed to designated elevations and grades to line and grade 6” below bottom of pipe and to width as specified. Place 6” of bedding material, compact in bottom of trench, and accurately shape to conform to lower portion of pipe barrel. After pipe installation, place select backfill and compact in maximum 8" layers, measured loose, to the top of the trench.

3.6 TRENCH BACKFILLING

A. Criteria: Trenches shall not be backfilled until required tests are performed and the utility systems comply with and are accepted by applicable governing authorities. Backfill trenches as specified. If improperly backfilled, reopen to depth required to obtain proper compaction. Backfill and compact as specified, to properly correct condition in an acceptable manner.

B. Backfilling: After pipe or conduit has been installed, bedded, and tested as specified, backfill trench or structure excavation with specified material placed in lifts or layers not exceeding 8" of loose material. Compact to minimum density of 95% of optimum density in accordance with ASTM D 698 (or 92% of optimum density in accordance with ASTM D 1557).

C. Compaction: Exercise proper caution when compacting immediately over top of pipes or conduits. Water jetting or flooding is not permitted as method of compaction.

D. Compaction Testing: Independent testing laboratory shall perform test at intervals not exceeding 200'-0" of trench for each 8" of compacted trench backfill and furnish copies of test results as specified. Contractor is to pay for compaction testing.

E. Finished Surface: After compaction and testing are complete, cap the trench with an assembly that is flush with and matches the existing construction in materials and method of application.

END OF SECTION

SECTION 31 31 16

TERMITE CONTROL

PART 1 GENERAL

1.1 WORK INCLUDED

A. Soil treatment below slabs on grade for subterranean insects.

B. Soil treatment at foundation perimeter, for subterranean insects.

1.2 REFERENCES

A. Environmental Protection Agency (EPA)
   1. EPA - Federal Insecticide, Fungicide and Rodenticide Act.

1.3 QUALITY ASSURANCE

A. Materials: Provide certification that toxicants conform to requirements of authority having jurisdiction.

B. Material Packaging: Manufacturer's labels and seals identifying content.

1.4 REGULATORY REQUIREMENTS

A. Conform to applicable requirements for application licensing and authority to use toxicant chemicals.

1.5 SUBMITTALS

A. Product Data: Submit through General Contractor to Architect.
   1. Indicate toxicants to be used, composition by percentage, dilution schedule, and intended application rate.
   2. Submit manufacturer's application instructions.

1.6 PROJECT RECORD DOCUMENTS:

A. Accurately record moisture content of soil before treatment, date and rate of application, areas of application, diary of meter readings and corresponding soil coverage.

1.7 WARRANTY

A. Provide five year warranty for material and installation. Cost for the five year warranty period will be included with the warranty.

B. Warranty: Cover against invasion or propagation of subterranean termites, damage to building or building contents caused by termites; repairs to building or building contents so caused.

C. Inspect work annually and report in writing to Architect.

D. Owner reserves right to renew warranty for an additional five years.

E. Warranty period will not begin until date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

A. Toxicant Chemical: Water based emulsion, uniform composition, synthetic dye to permit visual identification of treated soil.

B. Approved chemicals.
1. Bifenchrin - Trade name Baseline, 1% emulsion.
2. Cypermethrin - Pyrethroid, trade name Demon TC, 1%.
3. Imidacloprid - Trade name Premise 75, .05% to .1%.
4. Cyano - Trade name Tirbute, .5% to 1%.
5. Other chemicals may be used as approved by appropriate regulatory agencies.

C. All instructions on the manufacturers label shall be closely followed and all state and federal laws strictly obeyed.

2.2 MIX DILUTION

A. Dilute and mix toxicant chemical to manufacturer's instructions.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify the soil surfaces are unfrozen, sufficiently dry to absorb toxicant, ready to receive treatment.

B. Beginning of application means acceptance of soil condition.

3.2 APPLICATION

A. Apply toxicant within 12 hours before installation of vapor barrier under slab-on-grade or finish grading outside foundation walls. If rain occurs after initial treatment and before installation of vapor barrier, re-application of termite treatment will be required.

B. Apply toxicant to soil at the following rates, using metered applicator:
   1. Under floor slabs-on-grade: One gallon per 10 sq. ft.
   2. Both sides of exterior foundation wall: Note-Treat exterior side of foundation walls and/or turn-down slab edges prior to topsoil placement.
      a. Concrete: Four gallons per 10 lineal feet, to depth of one foot.
      b. Masonry: Four gallons per 10 lineal feet for each foot of foundation depth.
   3. Two gallons per lineal foot at foundation penetrations.

C. Apply as a coarse spray to ensure uniform distribution.

D. Coordinate soil treatment at foundation perimeter with finish grading and landscaping work to avoid disturbance of treated soil. Retreat disturbed treated soil.

3.3 RE-TREATMENT

A. If inspection identifies the presence of termites, retreat soil and retest.

B. Use same toxicant as for original treatment.

3.4 TREATMENT CONFORMATION

A. Colored Dye to be added to treatment mix for visual inspection.

B. Keep application tickets on site for Architect's review. If long distance observation is made by Architect by viewing photos sent by email, forward treatment tickets to Architect for confirmation.

END OF SECTION

SECTION 31 35 00

SLOPE PROTECTION AND EROSION CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Installation of temporary and permanent erosion control systems.

B. Installation of temporary and permanent slope protection systems.

C. Contractor Responsibilities.

1.2 RELATED SECTIONS

A. Section 31 11 00 - Site Preparation

B. Section 32 92 19 – Seeding

C. Storm Water Pollution Prevention Plan

D. Construction Drawings

1.3 ENVIRONMENTAL REQUIREMENTS

A. Protect adjacent properties and water resources from erosion and sediment damage throughout life of contract.

1.4 CONTRACTOR RESPONSIBILITIES

A. **The Owner (through the Civil Engineer) will submit the Notice of Intent to the Arkansas Department of Environmental Quality (ADEQ) and obtain the NPDES Permit prior to beginning construction**. The Contractor will be responsible for implementing and maintaining all requirements under the Storm Water Pollution Prevention Plan (SWPPP). This includes, but is not limited to, installing best management practices (BMP), maintaining/replacing of BMPs when needed, stabilizing all disturbed areas on the project, completing inspection report forms at the frequency specified in the permit, and maintaining the SWPPP, all required postings, and rain gauge on the site. If the City of Bentonville, Arkansas, is issued a citation or fine for any storm water infractions or deficiencies by ADEQ, Environmental Protection Agency (EPA), or any other Entity having jurisdiction over storm water quality, because of negligence by the Contractor in maintenance of the SWPPP, the Contractor will be responsible for payment of the fines or citation fees. The amount of the fines shall be withheld out of the amount due to the Contractor. The BMPs shown in the erosion control plans are minimum measures and additional or different BMPs may be necessary in the field. The

contractor shall add or modify BMPs as necessary and document these changes in the SWPPP as required.

B. A copy of the permit and SWPPP will be furnished to the Contractor at the Pre-construction meeting.

PART 2 PRODUCTS

2.1 MATERIALS

A. Quick growing grasses such as wheat, rye, or oats in accordance with Section 32 92 19.

B. Stone check dams as specified on Construction Drawings.

C. Fencing for siltation control as specified on Construction Drawings.

D. Acceptable Filter/Drainage Fabrics:
   1. Mirafi 140 N
   2. Dupont Typar HR
   3. Approved alternate

E. Curlex blankets by American Excelsior Company or approved alternate.

F. Temporary mulches such as loose hay, straw, netting, wood cellulose, or agricultural silage.

G. Fence stakes shall be minimum of 5-ft in length and be either metal stakes or 2-in. x 2-in. hardwood stakes driven 1'-6" into ground.

H. Rip-Rap in accordance with Section 31 37 16.

PART 3 EXECUTION

3.1 PREPARATION

A. Review Construction Drawings and Storm Water Pollution Prevention Plan.

B. Deficiencies or changes on Construction Drawings or Storm Water Pollution Prevention Plan as it is applied to current conditions will be brought to the attention of the Owner or his designated representative for remedial action.

3.2 EROSION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

A. Place erosion control systems in accordance with Construction Drawings and Storm Water Pollution Prevention Plan.

B. The Owner or his designated representative has authority to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow, and embankment operations and to direct Contractor to provide immediate permanent or temporary pollution control measures. Contractor will be required to incorporate permanent erosion control features into project at earliest practical time to minimize need for temporary controls. Cut slopes shall be permanently seeded and mulched when finish grades are achieved as excavation proceeds to extent considered desirable and practical.

C. Temporary erosion control systems installed by Contractor shall be constantly maintained to control siltation during life of contract. Contractor must respond to maintenance or additional work as required by the Owner or his designated representative within 48 hours.

D. Additional material and work required and authorized by the Owner or his designated representative which is beyond extent of Construction Drawings and Storm Water Pollution Prevention Plan shall be paid for by Owner.

E. Contractor is totally responsible to protect all slopes when erosion begins by whatever methods necessary.

END OF SECTION

SECTION 32 11 16

CRUSHED STONE BASE COURSE

PART 1 GENERAL

1.1 SCOPE

A. This Section covers the materials for crushed stone base course to be used as a base material for asphaltic and concrete paving.

B. This material may also be used for embedment for water and sewer utility lines.

1.2 RELATED WORK

A. Section 31 23 00: Excavation and backfill-filling and site preparation for streets and parking areas.

B. Section 32 12 16: Asphaltic Concrete Paving

C. Section 32 13 13: Portland Cement Concrete paving

1.3 QUALITY ASSURANCE

A. The moisture density relations of material shall be determined in the laboratory in accordance with AASHTO T-180.

B. Compacted base shall be tested for depth and any deficiencies corrected by scarifying, placing additional material, mixing, reshaping, and re-compacting to the specified density, as directed.

1.4 PUBLIC WORK

A. Comply with the City of Bentonville standard specifications for Public Street Construction. If conflict should be found between this section and the City Standards for Public Street Construction, City Standards shall be the priority.

PART 2 PRODUCTS

2.1 MATERIALS

A. Crushed stone base course shall consist of crusher run stone or a mixture of crushed stone and natural fines uniformly mixed and so proportioned as to meet all the requirements hereinafter specified, with the further provision that a mixture of crushed stone and natural fines shall contain not less than 95 percent crusher produced material.

B. Stone shall be hard and durable with a percent of wear by the Los Angeles Test (AASHTO T96) not greater than 45.

C. Shale and slate shall not be used for crushed stone base course.

D. The material furnished shall not contain more than 5 percent by weight of shale, slate and other deleterious matter.

E. Crushed stone base course shall conform to the following grading (AASHTO T 11 and T 27) and crushing (ARDOT Specification Section 303) requirements.

Size of Sieve	Percent Passing by Weight
	Class 7
1-1/2"	100
1"	
3/4"	50-90
3/8"	
#4	25-55
#10	
#40	10-30
#200	3-12

1. The fraction passing the No. 200 sieve shall not be greater than three quarters the fraction passing the No. 40 sieve. The fraction passing the No. 40 sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 6.

2. When it is necessary to blend two or more materials, each material shall be proportioned separately by weight through mechanical feeders to insure uniform production. Pre-mixing or blending in the pit to avoid separate feeding will not be permitted.

3. The specific type of crushed stone for different applications shall be as specified or shown on Drawings.

PART 3 - EXECUTION

3.1 BASE COURSE

A. The base course material shall be placed on the completed and approved subgrade, that has been bladed to substantially conform to the grade and cross section shown on the Drawings.

B. The sub-grade shall be prepared as specified and shall be free from an excess or deficiency of moisture at the time of placing the base course.

C. The subgrade shall also comply, where applicable, with the requirements of other items that may be contained in the contract that provide for the construction, reconstruction or shaping of the subgrade or the reconstruction of the existing base course.

D. Base course material shall not be placed on a frozen subgrade.

E. The crushed stone shall be placed on the subgrade or previous base course layer in lifts not to exceed 4" and spread uniformly to such depth and lines that when compacted it will have the thickness as follows:
   1. Asphalt Paving Areas: 6" base course
   2. Concrete Dumpster Pad: 4" base course.

F. The spreading shall be done the same day that the material is hauled and shall be performed in such a manner that no segregation of coarse and fine particles nor nests or hard areas caused by dumping the crushed stone on the subgrade will exist.

G. To ensure proper mixing, the crushed stone shall be bladed across the roadbed before being spread. Care must be taken to prevent mixing of subgrade or shoulder material with the base course material in the blading and spreading operation

H. The crushed stone shall be substantially maintained at optimum moisture during the mixing, spreading, and compacting operations, water being added or the material aerated as may be necessary.

I. The specified grade and section shall be maintained by blading throughout the compaction operation.

J. The material in each course shall be compacted to a density, as determined by AASHTO T 238, Method B, of not less than 95% of the maximum laboratory density determined in the laboratory by AASHTO T 180, Method D. The aggregate shall be compacted across the full width of application.

K. The crushed stone shall be compacted across the full width of application.

L. The compacted base course shall be tested for depth and any deficiencies corrected by scarifying, placing additional material, mixing, reshaping, and re-compacting to the specified density, as required by the Architect.

M. Compaction testing shall be as specified in Section 31 23 00

END OF SECTION

SECTION 32 12 16

ASPHALTIC CONCRETE PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Placement of asphaltic paving, including prime coat materials and installation, and hot mix asphalt binder and surface course.

1.2 RELATED SECTIONS

A. General quality control requirements and the division of responsibilities for laboratory and field testing are specified in the General Requirements.

B. Site preparation is specified in Section 31 23 00.

C. Pavement Markings: Section 32 17 23.

D. Sub-grade preparation and base course construction are specified Section 32 11 16.

E. Standard Specification for Highway Construction, ARDOT, Current edition

1.3 REFERENCES

A. AASHTO
1. M 17, “Mineral Filler for Bituminous Paving Mixtures”
2. M 81, “Cut-Back Asphalt (Rapid-Curing Type)”
3. M 140, “Emulsified Asphalt”
4. M 145, “The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes”
5. M 208, “Cationic Emulsified Asphalt”
6. M 226, “Viscosity Graded Asphalt Cement”
7. T 30, “Mechanical Analysis of Extracted Mixture”
8. T 44, “Solubility of Bituminous Materials in Organic Solvents”
9. T 48, “Flash and Fire Points by Cleveland Open Cup”
10. T 49, “Penetration of Bituminous Materials”
11. T 51, “Ductility of Bituminous Materials”
12. T 78, “Distillation of Cut-Back Asphaltic (Bituminous) Products”
13. T 96, “Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine”
14. T 102, “Spot Test of Asphaltic Materials”
15. T 104, “Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate”
16. T 166, “Bulk Specific Gravity of Compacted Bituminous Mixtures”

B. ARDOT
   1. Standard Specifications for Highway Construction, Current Edition, referencing the following specific sections:
      a. 401, Prime and Tack Coats and Emulsified Asphalt in Base Course
      b. 403, Materials and Equipment for Prime, Tack, and Asphalt Surface Treatment
      c. 404, Design and Quality Control of Asphalt Mixtures
      d. 406, Asphalt Concrete Hot Mix Binder Course
      e. 407, Asphalt Concrete Hot Mix Surface Course
      f. 409, Materials and Equipment for Asphalt Hot Mix Binder and Surface Courses
      g. 410, Construction Requirements for Asphalt Hot Mix Binder and Surface Courses
   2. ARDOT Test Method 449/449A
   3. ARDOT Test Method 450
   4. ARDOT Test Method 460

C. ASTM standards may be substituted for the listed AASHTO standard when the standards are essentially the same.

1.4 PUBLIC WORK

A. Comply with the City of Bentonville standard specifications for Public Street Construction. If conflict should be found between this section and the City Standards for Public Street Construction, City Standards shall be the priority.

1.5 SUBMITTALS

A. Submit product information on prime coat and tack coat products, and on asphalt cement when requested by Owner or his designated representative.

B. Submit mix design information in accordance with paragraph 2.4.

C. Submit source quality control information when requested by Owner or his designated representative in accordance with Paragraph 2.5.

1.6 QUALITY ASSURANCE

A. Testing for materials and construction performance shall be at the option of Owner, or as specified herein. Owner has the authority to require any test needed, in their opinion, to demonstrate that the quality of the construction materials or workmanship meet the specified requirements.

B. Site tests shall be made in the presence of Owner or his designated representative. Required tests must demonstrate compliance with the specifications before the paving work will be accepted.

1.7 DELIVERY, STORAGE, AND HANDLING

A. HMAC mixtures shall be transported from mixing plant to the Work in vehicles with clean, tight beds.

B. When mixtures are hauled more than 15 miles, or when mixtures are being placed between November 1 and April 1, cover beds of vehicles with canvas or other suitable material to retard loss of heat. Cover shall extend over the sides and ends of truck bed and shall be securely fastened. Store cover on truck at all times regardless of haul distance or time of year.

C. Utilize sufficient number of vehicles to provide a continuous operation on the roadway.

D. Use only non-petroleum release agents.

PART 2 PRODUCTS

2.1 SOURCES

A. Obtain aggregate from a permanently established quarry regularly engaged in supplying mineral aggregates for asphaltic concrete mixtures. Quarry shall have an established quality control program.

B. Obtain asphalt cement from sources that have executed a certification agreement with ARDOT.

C. Obtain asphaltic concrete mixtures from a permanently established mixing plant regularly engaged in supplying paving materials conforming to ARDOT specifications. Applicable provisions of ARDOT 409.03 shall apply, except that Owner or his designated representative will not be inspecting or monitoring operations of the plant.

D. **ABSOLUTELY NO RECYCLED ASPHALT WILL BE USED ON THIS PROJECT FOR ASPHALT PAVING.**

2.2 PRIME AND TACK COATS

A. Prime coat shall be emulsified petroleum resin, EPR-1, manufactured by Blackridge, or equal.

B. Bituminous tack coat shall be rapidly curing cutback asphalt conforming to AASHTO M 81, or an emulsified asphalt conforming to AASHTO M 140 or M 208. Cationic emulsified asphalt shall have a minimum Saybolt Furol Viscosity at 122 degrees F at the point of manufacture of 200 seconds, and a maximum Saybolt Furol Viscosity of 500 seconds.

2.3 ASPHALTIC CONCRETE

A. Mineral Aggregates

1. Mineral aggregates for asphaltic concrete binder course and surface course shall consist of combinations of coarse aggregate, fine aggregate, and mineral filler proportioned as provided for in the specifics mix designs.

2. Coarse aggregate is that fraction retained on the #10 sieve and shall consist of crushed gravel, crushed stone, or slag.

3. Fine aggregate is that fraction passing the #10 sieve, and shall consist of clean, hard, durable particles of natural or manufactured sand or combinations of the two. Natural sand shall meet the requirements of AASHTO M 145 except that a maximum of 35 percent may pass the #200 sieve. Fine aggregate may contain a maximum of 2 percent coal and lignite by weight of the fine aggregate.

4. Crushed stone shall consist of clean, hard, durable fragments of rock of uniform quality, free from an excess of soft particles. The stone shall have a percent of wear, measured by AASHTO T 96, not greater than 40, and when subject to 5 cycles of the Sodium Sulfate Soundness test, AASHTO T 104, the loss shall not exceed 12 percent.

5. Crushed gravel shall consist of clean, hard, durable aggregate free from an excess of soft particles in which at least 98 percent of the particles retained on the #10 sieve have been produced form larger particles by crushing operations. Gravel shall have a percent of wear, measured by AASHTO T 96, not greater than 40.

6. Mineral aggregates shall be clean and free of deleterious material and adherent films of clay that will prevent thorough coating with asphalt materials. The fraction passing the #40 sieve shall have a plasticity index not greater than 4. For asphaltic concrete mixes, a minimum of 65 percent of total aggregate shall be produced by crushing larger particles.

7. Mineral filler shall comply with the requirements of AASHTO M 17.

8. Gradation of aggregates shall comply with the design mix, within the master ranges given in paragraphs 2.03 C and 2.03D.

B. Asphalt cement shall conform to AASHTO M 226. Physical requirements are per Table II of AASHTO M 226, with the further provision that ductility for all grades of asphalt cement shall be a minimum of 100 cm and all grades shall have a negative spot as determined by the Spot Test. The grade to be used will be determined by the mix design.

C. Surface course shall be composed of mineral aggregates, asphalt cement, and any required additives proportioned to meet the requirements for ARDOT Type III surface course.

D. Surface course shall contain not more than 60 percent limestone aggregate in the coarse mineral aggregate fraction. When limestone is the primary coarse mineral aggregate, crushed sandstone, crushed siliceous gravel, syenite, novaculite, or crushed slag shall be used as the remaining coarse mineral fraction.

2.4 MIX DESIGN

A. A special mix design prepared specifically for this project will not be required. Submit for review the mix design in use at the mixing plant for its regular supply of the mixes specified.

B. Mix designs shall be prepared by laboratory analysis in accordance with the requirements of the specifications. Mix design preparation shall comply with applicable provisions of ARDOT 404.01.

2.5 SOURCE QUALITY CONTROL

A. Contractor is responsible for quality control testing of the HMAC mixtures to be incorporated in the work prior to their placement in the work, in accordance with the General Requirements.

B. Tests shall be conducted by the mixing plant, as part of a regular quality control program. Such tests shall be of the type and at the frequency required to demonstrate that the mixing plant is producing mixtures in conformance with required design mixes.

C. If required by Owner or his designated representative, submit a copy of standing quality control program in use at the mixing plant.

D. If required by Owner or his designated representative, submit copies of testing records of tests conducted at the mixing plant on the HMAC products delivered for this project. Such tests will be ordered if Owner or his designated representative has reason to believe the HMAC mixtures supplied are not in compliance with the specifications, or if the mixtures appear to result in overly difficult placement or compaction such that specified results are not obtained. Such testing , if ordered, may include: extraction tests (ARDOT 450) and sieve analysis (AASHTO T 30) of the extracted aggregate; nuclear asphalt content gauge (ARDOT 449/449A) and sieve analysis (AASHTO T 30) of the aggregate sample obtained by ARDOT Test Method 460. Additional tests required for further evaluation of the mixture will be as needed to prove the adequacy of the mixture.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which work will be performed. Conditions detrimental to timely and proper execution of this work shall be corrected. No work shall be done until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Before application of each course or surface coat, prepare the existing course to receive the new course. Such preparation may include filling sags and depressions with asphalt binder or surface course mixtures. Accomplish this work by hand, blade grader, or mechanical spreader methods. Featheredge to a smooth and even surface around the edges of these areas. Prime coat or tack coat as applicable before placing this material. Examine base course to verify that the lines and grades conform to the requirements of the Drawings and Specifications.

B. Clean loose and foreign materials.

C. Paint contact surfaces of curbing, gutters, manholes, and other structures with a thin coating of rapid curing cutback asphalt or emulsified asphalt.

3.3 INSTALLATION

A. Prime Coat
   1. Clean surface to be treated with prime coat of dust, dirt, and loose or foreign material by sweeping with mechanical brooms immediately preceding application of prime coat. Take care to clean but not loosen or dislodge embedded aggregate in base course. Remove patches of asphalt, dirt, or other material which does not form an integral part of the surface to be treated.
   2. Perform cleaning only far enough in advance of the application to ensure the surface being properly prepared at the time of application.
   3. Spray prime coat material uniformly over surface by means of mechanical pressure distributor at the rate of 0.25 gallons per square yard, or as recommended by the manufacturer for project conditions. Remove surplus material that collects in surface depressions.
   4. Allow prime coat to cure per manufacture's recommendations before application of asphalt material. NO material for a succeeding course shall be placed on a primed base course until the prime coat has cured sufficiently to prevent damage by hauling operations.
   5. Do not apply when air temperature is below 45 degrees F.
   6. Observe special precautions to ensure uniform distribution of prime coat material. Adjust and operate distributor so as to evenly distribute material. Remove excess quantities on the road surface caused by stopping or starting the distributor, by overflow, leakage, or otherwise.
   7. Apply prime coat material only at temperatures within manufacturer's recommendations.
   8. Repair prime coat that becomes damaged.

B. Apply tack coat in a manner similar to that described in paragraph 3.3.A for prime coat. Apply at the rate of 0.02 to 0.03 gallons per square yard. Apply tack coat sufficiently in advance of asphalt course to allow proper curing of the tack coat material but not so far in advance as to lose its adhesives as a result of being covered with dust or foreign material.

If tack coat becomes damaged or covered with foreign material, clean and re-treat with tack coat as required.

C. Binder Course construction is covered in general in AHTD Sections 406 and 410. Preparing HMAC mixture is covered in general in AHTD Section 409. Binder course shall be constructed to the following standards:

Minimum Density, percent of theoretical	92.0
Maximum Moisture, percent (Roadway)	0.75

1. Place mixture on prepared surface, spread, and strike off to line, grade, and elevation required. Place mixture only on a base that shows no evidence of free moisture and when weather conditions rare suitable. Engineer may permit work of this character to continue when overtaken by sudden rains to utilize materials that may be in transit from the mixing plant to the site.
2. Mixture shall be delivered to the paver within recommended compaction temperature range according to the design mix. Do not place binder course on roadway at a temperature lower than 250 degrees F.
3. Hand spreading is permitted only in areas inaccessible to paver.
4. Paver shall uniformly distribute and compact mixture in from of the screed for full width being paved. Finished surface shall be smooth and of uniform texture.
5. Screed or strike-off assembly shall effectively produce a finished surface of required evenness and texture without tearing, shoving, or gouging mixture.
6. Operate paver at forward speeds consistent with satisfactory laying of mixture. Match speed of paver with mixing plant production rate and number of hauling units.
7. Establish edge of binder course by string or chalk line for at least 500 feet ahead of spreading operation.
8. Thoroughly compact mixture after spreading by rolling as soon as it will bear weight of rollers without undue displacement.
9. Establish an optimum rolling pattern at beginning of placement of each mix design.
10. The number, weight, and type of rollers, and the optimum rolling pattern shall be such that the specified density and surface requirements are consistently attained while mixture is in a workable condition. Rollers which produce excessive crushing of aggregate particles will not be permitted. Compact asphalt to 92 percent of theoretical density as determined by ASSHTO T-275.
11. Following the breakdown rolling operation and as soon as the mat will support the roller without displacement, pass pneumatic roller over binder course a sufficient number of times to knead and seal entire mat being place.
12. Exercise due care when using vibratory rollers to prevent any deterioration of material caused by excessive rolling or vibration. Operate vibratory rollers in such a manner that overlap of adjacent passes shall be held to a minimum.
13. Start rolling longitudinally at the low edge and proceed toward the higher portion of the mat. When paving abutting a previously placed lane, longitudinal joint shall be rolled first followed by regular rolling procedure. Terminate alternate passes of roller 3 feet from any preceding stop. Do not set rollers perpendicular to centerline of traveled way.
14. Restrict speed of roller to avoid displacement of hot mixture, and do not exceed 3 mph. Operate roller in such a manner that no displacement of the mat will occur.

Rolling shall proceed continuously until all roller marks are eliminated and required density attained. Keep rollers moist for full width of roller to prevent adhesion of asphalt mixture to roller. Excess water will not be permitted.

15. Do not pass rollers over unprotected end of a freshly laid mixture. Form transverse joints by cutting back on previous run to expose full depth of the course. Use a brush coat of asphalt material on contact surfaces of transverse joints just before additional mixture is placed against previously placed material.
16. Upon completion of rolling operations, surface shall be smooth and of uniform texture.

D. Surface Course construction is covered in general AHTD Sections 407 and 410. Preparing HMAC mixture is covered in general in AHTD Section 409. Surface course shall be constructed to the following standards.

Minimum Density, percent of theoretical	92.0
Maximum Moisture, percent (Roadway)	0.75

Surface course construction shall comply with the requirements of Paragraph 3.3.C, and with the following additional requirements:

1. Offset longitudinal joint in one layer by approximately 6-inches from the layer below. However, joint in top layer of non-parking lot paving shall be at the centerline of pavement or at lane lines. General casting back of material or hand raking material onto surface will not be permitted.
2. Establish edge of surface course at least 500 feet ahead of spreading operation.
3. Finished surface, when checked with a 10-foot straight edge parallel to the centerline, shall show no variation more than 1/8-inch for surface course.

3.4 PAVING THICKNESS

A. After the base course has been primed, the asphaltic concrete wearing course shall be applied in thickness as follows:
   1. 3” thick surface course over 6” base

3.5 FIELD QUALITY CONTROL

A. Owner will be responsible for quality control testing of the completed pavement, in accordance with the General Requirements. Tests to be taken and their frequency will be determined by Owner or his designated representative. Tests may include coring for depth and laboratory density, in-place density, and straight edge for smoothness. Density of compacted mixtures shall be in accordance with AASHTO T 166.

B. If testing shows deficiencies, correct deficiencies by means satisfactory to Owner or his designated representative prior to beginning additional work. If deficiencies appear to be the result of variation from approved mix design, an inadequate mix design, or materials (as opposed to workmanship), operation will be stopped until corrections can be made at the mixture source. If deficiencies are a result of workmanship, adjust operations and equipment to achieve the specified results. If deficiencies of failing areas are discovered after paving is complete, core samples will be taken of failed area and surrounding area at contractor’s expense. In deficient or failed areas, Asphaltic concrete and base course

material will be removed, subgrade re-compacted and tested for proper compaction. Install base course, compact, and pave, meeting specifications and minimum thickness. Finished grades shall not be altered from original finished elevations.

3.6 ASPHALTIC PAVING PATCHING

A. Provide patching and repair of existing asphaltic concrete paving where removed for construction including complete sub-grading, application and finishing asphaltic concrete in areas as shown on drawings or as required to make a complete job.

B. Existing asphaltic concrete where cuts for new sidewalks, utilities, etc., occur due to the new construction called for shall be patched a minimum of 3" thick wearing course at parking areas, and 4" at drive areas. Base material shall be as specified in this section. Sub-base shall be compacted to a minimum of 95% of the materials maximum laboratory dry density determined in accordance with ASTM Specification D-698, the Standard Proctor procedure.

3.7 CLEANING

A. Clean surface of pavement as required of debris and loose material after compaction and before final acceptance.

B. Clean ACHM splatter or excess material from curbs, gutters, drainage structures, and other places where it has been placed and exceeds the limits of paving indicated on the Drawings.

END SECTION

SECTION 32 13 13

PORTLAND CEMENT CONCRETE PAVING

PART 1 GENERAL

1.1 SUMMARY: Concrete Paving where shown on construction drawings.

B. Related Sections:

Section 31 23 00:	Earthwork
Section 32 11 16:	Crushed Stone Base Course
Section 03 11 00:	Concrete Form Work
Section 03 21 00:	Concrete Reinforcement
Section 03 30 00:	Cast-in-Place Concrete
Section 07 92 00:	Joint Sealant

1.2 PROJECT CONDITIONS

A. Traffic Control:
Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Utilize flagmen, barricades, warning signs, and warning lights as required.

1.3 REFERENCES

A. ARDOT specifications

1.4 PUBLIC WORK

A. Comply with the City of Bentonville standard specifications for Public Street and Entry Drive Construction. If conflict should be found between this section and the City Standards for Public Street Construction, City Standards shall be the priority.

B. Driveway “crosswalks” shall have a 5’ wide herringbone pattern, brick-stamped concrete or approved equal. The concrete shall be colored with integral color mix antique brick red. The appropriate standard detail to be used will be determined based on the context of the crossing.

PART 2 PRODUCTS

2.1 MATERIALS

A. Forms:
   1. Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.
   2. Use flexible spring steel forms or laminated boards to form radius bends as required.
   3. Form Release Agent: Coat forms with non-staining type coating that will not discolor or deface surface of concrete.

B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A 185. Furnish in flat sheets, not rolls.

C. Reinforcing Bars: Deform steel bars, ASTM A 615, Grade 40.

D. Concrete Materials: Comply with requirements of applicable Division 3 sections for concrete materials, admixtures, bonding materials, curing materials, and others as required.

E. Joint Fillers: Resilient pre-molded bituminous impregnated fiberboard units complying with ASTM D 1751 FS HH-F-341, Type II, Class A; or AASHTO M 153, Type I.

F. Curing Compound: FS TT-C-800, with a minimum of 17% solids content.

2.2 MIXING

A. Concrete Mix, Design and Testing: Comply with requirements of applicable Section 03 30 00 for concrete mix design, sampling and testing, and quality control.

B. Design mix to produce normal weight concrete consisting of portland cement, aggregate, water-reducing or high-range water-reducing admixture (super-plasticizer), air-entraining admixture and water to produce following properties:

C. Compressive Strength: 4,000 psi, minimum at 28 days.

D. Slump Range: 8" for concrete containing HRWR admixture(super- plasticizer); 3"-5" for other concrete.

E. Air Content: 5% to 7%.

PART 3 EXECUTION

3.1 PREPARATION

A. Surface Preparation: Remove loose material from compacted base material surface immediately before placing concrete.

B. Proof-roll prepared base material surface to check for unstable areas. The paving work shall begin after the unsuitable areas have been corrected and are ready to receive paving. Compaction testing for the base material shall be completed prior to the placement of the paving.

3.2 CONCRETE INSTALLATION

A. Form Construction:
   1. Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.
   2. Check completed form work for grade and alignment to following tolerances:
   3. Top of forms not more than 1/8" in 10'-0".
   4. Vertical face on longitudinal axis, not more than 1/4" in 10'-0".
   5. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.
   6. Reinforcement: Locate, place, and support reinforcement as specified in Division 3 sections.

B. Concrete Placement:
   1. Paving thicknesses are as follows:
      a. Dumpster Pad: 8” concrete over 4” base
      b. Driveway Concrete: 6” concrete over 4” base
   2. Comply with requirements of Section 03 30 00 for mixing and placing concrete.
   3. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Concrete shall be placed around manholes or other structures until they are at the required finish elevation and alignment.
   4. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement or side forms. consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
   5. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hours, place construction joint.

3.3 JOINT CONSTRUCTION

A. Provide joints as shown on drawings and as specified, but in no case exceed requirements of ACI 302.1R and 316R code requirements.

B. Construction expansion, weakened-plan (contraction),and construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

C. Weakened-Plan (Contraction) Joints: Provide weakened-plane(contraction) joints, sectioning concrete into areas at 15'-0" o.c. maximum each way. Construct weakened-plane joints for depth equal to at least 1/4 concrete thickness, as follows:

D. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with recommended cutting tool and finishing edges with jointer.

E. Sawed Joints: Form weakened-plane joints using powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.

F. Construction Joints:
   1. Place concrete joints at end of placements and at locations where placement operations are stopped for period of more than 1/2 hour, except where such placements terminate at expansion joints.
   2. Construct joints using standard metal keyway-section forms.

G. Expansion Joints:
   1. Provide pre-molded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks, and other fixed objects.
   2. Locate expansion joints at 60'-0" o.c. maximum for each pavement lane.

H. Joint Fillers:
   1. Extend joint fillers full-width and depth of joint, and not less than 1/2" or more than 1" below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.
   2. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace of clip joint filler sections together.

I. Joint Sealants:
   1. Exterior pavement joint sealants shall composed of a non-priming, pourable, self-leveling type of a coal tar modified polyurethane, or a polyurethane, sealant suitable for use in pavements and sidewalks.

3.4 CONCRETE FINISHING

A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with 10’-0" straightedge. Distribute concrete as required to remove surface irregularities and re-float repaired areas to provide continuous smooth finish.

C. Work edges of slabs, back top edge of gutter, and formed joints with an edging tool, and round to 1/2" radius. Eliminate tool marks on concrete surface.

D. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

1. Broom finish by drawing fine-hair broom across concrete surface perpendicular to line of traffic. Repeat operation if required to provide fine line texture. Inclined Slab Surfaces: Provide coarse, non-slip finish by scoring surface with stiff-bristled broom perpendicular to line traffic.

E. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed.

F. Protect and cure finished concrete paving using acceptable moist-curing methods.

3.5 CLEANING AND ADJUSTING

A. Repair or replace broken or defective concrete, as directed.

B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

C. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

3.6 TESTING AND SAMPLING:

A. Slump Tests: A minimum of two slump tests shall be made each day concrete is placed with one test being made at the time test cylinders are made. Slump tests are to be made in accordance with "Method of Test for Slump of Portland Cement Concrete" (ASTM C-143-78). Where slump exceeds five inches (5") or the average 28 day strength of the three test specimens falls below the strength specified (3000 p.s.i.) for the class of concrete tested, or below proportional minimum 7 day strengths, (2,400 psi) the proportions, water content or temperature conditions shall be changed to secure the required properties, and, at the discretion of the Architect, portions of the structure containing such concrete shall be removed and replaced, or reinforced as necessary.

B. Strength Tests: Compression strength test shall be performed in accordance with "Method of Test for Compressive Strength of Molded Concrete Cylinders" (ASTM C39-81). Samples for concrete cylinders shall be made in accordance with "Method of Sampling Fresh Concrete" (ASTM C172-82), and test cylinders shall be prepared and laboratory cured in accordance with "Method of Making and Curing Concrete Compression and Flexture Test in the Field" (ASTM C31-69).

C. Cylinders: Three cylinders from the same batch shall be made for each 50 cubic yards or fraction thereof placed, but not less than three cylinders for each day of concrete operations shall be made. Location of batch as to placement on the subject shall be noted, and cylinders so designated. No tests shall be required for sidewalks. One cylinder shall be tested at 7 days and two at 28 days.

D. A minimum of 9 cylinders shall be tested for each class of concrete used on the project and the average of any three consecutive strength tests at 28 days shall be equal to or greater than the specified strength. Result of any individual strength test shall not be less than 500 p.s.i. of required fc.

E. Contractor shall bear expense of all testing by a recognized licensed engineer.

END OF SECTION

SECTION 32 16 00

WALKS & CURBS

PART 1 GENERAL

1.1 SCOPE:

A. Provide all materials, labor, equipment and related items necessary to complete the concrete walks and curbs as shown on the drawings.

B. Accessible ramp tactile warning system

1.2 RELATED SECTIONS

A. Section 32 11 16: Crushed Stone Base Course.

B. Section 32 12 16: Asphalt Paving

C. Section 32 13 13: Portland Cement Concrete Paving

E. Section 03 11 00: Concrete Form Work

F. Section 03 21 00: Concrete Reinforcement

G. Section 03 30 00: Cast-in-Place Concrete

H. Section 07 92 00: Sealants

1.3 PUBLIC WORKS

A. Comply with the City of Bentonville standard specifications for Public Street Construction. If conflict should be found between this section and the City Standards for Public Street Construction, City Standards shall be the priority.

PART 2 PRODUCTS/ /MATERIALS

2.1 WALKS & CURBS:

A. 3,000 psi at 28 days in accordance with ACI and CRSI Standards, 3,500 for curbs. Materials, testing, and placing shall be specified in Division 3. Concrete to be air entrained per Section 03 30 00. No fly ash is permitted in walks or curbs.

2.2 EXPANSION JOINTS

A. Expansion joint material shall be 1/2" pre-molded filler especially made for such use - not INSULATION or SHEATHING BOARD for all curbs and non-exposed aggregate walks and pavement.

2.3 TACTILE WARNING SYSTEM

A. Provide raised truncated dome tactile warning at all ramps to meet ADAAG guideline requirements from either of the following two systems:
   1. “Armor-Tile” pre-manufactured cast-in-place or surface-applied tactile system (size as required to fill ramp area-including flared sides), manufactured by Engineered Plastics Inc., Williamsville, NY (800) 682-2525,.
      a. Architect to select color from minimum 5 color selections.
      b. Provide manufacturer’s 5-year warranty.
   2. Other approved manufacturers:
      a. Truncated dome system, manufactured by Vanguard ADA Systems of America, Snohomish, WA (360) 668-5700.
      b. Detectable warning plates, manufactured by Neenah foundry Company, Neenah, Wisconsin, (800) 558-5075.
      c. Cast-In-Place Detectable Warning Surface, manufactured by ADA Solutions, Inc., 800-372-0519.
      d. Approved alternate product and manufacturer

PART 3 EXECUTION

3.1 CONCRETE WALKS

A. Concrete walks shall be of one course construction 4 inches thick, and of widths shown on the drawings. Provide 1/8" per foot crown or cross slope in the direction of drainage. All steps are to drain freely. Provide tooled joints as shown on drawings.

B. Expansion joints: Provide 1/2" transverse expansion joints, at walk junctions and intersections, at top and bottom of steps, and where walks abut curb returns, buildings, platforms or other fixed structures, or terminate at curbs. Expansion joints shall be at right angles to the slab and extend the full depth thereof. Pre-molded filler where called for shall extend to within 1/2" of the surface. Fill remaining void with sealant as specified in Section 07 92 00. Locate expansion joints in walks as shown on plans and nearly as practicable opposite those in abutting curbs, approximately 25' on center.

C. Control Joints: Provide troweled joints 1/4 of slab depth where indicated on plans.

D. Protection. Remove no forms for 24 hours after pouring concrete. Protect concrete walks and courtyards from pedestrian traffic for a period of three days after pouring.

3.2 WALKS AND CURB FINISH

A. Finish Types shall be the following:
   1. Light Broom Finish

B. Light Broom Finish:
   1. After placing concrete paving, do not work the surface further until ready for floating.
   2. Begin floating when the surface water has disappeared and when the concrete has stiffened sufficiently to permit operation of a power- driven float, or both.
   3. Consolidate the surface with power-driven floats, or by hand-floating if the area is small or inaccessible to power units.
   4. Check and level the surface plane to a tolerance not exceeding 6mm in 3 m (1/4" in 10'-0") when tested with a 3 m (10'-0") straightedge placed on the surface at not less than two different angles.
   5. Cut down high spots and fill low spots.
   6. Uniformly slope surfaces to drains where required.
   7. Immediately after leveling, re-float the surface to a uniform, smooth, granular texture as approved by the Architect.
   8. At this point, apply a light broom finish in one direction. Make sweeps uniform and continuous, keeping bristles clean after each sweep. Provide a small sample area for approval by Architect prior to finishing entire surface.

3.3 CONCRETE CURBS

A. All machine poured curbs to be shape and profile shown on Drawings.

B. Construct hand formed concrete curbs in small workable sections. Size and depth of curbs shall be generally 6" wide x 24" deep with sloped face, unless noted otherwise on Drawings.

C. Provide 1/2 inch expansion joints, with pre-molded filler cut to shape of cross section at ends of all returns at 40 foot intervals, maximum. Align with sidewalk expansion joints where curb abuts sidewalk. Fill top 1/2” of joint with sealant as specified in section 07 92 00. Provide sawn control joints at 20’ o.c., max. Fill with sealant.

D. Tamp and screed concrete as soon as placed. Remove division plates and face forms as soon as practicable; fill any honeycombed places with 1:2 mortar and give exposed surfaces same finish as specified for concrete walks.

E. Remove no forms, except face forms, for 24 hours after placing concrete. Protect against pedestrian traffic for three (3) days and against vehicular traffic for 14 days. Compact thoroughly and backfill behind curb. Place and compact fill behind curb as soon as practical.

3.4 CURB CUTS

A. At streets, where indicated on Drawings, construct curbs to conform to shape and dimension as shown on the Drawings.

B. Contractor is responsible for obtaining permit to cut curbs on highways and paying any fees associated with the same.

3.5 TACTILE WARNINGS

A. Provide at all handicapped accessible ramps fronting any drive, road or parking area. Tactile warning system to extend full width and minimum 2’ depth of ramp beginning 6” to 8” from face of curb or driveway surface.

B. Install per manufacturer’s instruction. Clean prior to substantial completion.

END OF SECTION

SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General painted pavement markings.

B. Fire Lane Marking

C. Handicapped symbol painting.

1.2 RELATED SECTIONS

A. Construction Drawings

B. Section 32 12 16 - Asphaltic Paving

1.3 PROJECT CONDITIONS

A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs and warning lights as required.

PART 2 PRODUCTS

2.1 MATERIALS

A. Paint Type: Federal Highway Administration approved. Paint shall be Promar alkyd traffic marking paint, manufactured by Sherwin Williams, factory mixed, quick-drying, non-bleeding, or approved equal.

B. The following items are to be painted with the colors noted below:

Letters, Arrows & Lane Striping:	Yellow
Handicap Symbols:	Blue & White (Refer to detail on drawings)
Guard posts/Bollards:	Color as selected.
Parking Stall Striping:	Yellow
Curb @ Fire lane:	Red with 4" high white block letters "No Parking Fire Lane" every 30 feet of curb. Paint entire curb, or if there is no curb, paint 6” wide stripe with 4” high letters on edge of pavement.

PART 3 EXECUTION

3.1 PREPARATION

A. Sweep and clean surface to eliminate loose material and dust.

3.2 APPLICATION

A. Apply two (2) coats of paint at manufacturer's recommended rate with total maximum of 320 lineal feet per gallon per coat with 4" wide stripe. Apply with mechanical equipment to produce uniform straight edges. At sidewalk curbs, use a straightedge to ensure a uniform, clean, and straight stripe.

B. Do not apply pavement marking paint until layout, colors and placement have been verified with Architect. Allow paving to age for minimum 20 days prior to pavement markings. Sweep and clean surfaces to eliminate loose materials and dust.

C. Pavement markings to be applied in suitable weather conditions.

END OF SECTION

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fence framework, fabric, and accessories.
2. Excavation and anchorages for post bases.
3. Manual gates and related hardware.

1.2 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00.

B. Product Data: Include descriptive literature and installation instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with specifications, use products of one of the following:
1. American Fence and Supply Company, Geogetown, TX Phone 512-930-4000
2. Wheatland Tube, 700 South Dock Street, Sharon, PA 16146 phone: 800.257.8182
3. Richard's Fence Company, 1600 Firestone Parkway, Akron, OH 44301
Phone (800) 624-5520
4. Approved alternate manufacturer.

2.2 MATERIALS

A. Framework:
1. End, Corner, and Pull Posts: Galvanized steel, Schedule 40; minimum sizes and weights as follows:
a. Up to 6 foot fabric height: 2.375 inch outside diameter pipe, 3.65 lbs/lin ft or 3.5 x 3.5 inch roll formed section, 4.85 lbs/lin ft.
b. Over 6 foot fabric height: 2.875 inch outside diameter pipe, 5.79 lbs/lin ft; or 3.5 x 3.5 inch roll formed section, 4.85 lbs/lin ft.

2. Line Posts: Galvanized steel, Schedule 40; minimum sizes and weights as follows:
a. Up to 6 foot fabric height: 1.90 inch outside diameter pipe, 2.70 lbs/lin ft; or 1.875 x 1.625 inch C-section, 2.78 lbs/lin ft.
b. 6 foot to 8 foot fabric height: 2.375 inch outside diameter pipe, 3.65 lbs/lin ft; or 2/25 x 1.875 inch H-section, 2.64 lbs/lin ft.
c. Over 8 foot fabric height: 2.875 inch outside diameter pipe, 5.79 lbs/lin ft; or 2.25 x 1.70 H-section, 3.26 lbs/lin ft.

3. Gate Posts: Galvanized steel; for single gate or one leaf of double gate, as follows:
   a. Up to 6 foot height; 2.875 inch outside diameter pipe, 5.79 lbs/lin ft; or 3.5 x 3.5 roll formed section,4.85 lbs/lin ft.
   b. 6 foot to 13 foot height: 4 inch outside diameter pipe, 9.11 lbs/lin ft.

4. Top Rail and Intermediate Rails: Galvanized steel, manufacturer's longest lengths.
   a. Typical: 1.66 inch outside diameter pipe, 2.27 lbs lin ft; or 1.625 x 1.25 inch roll formed section, 1.35 lbs/lin ft.
   b. Couplings: Expansion type, approximately 6 inches long.
   c. Attaching Devices: Means of attaching top rail securely to each gate, corner, pull, and end post.

B. Accessories:
1. Sleeves: Galvanized steel pipe not less than 6 inches long and with inside diameter not less than 1/2 inch greater than outside diameter of pipe. Provide steel plate closure welded to bottom of sleeves of width and length not less than 1 inch greater than outside diameter of sleeve.

2. Tension Wire: 7 gage galvanized steel, coated coil spring wire, located at bottom of fence fabric.

3. Wire Ties: 11 gage galvanized steel. Aluminum ties are not acceptable.

4. Post brace assembly: Manufacturer's standard adjustable brace at end and gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same materials as top rail for brace, and truss to line posts with 0.375 inch diameter rod and adjustable tightener.

5. Post tops: Galvanized steel, weathertight closure cap for tubular posts, one cap for each post. Furnish cap with openings to permit passage of top rail.

6. Stretcher bars: Galvanized steel, one piece lengths equal to full height of fabric; with minimum cross section of 3/16 x 3/4 inch. Provide one stretcher bar for each gate and end post, and two for each corner and pull post.

7. Stretcher bar bands: Manufacturer's standard.

8. Gate cross-bracing: 3/8 inch diameter galvanized steel adjustable length truss rods.

9. Barbed Wire: Shall be aluminum coated double strand 12-1/2 gage twisted wire with 14 gage, 4 point round aluminum barbs spaced on approximately 5” centers conforming to ASTM-A585.

10. Extension Arms for Barbed Wire: Arms for supporting 3 strands of barbed wire shall be set at an approximate 45 degree outward angle. Arms shall be of sufficient strength to withstand a weight of 200 pounds.

C. Gate Hardware:
   1. Swinging gate hardware:
      a. Hinges: Size and material to suit gate size; offset to permit 180 gate opening. Provide 1-1/2 pair of hinges for each leaf over 6'-0" nominal height.
      b. Latch: Forked type or plunger-bar type to permit operation from both sides of gate, with padlock eye.

   2. Sliding gate hardware: Provide manufacturer's standard heavy duty track, ball-bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, and accessories required.

D. Fabric: No. 9 gage (0.148 nominal) galvanized steel wire in 2 inch mesh, with both top and bottom selvages knuckled.

E. Plastic Slat: Tubular plastic slats designed for use in 2 inch mesh fabric, installed vertically.
   1. Colored PVT slats by Patrician Products, Inc.,468 Union Avenue, Westbury, NY 11590 (516)333-3910. Color to match building color.

2.3 SETTING MIXES

A. Concrete: ASTM C94.

B. Grout: Premixed, factory-packaged, non-staining, non-corrosive grout. See Section 03 30 00. Provide type especially formulated for exterior application.

2.4 GATE FABRICATION

A. Fabricate swing gate perimeter frames of 1.90 inch outside diameter galvanized steel pipe. Provide horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware, and accessories. Space frame members maximum 8'-0" apart.

B. Assemble gate frames rigidly by welding or with special fittings and rivets. Use same fabric as for fence. Install fabric with stretcher bars at vertical edges. Bars may also be used at top and bottom edges. Attach stretchers to frame at not more than 15 inches on center. Install diagonal cross-bracing on gates as required to ensure frame rigidity without sag or twist.

C. Attach hardware to provide security against removal or breakage.

2.5 FINISH

A. Galvanize as follows:
   1. Fabric: Not less than 1.2 oz zinc/sq ft.
   2. Framing: Not less than 1.8 oz zinc/sq ft.

B. Poly (Vinyl Chloride) (PVC) Coated
   1. Fused and adhered poly (vinyl chloride) PVC coated steel chain link fence fabric.

2. Vinyl coating is thermally bonded to a thermoset bonding layer over a galvanized steel wire.
3. Vinyl coating thickness, galvanized coating weight, and wire tensile strength is to conform to ASTM F668, Class 2b. coating thickness minimum: .006 inches, Max: .010 inches
4. If PVC coating is damaged during installation, contractor must replace or repair the material at own expense.
5. Color is to be black

PART 3 EXECUTION

3.1 INSTALLATION

A. Space line posts 10'-0" on center maximum.

B. Grade-set Posts:
   1. Drill or hand excavate.
   2. Excavate each post hole to 12 inch diameter, or not less than four times diameter of post. Excavate approximately 3 inches lower than post bottom; set post bottom not less than 36 inches below finish grade.
   3. Hold post in position while placing, consolidating, and finishing concrete.

C. Sleeve-set Post: Anchor posts in concrete by means of pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with grout, mixed and placed to manufacturer's recommendations.

D. Top Rails: Run rail continuous through post caps, bending smoothly for curved runs. Provide expansion couplings as recommended by fencing manufacturer.

E. Center Rails: Provide center rails where indicated. Install in one piece between posts and flush with post on fabric side, using offset fittings where necessary.

F. Brace Assemblies: Install braces so posts are plumb with rod tension.

G. Tension Wire: Install tension wires through post cap loops before stretching fabric and tie to each post cap with not less than 6 gage galvanized wire. Fasten fabric to tension wire using 11 gage galvanized steel hog rings spaces 24 inches on center.

H. Fabric: Leave approximately 2 inches between finish grade and bottom selvage. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so fabric remains in tension after pulling force is released.

I. Stretcher Bars: To secure end, corner, pull, and gate posts, thread through or clamp to fabric 4 inches on center and secure to posts with metal bands spaced 15 inches on center.

J. Tie Wires:
   1. Use U-shaped wire conforming with diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least two full turns. Bend ends of wire to minimize hazards to persons or clothing

   2. Tie fabric to line posts with wire ties spaced 12 inches on center. Tie fabric to rails and braces with wire ties spaced 24 inches on center. Manufacturer's standard procedure will be accepted if of equal strength and durability.

K. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

L. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

M. Install barbed wire and extension arms for wire support, where noted on drawings

N. Install plastic slats vertically to manufacturer's instructions.

END OF SECTION

SECTION 32 80 00

IRRIGATION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Piping.
2. Encasement for piping.
3. Manual valves.
4. Pressure-reducing valves.
5. Automatic control valves.
6. Automatic drain valves.
7. Transition fittings.
8. Dielectric fittings.
9. Miscellaneous piping specialties.
10. Sprinklers.
11. Quick couplers.
12. Drip irrigation specialties.
13. Controllers.
14. Boxes for automatic control valves.

1.3 DEFINITIONS

A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.

B. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.

C. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.

D. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 PERFORMANCE REQUIREMENTS

A. Irrigation zone control shall be automatic operation with controller and automatic control valves.

B. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100 percent irrigation coverage of areas indicated.

C. Delegated Design: Design 100 percent coverage irrigation system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

D. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties unless otherwise indicated:

1. Irrigation Main Piping: 200 psig (1380 kPa).
2. Circuit Piping: 150 psig (1035 kPa)

1.5 SUBMITTALS

A. Product Data: Comply with Section 01 33 00. Submit for each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For irrigation systems indicated to comply with Section 01 33 00, performance requirements and design criteria.

D. Coordination Drawings: Irrigation systems, drawn to scale, on which components are shown and coordinated with each other, using input from installers of the items involved. Also include adjustments necessary to avoid plantings and obstructions such as signs and light standards.

E. Qualification Data: For qualified Installer.

F. Zoning Chart: Show each irrigation zone and its control valve.

G. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.

H. Field quality-control reports.

I. Operation and Maintenance Data: For sprinklers, controllers and automatic control valves to include in operation and maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

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

B. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify General Contractor no fewer than two days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without General Contractor written permission.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Impact Sprinklers: Equal to 5 percent of amount installed for each type and size indicated, but no fewer than 1 units.
2. Spray Sprinklers: Equal to 5 percent of amount installed for each type and size indicated, but no fewer than 1 units.
3. Bubblers: Equal to 5 percent of amount installed for each type indicated, but no fewer than 1 units.
4. Emitters: Equal to 5 percent of amount installed for each type indicated, but no fewer than 1 units.
5. Drip-Tube System Tubing: Equal to 5 percent of total length installed for each type and size indicated, but not less than 100 feet (30 m).
6. Soaker Tubes: Equal to 5 percent of total length installed for each type and size indicated, but not less than 50 feet (15.2 m).

1.9 WARRANTY

A Contractor will provide a three (3) year warranty for irrigation system on parts and labor.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Comply with requirements in the piping schedule for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

B. Galvanized-Steel Pipe: ASTM A 53/A 53M, Standard Weight, Type E, Grade B.

1. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless-steel pipe with threaded ends.
2. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
3. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface, and female threaded ends.
4. Cast-Iron Flanges: ASME B16.1, Class 125.

C. Ductile-Iron Pipe with Mechanical Joints: AWWA C151, with mechanical-joint bell and spigot ends.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Ductile-Iron Pipe with Push-on Joint: AWWA C151, with push-on-joint bell and spigot ends.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Gaskets: AWWA C111, rubber.

E. Soft Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, annealed temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

F. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) and ASTM B 88, Type M (ASTM B 88M, Type C), water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

G. PE Pipe with Controlled ID: ASTM F 771, PE 3408 compound; SIDR 11.5 and SIDR 15.

1. Insert Fittings for PE Pipe: ASTM D 2609, nylon or propylene plastic with barbed ends. Include bands or other fasteners.

H. PE Pipe with Controlled OD: ASTM F 771, PE 3408 compound, SDR 11.

1. PE Butt, Heat-Fusion Fittings: ASTM D 3261.
2. PE Socket-Type Fittings: ASTM D 2683.

I. PE Pressure Pipe: AWWA C906, with DR of 7.3, 9, or 9.3 and PE compound number required to give pressure rating not less than 200 psig (1380 kPa).

1. PE Butt, Heat-Fusion Fittings: ASTM D 3261.
2. PE Socket-Type Fittings: ASTM D 2683.

J. PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedule 40 and 80.

1. PVC Socket Fittings: ASTM D 2466, Schedules 40 and 80.
2. PVC Threaded Fittings: ASTM D 2464, Schedule 80.
3. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket ends.

K. PVC Pipe, Pressure Rated: ASTM D 2241, PVC 1120 compound, SDR 21 and SDR 26.

1. PVC Socket Fittings: ASTM D 2467, Schedule 80.
2. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket or threaded ends.

2.2 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

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

2.3 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105.

B. Form: Sheet or tube.

C. Material: LLDPE film of 0.008-inch (0.20-mm) minimum thickness or high-density, cross-laminated PE film of 0.004-inch (0.10-mm) minimum thickness.

D. Color: Black or Natural.

2.4 MANUAL VALVES

A. Curb Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following or equal:

    a. Amcast Industrial Corporation; Lee Brass Company.
    b. Ford Meter Box Company, Inc. (The).
    c. Jones, James Company.
    d. McDonald, A. Y. Mfg. Co.
    e. Mueller Co.; Water Products Division.
    f. Red Hed Manufacturing & Supply.

3. Description:

    a. Standard: AWWA C800.
    b. NPS 1 (DN 25) and Smaller Pressure Rating: 100 psig (690 kPa) minimum.
    c. NPS 1-1/4 to NPS 2 (DN 32 to DN 50) Pressure Rating: 80 psig (550 kPa) minimum.
    d. Body Material: Brass or bronze with ball or ground-key plug.
    e. End Connections: Matching piping.
    f. Stem: With wide-tee head.

B. Curb-Valve Casing:

1. Standard: Similar to AWWA M44 for cast-iron valve casings.
2. Top Section: Telescoping, of length required for depth of burial of curb valve.
3. Barrel: Approximately 3-inch (75-mm) diameter.
4. Plug: With lettering "WATER."
5. Bottom Section: With base of size to fit over valve.
6. Base Support: Concrete collar.

C. Shutoff Rods for Curb-Valve Casings: Furnish one steel, tee-handle shutoff rod(s) with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve for Project.

D. Brass Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following or equal:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Jenkins Valves.
    c. DynaQuip Controls.
    d. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
    e. Hammond Valve.
    f. Jamesbury; a subsidiary of Metso Automation.
    g. Jomar International, LTD.
    h. KITZ Corporation.
    i. Legend Valve.
    j. Marwin Valve; a division of Richards Industries.
    k. Milwaukee Valve Company.
    l. NIBCO INC.
    m. Red-White Valve Corporation.
    n. RuB Inc.

3. Description:

    a. Standard: MSS SP-110.
    b. SWP Rating: 150 psig (1035 kPa).
    c. CWP Rating: 600 psig (4140 kPa).
    d. Body Design: Two piece.
    e. Body Material: Forged brass.
    f. Ends: Threaded or solder joint if indicated.
    g. Seats: PTFE or TFE.
    h. Stem: Brass.
    i. Ball: Chrome-plated brass.
    j. Port: Full.

E. Bronze Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following or equal:

    a. American Valve, Inc.
    b. Conbraco Industries, Inc.; Apollo Valves.
    c. Crane Co.; Crane Valve Group; Crane Valves.
    d. Hammond Valve.
    e. Lance Valves; a division of Advanced Thermal Systems, Inc.
    f. Legend Valve.
    g. Milwaukee Valve Company.
    h. NIBCO INC.
    i. Red-White Valve Corporation.
    j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

3. Description:

    a. Standard: MSS SP-110.
    b. SWP Rating: 150 psig (1035 kPa).
    c. CWP Rating: 600 psig (4140 kPa).
    d. Body Design: Two piece.
    e. Body Material: Bronze.
    f. Ends: Threaded or solder joint if indicated.
    g. Seats: PTFE or TFE.
    h. Stem: Bronze.
    i. Ball: Chrome-plated brass.
    j. Port: Full.

F. Iron Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following or equal:

    a. American Valve, Inc.
    b. Conbraco Industries, Inc.; Apollo Valves.
    c. KITZ Corporation.
    d. Sure Flow Equipment Inc.
    e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

3. Description:

    a. Standard: MSS SP-72.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Design: Split body.
    d. Body Material: ASTM A 126, gray iron.

e. Ends: Flanged.
f. Seats: PTFE or TFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel.
i. Port: Full.

G. Plastic Ball Valves:

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

a. American Valve, Inc.
b. Asahi/America, Inc.
c. Colonial Engineering, Inc.
d. Fischer, George Inc.
e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
f. IPEX Inc.
g. Jomar International, LTD.
h. KBI (King Bros. Industries).
i. Legend Valve.
j. NIBCO INC.
k. Sloane, George Fischer, Inc.
l. Spears Manufacturing Company.
m. Thermoplastic Valves Inc.
n. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-122.
b. Pressure Rating: 125 psig (860 kPa) minimum.
c. Body Material: PVC.
d. Type: Union.
e. End Connections: Socket or threaded.
f. Port: Full.

H. Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following or equal:

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. KITZ Corporation.

g. Milwaukee Valve Company.
h. NIBCO INC.
i. Powell Valves.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
k. Zy-Tech Global Industries, Inc.

3. Description:

a. Standard: MSS SP-80, Type 2.
b. Class: 125.
c. CWP Rating: 200 psig (1380 kPa).
d. Body Material: ASTM B 62 bronze with integral seat and screw-in bonnet.
e. Ends: Threaded or solder joint.
f. Stem: Bronze, nonrising.
g. Disc: Solid wedge; bronze.
h. Packing: Asbestos free.
i. Handwheel: Malleable iron, bronze, or aluminum.

I. Iron Gate Valves, Resilient Seated:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following or equal:

a. American AVK Company.
b. American Cast Iron Pipe Company; American Flow Control.
c. Clow Valve Co.; a division of McWane, Inc.
d. Kennedy Valve; a division of McWane, Inc.
e. M&H Valve; a division of McWane, Inc.
f. Mueller Co.; Water Products Division.
g. NIBCO INC.
h. U.S. Pipe.

3. Description:

a. Standard: AWWA C509.
b. Pressure Rating: 200 psig (1380 kPa) minimum.
c. Body Material: Ductile or gray iron with bronze trim.
d. End Connections: Mechanical joint or push-on joint.
e. Interior Coating: Comply with AWWA C550.
f. Body Design: Nonrising stem.
g. Operator: Stem nut.
h. Disc: Solid wedge with resilient coating.

J. Iron Gate Valve Casings:

1. Standard: AWWA M44 for cast-iron valve casings.

2. Top Section: Adjustable extension of length required for depth of burial of valve.
3. Barrel: Approximately 5-inch (125-mm) diameter.
4. Plug: With lettering "WATER."
5. Bottom Section: With base of size to fit over valve.
6. Base Support: Concrete collar.

K. Operating Wrenches for Iron Gate Valve Casings: Furnish one steel, tee-handle operating wrench(es) with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut for Project.

L. Iron Gate Valves, NRS:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following or equal:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Jenkins Valves.
    c. Crane Co.; Crane Valve Group; Stockham Division.
    d. Flo Fab Inc.
    e. Hammond Valve.
    f. KITZ Corporation.
    g. Legend Valve.
    h. Milwaukee Valve Company.
    i. NIBCO INC.
    j. Powell Valves.
    k. Red-White Valve Corporation.
    l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    m. Zy-Tech Global Industries, Inc.

3. Description:

    a. Standard: MSS SP-70, Type I.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Material: ASTM A 126, gray iron with bolted bonnet.
    d. Ends: Flanged.
    e. Trim: All bronze.
    f. Disc: Solid wedge.
    g. Packing and Gasket: Asbestos free.

M. Iron Gate Valves, OS&Y:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following or equal:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Flo Fab Inc.
e. Hammond Valve.
f. KITZ Corporation.
g. Legend Valve.
h. Milwaukee Valve Company.
i. NIBCO INC.
j. Powell Valves.
k. Red-White Valve Corporation.
l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
m. Zy-Tech Global Industries, Inc.

3. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: All bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

2.5 PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following or equal:

a. Cash Acme; a division of The Reliance Worldwide Corporation.
b. Conbraco Industries, Inc.; Apollo Valves.
c. Honeywell International Inc.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
e. Zurn Plumbing Products Group; Wilkins Water Control Products.

3. Description:

a. Standard: ASSE 1003.
b. Body Material: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved.
c. Pressure Rating: Initial pressure of 150 psig (1035 kPa).
d. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

B. Water Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following or equal:

    a. CLA-VAL Automatic Control Valves.
    b. Flomatic Corporation.
    c. OCV Control Valves.
    d. Watts ACV; a division of Watts Water Technologies, Inc.
    e. Zurn Plumbing Products Group; Wilkins Water Control Products.

3. Description: Pilot-operation, diaphragm-type, single-seated main water control valve. Include small pilot control valve, restrictor device, specialty fittings, and sensor piping.

    a. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
    b. Pattern: Angle-valve design.
    c. Trim: Stainless steel.
    d. Pressure Rating: Initial pressure of 150 psig (1035 kPa) minimum.
    e. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.

2.6 AUTOMATIC CONTROL VALVES

A. Bronze, Automatic Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following or equal:

    a. Buckner; a division of Storm Manufacturing Group Inc.
    b. Ceres Products Company.
    c. Champion Irrigation Products.
    d. Netafim USA.
    e. Superior Controls Co., Inc.
    f. Toro Company (The); Irrigation Division.
    g. Weathermatic.

3. Description: Cast-bronze body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24-V ac solenoid.

B. Plastic, Automatic Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following or equal:

    a. Buckner; a division of Storm Manufacturing Group Inc.
    b. Ceres Products Company.
    c. Champion Irrigation Products.
    d. Dig Corporation.
    e. Greenlawn Sprinkler Company.
    f. Hit Products Corporation.
    g. Hunter Industries Incorporated.
    h. Irritrol Systems.
    i. Nelson, L. R. Corporation.
    j. Netafim USA.
    k. Olson Irrigation Systems.
    l. Orbit Irrigation Products, Inc.
    m. Rain Bird Corporation.
    n. Superior Controls Co., Inc.
    o. Toro Company (The); Irrigation Division.
    p. Weathermatic.

3. Description: Molded-plastic body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24-V ac solenoid.

2.7 AUTOMATIC DRAIN VALVES

A. Description: Spring-loaded-ball type of corrosion-resistant construction and designed to open for drainage if line pressure drops below 2-1/2 to 3 psig (17 to 20 kPa).

2.8 TRANSITION FITTINGS

A. General Requirements: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings:

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

    a. Cascade Waterworks Manufacturing.
    b. Dresser, Inc.; DMD Division.
    c. Ford Meter Box Company, Inc. (The).
    d. JCM Industries.
    e. Smith-Blair, Inc; a Sensus company.
    f. Viking Johnson.

2. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

C. Plastic-to-Metal Transition Fittings:

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

a. Harvel Plastics, Inc.
b. Spears Manufacturing Company.

2. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-socket or threaded end.

D. Plastic-to-Metal Transition Unions:

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

a. Colonial Engineering, Inc.
b. NIBCO INC.
c. Spears Manufacturing Company.

2. Description: MSS SP-107, PVC four-part union. Include one brass or stainless-steel threaded end, one solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

2.9 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following or equal:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Epco Sales, Inc.
d. Hart Industries International, Inc.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
f. Zurn Plumbing Products Group; Wilkins Water Control Products.

3. Description: Factory-fabricated union, NPS 2 (DN 50) and smaller.

    a. Pressure Rating: 150 psig (1035 kPa) minimum at 180 deg F (82 deg C).
    b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following or equal:

    a. Capitol Manufacturing Company.
    b. Central Plastics Company.
    c. Epco Sales, Inc.
    d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

3. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 (DN 65 to DN 100) and larger.

    a. Pressure Rating: 150 psig (1035 kPa) minimum.
    b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

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

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Central Plastics Company.
    d. Pipeline Seal and Insulator, Inc.

2. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 (DN 65) and larger.

    a. Pressure Rating: 150 psig (1035 kPa) minimum.
    b. Gasket: Neoprene or phenolic.
    c. Bolt Sleeves: Phenolic or polyethylene.
    d. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

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

    a. Calpico, Inc.

b. Lochinvar Corporation.

2. Description: Galvanized-steel coupling.

a. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
b. End Connections: Female threaded.
c. Lining: Inert and noncorrosive, thermoplastic lining.

F. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements provide products by one of the following or equal:

a. Perfection Corporation.
b. Precision Plumbing Products, Inc.
c. Victaulic Company.

2. Description: Electroplated steel nipple complying with ASTM F 1545.

a. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
b. End Connections: Male threaded or grooved.
c. Lining: Inert and noncorrosive, propylene.

2.10 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASSE 1010 or PDI WH 201, with bellows or piston-type pressurized cushioning chamber and in sizes complying with PDI WH 201, Sizes A to F.

B. Pressure Gages: ASME B40.1. Include 4-1/2-inch- (115-mm-) diameter dial, dial range of two times system operating pressure, and bottom outlet.

2.11 SPRINKLERS

A. General Requirements: Designed for uniform coverage over entire spray area indicated at available water pressure.

B. Plastic, Pop-up, Gear-Drive Rotary Sprinklers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following or equal:

a. Buckner; a division of Storm Manufacturing Group Inc.
b. Champion Irrigation Products.
c. Hunter Industries Incorporated.

d. Irritrol Systems.
e. K-RAIN Manufacturing Corporation.
f. Nelson, L. R. Corporation.
g. Rain Bird Corporation.
h. Toro Company (The); Irrigation Division.
i. Weathermatic.

3. Description:

a. Body Material: ABS.
b. Nozzle: ABS or Brass.
c. Retraction Spring: Stainless steel.
d. Internal Parts: Corrosion resistant.

C. Plastic, Pop-up, Impact-Drive Rotary Sprinklers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following or equal:

a. Buckner; a division of Storm Manufacturing Group Inc.
b. Ceres Products Company.
c. Champion Irrigation Products.
d. Nelson, L. R. Corporation.
e. Toro Company (The); Irrigation Division.

3. Description:

a. Case: ABS.
b. Pop-up Height: Approximately 3 inches (75 mm).
c. Sprinkler Construction: ABS and other corrosion-resistant metals.

D. Plastic, Pop-up Spray Sprinklers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following or equal:

a. Buckner; a division of Storm Manufacturing Group Inc.
b. Ceres Products Company.
c. Champion Irrigation Products.
d. Hit Products Corporation.
e. Hunter Industries Incorporated.
f. K-RAIN Manufacturing Corporation.
g. Nelson, L. R. Corporation.
h. Orbit Irrigation Products, Inc.

i. Rain Bird Corporation.
j. Toro Company (The); Irrigation Division.
k. Weathermatic.

3. Description:

a. Body Material: ABS.
b. Nozzle: ABS or Brass.
c. Retraction Spring: Stainless steel.
d. Internal Parts: Corrosion resistant.
e. Pattern: Fixed, with flow adjustment.

2.12 QUICK COUPLERS

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following or equal:

1. Buckner; a division of Storm Manufacturing Group Inc.
2. Ceres Products Company.
3. Champion Irrigation Products.
4. Hunter Industries Incorporated.
5. Nelson, L. R. Corporation.
6. Rain Bird Corporation.
7. Toro Company (The); Irrigation Division.
8. Weathermatic.

C. Description: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.

1. Locking-Top Option: Vandal-resistant locking feature. Include two matching key(s).

2.13 DRIP IRRIGATION SPECIALTIES

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

1. Agrifim.
2. Aquarius Brands, Inc.
3. Buckner; a division of Storm Manufacturing Group Inc.
4. Dig Corporation.
5. Geoflow, Inc.

6. Hendrickson Bros.
7. Hit Products Corporation.
8. Irritrol Systems.
9. Maxijet, Inc.
10. NDS/Raindrip.
11. Netafim USA.
12. Olson Irrigation Systems.
13. Orbit Irrigation Products, Inc.
14. Rain Bird Corporation.
15. Roberts Irrigation Products, Inc.
16. Salco Products.
17. Toro Company (The); Irrigation Division.

B. Freestanding Emitters: Device to deliver water at approximately 20 psig (138 kPa).

1. Body Material: PE or vinyl, with flow control.
2. Riser to Emitter: PE or PVC flexible tubing.
3. Capacities and Characteristics:

    a. Flow: 1/2 gph (1.9 L/h) at approximately 20 psig (138 kPa).
    b. Tubing: PE or PVC; 1/8-inch (3-mm) minimum ID.
    c. Mounting Height: Per manufacturers specifications.

C. Manifold Emitter Systems: Manifold with tubing and emitters.

1. Manifold: With multiple outlets to deliver water to emitters.

    a. Body Material: Plastic.
    b. Outlet Caps: Plastic, for outlets without installed tubing.
    c. Operation: Automatic pressure compensating.

2. Tubing: PE or PVC; 1/8-inch (3-mm) minimum ID.
3. Emitter: Device to deliver water at approximately 20 psig (138 kPa).

    a. Body Material: PE or vinyl, with flow control.

D. Multiple-Outlet Emitter Systems: Emitter with tubing and button-type outlets.

1. Emitter: With multiple outlets to deliver water to remote outlets.

    a. Body Material: Plastic, with flow control.
    b. Outlet Caps: Plastic, for outlets without installed tubing.
    c. Operation: Automatic pressure compensating.
    d. Emitters: Devices to deliver water at approximately 20 psig (138 kPa).

2. Tubing: PE or PVC; 1/8-inch (3-mm) minimum ID.

3. Capacities and Characteristics:

a. Emitter:

1) Flow: 1/2 gph (1.9 L/h).
2) Number of Outlets: Six.

E. Drip Tubes with Direct-Attached Emitters:

1. Tubing: Flexible PE or PVC with plugged end.
2. Emitters: Devices to deliver water at approximately 20 psig (138 kPa).

a. Body Material: PE or vinyl, with flow control.
b. Mounting: Inserted into tubing at set intervals.

3. Capacities and Characteristics:

a. Tubing Size: NPS 1/2 (DN 15).
b. Emitter Flow: 1/2 gph (1.9 L/h).

F. Drip Tubes with Remote Discharge:

1. Tubing: Flexible PE or PVC with plugged end.
2. Emitters: Devices to deliver water at approximately 20 psig (138 kPa).

a. Body Material: PE or vinyl, with flow control.
b. Mounting: Inserted into tubing at set intervals.

3. Capacities and Characteristics:

a. Tubing Size: NPS 1/2 (DN 15).
b. Emitter Flow: 1/2 gph (1.9 L/h).
c. Branch Tubing Size: NPS 1/4 (DN 8) with button-type outlet.

G. Off-Ground Supports: Plastic stakes.

H. Application Pressure Regulators: Brass or plastic housing, NPS 3/4 (DN 20), with corrosion-resistant internal parts; capable of controlling outlet pressure to approximately 20 psig (138 kPa).

I. Filter Units: Brass or plastic housing, with corrosion-resistant internal parts; of size and capacity required for devices downstream from unit.

J. Air Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts.

K. Vacuum Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts.

2.14 CONTROLLERS

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following or equal:

1. Buckner; a division of Storm Manufacturing Group Inc.
2. Champion Irrigation Products.
3. Hit Products Corporation.
4. Hunter Industries Incorporated.
5. Irritrol Systems.
6. K-RAIN Manufacturing Corporation.
7. Nelson, L. R. Corporation.
8. Netafim USA.
9. Orbit Irrigation Products, Inc.
10. Rain Bird Corporation.
11. Superior Controls Co., Inc.
12. Toro Company (The); Irrigation Division.
13. Weathermatic.

C. Description:

1. Controller Stations for Automatic Control Valves: Each station is variable from approximately 5 to 60 minutes. Include switch for manual or automatic operation of each station.
2. Exterior Control Enclosures: NEMA 250, Type 4, weatherproof, with locking cover and two matching keys; include provision for grounding.

    a. Body Material: Stainless-steel sheet metal or Molded plastic.
    b. Mounting: Surface type for wall.

3. Interior Control Enclosures: NEMA 250, Type 12, dripproof, with locking cover and two matching keys.

    a. Body Material: Stainless-steel sheet metal orMolded plastic.
    b. Mounting: Surface type for wall.

4. Control Transformer: 24-V secondary, with primary fuse.
5. Timing Device: Adjustable, 24-hour, 14-day clock, with automatic operations to skip operation any day in timer period, to operate every other day, or to operate two or more times daily.

    a. Manual or Semiautomatic Operation: Allows this mode without disturbing preset automatic operation.

b. Nickel-Cadmium Battery and Trickle Charger: Automatically powers timing device during power outages.
c. Surge Protection: Metal-oxide-varistor type on each station and primary power.

6. Moisture Sensor: Adjustable from one to seven days, to shut off water flow during rain.
7. Wiring: UL 493, Type UF multiconductor, with solid-copper conductors; insulated cable; suitable for direct burial.

a. Feeder-Circuit Cables: No. 12 AWG minimum, between building and controllers.
b. Low-Voltage, Branch-Circuit Cables: No. 14 AWG minimum, between controllers and automatic control valves; color-coded different from feeder-circuit-cable jacket color; with jackets of different colors for multiple-cable installation in same trench.
c. Splicing Materials: Manufacturer's packaged kit consisting of insulating, spring-type connector or crimped joint and epoxy resin moisture seal; suitable for direct burial.

8. Concrete Base: Reinforced precast concrete not less than 36 by 24 by 4 inches (900 by 600 by 100 mm) thick, and 6 inches (150 mm) greater in each direction than overall dimensions of controller. Include opening for wiring.

2.15 BOXES FOR AUTOMATIC CONTROL VALVES

A. Plastic Boxes:

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

a. Armorcast Products Company.
b. Carson Industries LLC.
c. Nationwide Plastics, Inc.
d. NewBasis.
e. Oldcastle, Inc.
f. Orbit Irrigation Products, Inc.
g. USFilter/Plymouth Products, Inc.

2. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.

a. Size: As required for valves and service.
b. Shape: Rectangular.
c. Sidewall Material: PE, ABS, or FRP.
d. Cover Material: PE, ABS, or FRP.

1) Lettering: "VALVE BOX."

B. Polymer-Concrete Boxes:

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

a. Armorcast Products Company.
b. Carson Industries LLC.
c. CDR Systems Corporation.
d. Christy Concrete Products.
e. NewBasis.
f. Strongwell Corporation; Lenoir City Division.

2. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.

a. Size: As required for valves and service.
b. Shape: Rectangular.
c. Sidewall Material: Polymer concrete with lateral and vertical sidewall design loading of 5000 lb (2268 kg) minimum over 10 by 10 inches (254 by 254 mm) square.
d. Cover Material: Polymer concrete with cover design loading of 5000 lb (2268 kg) minimum over 10 by 10 inches (254 by 254 mm) square.

1) Lettering: "VALVE BOX."

C. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3/4 inch (19 mm) minimum to 3 inches (75 mm) maximum.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

B. Install warning tape directly above pressure piping, 12 inches (300 mm) below finished grades, except 6 inches (150 mm) below subgrade under pavement and slabs.

C. Drain Pockets: Excavate to sizes indicated. Backfill with cleaned gravel or crushed stone, graded from 3/4 to 3 inches (19 to 75 mm), to 12 inches (300 mm) below grade. Cover gravel or crushed stone with sheet of asphalt-saturated felt and backfill remainder with excavated material.

D. Provide minimum cover over top of underground piping according to the following:

1. Irrigation Main Piping: Minimum depth of 36 inches (900 mm) below finished grade, or not less than 18 inches (450 mm) below average local frost depth, whichever is deeper.
2. Circuit Piping: 12 inches (300 mm).
3. Drain Piping: 12 inches (300 mm).
4. Sleeves: 24 inches (600 mm).

3.2 PREPARATION

A. Set stakes to identify locations of proposed irrigation system. Obtain Architect's approval before excavation.

3.3 PIPING INSTALLATION

A. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.

B. Install piping at minimum uniform slope of 0.5 percent down toward drain valves.

C. Install piping free of sags and bends.

D. Install groups of pipes parallel to each other, spaced to permit valve servicing.

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

F. Install unions adjacent to valves and to final connections to other components with NPS 2 (DN 50) or smaller pipe connection.

G. Install flanges adjacent to valves and to final connections to other components with NPS 2-1/2 (DN 65) or larger pipe connection.

H. Install underground thermoplastic piping according to ASTM D 2774.

I. Install expansion loops in control-valve boxes for plastic piping.

J. Lay piping on solid subbase, uniformly sloped without humps or depressions.

K. Install ductile-iron piping according to AWWA C600.

L. Install PVC piping in dry weather when temperature is above 40 deg F (5 deg C). Allow joints to cure at least 24 hours at temperatures above 40 deg F (5 deg C) before testing.

M. Install water regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Install shutoff valve on outlet. Install aboveground or in control-valve boxes.

N. Water Hammer Arresters: Install between connection to building main and circuit valves aboveground or in control-valve boxes.

O. Install piping in sleeves under parking lots, roadways, and sidewalks.

P. Install sleeves made of Schedule 40 PVC pipe and socket fittings, and solvent-cemented joints.

Q. Install transition fittings for plastic-to-metal pipe connections according to the following:

1. Underground Piping:

a. NPS 1-1/2 (DN 40) and Smaller: Plastic-to-metal transition fittings.
b. NPS 2 (DN 50) and Larger: AWWA transition couplings.

2. Aboveground Piping:

a. NPS 2 (DN 50) and Smaller: Plastic-to-metal transition fittings.
b. NPS 2 (DN 50) and Larger: Use dielectric flange kits with one plastic flange.

R. Install dielectric fittings for dissimilar-metal pipe connections according to the following:

1. Underground Piping:

a. NPS 2 (DN 50) and Smaller: Dielectric coupling or dielectric nipple.
b. NPS 2-1/2 (DN 65) and Larger: Prohibited except in control-valve box.

2. Aboveground Piping:

a. NPS 2 (DN 50) and Smaller: Dielectric union.
b. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Dielectric flange.
c. NPS 5 (DN 125) and Larger: Dielectric flange kit.

3. Piping in Control-Valve Boxes:

a. NPS 2 (DN 50) and Smaller: Dielectric union.
b. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Dielectric flange.
c. NPS 5 (DN 125) and Larger: Dielectric flange kit.

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Flanged Joints: Select rubber gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

E. Ductile-Iron Piping Gasketed Joints: Comply with AWWA C600 and AWWA M41.

F. Copper-Tubing Brazed Joints: Construct joints according to CDA's "Copper Tube Handbook," using copper-phosphorus brazing filler metal.

G. Copper-Tubing Soldered Joints: Apply ASTM B 813 water-flushable flux to tube end unless otherwise indicated. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.

H. PE Piping Fastener Joints: Join with insert fittings and bands or fasteners according to piping manufacturer's written instructions.

I. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.
2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

J. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Pressure Piping: Join schedule number, ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
3. PVC Nonpressure Piping: Join according to ASTM D 2855.

3.5 VALVE INSTALLATION

A. Underground Curb Valves: Install in curb-valve casings with tops flush with grade.

B. Underground Iron Gate Valves, Resilient Seat: Comply with AWWA C600 and AWWA M44. Install in valve casing with top flush with grade.

1. Install valves and PVC pipe with restrained, gasketed joints.

C. Aboveground Valves: Install as components of connected piping system.

D. Pressure-Reducing Valves: Install in boxes for automatic control valves or aboveground between shutoff valves. Install full-size valved bypass.

E. Throttling Valves: Install in underground piping in boxes for automatic control valves.

F. Drain Valves: Install in underground piping in boxes for automatic control valves.

3.6 SPRINKLER INSTALLATION

A. Install sprinklers after hydrostatic test is completed.

B. Install sprinklers at manufacturer's recommended heights.

C. Locate part-circle sprinklers to maintain a minimum distance of 4 inches (100 mm) from walls and 2 inches (50 mm) from other boundaries unless otherwise indicated.

3.7 DRIP IRRIGATION SPECIALTY INSTALLATION

A. Install freestanding emitters on pipe riser to mounting height indicated.

B. Install manifold emitter systems with tubing to emitters. Plug unused manifold outlets. Install emitters on off-ground supports at height indicated.

C. Install multiple-outlet emitter systems with tubing to outlets. Plug unused emitter outlets. Install outlets on off-ground supports at height indicated.

D. Install drip tubes with direct-attached emitters on ground.

E. Install drip tubes with remote-discharge on ground with outlets on off-ground supports at height indicated.

F. Install off-ground supports of length required for indicated mounted height of device.

G. Install application pressure regulators and filter units in piping near device being protected, and in control-valve boxes.

H. Install air relief valves and vacuum relief valves in piping, and in control-valve boxes.

3.8 AUTOMATIC IRRIGATION-CONTROL SYSTEM INSTALLATION

A. Equipment Mounting: Install interior controllers on wall.

1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.

B. Equipment Mounting: Install exterior freestanding controllers on precast concrete bases.

1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Install control cable in same trench as irrigation piping and at least 2 inches (51 mm) below or beside piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install cable in separate sleeve under paved areas.

3.9 CONNECTIONS

A. Comply with requirements for piping specified in Division 2 Section "Water Distribution" for water supply from exterior water service piping, water meters, protective enclosures, and backflow preventers. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment, valves, and devices to allow service and maintenance.

C. Connect wiring between controllers and automatic control valves.

3.10 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Division 15 Section "Identification for Plumbing Piping and Equipment."

B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on each automatic controller.

1. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tapes over underground piping during backfilling of trenches. See Division 2 Section "Earthwork" for warning tapes.

3.11 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Any irrigation product will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.12 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that controllers are installed and connected according to the Contract Documents.
3. Verify that electrical wiring installation complies with manufacturer's submittal.

3.13 ADJUSTING

A. Adjust settings of controllers.

B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.

C. Adjust sprinklers and devices, except those intended to be mounted aboveground, so they will be flush with, or not more than 1/2 inch (13 mm) above, finish grade.

3.14 CLEANING

A. Flush dirt and debris from piping before installing sprinklers and other devices.

3.15 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain automatic control valves and controllers.

3.16 PIPING SCHEDULE

A. Install components having pressure rating equal to or greater than system operating pressure.

B. Piping in control-valve boxes and aboveground may be joined with flanges or unions instead of joints indicated.

C. Aboveground irrigation main piping, NPS 4 (DN 100) and smaller, shall be one of the following:

1. Galvanized-steel pipe and galvanized-steel pipe nipples; galvanized, gray-iron threaded fittings; and threaded joints.
2. Type L (Type B) hard copper tube, wrought- or cast-copper fittings, and soldered joints.
3. Schedule 40, PVC pipe; socket-type PVC fittings; and solvent-cemented joints.
4. Schedule 80, PVC pipe; Schedule 80, threaded PVC fittings; and threaded joints.

D. Aboveground irrigation main piping, NPS 5 (DN 125) and larger, shall be one of the following:

1. Galvanized-steel pipe and galvanized-steel pipe nipples; galvanized, gray-iron threaded fittings; and threaded joints.
2. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
3. Schedule 80, PVC pipe; Schedule 80, threaded PVC fittings; and threaded joints.

E. Underground irrigation main piping, NPS 4 (DN 100) and smaller, shall be one of the following:

1. NPS 3 and NPS 4 (DN 80 and DN 100) ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings, glands, bolts, and nuts; and gasketed joints.
2. NPS 3 and NPS 4 (DN 80 and DN 100) ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings and gaskets; and gasketed joints.
3. Type L (Type B) soft copper tube, wrought-copper fittings, and brazed joints.
4. NPS 4 (DN 100) PE pressure pipe; PE butt, heat-fusion or socket-type fittings; and heat-fusion joints.
5. Schedule 80, PVC pipe and socket fittings, and solvent-cemented joints.
6. Schedule 80, PVC pipe; Schedule 80, threaded PVC fittings; and threaded joints.

7. SDR 21, PVC, pressure-rated pipe; Schedule 80, PVC socket fittings; and solvent-cemented joints.

F. Underground irrigation main piping, NPS 5 (DN 125) and larger, shall be one of the following:

1. NPS 6 (DN 150) and larger ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings, glands, bolts, and nuts; and gasketed joints.
2. NPS 6 (DN 150) and larger ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings and gaskets; and gasketed joints.
3. PE pressure pipe; PE butt, heat-fusion fittings; and heat-fusion joints.
4. Schedule 80, PVC pipe and socket fittings; and solvent-cemented joints.
5. SDR 21, PVC, pressure-rated pipe; Schedule 80, PVC socket fittings; and solvent-cemented joints.

G. Circuit piping, NPS 2 (DN 50) and smaller, shall be one of the following:

1. SIDR 7, PE, controlled ID pipe; insert fittings for PE pipe; and fastener joints.
2. DR 9], PE, controlled OD pipe; PE butt, heat-fusion, or PE socket-type fittings; and heat-fusion joints.
3. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
4. SDR 26, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.

H. Circuit piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100), shall be one of the following:

1. SIDR 7, PE, controlled ID pipe; insert fittings for PE pipe; and banded or fastener joints.
2. DR 9, PE, controlled OD pipe; PE socket or butt-fusion fittings; and heat-fusion joints. NPS 3 (DN 80) pipe and fittings if NPS 2-1/2 (DN 65) pipe and fittings are not available.
3. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
4. SDR 26, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.

I. Underground Branches and Offsets at Sprinklers and Devices: Schedule 80, PVC pipe; threaded PVC fittings; and threaded joints.

1. Option: Plastic swing-joint assemblies, with offsets for flexible joints, manufactured for this application.

J. Risers to Aboveground Sprinklers and Specialties: Type L (Type B) hard copper tube, wrought-copper fittings, and soldered joints.

K. Risers to Aboveground Sprinklers and Specialties: Schedule 80, PVC pipe and socket fittings; and solvent-cemented joints.

L. Drain piping shall be one of the following:

1. SIDR 9, 11.5, or 15, PE, controlled ID pipe; insert fittings for PE pipe; and banded or fastener joints.
2. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
3. SDR 21, 26, or 32.5, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.

3.17 VALVE SCHEDULE

A. Underground, Shutoff-Duty Valves: Use the following:

1. NPS 2 (DN 50) and Smaller: Curb valve, curb-valve casing, and shutoff rod.
2. NPS 3 (DN 80) and Larger: Iron gate valve, resilient seated; iron gate valve casing; and operating wrench(es).

B. Aboveground, Shutoff-Duty Valves:

1. NPS 2 (DN 50) and Smaller: Brass or bronze ball valve.
2. NPS 2 (DN 50) and Smaller: Bronze gate valve.
3. NPS 2-1/2 (DN 65) and Larger: Iron ball valve.
4. NPS 2-1/2 (DN 65) and Larger: Iron gate valve, NRS.

C. Throttling-Duty Valves:

1. NPS 2 (DN 50) and Smaller: Bronze or Plastic automatic control valve.
2. NPS 2 (DN 50) and Smaller: Brass or bronze or plastic ball valve.
3. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): Bronze or Plastic automatic control valve.
4. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): Iron ball valve.

D. Drain Valves:

1. NPS 1/2 and NPS 3/4 (DN 15 and DN 20): Automatic drain valve.
2. NPS 1/2 and NPS 3/4 (DN 15 and DN 20): Plastic ball valve.
3. NPS 1/2 and NPS 3/4 (DN 15 and DN 20): Bronze gate valve.
4. NPS 1 to NPS 2 (DN 25 to DN 50): Plastic ball valve.
5. NPS 1 to NPS 2 (DN 25 to DN 50): Bronze gate valve.

END OF SECTION

SECTION 32 92 19

SEEDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Preparation of subsoil.

B. Placing topsoil.

C. Seeding, mulching and fertilizing.

D. Maintenance.

1.2 RELATED SECTIONS

A. Section 31 23 00 – Excavation and Backfill: Topsoil material.

B. Section 31 35 00 – Slope Protection and Erosion Control

1.3 REFERENCES

A. FS O-F-241 - Fertilizers, Mixed, Commercial.

1.4 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

A. Section 01 77 00 - Contract Closeout: Procedures for submittals.

B. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

1.6 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

1.7 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer, herbicide, and pesticide composition and application.

1.8 DELIVERY, STORAGE, AND PROTECTION

A. Section 01 60 00 - Material and Equipment: Transport, handle, store, and protect products.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.9 MAINTENANCE SERVICE

A. Section 01 77 00 - Contract Closeout.

B. Contractor to maintain seeded areas immediately after placement until grass is well established and exhibits a vigorous growing condition for one cutting. This shall include watering fertilizing, and weed control at regular intervals. Architect to determine if grass is well established and exhibits vigorous growth condition.

PART 2 PRODUCTS

2.1 SEED MIXTURE

A. Seed Mixture as indicated below, unless noted otherwise on Civil drawings.
   1. Turf Type Fescue Grass: 8 pounds per 1000 square feet.
   2. Quick-Cover Annual Rye Grass: 3 - 4 pounds per 1000 square feet.
   3. During certain periods of the year, Annual Rye Grass may be deleted upon approval of a local A.N.L. A. certified nursery and Architect.

2.2 SOIL MATERIALS

A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds.

2.3 ACCESSORIES

A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

B. Fertilizer: FS O-F-241; as recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil to the following proportions: Nitrogen 13 percent, phosphoric acid 13 percent, soluble potash 13 percent.

C. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

D. Herbicide: Type as recommended by local county agent.

E. Erosion Fabric: Curlex Blankets, manufactured by American Excelsior Company or approved alternate.

F. Stakes: Softwood lumber, chisel pointed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that prepared soil base is ready to receive the work of this section.

3.2 PREPARATION OF SUBSOIL

A. Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated subsoil.

C. Scarify subsoil to a depth of 4 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.

3.3 PLACING TOPSOIL

A. Spread topsoil to a minimum depth of 4 inches over area to be seeded. Rake until smooth.

B. Place topsoil during dry weather and on dry unfrozen subgrade.

C. Remove vegetable matter and foreign nonorganic material from topsoil while spreading.

D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

3.4 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.

B. Apply after smooth raking of topsoil and prior to roller compaction.

C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.

D. Mix thoroughly into upper 2 inches of topsoil.

E. Lightly water to aid the dissipation of fertilizer.

3.5 SEEDING

A. Apply seed at a rate described in specifications or on drawings. Apply evenly in two intersecting directions. Rake in lightly.

B. Do not seed areas in excess of that which can be mulched on same day.

C. Planting Season: Verify with a local A.N.L.A. certified nursery.

D. Do not sow immediately following rain, or when ground is too dry, or during windy periods.

E. Roll seeded area with roller not exceeding 112 lbs.

F. Immediately following seeding and compacting, apply mulch to a thickness of 1/8 inches. Maintain clear of shrubs and trees.

G. Apply water with a fine spray immediately after each area has been mulched. Saturate soil to a depth of 4 inches.

3.7 SEED PROTECTION

A. Cover seeded slopes where grade is 3:1 or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.

B. Lay fabric smoothly on surface, bury top end of each section in 6 inch deep excavated topsoil trench. Provide 12 inch overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.

C. Secure outside edges and overlaps at 36 inch intervals with stakes.

D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

3.8 MAINTENANCE

A. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at any one mowing.

B. Neatly trim edges and hand clip where necessary.

C. Immediately remove clippings after mowing and trimming.

D. Water to prevent grass and soil from drying out.

E. Roll surface to remove minor depressions or irregularities.

F. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.

G. Immediately reseed areas which show bare spots.

H. Protect seeded areas with warning signs during maintenance period.

3.9 EROSION

A. If topsoil begins to erode before grass is established, redress to finish grades and re-seed.

3.10 SCHEDULE

A. As indicated on drawings, where disturbed by construction, at perimeter of building and paved areas unless sod is called for in areas shown on drawings.

END OF SECTION

SECTION 32 92 23

SODDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Preparation of subsoil.

B. Fertilizing.

C. Sod installation.

D. Maintenance.

1.2 RELATED SECTIONS

A. Section 31 23 00 – Excavation and Backfill: Topsoil material.

B. Section 32 92 19 - Seeding.

C. Section 32 93 00 - Trees, Plants, and Ground Cover.

1.3 REFERENCES

A. ASPA (American Sod Producers Association) - Guideline Specifications to Sodding.

B. FS O-F-241 - Fertilizers, Mixed, Commercial.

1.4 DEFINITIONS

A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

A. Section 01 77 00 - Contract Closeout: Procedures for submittals.

B. Operation Data: Submit for continuing Owner maintenance.

C. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

1.6 QUALITY ASSURANCE

A. Sod: Minimum age of 18 months, with root development that will support its own weight without tearing, when suspended vertically by holding the upper two corners.

B. Submit sod certification for grass species and location of sod source.

C. Sod Producer: Company specializing in sod production and harvesting with minimum five years experience.

D. Installer: Company approved by the sod producer.

1.7 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.8 DELIVERY, STORAGE, AND PROTECTION

A. Section 01 60 00 - Material and Equipment: Transport, handle, store, and protect products.

B. Deliver sod on pallet or in rolls. Protect exposed roots from dehydration.

C. Do not deliver more sod than can be laid within 24 hours.

1.9 PROJECT CONDITIONS

A. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

B. Coordinate with installation of underground sprinkler system piping and watering heads.

C. Sod Installation Season: Verify with a local A.N.L. A. certified nursery or county agent.

1.10 MAINTENANCE SERVICE

A. Contractor to provide service and maintenance of sodded areas for three months from Date of Substantial Completion or until grass is well established and exhibits a vigorous growing condition for two cuttings, whichever is the longer period. Architect to determine if sod is well established and exhibits vigorous growth condition.

PART 2 PRODUCTS

2.1 MATERIALS

A. Sod: ASPA Approved Field grown; cultivated grass sod; type indicated below, unless noted otherwise on Civil drawings with strong fibrous root system, free of stones, burned or bare spots; containing no more than 10 weeds per 1000 sq ft.
   1. Bermuda Grass type: Tiff
   2. Bermuda Grass Type: U3
   3. Fescue Grass Type: Turf
   4. Zoysia Grass Type: Meyer Z-52
   5. Kentucky Bluegrass

B. Topsoil: As specified in Section 31 23 00.

C. Fertilizer: 13-13-13 Time release.

D. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

2.2 ACCESSORIES

A. Wood Pegs: Softwood, sufficient size and length to ensure anchorage of sod on slope.

B. Wire Mesh: Interwoven hexagonal plastic mesh of 2 inch size.

2.3 HARVESTING SOD

A. Machine cut sod and load on pallets in accordance with ASPA Guidelines.

B. Cut sod in area not exceeding 1 sq yd, with minimum 1/2 inch and maximum 1 inch topsoil base.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that prepared soil base is ready to receive the work of this section.

3.2 PREPARATION OF SUBSOIL

A. Prepare subsoil and eliminate uneven areas and low spots.

B. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

C. Remove foreign materials and undesirable plants and their roots. Do not bury foreign material beneath areas to be sodded.

D. Remove contaminated subsoil.

E. Scarify subsoil to a depth of 4 inches where topsoil is to be placed.

F. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.

3.3 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.

B. Apply after smooth raking of topsoil and prior to installation of sod.

C. Apply fertilizer no more than 48 hours before laying sod.

D. Mix thoroughly into upper 2 inches of topsoil.

E. Lightly water to aid the dissipation of fertilizer.

3.4 LAYING SOD

A. Moisten prepared surface immediately prior to laying sod.

B. Lay sod within 24 hours after harvesting to prevent deterioration.

C. Lay sod tight with no open joints visible, and no overlapping; stagger end joints 12 inches (300 mm) minimum. Do not stretch or overlap sod pieces.

D. Lay smooth. Align with adjoining grass areas.

E. Place top elevation of sod 1/2 inch below adjoining paving or curbs.

F. On slopes 3:1 and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2 feet on center. Drive pegs flush with soil portion of sod.

G. Water sodded areas immediately after installation. Saturate soil to a depth of 4 inches.

H. After sod and soil have dried, roll sodded areas to ensure good bond between sod and soil and to remove minor depressions and irregularities. Roll sodded areas with roller.

3.5 MAINTENANCE

A. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at any one mowing.

B. Neatly trim edges and hand clip where necessary.

C. Immediately remove clippings after mowing and trimming.

D. Water to prevent grass and soil from drying out.

E. Roll surface to remove minor depressions or irregularities.

F. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.

G. Immediately replace sod to areas which show deterioration or bare spots.

H. Protect sodded areas with warning signs during maintenance period.

END OF SECTION

SECTION 32 93 00

TREES, PLANTS, AND GROUND COVER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Preparation of subsoil and topsoil.

B. Topsoil bedding.

C. New trees, plants, and ground cover.

D. Mulch and fertilizer.

E. Maintenance.

F. Tree Pruning.

1.2 RELATED SECTIONS

A. Section 31 23 00 - Excavation and Backfill: Placement of topsoil in preparation for the work of this Section.

B. Section 32 80 00 – Irrigation System

C. Section 32 92 19 – Seeding

D. Section 32 92 23 - Sodding.

1.3 REFERENCES

A. ANSI Z60.1 - Nursery Stock.

B. NAA (National Arborist Association) - Pruning Standards for Shade Trees.

1.4 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

B. Plants: Living trees, plants, and ground cover specified in this Section, and described in ANSI Z60.1.

1.5 SUBMITTALS - PROJECT CLOSEOUT

A. Section 01 77 00 - Contract Closeout: - Operation and Maintenance Data: Procedures for submittals.

B. Maintenance Data: Include cutting and trimming method; types, application frequency, and recommended coverage of fertilizer.

C. Submit list of plant life sources.

1.6 QUALITY ASSURANCE

A. Nursery Qualifications: Company specializing in growing and cultivating the plants with three (3) years experience and licensed by State Plant Board.

B. Installer Qualifications: Company specializing in installing and planting the plants with five (5) years experience, approved by nursery.

C. Tree Pruner Qualifications: Company specializing in pruning trees with proof of Arborist Certification.

D. Tree Pruning: NAA - Pruning Standards for Shade Trees.

E. Maintenance Services: Performed by installer.

1.7 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of plants, fertilizer and herbicide mixture.

C. Plant Materials: Certified by state department of agriculture, Described by ASTM Z60.1, free of disease or hazardous insects.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

C. Protect and maintain plant life until planted.

D. Deliver plant life materials immediately prior to placement. Keep plants moist.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not install plant life when ambient temperatures may drop below 35 degrees F or rise above 90 degrees F.

B. Do not install plant life when wind velocity exceeds 30 mph.

1.10 COORDINATION

A. Coordinate work under provisions of Section 01 31 00.

1.11 WARRANTY

A. Provide one (1) year warranty under provisions of Section 01 77 00.

B. Warranty: Include coverage for one continuous growing season; replace dead or unhealthy plants.

C. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

D. Contractor shall notify owner to provide letter stating they will Guarantee and maintain landscaping for a period of Three (3) years from date of substantial completion per City of Bentonville, AR, requirements.

1.12 MAINTENANCE SERVICE

A. Maintain plant life immediately after placement until plants are well established and exhibit a vigorous growing condition. Continue maintenance until termination of warranty period.

B. Maintenance to include:
   1. Cultivation and weeding plant beds and tree pits.
   2. Applying herbicides for weed control in accordance with manufacturer's instructions.
   3. Remedy damage resulting from use of herbicides.
   4. Remedy damage from use of insecticides.
   5. Irrigating sufficient to saturate root system.
   6. Pruning, including removal of dead or broken branches, and treatment of pruned areas or other wounds.
   7. Disease control.
   8. Maintaining wrapping, guys, turnbuckles, and stakes. Adjust turnbuckles to keep guy wires tight. Repair or replace accessories when required.
   9. Replacement of mulch.

PART 2 PRODUCTS

2.1 TREES, PLANTS, AND GROUND COVER

A. Trees, Plants, and, Ground Cover: Species and size identifiable in plant schedule, grown in climatic conditions similar to those in locality of the Work.

2.2 SOIL MATERIALS

A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; minimum pH value of 5.4 and maximum 7.0.

2.3 SOIL AMENDMENT MATERIALS

A. Fertilizer: Containing fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated in analysis to the following proportions: Nitrogen 13 percent, phosphoric acid 13 percent, soluble potash 13 percent.

B. Composted organic material; free of lumps, roots, inorganic material or acidic materials; minimum of 85 percent organic material measured by oven dry weight.

C. Bone Meal: Raw, finely ground, commercial grade, minimum of 3 percent nitrogen and 20 percent phosphorous.

D. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates.

E. Water: Clean, fresh, and free of substances or matter which could inhibit vigorous growth of plants.

2.4 MULCH MATERIALS

A. Mulching Material: Cedar or cypress mulch, free of growth or germination inhibiting ingredients.

2.5 ACCESSORIES

A. Stakes: Softwood lumber, pointed end or mild steel angle, galvanized, pointed end.

B. Cable, Wire, Eye Bolts and Turnbuckles: Non-corrosive, of sufficient strength to withstand wind pressure and resulting movement of plant life.

C. Plant Protectors: Rubber sleeves over cable to protect plant stems, trunks, and branches.

2.6 TOP SOIL MIX AND PLANT SOIL MIX

A. A uniform mixture of 1 part composted organic material and 3 parts topsoil by volume.

2.7 SOURCE QUALITY CONTROL AND TESTS

A. Provide analysis of imported and existing topsoil.

B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt and organic matter; pH value.

C. Submit minimum 10 oz sample of topsoil proposed. Forward sample to testing laboratory in sealed containers to prevent contamination. Testing is not required if recent tests are available for imported topsoil.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that prepared subsoil are ready to receive work.

B. Saturate soil with water to test drainage.

C. Verify that required underground utilities are available, in proper location, and ready for use.

3.2 PREPARATION OF SUBSOIL

A. Prepare subsoil to eliminate uneven areas. Maintain profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated subsoil.

C. Scarify subsoil to a depth of 4 inches where plants are to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.

D. Dig pits and beds to same depth as plant root system and twice as wide as plant root system.

3.3 PLACING TOPSOIL

A. Spread topsoil to a minimum depth of 4 inches in seeded areas and 12” in planting beds. Rake smooth.

B. Place topsoil during dry weather and on dry unfrozen subgrade.

C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.

D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

3.4 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.

B. Apply after initial raking of topsoil.

C. Mix thoroughly into upper 2” of topsoil.

D. Lightly water to aid the dissipation of fertilizer.

3.5 PLANTING

A. Place plants for best appearance for review and final orientation by Architect/Engineer.

B. Set plants vertical.

C. Remove non-biodegradable root containers.

D. Set plants in pits or beds, partly filled with prepared plant mix, at a minimum depth of 6 inches (150 mm) under each plant. Remove burlap, ropes, and wires, from the root ball.

E. Place bare root plant materials so roots lay in a natural position. Backfill soil mixture in 6 inch layers. Maintain plant life in vertical position.

F. Saturate soil with water when the pit or bed is half full of topsoil and again when full.

3.6 INSTALLATION OF ACCESSORIES

A. Place tree protectors.

3.7 PLANT SUPPORT

A. Brace plants vertically with a minimum of 3 plant protector wrapped guy wires and stakes.

3.8 TREE PRUNING

A. Prune trees remove any dead or damaged limbs.

3.9 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Assurance: Field inspection and testing.

B. Plants will be rejected if a ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

3.10 MAINTENANCE

A. Neatly trim plants where necessary.

B. Immediately remove clippings after trimming.

C. Water to prevent soil from drying out.

D. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions.

E. Apply pesticides in accordance with manufacturers instructions.

3.11 SCHEDULE - PLANT LIST

A. Refer to Drawings.

END OF SECTION

SECTION 33 11 00

WATER DISTRIBUTION SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Site water piping and fittings including domestic waterline and fire sprinkler system waterline including valves, fire hydrants and appurtanences.

B. Connection of site water system to municipal water systems and testing.

C. Utility line Detection tape

1.2 RELATED SECTIONS

A. Section 31 23 33 - Excavation, Backfill, and Compaction for Utilities

B. Local Governing Authority and Code Requirements

C. Construction Drawings

1.3 PUBLIC WORK

A. Comply with the current City of Bentonville standard water and sewer specifications for public water and sewer lines. If conflict should be found between this section and city standards for Public Utilities, city standards shall be the priority. It shall be the Contractor's responsibility to obtain city standard water and sewer specifications and comply with the minimum requirements.

1.4 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME) latest edition
   B 16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

B. American Society for Testing and Materials (ASTM) latest edition
   B 88 Seamless Copper Water Tube
   D 1784 Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
   D 2241 Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR-Series)
   D 2564 Poly(Vinyl Chloride) (PVC) Solvent Cement
   D 2672 Poly(Vinyl Chloride) (PVC) Integrally Molded Bell Ends for Solvent-Cemented Pipe Joints
   D 2855 Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings

D 3139	Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals
F 477	Elastomeric gaskets and lubricant
F 656	Poly(Vinyl Chloride) (PVC) Cement Primer

C. American National Standards Institute (ANSI) latest edition
A21.8

D. American Water Works Association (AWWA) latest edition

C104	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
C105	Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
C110/C153	Ductile-Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids
C111	Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
C151	Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
C500	Gate Valves for Water and Sewage Systems
C502	Dry-Barrel Fire Hydrants
C504	Rubber-Seated Butterfly Valves
C508	Swing-Check Valves for Waterworks Service, 2 In. Through 24 In. NPS
C509	Resilient-Seated Gate Valves for Water and Sewage Systems
C600	Installation of Ductile-Iron Water Mains and Appurtenances
C606	Grooved and Shouldered Joints
C651	Disinfecting Water Mains
C900	Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution

E. Underwriters Laboratories (UL) latest edition

246	Hydrants for Fire Protection Service

1.4 QUALITY ASSURANCE

A. Perform installation in accordance with applicable utility company or municipality requirements.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Compaction testing of trench backfill shall be performed in accordance with Section 31 23 33.

D. Water distribution system pipe installed below grade and outside building shall be tested in accordance with the following procedures:
   1. Perform testing of pipe materials, joints, and other materials incorporated into construction of water mains and force mains to determine leakage and watertightness. Pressure pipeline shall be tested in accordance with Section 4 of AWWA C600. In event state or local code requires more stringent test, the more stringent shall apply.

2. Pressure Test for private water main:
   After pipe has been laid, newly laid pipe or valved section thereof shall be subjected to hydrostatic pressure of at least 1.5 times working pressure at lowest elevation of testing and not less than 1.25 times working pressure at highest elevation along test section.
3. Leakage Test:
   Leakage test shall be conducted concurrently with pressure test. Leakage is defined as quantity of water that must be supplied into newly laid pipeline or valved section thereof to maintain pressure within 5 psi of specified test pressure after air in pipeline has been expelled and pipeline has been filled with water. Leakage shall not be measured by drop in pressure in test section over period of time.
   No pipeline installation will be accepted if leakage is greater than that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{148{,}000}$$

   L = allowable leakage, (gallons per hour)
   S = length of pipe tested, (feet)
   D = nominal diameter of pipe, (inches)
   P = average test pressure during test, (psig)

4. Visible Leakage:
   Visible leaks shall be repaired regardless of amount of leakage measured.
5. Acceptance of Installation:
   If test of pipe laid in place discloses leakage greater than that specified, Contractor shall, at his own expense, locate leak and make repairs as necessary until leakage is within specified allowance.

   Supply water for testing at no expense to Owner.

1.5 SUBMITTALS

A. Product Data: Provide submittal data on pipe materials, pipe fittings, hydrants, valves, and accessories.

B. Manufacturer's Certificate: Certify that products meet or exceed state or local requirements.

C. Furnish 1 copy of results of leakage test and pressure test to the Owner or his designated representative and utility company upon completion of water distribution backfilling operations.

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of piping mains, valves, connections, and top of pipe elevations.

A. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

PART 2 PRODUCTS

2.1 PIPE

A. Pipe sizes less than 3-in. that are installed below grade and outside building shall comply with one or combination of following:
   1. Water piping buried **beyond 5 feet** of building perimeter:
      a. Seamless Copper Tubing: Type "K" soft copper to comply with ASTM B 88 and installed with wrought copper (95-5 Tin Antimony solder joint) fittings in accordance with ASME B 16.22.
      b. Polyvinyl Chloride (PVC) Water Pipe: Pipe shall conform to ASTM D 2241 with SDR 21 rating and shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 1784 material classification. Pipe joints using solvent cement shall be integrally molded bell ends in accordance with ASTM D 2672. Cement primer shall comply with ASTM F656 and solvent cement shall comply with ASTM D2564.
   2. Water Piping buried **within 5 feet** of building
      a. Copper Pipe: ASTM B 42, hard drawn.
         i. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
         ii. Joints: AWA A5.8, BCuP silver braze.

B. Pipe sizes 3-in. and larger that are installed below grade and outside building shall comply with one or a combination of the following:
   1. Ductile Iron Water Pipe: In accordance with ANSI/AWWA C111/A21, minimum thickness Class 50 or pressure Class 350. Fittings shall be either mechanical joint, push-on joint or locked-joint complying with AWWA C110 or AWWA C153. Elastomeric gaskets and lubricant shall comply with ASTM F477 or AWWA C111.
   2. Polyvinyl Chloride (PVC) Water Pipe: Pipe shall meet the requirements of AWWA C900 DR-14, pressure classification rated class 305. Pipe shall be continually marked as required for smaller pipes. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3139. Elastomeric gaskets and lubricant shall comply with ASTM F477 or AWWA C111.

2.2 GATE VALVES - 3 inch and Larger

A. Manufacturers:
Resilient Seat Gate Valves by: American Flow Control Model 2500; Clow Valve Company, Model 2638; Mueller Company, Model A2361.

B. AWWA C515, Ductile Iron body, non-rising stem with square nut, resilient seat, mechanical joint ends, control rod, post indicator where indicated on Construction Drawings, extension box and valve key.

2.3 BALL VALVES - Smaller than 3 inch

A. Manufacturers:
Mueller Oriseal or approved equal.

B. Brass body, teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA compression inlet end, compression outlet with electrical ground connector, with control rod, extension box and valve key.

2.4 BUTTERFLY VALVES - 3 inch and larger.

A. AWWA C504, Ductile Iron body, bronze or heat treated ductile iron disc, resilient replaceable seat, mechanical joint ends, infinite position lever handle.

2.5 CHECK VALVES - 3 inch and larger.

A. AWWA C 508, Ductile Iron body, mechanical joint ends

2.6 POST INDICATOR VALVES - From 4-in. to 14-in.

A. F-5760 and/or NFPA 13 or local codes, whichever is more stringent.

2.7 BACKFLOW PREVENTORS - Comply with applicable local code and/or NFPA 24

2.8 FIRE HYDRANTS

A. Fire Hydrants: Type as required by utility company and as shown on Construction Drawings.

B. Hydrant Extensions: Fabricate in multiples of 6-in. with rod and coupling to increase barrel length.

C. Hose and Steamer Connections: Match size and thread as required by applicable utility company, with two hose nozzles and one pumper nozzle.

D. Finish: Apply primer and 2 coats of enamel or special coating of color as required by applicable utility company.

2.9 DETECTION TAPE

A. Provide metallic detection tape installed approximately 12” above pipe installed on site outside of building footprint. Tape shall be continuous and be marked indicating water line.

2.10 ACCESSORIES

A. Thrust Blocking: Place 4,000 psi concrete to provide sufficient bearing area to transmit unbalanced thrust from bends, tees, caps, or plugs to undisturbed soil. Refer to applicable detail on construction drawings for requirements.

B. Locked or restrained joint fittings shall be installed in addition to thrust blocking requirements where vertical changes in direction are required asapproved by governing authority.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that building service connection and municipal utility water main size, location, and depth are as indicated on Construction Drawings.

3.2 PREPARATION

A. Ream pipe ends and remove burrs prior to assembly.

B. Remove scale and dirt, on inside and outside, prior to assembly.

C. Prepare and properly align pipe for connections to equipment.

D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

3.3 BEDDING

A. Excavate pipe trench and place bedding material in accordance with Section 31 23 33.

3.4 INSTALLATION - PIPE AND FITTINGS

A. Maintain separation of water main from sanitary and storm sewer piping in accordance with state or local codes.

B. Install pipe and fittings in accordance with AWWA C600.

C. Install pipe to allow for expansion and contraction without stressing pipe or joints as specified by pipe manufacturer.

D. Install access fittings in accordance with local codes to permit disinfection of water system performed under this Section.

E. Connections with Existing Pipelines: Where connections are made between new work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions that cause the least interference with the operation of existing pipeline and in compliance with local utility company requirements.

F. Form and place concrete for thrust blocks or other specified methods of retainage at each change of direction or end of pipe main.

G. Establish elevations of buried piping in accordance with Section 31 23 33.

H. Backfill trench in accordance with Section 31 23 33

3.5 INSTALLATION - VALVES AND HYDRANTS

A. Install gate valves as indicated on Construction Drawings and supported on concrete pads with valve stem vertical and plumb. Install valve boxes in manner that will not transmit loads, stress, or shock to valve body. Center valve box over operating nut of valve vertical and plumb. Securely fit valve box together leaving cover flush with finished surface in walks or paved areas or elevated as needed to acoomodate concrete valve pads in “green areas”.

B. Install fire hydrant assemblies where and as indicated on Construction Drawings in vertical and plumb position with steamer/pumper nozzle pointed perpendicular to traffic where hydrant is adjacent to street, roadway, or parking lot drive or toward protected building unless otherwise directed by local authorities. Support hydrant assembly on concrete pad and firmly brace on side opposite inlet pipe against undisturbed soil and concrete thrust blocking. Place a minimum of 6 cu. ft of crushed stone or gravel around hydrant base and barrel after thrust blocking has cured at least 24 hours. Exercise care when backfilling and compacting so proper vertical position will not be altered.

3.6 DISINFECTION OF WATER PIPING SYSTEM

A. Disinfect distribution system with chlorine before acceptance for domestic operation. Amount of chlorine shall be such as to provide dosage of not less than 50 parts per million. Thoroughly flush lines before introduction of chlorinating materials and after contact period of not less than 24 hours, system shall be flushed with clean water until residual chlorine content is not greater than 1.0 part per million. Open and close valves in lines being disinfected several times during contact period. After disinfection, take water sample and bacteriologically test in accordance with AWWA C651. Do not place distribution system in service until approval is obtained from local governing authorities.

3.7 SERVICE CONNECTIONS

A. Provide water service connection in compliance with utility company requirements including reduced pressure backflow preventor if required and water meter with by-pass valves and sand strainer.

END SECTION

SECTION 33 31 13

SANITARY SEWER SYSTEMS

PART 1 GENERAL

1. 1 SECTION INCLUDES

A. Sanitary sewer drainage piping, fittings, accessories, cleanouts, and bedding.

B. Connection of site and/or building sanitary sewer system to municipal sanitary sewer systems.

1.2 RELATED REQUIREMENTS

A. Section 31 23 33 - Excavation, Backfill, and Compaction for Utilities

B. Section 33 39 00 – Sanitary and Storm Sewer Manhole Structures

C. Local governing authority and code requirements

D. Construction Drawings

1.3 PUBLIC WORK

A. Comply with the City of Bentonville standard water and sewer specifications for public water and sewer lines. If conflict should be found between this section and city standards for Public Utilities, city standards shall be the priority. It shall be the Contractor's responsibility to obtain city standard water and sewer specifications and comply with the minimum requirements.

1.4 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) latest edition

A 74	Cast Iron Soil Pipe and Fittings
A 746	Ductile Iron Gravity Sewer Pipe
C 12	Practice for Installing Vitrified Clay Pipe Lines
C 14	Concrete Sewer, Storm Drain, and Culvert Pipe
C 76	Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
C 425	Compression Joints for Vitrified Clay Pipe and Fittings
C 443	Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
C 564	Rubber Gaskets for Cast Iron Soil Pipe and Fittings
C 700	Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
D 1785	Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
D 2321	Underground Installation of Flexible Thermoplastic Sewer Pipe
D 3034	Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
F 477	Elastomeric Seals (Gaskets) for Joining Plastic Pipe
F 949	Polyvinyl Chloride (PVC) Pipe and Fittings

B. American Association of State Highway and Transportation Officials (AASHTO) latest edition
   M 252 Corrugated Polyethylene Drainage Tubing
   M 294 Polyvinyl Chloride (PVC) Pipe and Fittings

C. American Water Works Association (AWWA) latest edition
   C111 Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings

1.5 QUALITY ASSURANCE

A. Compaction testing will be performed in accordance Section 31 23 33

B. Test sanitary sewer pipe system installed below grade and outside building in accordance with the following procedures:

1. Perform testing of manhole construction, pipe materials, joints, or other materials incorporated into construction of sanitary sewer system to determine leakage and watertightness. In event state or local code requires more stringent test, the more stringent shall apply.

2. Manhole Testing:
   The Owner or his designated representative or Governing Agency shall determine method of testing set forth below. Method selected will be determined by depth of each manhole, groundwater level, concrete honeycombing, or other conditions which make selected test suitable for determining physical condition and watertightness of manhole.

   2.1 Manhole Exfiltration Testing:
   Incoming and outgoing sewer lines shall be plugged and manhole filled with water up to top of poured concrete or above highest precast barrel joint. Manhole fails if water loss exceeds maximum allowable shown below:

Depth of Manhole	Maximum Allowable Water Loss
0 - 8-ft	1-in. over 5 minutes
greater than 8-ft	1/8 gal/vertical ft over 5 minutes

   2.2 Manhole Vacuum Testing:
   Test shall be performed with suitable apparatus made for such purpose and shall draw vacuum of 10-in. of Mercury (Hg). Test passes if vacuum remains at 10-in. of Hg or drops to not less than 9-in. of Hg in 1 min.

3. Flexible Pipe Deflection Testing:
   3.1 Allowable Deflection:
   Maximum allowable pipe deflection shall not exceed 5 percent of nominal inside diameter.

3.2 Mandrel:
Mandrel, go/no-go, device shall be cylindrical in shape and constructed with either 9 or 16 evenly spaced arms or prongs. Mandrels with less arms will be rejected as not sufficiently accurate. Contact length of mandrel's arms shall equal or exceed nominal inside diameter of sewer to be inspected. Critical mandrel dimensions shall carry tolerance of 0.01-in. maximum. Mandrel and necessary equipment for mandrel test shall be provided by Contractor.

3.3 Procedure:
Mandrel shall be hand-pulled through flexible pipe sewer lines no earlier than 30 days after trench has been completely backfilled and compacted. Sections of sewer not passing mandrel shall be uncovered and rebedded, rerounded, or replaced to satisfaction of the Owner or his designated representative or Governing Agency. Repaired section shall be retested.

3.4 Mandrel O.D. (outside diameter):
Outside diameter of mandrel shall be set according to the following table:

Nominal Diameter, in.	Mandrel O.D., in.
4	3.60
6	5.40
8	7.12
10	8.80
12	10.44
15	12.90
18	15.30

3.5 Contractor's Warranty:
The Owner or his designated representative or Governing Agency reserves the right to mandrel test flexible pipe sewer line before acceptance, and also prior to expiration of first year of operation. If previously accepted line fails mandrel test performed during first year of operation, defects must be corrected at Contractor's expense.

4. Air Testing of Gravity Sewers:

4.1 Procedure:

4.1.1 Plug pipe outlets with suitable test plugs and brace each plug securely.
4.1.2 Pipe air supply to pipeline to be tested in such manner that air supply may be shut off, pressure observed, and air pressure released from pipe without workmen entering manhole.

4.1.3 Add air slowly to portion of pipe under test until internal pressure of line is raised to approximately 4 psig, but less than 5 psig.

4.1.4 Shut air supply off and allow at least 2 minutes for air pressure to stabilize.

4.1.5 When pressure has stabilized and is at or above starting test pressure of 3.5 psi, start test.

4.1.6 Determine time in seconds with stopwatch for pressure to fall 0.5 psig so that pressure at end of time is at or above 3.0 psig.

4.1.7 Compare observed time with minimum allowable times in chart on following page for pass/fail determination.

1 Nominal Pipe Diameter (inches)	2 Minimum Time (min:sec.)	3 Length for Minimum Time (feet)	4 Time for Longer Length (sec.)	SPECIFICATION TIME FOR LENGTH (L) SHOWN (MIN:SEC)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	.190L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837L	11:24	17:57	22:48	28:30	34:16	39:53	45:35	51:17
27	12:45	88	8.653L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	46:54
30	14:10	80	10.683L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23

4.2 Safety Precautions:

Low pressure air test may be dangerous to personnel if, through lack of understanding or carelessness, line is overpressurized or plugs are installed improperly. It is extremely important that various plugs be installed so as to prevent

the sudden expulsion of poorly inflated plug. As example of hazard, force of 250-lb is exerted on 8-in. plug by internal pressure of 5 psi. Observe following safety precautions:

4.2.1 No person shall be allowed in manholes during test or when plugged pipe is under pressure.

4.2.2 Gauges, air piping manifolds, and valves shall be located at top of ground.

4.2.3 Install and brace plugs securely.

4.2.4 Do not overpressurize lines.

4.3 Groundwater Elevation:
If pipeline to be tested is below groundwater level, starting test pressure shall be increased by 0.433 psi for each foot groundwater level is above invert of sewer pipe. In no case shall starting test pressure exceed 9.0 psig.

4.4 Acceptance of Installation:
No gravity sewer or manhole will be accepted that does not comply with minimum requirements of tests described in herein.

4.5 Test Equipment:
Necessary equipment to perform air test in accordance with Specifications shall be provided by Contractor. Test gauge shall preferably have incremental division of 0.10 psi and have accuracy of at least 0.04 psi. In no case shall test gauge be used which has incremental divisions of greater than 0.25 psi. Gauge shall be of sufficient size in order to determine this accuracy.

4.6 Furnish 1 copy of gravity sewer and manhole test results to the Owner or his designated representative and Governing Agency upon completion of gravity sewer system backfilling operations.

1.5 SUBMITTALS

A. Product Data: Provide data of pipe materials, pipe fittings, and accessories.

B. Manufacturer's Certificate: Certify that products meet or exceed specified local requirements.

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of pipe runs, connections, cleanouts, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.7 PROJECT CONDITIONS

A. Coordinate work with sanitary sewer connections to structures and to municipal sewer system.

PART 2 PRODUCTS

2.1 SEWER PIPE MATERIALS

A. Sanitary sewer piping, buried **beyond 5 feet** of building
   1. PVC Pipe: ASTM D 2665 or ASTM D 3034
      a. Fittings: PVC
      b. Joints: Solvent welded, with ASTM D 2564 solvent cement.

B. Sanitary sewer piping, buried within 5 feet of building
   1. PVC Pipe: ASTM D 2665 or ASTM D 3034
      a. Fittings: PVC
      b. Joints: Solvent welded, with ASTM D 2564 solvent cement.

2.2 PIPE ACCESSORIES

A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.

B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps, etc.

2.3 CLEANOUTS

A. Lid and Frame: Heavy Duty cast iron construction, as manufactured by Mueller or approved equal. Lid Design: Closed Lid.

B. Shaft Construction: Cast Iron shaft of internal diameter as indicated on Construction Drawings with 2500 psi concrete collar matching finish grade.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify items specified in other sections are properly sized and located.

B. Verify that trench cut and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on Construction Drawings.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct overexcavation with bedding material.

B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

3.3 BEDDING

A. Excavate trench and place bedding material in accordance with Section 31 23 33.

3.4 INSTALLATION – PIPE

A. Install pipe, fittings, and accessories in accordance with ASTM C 12, ASTM C 14, ASTM D 2321, or manufacturer's instructions and local requirements.

B. Lay pipe to slope gradients noted on Construction Drawings.

C. Install pipe on bedding in accordance with Section 31 23 33.

D. Refer to Section 31 23 33 for trenching requirements. Do not displace or damage pipe when backfilling and compacting.

E. Refer to Section 33 39 00 for manhole requirements.

F. Connect to building sanitary sewer outlet and municipal sewer system as indicated on Construction Drawings.

3.5 INSTALLATION - CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Provide concrete encasement as indicated on Construction Drawings after sanitary sewer pipe and fittings have been installed to proper elevations.

END OF SECTION

SECTION 33 39 00

SANITARY AND STORM SEWER MANHOLE STRUCTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Monolithic, cast in place concrete manhole barrel and either monolithic concrete or masonry transition to lid frame.

B. Modular precast concrete manhole barrel with tongue-and-groove joints and either precast concrete or masonry transition to lid frame.

C. Precast polyethylene manhole assemblies.

D. Preparation and installation of lid frame, covers, anchorage, and accessories.

1.2 RELATED SECTIONS

A. Section 31 23 33 - Excavation, Backfill, and Compaction for Utilities

B. Section 33 41 00 - Storm Sewer Systems

C. Section 33 31 13 - Sanitary Sewer Systems

D. Section 32 13 13 – Portland Cement Concrete Paving

E. Local governing authority and code requirements

F. Construction Drawings

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) latest edition

A 48	Gray Iron Castings
C 55	Concrete Building Brick
C 478	Precast Reinforced Concrete Manhole Sections
C 923	Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes
D 1248	Polyethylene Plastics Molding and Extrusion Materials

B. International Masonry Industry All-Weather Council (IMIAC) latest edition Recommended Practices and Guide Specification for Cold Weather Masonry Construction

1.4 SUBMITTALS

A. Shop Drawings: Indicate reference to Construction Drawings regarding manhole locations, elevations, piping with sizes, locations, and elevations of structure penetrations.

B. Product Data: Provide data for manhole covers, component construction, features, configuration, and dimensions.

1.5 PUBLIC WORK

A. Comply with the City of Bentonville standard water and sewer specifications for public water and sewer lines. If conflict should be found between this section and city standards for public utilities, city standards shall be the priority. It shall be the Contractor's responsibility to obtain city standard water and sewer specifications and comply with the minimum requirements.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manhole Barrel: Nonreinforced cast-in-place concrete in accordance with Section 03 30 00.
   1. Cast-in-place manholes shall be not less than 4'-0" inside diameter and constructed of 3500 psi concrete.
   2. Forms shall be made of steel sheets accurately shaped and fabricated of sufficient strength to form dense watertight walls to true dimensions.
   3. Concrete shall be deposited in evenly distributed layers of about 18 in., with each layer vibrated to bond to preceding layer.

B. Manhole Barrel: Reinforced precast concrete in accordance with ASTM C 478 with gaskets in accordance with ASTM C 923.

   Construct manholes of precast concrete sections as required by Construction Drawings to size, shape, and depth indicated, but never less than 4'-0" inside diameter.

C. Manhole Barrel: Precast polyethylene in accordance with ASTM D 1248. ~~Manholes shall be manufactured with factory-molded steps.~~ Nominal cylinder internal diameter shall be 48-in. and shall be designed to accept concrete filled polyethylene manhole lids and standard cast iron frames with lid or grate. Manholes shall have a compressive strength which meets ASTM D 2412 standards. Acceptable Manufacturers: Advanced Drainage Systems (ADS) or approved equal.

E. Mortar and Grout: Mortar for finishing and sealing shall be Class "C". Honeycombing less than 2-in. deep shall be repaired using Class "D" mortar.

2.2 COMPONENTS

A. Lid and Frame: Lid and frame shall comply with ASTM A 48, Class 35B heavy duty cast iron construction, machined flat bearing surface, removable lid, closed or open as indicated on Construction Drawings with sealing gasket and manufactured by Neenah Foundry Company or approved equal.

B. Base Pad: Cast-in-place concrete as specified in Section 03 30 00.

2.3 CONFIGURATION

A. Barrel Construction: Concentric barrel with eccentric cone top section.

B. Shape: Cylindrical

C. Clear Inside Dimensions: 48-in. diameter or as indicated on Construction Drawings.

D. Design Depth: As indicated on Construction Drawings.

E. Clear Lid Opening: 22-in. diameter minimum

F. Pipe Entry: Provide openings as indicated on Construction Drawings

G. Main and Lateral Pipes: Neatly cut off main and lateral pipes flush with inside of manhole or inlet where they enter structure walls. Point up irregularities and rough edges with nonshrinking grout.

H. Inverts: Shape inverts for smooth flow across structure floor as indicated on Construction Drawings. Use concrete and mortar to obtain proper grade and contour. Finish surface with fine textured wood float.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify items specified by other Sections are properly sized and located.

B. Verify that items associated with structures are in proper location and ready for connection to other work and/or structure construction.

C. Verify that the excavation for manholes and other structures are correct.

3.2 PREPARATION

Coordinate placement pipe connections to structure as indicated on Construction Drawings.

3.3 PLACING PRECAST MANHOLE BARREL SECTIONS

A. Place slab foundation to proper elevation and location and trowel top surface level for placement of manhole barrel.

B. Place manhole barrel plumb and level to correct elevations and anchor to base pad.
   1. After completion of slab foundation, first joint of manhole barrel shall be lowered into position, grooved end first, and set level and plumb on concrete slab. Align and adjust to proper grade prior to placing and forming invert which shall be poured immediately after setting of first section of manhole barrel.
   2. Prior to setting subsequent manhole barrel sections, apply primer to tongue and groove ends and allow to set in accordance with manufacturer's recommendations. Place "Ram-nek", or equivalent joint sealing material on tongue end. Lower next section into position, and remove excess sealing material from interior of structure. Add additional material on exterior of joint, if necessary, for a completely watertight joint.

END OF SECTION

SECTION 33 41 00

STORM SEWER SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Site storm sewer drainage piping, fittings, accessories, and bedding.

B. Connection of site and/or building storm water drainage system to municipal storm sewers.

1.2 RELATED REQUIREMENTS

A. Section 31 23 33 - Excavation, Backfill, and Compaction for Utilities

B. Section 33 44 00 – Storm Drainage Structures

C. Local governing authority and code requirements

D. Construction Drawings

1.3 PUBLIC WORK

A. Comply with the City of Bentonville standard water and sewer specifications for public water and sewer lines. If conflict should be found between this section and city standards for public utilities, city standards shall be the priority. It shall be the Contractor's responsibility to obtain city standard water and sewer specifications and comply with the minimum requirements.

1.4 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO) latest edition
   - M 36 Metallic (Zinc or Aluminum) Coated Corrugated Steel Culverts and Underdrains
   - M 198 Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets
   - M 252 Corrugated Polyethylene Drainage Tubing
   - M 274 Pure Aluminum Type 2 Coated Corrugated Steel Culverts and Uderdrains
   - M 294 Polyvinyl Chloride (PVC) Pipe and Fittings

B. American Society for Testing and Materials (ASTM) latest edition
   - A 760 Spiral Rib Metal Pipe (Type 1 R)
   - C 14 Concrete Sewer, Storm Drain, and Culvert Pipe
   - C 76 Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
   - C 443 Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
   - D 2321 Underground Installation of Flexible Thermoplastic Sewer Pipe

D 3034 Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
F 794 Polyvinyl Chloride (PVC) Pipe and Fittings

1.5 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, and accessories.

B. Manufacturer's Certificate: Certify that products meet or exceed specified local requirements.

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.7 PROJECT CONDITIONS

A. Coordinate work with storm sewer connections to structures and to municipal storm sewer system.

PART 2 PRODUCTS

2.1 SEWER PIPE MATERIALS AND ACCESSORIES

A. Reinforced Concrete Pipe: Comply with requirements of ASTM C 76, Class III unless another class type is indicated on Construction Drawings, installed with flexible plastic, bitumen gaskets at joints. Gaskets shall comply with AASHTO M 198 75I, Type B, and shall be installed in strict accordance with pipe manufacturer's recommendations.

B. Corrugated Steel Pipe: Galvanized, aluminized, or bituminous coated as specified on Construction Drawings. Only permitted when specifically indicated on Construction Drawings and shall comply with requirements of ASTM A 760; 16 gauge unless another gauge is indicated on Construction Drawings. Install with matching band connectors. Install sleeve gaskets in accordance with pipe manufacturer's recommendations. Corrugated steel pipe may be round pipe, arch pipe, or slotted drain pipe as indicated on Construction Drawings. Slotted drain pipe shall have 1.75-in. wide drain waterway openings and 6-in. minimum height drain guide.

C. Spiral Rib Metal Pipe Type 1R: Galvanized, aluminized, or bituminous coated as specified on Construction Drawings. Only permitted when specifically indicated on Construction Drawings. Pipe ends shall be re-corrugated and installed with semi-corrugated Hugger-type bands and "O" ring gaskets in accordance with pipe manufacturer's installation requirements. Spiral Rib metal pipe must comply with ASTM A 760 Type 1R. Acceptable manufacturer: CONTECH, INC. "ULTRA FLO or ULTRA FLO II", Caldwell Culvert Co. "Smooth Rib", or approved alternate.

D. Corrugated Polyvinyl Chloride smooth interior storm sewer pipe and fittings shall comply with ASTM F949-93A, meet all requirements of AASHTO M304-91 (H-20 Loading) and be marked with manufacturers name, pipe size, cell classification and ASTM F 949 classification. Pipe must be installed per manufacturers installation requirements. Acceptable manufacturer: CONTECH, INC. "D-2000" PVC storm sewer pipe or approved alternate.

E. Corrugated Polyethylene Pipe (CPP) Smooth Interior: Only permitted when specifically indicated on Construction Drawings and shall conform with AASHTO Designation M 252 and M 294. Pipe must be installed in accordance with pipe manufacturer's installation Guidelines for Culvert Storm Drainage Applications. Acceptable manufacturers: Advanced Drainage Systems, Inc. "ADS N-12", HANCOR, INC. "Hi-Q", or approved alternate.

F. Polyvinyl Chloride (PVC) large diameter closed profile gravity sewer pipe, UNI-B-9: Only permitted when specifically indicated on Construction Drawings. Pipe and fittings shall comply with ASTM F 794. Pipe must be installed in accordance with pipe manufacturer's installation guidelines. Acceptable manufacturer: Carlon "Vylon H.C." or approved alternate.

G. Polyvinyl Chloride (PVC) 8-in. through 30-in. diameter, smooth interior, open profile gravity sewer pipe. Only permitted when specifically indicated on Construction Drawings. Pipe and fittings shall comply with ASTM F 794 and Uni-Bell UNI-B-9. Pipe must be installed in accordance with pipe manufacturer's installation guidelines. Acceptable manufacturer: Extrusion Technologies, Inc. "Ultra-Rib" or approved alternate.

H. Corrugated Polyvinyl Chloride smooth interior sanitary sewer pipe and fittings shall comply with ASTM F 949-93A and be marked with manufacturers name, pipe size, cell classification and ASTM F 949 classification. Pipe must be installed per manufactuers installation requirements. Acceptable manufacturer: CONTECH, INC. "A-2000" PVC sanitary sewer pipe or approved alternate.

I. Polyvinyl Chloride Storm Sewer Truss Pipe and fittings shall comply with ASTM D 2680 and be marked with manufacturers name, pipe size, cell classification and ASTM D 2680 classification. Acceptable manufacturer: CONTECH, INC. "Contect PVC Storm Sewer Truss Pipe" or approved alternate.

2.2 INLETS, CATCH BASINS AND JUNCTION BOXES

A. Lid and frame per details shown on Construction Drawings.

B. Structure construction shall be in accordance with details shown on Construction Drawings and in accordance with Section 33 44 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify items specified in other sections are properly sized and located.

B. Verify that trench cut and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on Construction Drawings.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with bedding material.

B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

C. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

3.3 BEDDING

A. Excavate pipe trench and place bedding material in accordance with Section 31 23 33.

3.4 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with ASTM C 14, ASTM D 2321, or manufacturer's instructions and state or local requirements.

B. Install pipe on bedding in accordance with Section 31 23 33.

C. Lay pipe to slope gradients noted on Construction Drawings.

D. Refer to Section 31 23 33 for trenching requirements. Do not displace or damage pipe when backfilling and compacting.

3.5 INSTALLATION - CATCH BASINS, INLETS, AND JUNCTION BOXES

A. Form bottom of excavation clean and smooth to correct elevation.
B. Form and place cast-in-place concrete base pad in accordance with section 03 30 00, with provision for storm sewer pipe to be placed at proper elevation.
C. Form and place cast-in-place concrete walls, sleeved at proper elevation to receive storm sewer pipe in accordance with section 03 30 00 and details shown on Construction Drawings.
D. Form and place cast-in-place top of structure in accordance with details shown on Construction Drawings.

END OF SECTION

SECTION 33 44 00

STORM DRAINAGE STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

Section Includes

1. Storm drainage structures.

1.2 Related Requirements

1. Section 01 40 00 – Quality Control
2. Section 02 32 00 - Earthwork
3. Section 31 23 33 - Excavation, Backfill, and Compaction for Utilities
4. Section 31 35 00 - Slope Protection and Erosion Control

1.3 REFERENCE STANDARDS

American Association of State Highway and Transportation Officials (AASHTO)

1. AASHTO M198 - Joints for Circular Sewer and Culvert Pipe Using Flexible Watertight Gaskets
2. AASHTO H170 - Reinforced Concrete Culvert, Storm Drain and Sewer Pipe

American Society for Testing and Materials (ASTM)

1. ASTM A185 - Steel welded Wire Fabric, Plain, for Concrete Reinforcement
2. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
3. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
4. ASTM C150 - Portland Cement
5. ASTM C206 - Finished Hydrated Lime
6. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

1.4 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, and accessories.

B. Manufacturer's Certificate: Certify that products meet or exceed specified local requirements.

Project Record Documents

1. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.
2. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.5 PROJECT CONDITIONS

A.Coordinate work with termination of storm sewer connection including connection to municipal storm sewer system.

PART 2 - PRODUCTS

2.1 DRAINAGE STRUCTURES

Cast-In-Place concrete for drainage structures including manholes, inlets, catch basins, collars, support blocks, headwalls and paved ditches shall conform to ACI 301.

1. Compressive Strength: Unless shown otherwise on drawings, 3500 psi at 28 days.
2. Reinforcement: ASTM A615, grade 40 or 60 deformed reinforcing bars, and ASTM A185 for wire fabric.

Cement Mortar used for paving inverts, filling lift holes, joints, patching and anchoring castings shall consist of one part Portland cement, type I, ASTM C150, 1/4 part hydrated lime, ASTM C206 and 2-1/2 parts clean, well-graded sand and water free of suspended matter, alkali, and containing no industrial or domestic waste.

If allowed by municipality, precast drainage structures may be provided, but must meet minimum requirements and design parameters of this specification and as shown on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

Verify that trench cut and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

Hand trim excavations to required elevations. Correct over excavation with bedding material. Remove large stones or other hard matter that could damage piping or impede consistent backfilling or compaction.

Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

3.3 INSTALLATION - PIPE

The pipe shall be inspected for defects and cracks before being lowered into the trench, piece by piece. Any defective, damaged or unsound pipe or any pipe that has had its grade disturbed after lying shall be taken up and replaced. Open ends shall be protected with a stopper to prevent earth or other material from entering the pipe during construction. The interior of the pipe shall be free from dirt, excess water and other foreign materials as the pipe laying progresses and left clean at the completion of the installation.

Excavate pipe trench and place bedding material in accordance with Section 31 23 33.

Installation shall commence at the lowest point for each segment of the route. RCP shall be laid with the groove or bell end upstream.

Lay pipe to the required line and slope gradients with the necessary fittings, bends, manhole, risers and other appurtenances placed at the required location as noted on Drawings.

Do not displace or damage pipe when compacting.

No pipe shall be laid in water or when trench conditions are unsuitable for such work.

Joints:

1. Joints shall be constructed as described herein and in accordance with manufacturer's installation instructions with the intent that they be made watertight.
2. For RCP, the joint surface shall be cleaned and washed with water, if necessary, before the joints are made. For tongue and groove joints in smaller sizes, make joints butting the inside of the bell with a cement mortar before joining. The inside joint shall be wiped clean of excess mortar by brush or a squeegee drawn through the pipe as the laying operations progress. In the larger diameters, which permit the entry of a man, annular space

between pipe sections shall be completely filled with mortar and finished off smooth with the inside surface of the pipe.

3.4 INSTALLATION – MANHOLES, CATCH BASINS, INLETS, AND JUNCTION BOXES

Drainage structures shall be constructed in accordance with details shown on Drawings and in accordance with City of Bentonville, AR, Water and Sewer Specifications as applicable.

Cast-In-Place sections shall be as shown on the drawings and in accordance with City of Bentonville, AR, Water and Sewer Specifications.

1. Form bottom of excavation clean and smooth to correct elevation.
2. Form and place cast-in-place concrete base pad, with provision for storm sewer pipe to be placed at proper elevation.
3. Form and place cast-in-place concrete walls, sleeved at proper elevation to receive storm sewer pipe in accordance with details shown on Drawings.

Invert channels shall be smooth and accurately shaped to a semicircular bottom conforming to the inside of the adjacent sewer section. Invert channels and structure bottoms shall be shaped with cement mortar. Changes in size and grade of invert shall be made gradually and evenly. Changes in direction of the sewer entering branch or branches shall have a true curve of as large a radius as the manhole will permit.

Frames and Covers:

1. Frames and covers shall be set to the proper elevation. The frames shall be firmly embedded in mortar approximately 1 inch thick and aligned to fit the top section of the structure.
2. Bricks set in mortar used to adjust the frame to finished grade shall be limited to no more than four courses.
3. Adjustment rings used to make adjustments in grade shall be made with the initial ring embedded in mortar and the exterior of the rings pargeted with mortar not less than 1/2 inch thick. No adjustment made in this manner shall exceed 8 inches.

Concrete cradles shall be constructed as shown on the drawings and as needed when crossing over and under sewer pipe or utility lines. Concrete shall be 3500 psi mix with a minimum thickness of 6 inches.

3.5 INSPECTION AND TESTING

General

1. Storm sewer systems and culverts, upon completion or at such time as directed, shall be cleaned, inspected and tested. The system or culvert shall have a true grade and line. Actual elevations shall be within 0.08 feet of the elevations given on the drawings.
2. After completion of the Work, or any part thereof, the job shall be tested and flow line elevations certified per Section 01 40 00 to determine that it has been installed in accordance with the drawings and specifications. In general, the Work shall prove to be in good condition, installed in accordance with the drawings and specifications and ready for use.

Cleaning and Testing

1. Visibly inspect and remove all debris and obstructions from storm pipe. Test for infiltration and exfiltration by hydrostatic testing per ASTM C969. Manholes and pipe shall conform to ASTM C969 leakage criteria.

Alignment Test

1. After backfill has been placed and compacted to a depth not less than one foot above top of pipe, a visual inspection shall be made by flashing a light between manholes. Any displacement or misalignment of invert shall be corrected.

END OF SECTION

SECTION 33 46 16

SUB-DRAINAGE SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sub-drainage system for roof drains and downspouts.

1.2 REFERENCES

A. American Society for Testing & Materials (ASTM):
   1. ASTM D2729 - Poly (Vinyl Chloride)(PVC) Sewer Pipe and Fittings.
   2. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fitting Materials.
   3. ASTM F405 - Standard Specification for Corrugated Polyethylene Tubing and Fittings.

PART 2 PRODUCTS

2.1 PIPE MATERIALS

A. Polyvinyl Chloride Pipe: Schedule 40, ASTM D2729; with required fittings.

B. Corrugated Polyethylene Drainage Pipe: ASTM D3350, non-perforated, with required fittings.

2.2 FILL MATERIAL

A. Type specified for remainder of building pad.

2.3 ACCESSORIES

A. Pipe transitions and pipe sleeves as required for installation.

PART 3: EXECUTION

3.1 EXAMINATION

A. Verify that excavation base is ready to receive work, and excavations, dimensions, and elevations are as indicated on Drawings.

B. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with fill material of coarse aggregate.

B. Remove large stones or other hard matter which could damage drainage tile or impede consistent backfilling or compaction.

3.3 INSTALLATION

A. Install and join pipe and pipe fittings.
   1. Place pipe at elevations shown on drawings
   2. Install coarse aggregate bed and surrounding cover as indicated on Drawings, minimum 12 inch depth.
   3. Join pipe ends mechanically.

B. Do not disturb drainage system in subsequent backfilling compaction operations.

c. See Mechanical and Civil Drawings for pipe sizes and routing of sub-drainage system.

3.4 PROTECTION

A. Protect pipe from damage or displacement until backfilling operation begins.

END OF SECTION

SECTION 33 51 00

GAS DISTRIBUTION SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe and fittings for natural gas distribution.

B. Connection of natural gas system to utility company system.

1.2 RELATED SECTIONS

A. Section 02 32 00 – Earthwork

B. Section 31 23 33 - Excavation, Backfill, and Compaction for Utilities

C. Construction Drawings

1.3 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME) latest edition

B 16.18	Cast Copper Alloy Solder Joint Pressure Fittings
B 16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
B 16.26	Cast Copper Alloy Fittings for Flared Copper Tubes
Sec. 8D	Pressure Vessels
Sec. 9	Welding and Brazing Qualifications
	Boiler and Pressure Code

B. American Society for Testing and Materials (ASTM) latest edition

A 120	Pipe, Steel, Black and Hot-Dipped, Zinc Coated (Galvanized) Welded and Seamless, for Ordinary Uses
A 234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperature
B 32	Solder Metal
B 75	Seamless Copper Tube
B 88	Seamless Copper Water Tube
D 2513	Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
D 2517	Reinforced Epoxy Resin Gas Pressure Pipe and Fittings
D 2683	Socket-Type Polyethylene Fittings For Outside Diameter-Controlled Polyethylene Pipe and Tubing
F 678	Polyethylene Gas Pressure Pipe, Tubing and Fittings

C. American Welding Society (AWS) latest edition

A 5.8	Brazing Filler Metal

D. American Water Works Association (AWWA) latest edition
   C105 Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids

E. American National Standards Institute (ANSI) latest edition
   B16.3 Malleable Iron Threaded Fittings
   B16.11 Forged Steel Fittings, Socket Welding and Threaded
   B31.2 Fuel Gas Piping
   B31.8 Gas Transmission and Distribution Piping Systems

F. National Fire Protection Agency (NFPA) latest edition
   54 National Fuel Gas Code

1.4 QUALITY ASSURANCE

A. Perform installation in accordance with applicable utility company requirements. Verify and coordinate responsibility of gas utility company and location of gas meter prior to bid or pricing.

B. Gas Cock: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ASME Boiler and Pressure Vessel Code and applicable state regulations.

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

E. Conform to NFPA 54, ANSI B31.2, or ANSI B31.8.

1.5 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories.

B. Manufacturer's Certificate: Certify that products meet or exceed specified local requirements.

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of pipe mains, valves, connections, and top of pipe elevations.

B. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to be included.
B. Deliver and store valves in shipping containers with labelling in place.

PART 2 PRODUCTS

2.1 PIPE

A. Steel Pipe Below Ground: ASTM A 120, Schedule 40 black:
   1. Fittings: ANSI B16.11, forged steel, or ASTM A 234 forged steel welding type.
   2. Joints: Welded and seamless.
   3. Jackets: AWWA C105 polyethylene jacket, Double layer, half lapped, 10 mil polyethylene tape.

B. Steel Pipe Above Ground: ASTM A 120, Schedule 40 black:
   1. Fittings: ANSI B16.3, malleable iron, ANSI Bl6.11, forged steel, or ASTM A 234, forged steel welding type.
   2. Joints: Threaded.

C. Polyethylene Pipe: ASTM D 2513, SDR 11.5 or ASTM F 678 Series 125:
   1. Fittings: ASTM D 2513
   2. Joints: Mechanical or Compression fit.
   3. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Natural Gas Service" in large letters.

D. Reinforced Epoxy Resin Piping: ASTM D 2517:
   1. Fittings: ASTM D 2517.
   2. Joints: Bell and spigot with epoxy resin.
   3. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Natural Gas Service" in large letters.

2.2 GAS COCKS

A. 2-In. and Smaller: 150 psig (1,040 kPa) WOG, bronze body, bronze tapered plug, non-lubricated, Teflon packing, threaded ends with cast iron curb box, cover, and key.

B. 2-In. and Larger: 125 psig (860 Kpa) WOG, Steel or Cast iron body and tapered plug, non-lubricated, Teflon packing, threaded ends, with cast iron curb box, cover, and key.

C. For Applications with Line Pressure Greater than 60 psig (415 KPA): Over 2-In. (50 mm): Cast iron body and plug, pressure lubricated, Teflon packing, flanged ends, with cast iron curb box, cover, and key.

2.3 PRESSURE REGULATING VALVES

A. Valves: Single stage, malleable iron body, corrosion-resistant, pressure regulator with atmospheric vent, elevation compensator; with threaded ends for 2-in. and smaller or flanged ends for larger than 2-in.

B. Capacity: For inlet and outlet gas pressures, specific gravity, and flow rate indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions.

B. Verify that building service connection and utility gas main size, location, and depth are as indicated on Construction Drawings.

3.2 PREPARATION

A. Ream pipe ends and remove burrs. Bevel plain end ferrous pipe over 2-in. diameter or thread ferrous pipe 2-in. diameter and under.

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

C. Prepare piping connections with flanges or threading for threaded unions connections.

3.3 BEDDING

A. Excavate pipe trench and place bedding material in accordance with Section 31 23 33.

3.4 INSTALLATION - PIPING

A. Maintain separation of gas line from sanitary sewer, water, or storm sewer piping in accordance with state or local code.
B. Install piping to conserve space and not interfere with efficient use of site space.

C. Install piping to allow for expansion and contraction without stressing pipe or joints.

D. Install cocks and other fittings as required.

E. Establish elevations of buried piping in accordance with Section 31 23 33.

F. Wrap couplings and fittings of steel pipe with polyethylene tape and heat shrink over pipe.
G. For Nonmetallic Pipe: Install trace wire continuous over top of pipe.

H. Backfill trench in accordance with Section 31 23 33.

I. Center and plumb valve box over valve. Set box cover flush with finished ground surface. Prevent shock or stress from being transmitted through valve box to valve.

J. Wrap valve and valve box with polyethylene tape and heat shrink or paint valves and valve boxes with red anti-rust primer and 1 coat of epoxy paint.

3.5 SERVICE CONNECTIONS

A. Provide sleeve in foundation wall for gas service main. Caulk enlarged sleeve watertight.

B. Anchor service main to interior surface of foundation wall.

C. Install service regulator adjacent to building wall at service entrance location indicated on Construction Drawings.

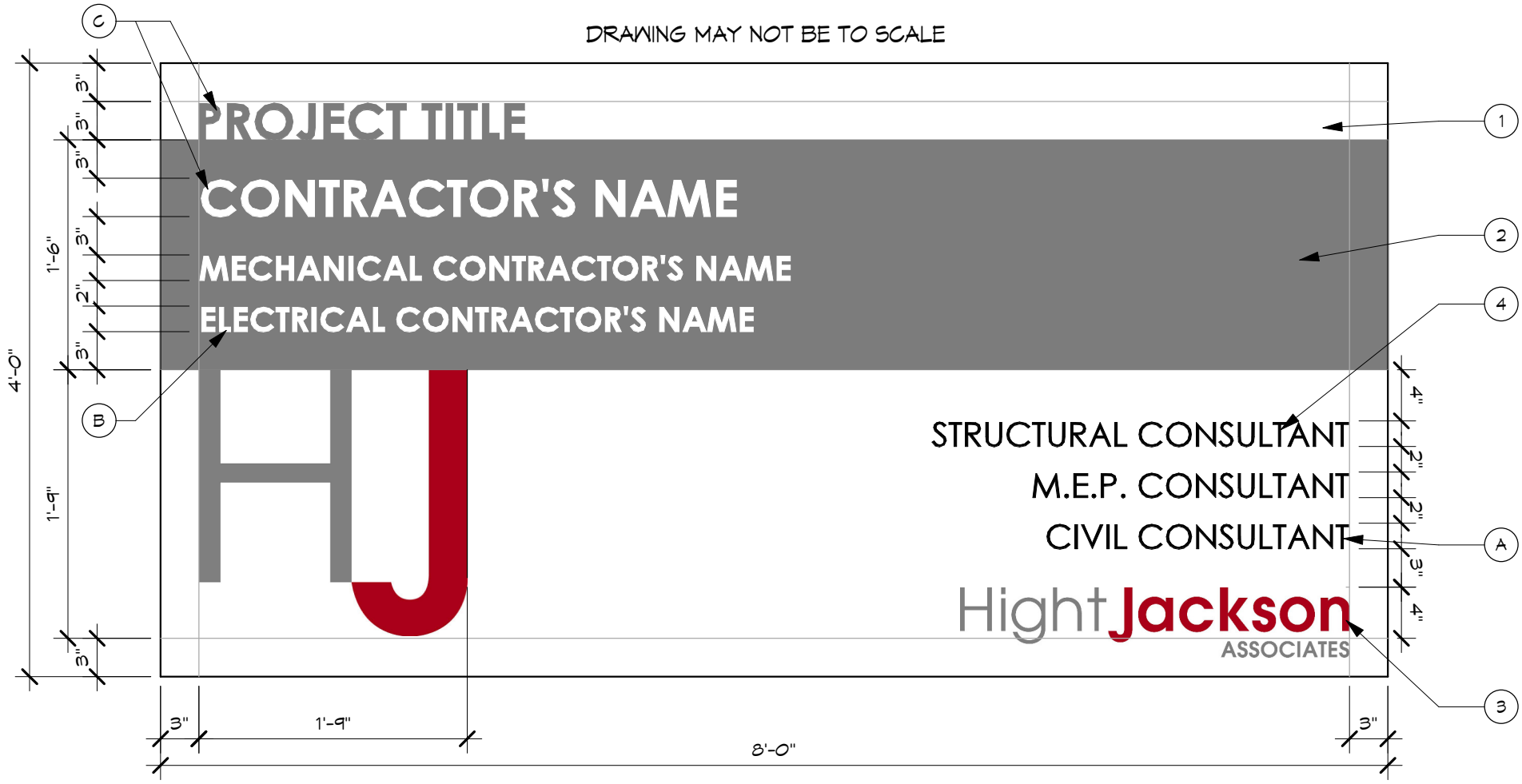
D. Install service regulator and riser pipe in a manner that prevents undue stress on service pipe. For plastic service pipe, use steel pipe riser from below ground to regulator.

E. Provide regulator vent with rain and insect proof opening, terminating not less than 5-ft away from building openings.

END OF SECTION

PROJECT IDENTIFICATION SIGN

DRAWING MAY NOT BE TO SCALE



NOTES: SIGN MATERIAL IS 4x8 SHEET OF 5/8" M.D.O. PLYWOOD OR EQUIVALENT A-C GRADE. PROVIDE DOUBLED 2x4 LEGS AT EACH END, SET INTO EARTH. ALTERNATE MOUNTING AND/OR LOCATION WILL BE DETERMINED IN THE FIELD BY THE ARCHITECT.

COLOR KEY

COLOR NO. ① = SHERWIN WILLIAMS 7006 "EXTRA WHITE"
COLOR NO. ② = SHERWIN WILLIAMS 7669 "SUMMIT GRAY"
COLOR NO. ③ = SHERWIN WILLIAMS 6866 "HEART THROB"
COLOR NO. ④ = SHERWIN WILLIAMS 6258 "TRICORN BLACK"

TEXT KEY

TEXT Ⓐ = 2 INCH CENTURY GOTHIC
TEXT Ⓑ = 2 INCH CENTURY GOTHIC BOLD
TEXT Ⓒ = 3 INCH CENTURY GOTHIC BOLD

APPENDIX "A"