MCKIM AND CREED PROJECT NO. 7002-0001

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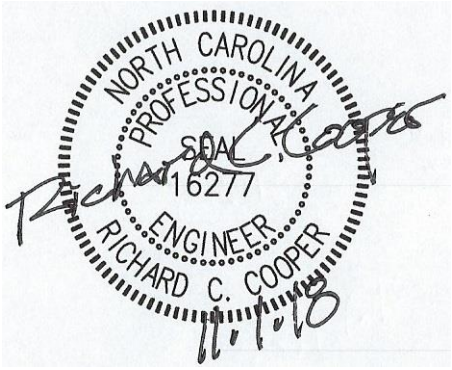

SECTION 22 01 00 - PLUMBING GENERAL

PART 1 GENERAL

1.1 STIPULATIONS

A. Drawings and general provisions of the contract documents including General and Supplementary Conditions and Division 1 Specification Section apply to all work in this section.

B. The General Conditions shall be carefully examined before proposals for any work are submitted. Division 22 shall not be interpreted as waiving or overruling any requirements expressed in the General Conditions unless Division 22 specifications contain statements more definitive or more restrictive.

C. Nothing herein contained shall be so construed to relieve the Contractor from doing his work according to the true intent and meaning of these drawings and specifications. He will be held to provide and install all materials and equipment and shall furnish all labor necessary for the complete, prompt and satisfactory execution of the work. He is also responsible for the proper coordination of his work with all other trades.

D. The Contractor shall bear all expenses incidental to the satisfactory completion of the work contained in these specifications and drawings.

1.2 SCOPE

A. Work consists of furnishing all labor, material, equipment and services necessary and reasonably incidental to the proper completion and proper operation of the plumbing systems. The work shall consist of but shall not necessarily be limited to the following:

1. Domestic water system including extension of piping and connections to all equipment, fixtures, water heaters, and accessories. The Domestic water system shall be extended from a point 5 (five) feet beyond the exterior face of the building.
2. Sanitary drain, waste and vent system including connection to all equipment, fixtures, and accessories. The sanitary system shall be extended to a point 5 (five) feet beyond the exterior face of the building. Final installation at the point of connection shall be made.
3. Plumbing Piping as specified in Section 22 05 03.
4. Plumbing Specialties as specified in Section 22 05 08.
5. Plumbing Fixtures as specified in Section 22 40 00.

1.3 DEFINITIONS

A. Words and phrases used throughout the contract documents shall be interpreted as indicated below:

1. Contractor - The person or organization awarded the contract for construction services. In the case of a construction project administered as a multiple-prime contract, the term shall be further defined as the Contractor holding a prime contract for plumbing construction work. The term “Plumbing Contractor” is used interchangeably with the term Contractor.
2. Provide - To furnish and install materials, equipment or systems.
3. Submittals - Submittals shall include manufacturers’ catalog data, shop drawings, calculations, certificates of compliance, testing reports, samples, and operation and maintenance manuals.
4. Professional - The Engineer of record.
5. Work By Others - Work provided by a person or organization other than the Contractor.

1.4 CODES, REFERENCES AND STANDARDS

A. The Contractor shall comply with all laws, ordinances, and regulations of all authorities having jurisdiction, including those of all applicable city, county, state, federal and public utility entities. The Contractor shall obtain all licenses, permits, etc. and shall pay all associated connection fees, tapping fees, inspection fees, etc. This cost shall be included in the contract price.

B. The publications listed below form a part of this specification. All publications shall be the latest edition as adopted by the authority having jurisdiction. The minimum standard of work under this contract shall be in accordance with the following model building codes:

1. North Carolina State Building Code:
   a. Building, 2012 edition
   b. Plumbing, 2012 edition
   c. Mechanical, 2012 edition
   d. National Electric Code, 2012 edition
   e. Fire Prevention, 2012 edition
   f. Fuel Gas, 2012 edition

C. The publications are referred to in the text by basic designation only.

1. American Iron and Steel Institute (AISI)
   1140 Connecticut Avenue
   Washington, DC 20036

a. Stainless Steel Tubing	AISI 316L	

2. American Water Works Association (AWWA)
   6666 West Quincy Avenue
   Denver, Colorado 80235

a. Cement Mortar Lining for Ductile-Iron Pipe	ANSI A21.4	AWWA C104
b. Rubber Gasket Joints for Ductile-Iron Pipe	ANSI A21.11	AWWA C111
c. Ductile-Iron Pipe	ANSI A21.51	AWWA C151

3. American National Standards Institute (ANSI)
   11 W. 42nd St.
   New York, New York 1003

   American Water Works Association (AWWA)
   6666 West Quincy Avenue
   Denver, Colorado 80235

a. Cement Mortar Lining for Ductile-Iron Pipe	ANSI A21.4	AWWA C104
b. Rubber Gasket Joints for Ductile-Iron Pipe	ANSI A21.11	AWWA C111
c. Ductile-Iron Pipe	ANSI A21.51	AWWA C151
d. Cast Iron Screwed Fittings	ANSI B16.4	
e. Cast Iron Drainage Fittings, Threaded	ANSI B16.12	
f. Pipe Fittings, Bronze, and 250 lb. Cast	ANSI B16.15	
g. Cast Copper Allow Solder-Joint Pressure Fittings	ANSI B16.18	
h. Solder-Joint Fittings, Pressure Wrought Copper and Copper Alloy	ANSI B16.22	

i. Cast Copper Alloy Solder-Joint Drainage Fittings	ANSI B16.23
j. Bronze Pipe Flanges and Flanged Fittings	ANSI B16.24
k. Solder-joint fittings, Drainage, DWV Wrought	ANSI B16.29
l. Copper and Copper Alloy	
m. Gas Water Heaters	ANSI Z-21-10.3

4. American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE)
1791 Tullie Circle NE
Atlanta, GA 30329 — ASHRAE 90A

5. American Society of Mechanical Engineers (ASME)
345 East 47th Street
New York, New York 10017

a. Cast Copper Alloy Fittings for Flared Copper Tubes	ASME B16.26
b. ASME Boiler and Pressure Vessel Code.	
(1) Section IV Low Pressure Heating Boilers.	
(2) Section VIII, Unfired Pressure Vessels.	

6. American Society of Testing and Materials (ASTM)
1916 Race Street
Philadelphia, PA 19103

a. Cast Iron Soil Pipe and Fittings Hub and Spigot	ASTM A74
b. Seamless Copper Water Tube	ASTM B88
c. Copper Tube, Drainage DWV	ASTM B306
d. Recommended Practices for Laying Sewer Pipe	ASTM C-12
e. PVC Pipe - Schedule 40	ASTM D1785
f. Pipe Fittings, PVC, Schedule 40	ASTM D2466
g. Sand Cone Method	ASTM D1557 Method D and ASTM D1556
h. Billet-Steel Bars for Concrete Reinforcement	ASTM A6l5

7. Cast Iron Soil Pipe Institute (CISPI)
1400 Chain Bridge Road
McLean, VA 22101

a. Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems	CISPI301

8. Compressed Gas Association, Inc. (CGA)
4221 Walney Road, Fifth Floor
Chantilly, VA 20151-2923

a. Pamphlet P-2.1

b. Pamphlet P-2.7

c. Pamphlet V-5

9. Manufacturer's Standardization Society (MSS)
5203 Leesburg Pike, Suite 502
Falls Church, VA 22041

a. Unions, Brass or Bronze, 250 pounds MSS-SP-72

b. Pipe Hangers and Supports – Materials, Design and Manufacturer. MSS-SP58-88

c. Pipe Hangers and Supports – Selection and Application MSS-SP69-91

10. North Carolina Department of Labor
Boiler and Pressure Vessel Division
4 West Edenton Street
Raleigh, North Carolina 27601-1092

a. The Uniform Boiler and Pressure Vessel Act of North Carolina and Administrative Rules - January 1998

11. Plumbing and Drainage Institute (PDI)
45 Bristol Drive, Suite 101
South Easton, MA 02375

a. Shock Absorbers PDI WH 201

1.5 QUALITY ASSURANCE AND COORDINATION

A. The Contractor shall coordinate his work with that of the other trades. Where interference with other trades occurs, the Contractor shall present his solution to the Professional. The Professional shall make the final decision regarding changes to be made in the work.

B. The Contractor shall thoroughly familiarize himself with all specifications and drawings for the project so that he clearly understands his responsibility in relationship to the work to be performed. The Contractor shall plan and perform his work so as to permit the use of the building at the earliest possible date.

C. The Contractor shall guarantee all work, materials and equipment furnished against defects, leaks, performance and non-operation for a period of one (1) year after the date of the Owner's final acceptance, or as indicated in the General Conditions. Defects shall be interpreted as defective materials or equipment or unsatisfactory installation and are not intended to apply to ordinary wear and tear. The Contractor shall pay for any repairs or replacements caused by these defects within the period covered by the guarantee, including all incidental work required to correct the deficiency.

D. The Contractor shall expressly and completely follow all manufacturers' instructions required for validation of the manufacturer's warranty agreement including but not limited to service, maintenance and adjustments of the equipment.

E. The Contractor is responsible for the proper installation of all materials and equipment required for a complete installation within the intent and meaning of the contract documents.

1.6 PROJECT RECORD DRAWINGS

A. Changes from the contract drawings necessary to coordinate the work with other trades, to conform to the building conditions or to conform to the rules and regulations of authorities having jurisdiction shall be made only after obtaining written permission from the Professional.

B. The Contractor shall keep a record of construction changes and deviations from the original contract drawings. All changes shall be recorded on a separate set of prints, which shall be kept at the job site specifically for that purpose. The record shall be made immediately after the work is completed.

Documentation shall include:

1. Location and elevation of new and existing utility lines.
2. Points of connection to existing utility pipelines.
3. Changes in pipe routing location.
4. Valve locations.
5. Equipment locations, etc.
6. Actual capacities and values of equipment provided as indicated in equipment schedules

C. The marked-up record set of drawings shall be delivered to the Professional before final acceptance of the Plumbing Contract work.

1.7 FIELD MEASUREMENTS

A. The Contractor is responsible to verify the location of any and all existing underground utilities in the vicinity of his work. When it has been indicated that these utilities are to remain in place, the Contractor shall provide adequate means of support and protection during excavation operations.

B. Before ordering any equipment and material, or performing any work, the Contractor shall verify all measurements and dimensions at the job site. The Contractor is responsible for the correctness of this information.

C. No extra compensation will be considered based on differences between actual dimensions and measurements and those indicated on the drawings.

D. Any difference identified by the Contractor shall be submitted to the Professional for consideration before proceeding with the work.

1.8 PROTECTION OF SERVICES AND EQUIPMENT

A. All existing service utilities shall remain active during construction. Any service underground, aboveground, interior or exterior damaged, broken or otherwise rendered inoperative during the course of construction due to activities on the part of the Contractor shall be properly repaired by the Contractor, at his own expense. The method used in repairing, replacing or maintaining the services shall be submitted to the Professional for review and approval.

B. At his own expense, the Contractor shall protect his work, materials or equipment that is subject to damage during the project duration. All openings into any piping, ducts or equipment shall be securely covered, or otherwise protected, to prevent injury due to carelessly or maliciously dropped tools or materials, grit, dirt, or any foreign material. The Contractor is responsible for all damage until his work is fully and finally accepted.

C. The Contractor is responsible to provide protection for motors, pumps, electrical equipment, and all similar items of equipment from dirt, grime, plaster, water, etc. during all phases of construction. This protection shall be provided by covering equipment with transparent plastic sheeting and/or locating the materials and equipment in an area free from the elements.

1.9 INTERRUPTION OF SERVICES

A. The Contractor shall schedule his work to avoid any major interruption of any utility services.

B. Existing utilities serving occupied facilities shall not be interrupted except when such interruptions have been authorized in writing by the Owner or the Professional. Interruptions may occur only after acceptable temporary utility services have been provided. The Contractor shall provide a minimum of ten-(10) working days notice to the Professional and Owner, and receive written notice to proceed before interrupting any utility.

1.10 CLEANUP

A. The Contractor shall maintain buildings, grounds and public properties free from accumulations of waste materials, debris and rubbish. At reasonable intervals during the progress of work, and when directed by the Owner's authorized representative, the site and public properties shall be cleaned and waste materials, debris and rubbish disposed of in an appropriate manner. The Contractor shall provide containers for collection of waste materials, debris and rubbish. Waste materials, debris and rubbish shall be removed from the job site and legally disposed of at a landfill area in accordance with all applicable regulations. Burning or burying waste materials, debris or rubbish on project site is not permitted.

B. At the completion of the Project, remove waste materials, rubbish, tools, equipment, machinery, surplus materials, etc., and clean all sight-exposed plumbing fixtures and equipment. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from sight-exposed plumbing fixtures and equipment. Broom clean paved and concrete surfaces. Rake clean other ground surfaces. Repair, patch and touch up marred surfaces to specified finish or to match adjacent surfaces.

1.11 SUBMITTALS

A. General

1. Refer to Section 22 01 00 of this manual for the requirements relating to shop drawings and submittals.

1.12 EXCAVATION, BACKFILLING AND COMPACTION

A. Excavation, Backfilling and Compaction shall comply with Division 2 of the Project Manual.

B. General

1. The Contractor shall notify “ONE CALL” prior to any work.
2. The Contractor shall perform all excavation, backfilling, compaction and necessary finishing for all piping, equipment, and accessories. Piping installation shall be in accordance with local water, sewer and gas utility regulations and applicable state and local codes.
3. The Contractor shall do all bracing, sheathing and shoring necessary to perform and protect his excavations. The Contractor shall provide safety rails, lights, signs, etc. as necessary or required for safety, or as required to conform to governing codes and laws.
4. The Contractor shall provide, maintain, and operate pumping equipment of sufficient capacity to insure that all his excavations and trenches are kept free of water at all times.
5. All surfaces of streets, walkways, seeded areas, or finished grade areas disturbed by the excavation shall be restored to their original condition and/or as indicated on the contract documents.
6. Protect existing structures, utilities, sidewalks, pavements and other facilities not indicated for removal, from damage caused by settlement, lateral movement, undermining, washout and other hazards resulting from excavation operations.
7. Existing utility lines shown on the contract documents do not indicate the exact in-place location of the lines. They do not show every pipe, fitting or appurtenance that may exist at the project site. The location and depth of all utilities shall be marked and recorded prior to any excavation. Should uncharted or incorrectly charted piping or other utilities be uncovered during excavation, contact the Professional immediately for directions before proceeding further with work in this area. Cooperate with owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility owner.
8. If it becomes necessary to install any lines or equipment in locations other than those shown, the Professional's acceptance shall be obtained before starting the excavation.

9. The presence of explosives on the project site or the use of explosives in the execution of the work under this contract is prohibited.

C. Excavation

1. All plumbing excavation is unclassified.

2. Trenches shall be dug to uniform width not less than 12-inches, nor more than 16-inches wider than the bell diameter of the piping. Trench sides shall be vertical. Excavate trenches to depth indicated or required. Carry depth of trenches for piping as required to establish required slopes and invert elevations. Beyond building perimeter, keep bottom of trenches sufficiently below finished grade to protect against frost. The bottom of trenches shall be accurately graded to provide uniform and smooth flow throughout. Any over-excavation shall be backfilled with modified aggregate and thoroughly tamped.

3. If trench excavation operations are performed when the atmospheric temperature is less than thirty-five (35) degrees Fahrenheit, the Contractor shall provide at his own expense cold weather protection as required to protect excavated trench bottoms from freezing. Piping shall not be placed in a trench containing water, or on a sub-grade containing frost.

4. Take up and re-lay pipe that is not laid true to required alignment or grade. Pipe that has had its joints disturbed after installation shall be taken up and relayed. Deviation from the required lines and grades will not be permitted unless approved by the Professional.

5. Excavation for the various catch basins, pits, manholes, tanks, etc., shall follow the general procedures as outlined above. The excavation shall extend as required for proper installation or construction. Backfill shall be carefully placed in layers and tamped.

   a. The base for all tanks, pits, manholes, etc., shall be a minimum of 12-inches compacted fill in 4 inch layers to ninety-five (95%) percent compaction or as detailed and noted on the contract documents.

6. All underground piping shall be laid on first class granular bedding. The bedding shall be a minimum depth of six (6) inches or 1/4 (one-fourth) the pipe diameter, whichever is greater. The bedding shall provide uniform longitudinal support to the pipe and shall be laid to provide the grade and line as shown on the drawings or as directed by the Professional. Hand tamp the embedment materials under the haunches and around the pipe to the spring-line of the pipe to a compaction density of ninety-five (95) percent. Final embedment for ferrous pipe materials shall extend from the spring-line of the pipe to a depth of 6 inches (minimum) above the top of the pipe. Final embedment for PVC pipe shall extend from the spring-line of the pipe to a depth of 18 inches (minimum) above the top of the pipe.

D. Backfilling

1. Backfilling shall not be undertaken until all tests and inspections have been made. Use care to avoid damaging or displacing piping systems. All backfill material shall be free from cinders, ashes, refuse, organic material, boulders, rocks or stones, frozen soil, or other material that is unsuitable. When the type of backfill material is not indicated on the plans or is not specified, the excavated material may be used, provided that such material consists of loam, clay, sand, gravel, or other material that is suitable for backfilling. From 1-foot above the top of the pipe to the sub-grade of the pavement, material containing stones greater than 6-inches in their greatest dimension may not be used.

2. Backfill shall be carefully performed and the original surface restored.

3. All trench backfill shall be brought to sub-grade ready for base material or topsoil. After the initial aggregate backfill layer has been placed, refill remainder of the trench using backfill materials as follows:

   a. Lawns - Successive 6-inch layers of clean earth backfill material shall be deposited after initial aggregate backfill. This backfill shall consist of excavated material free from large

clods of earth and stone. If large stones (greater than 6-inches) are encountered, remove stones from site and haul in clean earth backfill. The entire trench shall be uniformly tamped after each successive layer is deposited. Replace topsoil to approximate depth of existing as final refill operation and crown to such height as required by the Professional. Maintain crowned surface to the satisfaction of the Professional.

b. Walks and Parking Areas - Clean earth backfill compacted in 6-inch layers to a point 8-inches below the adjacent existing surfaces. Refill the remaining 8-inches with compacted stone and replace walk or paving as required.

c. Paved Areas - When working within the right-of-way limits of all North Carolina State highways, backfilling must be in conformance with the requirements of the North Carolina Department of Transportation, which is made a part of these specifications by this reference thereto. Trenches located within the areas described above shall be backfilled with aggregate material from the top of the "pipe bedding" to the bottom elevation of the pavement structure and must be spread and compacted in layers not to exceed 4 inches when using a mechanical damper. The Contractor is to understand that payment for special backfilling material shall not be made unless specifically provided in the form of Proposal.

E. Compaction

1. Backfill trenches to point twelve (12) inches above the top of the outside barrel of the pipe. Continue thereafter with the backfill in twelve (12) inch lifts.

2. All backfill shall be compacted to ninety-five (95) percent. Each lift shall be compacted to the specified percent of maximum density obtained at optimum moisture content, in accordance with ASTM D1557, method D and ASTM D1556 sand cone method.

3. Compaction shall be accomplished by approved equipment suited to the soil being compacted. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.

4. Thoroughly compact successive layers of backfill material with a vibrating compactor of a type and size satisfactory to the Professional. Compacting of this backfill by puddling or jetting will not be permitted. Use mechanical tampers to compact backfill materials in trench refill operations to produce a density of backfill at the bottom of each layer of not less than 95-percent of the maximum density obtained at optimum moisture content.

5. The use of special equipment such as the "HYDRA-HAMMER" for compaction of backfill is prohibited.

1.13 CONCRETE

A. Reinforcing shall conform to ASTM A-6l5, Grade 60. Concrete exposed to freezing and thawing, salts, sulfates and corrosion shall comply with North Carolina State Building Code.

B. All concrete shall be of minimum 3000 pounds per square inch (psi) strength in 28 (twenty-eight) days. All concrete shall be mixed by machine. No wet or moistened mixture containing cement shall remain unplaced for a period exceeding 30 (thirty) minutes and shall not be used after its initial set. Re-tempering after initial set is prohibited. Exposed surfaces shall be protected from drying for at least 7 (seven) days. All forms shall be built true and rigid. Form removal shall not injure the concrete.

C. All concrete is to be finished with a hard, smooth troweled finish and is to be faced smooth with rounded corners.

1.14 INSPECTION AND TESTING

A. General

1. New plumbing systems and parts of existing systems, which have been altered, extended or repaired, shall be tested to disclose leaks and defects.

2. The Contractor shall notify the Professional a minimum of five (5) working days prior to testing to coordinate the testing and inspection procedures.

3. If the Professional determines that the plumbing systems do not pass the prescribed tests, the Contractor shall be required to make the necessary repairs, at his own expense. The Contractor shall re-inspect and re-test the systems. Repairing, inspection and testing shall be continued until all systems pass as determined by the Professional.

4. All new, altered, extended or replaced plumbing shall be left uncovered and unconcealed until it has be inspected, tested and accepted by the Professional. Where such work has been covered or concealed before it has been inspected, tested and accepted, it shall be uncovered by the Contractor, at his own expense as directed by the Professional.

5. The Contractor shall furnish all equipment, material, labor, etc. required for testing the plumbing systems.

B. Sanitary, Vent, and Storm Drain Systems

1. The systems shall be tested in accordance with the North Carolina State Building Code, Plumbing.

2. Rough Plumbing - Systems shall be tested upon completion of the rough piping installation and proved watertight. The water test shall be applied to the system either in its entirety or in sections after rough piping has been installed.

   a. Where applied to the entire system, all openings in the piping shall be closed, except the highest opening, and the system filled with water to point of overflow.

   b. Where the system is tested in sections, each opening shall be plugged, except the highest opening of the section under test, and each section shall be filled with water. A section shall not be tested with less than a 10-foot head of water.

   c. All joints or pipes in the building, except the uppermost 10 feet of the system, shall be subjected to a test of less than a 10-foot head of water.

   d. The water shall be kept in the system or in the portion under test for a minimum of 2 (two) hours before inspection starts. The system shall then be inspected to ensure that it is tight at all points.

3. Finished Plumbing - after the plumbing fixtures have been set and their traps filled with water, the plumbing fixture connections shall be tested and proved gas and watertight.

   a. A smoke test shall be made by filling all traps with water and then introducing into the system smoke produced by one or more smoke machines. When the smoke appears at stack openings on the roof, the stack openings shall be closed and a pressure equivalent to a 1-inch water column shall be introduced and maintained for the period of the inspection.

   b. Where the local Authority Having Jurisdiction finds that a smoke test need not be performed, a peppermint test shall be performed. Two (2) ounces of oil of peppermint shall be poured into the roof terminal of every line or stack to be tested. The oil of peppermint shall be followed at once by 10 quarts of hot (140-degrees Fahrenheit) water. All roof vent terminals shall then be sealed. The system shall then be inspected for the detection of odor of peppermint. If odor of peppermint is detected, repairs shall be made and the system shall be retested.

C. Building Sewer

1. The building sewer shall be tested by insertion of a test plug at the point of connection with the public sewer. The building sewer shall then be filled with water under a head of not less than 10-feet. The water level at the top of the test head of water shall not drop for at least 15 (fifteen) minutes.

D. Domestic Water Systems

1. The system shall be tested either in its entirety or in sections.
2. The system shall be tested and proved tight under a water pressure of 150 pounds per square inch for a period of 2 hours.
3. Potable water shall be used for testing.

E. Fuel Gas Systems

1. The systems shall be tested in accordance with NFPA 54.
2. All fuel gas piping shall be pneumatically tested for tightness prior to commencement of gas service. Air or nitrogen shall be used as the test medium. For low pressure systems the piping system shall be pressurized to a minimum of 10 psig for a period of not less than 10 minutes without showing any drop in pressure. For high pressure systems, 5 PSI and greater, the piping system shall be pressurized to at least 50 psig for not less than 10 minutes without showing any loss of pressure. All joints shall be leak tested with detection solution while the system is pressurized. The Contractor shall provide a valved 1/4 inch FPT connection in the system to which shall be attached a 24 hour pressure recording gauge. The Contractor shall arrange for a gas company representative to witness the test. Leaks shall be repaired by tightening or replacing joints. Caulking of joints is not permitted.

1.15 STERILIZATION OF THE DOMESTIC WATER SYSTEM

A. After the system has been tested and approved, the entire new system, including valves and accessories, shall be chlorinated. Disinfecting shall be in accordance with AWWA C651.

B. Chlorine may be applied in any of the following forms:

1. Liquid chlorine gas-water mixture
   a. Chlorine gas-water mixture shall be applied by a solution feed chlorinating device.
2. Calcium hypochlorite and water mixture.
   a. Calcium hypochlorite shall be HTH, Perchlorene and Maxochlor, or accepted substitute. A solution consisting of five (5%) percent powder to ninety-five (95%) percent water by weight shall be prepared. The calcium hypochlorite and water mixture, first made into a paste and then thinned to a slurry, shall be injected or pumped into the system.

C. The system or any part thereof shall be filled with a water/chlorine solution containing at least 50 parts per million of chlorine. The system or part thereof shall be valved off and allowed to stand for 24 hours. Or the system or any part thereof shall be filled with a water/chlorine solution containing at least 200 parts per million of chlorine and allowed to stand for 3 hours. During the chlorination process all valves and accessories shall be operated.

D. After the chlorination process, the chlorine shall be flushed from the system until the system water is

equal in chemical and bacteriological composition to those of the permanent source of water supply. Spent chlorinated water shall be disposed of with in an environmentally responsible procedure.

E. The Contractor shall submit samples of the system water to a competent laboratory for analysis. Laboratory tests of the water shall be paid for by the Contractor. The “Water Test Report for Use” shall be submitted to the Engineer of Record for review and approval.

F. Water supply shall not be placed into service until bacteriological test results are found to be satisfactory and the water meets EPA quality standards for drinking water. After acceptance by the Engineer of Record, the “Water Test Report for Use” shall be submitted to the State Construction Office prior to sending a request for Final Acceptance and Occupancy Permit.

1.16 INSTRUCTION OF THE OWNER

A. After acceptance of the Project, the Contractor shall furnish the services of personnel thoroughly familiar with the completed installation to instruct the Owner in the proper operation and maintenance of all equipment and appurtenances provided.

B. The Contractor shall provide the Owner with two (2) weeks advance notice before the instruction session.

1.17 CHASES AND OPENINGS

A. All openings required for the installation of the work shall be coordinated with the other trades. The Contractor shall provide the other trades with sufficient time (one (1) week minimum) for coordination of all openings. The Contractor shall be responsible for cutting and patching all openings necessary for his work. The work shall be performed to the satisfaction of the Professional.

B. Penetrations made in fire rated partitions, floors, etc. shall be sealed with an approved material and method as required to maintain the integrity of the fire separation.

C. The Contractor shall provide all sleeves, hangers, and anchors required for installation of the work in chases and openings.

1.18 WATER SERVICE AND METERS

A. The Contractor shall coordinate water meter requirements in accordance with the local water utility regulations, including required permits, meters, piping, valves, bypasses, supports and other accessories.

1.19 PAINTING

A. Painting shall be in accordance with Division 9.

1.20 RELATED WORK

A. All work related to providing complete plumbing systems and equipment shall be the responsibility of the Contractor. The following related work shall be provided as indicated in other specification divisions, unless noted otherwise, but shall remain the responsibility of the Contractor for workmanship and completeness:

1. General Contractor
    a. Installation of access panels.
    b. Leaders and gutters.
    c. New catch basins and foundation drains. Final connections shall be by the Contractor, as indicated on the drawings and as herein specified.
    d. Final painting of existing walls, floors and ceilings where the surfaces are being refinished and remodeled under the general contract. Refer to general construction drawings.
    e. Equipment and furnishings including shop equipment and laboratory equipment. The Contractor shall make all final connections to equipment and furnishings. The Contractor shall be responsible for coordination of plumbing services with the equipment and furnishings.
2. Mechanical Contractor
    a. Side wall ventilators and air conditioning equipment.
3. Electrical Contractor
    a. Verification of the proper rotation of three-phase equipment, and making modifications as required to correct improper rotation.
    b. Installation of all combination starters/disconnects and overload protectors.

1.21 MISCELLANEOUS STEEL AND ACCESSORIES

A. The Contractor shall provide all necessary steel angles, channels, pipe, rods, nuts, bolts, etcetera, as shown on plans, as specified, or as may be required for complete and proper installation of plumbing fixtures, systems and equipment. All material and workmanship shall be of the best quality and shall be installed in accordance with the best practices of the trade.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials used on plumbing systems shall comply with the following lead ban requirements:
    1. Solders with lead content exceeding 0.2% (two-tenths of a percent) are prohibited. Brass and bronze materials containing 2.0% (two percent) or greater lead are prohibited.

PART 3 EXECUTION

3.1 GENERAL

A. The contract drawings are diagrammatic and are indicative of the work to be performed. It is not intended that they show every pipe, fitting or apparatus required for a complete installation.

B. The contract documents are not intended to indicate every bend, offset, change in direction and appurtenance required to provide a complete and workable system.

C. All materials and equipment used shall be installed in strict accordance with the standards under which the materials are accepted and approved, and in strict accordance with the manufacturer's instructions.

D. Except where otherwise indicated, minimum cover on site shall not be less than the following:

1. Sanitary sewer piping: 3'-0"
2. Storm drain piping: 2'-0"
3. Domestic water piping: 3'-0"
4. Natural gas piping: 2'-0"

END OF SECTION

SECTION 22 05 03 - PLUMBING PIPING

PART 1 GENERAL

1.1 REQUIREMENTS

A. General Conditions of the Contract, Special Conditions, Instructions to Bidders, and other General Requirements contained in Division 1 and 2 are a part of these Specifications.

1.2 SECTION INCLUDES

A. Work in this Section includes the following:

1. Domestic water piping
2. Sanitary waste, vent and storm drain piping
3. Fuel gas piping
4. Sleeves and floor plates
5. Supports, hangers, inserts and fasteners
6. Valves
7. Pipe insulation
8. Pipe identification labels
9. Valve tags
10. Utility marking tape

1.3 RELATED SECTIONS

A. All sections of the Project Manual apply to this section.

1.4 SUBMITTALS

A. Submittals shall be in accordance with Section 22 01 05 – Shop Drawings and Submittals.

B. The Contractor shall submit manufacturer's catalog data for the following:

1. Domestic water piping
2. Sanitary waste, vent and storm drain piping
3. Fuel gas piping
4. Sleeves and floor plates
5. Supports, hangers, inserts and fasteners
6. Valves
7. Pipe insulation
8. Pipe identification labels
9. Valve tags
10. Utility marking tape

B. The Contractor shall submit Certificates of Compliance for the following:

1. Schedule of UL listed through penetration assemblies

C. The Contractor shall submit Operation and Maintenance Data for the following:

1. Valves

1.5 JOB CONDITIONS

A. The Contractor shall verify the requirements for the gas service with the Gas Utility Company before starting work.

The Contractor shall include in his bid price the cost to obtain, furnish and install the gas meter, regulators, associated concrete pads, piping, supports and valves required by the Gas Utility Company as a condition to provide service

PART 2 PRODUCTS

2.1 DOMESTIC WATER PIPING AND TRAP PRIMER PIPING

A. Aboveground:

Piping: Type "L" hard temper copper tubing, ASTM B88

Fittings: Cast bronze or wrought copper solder end fittings, ANSI B16.18, ANSI B16.22

Solder: 95-5 tin-antimony solder, ASTM B32 for sizes up to 1-1/4 -inch

Brazing solder: ASTM B260 for sizes 1-1/2-inch and larger using copper-phosphorus or copper-phosphorus-silver brazing filler material (BCuP series) in accordance with ANSI/AWS standards.

B. Underground (1/2-inch through 2-1/2-inches): (Water piping within the building and below the slab shall have no joints below the slab.)

Piping: Type "K" copper tubing, ASTM B88

Fittings: Cast bronze flared fittings, AWWA

C. Underground (3-inches and larger):

Piping: Ductile Iron pressure pipe Class 52, ANSI A21.51/AWWA C151 with ANSI A21.4/AWWA C104 cement lining

Fittings: Mechanical joint ANSI A21.10/AWWA C110 with gaskets

2.2 SANITARY WASTE, VENT AND STORM DRAIN PIPING

A. Aboveground:

Piping: Cast iron, no-hub, service weight cast iron CISPI 301

Fittings: Heavy duty “No-Hub” drainage pattern type CISPI 301.

Couplings: Type 304 stainless steel Sealing sleeve with a minimum gauge 0.015 clamp assembly with a 3/8 inch worm gear tightened to a torque of 80 inch pounds conforming to ASTM C 1540 and an elastomeric sealing sleeve conforming to ASTM C564.

Clamp width – 3” wide minimum for 1½” to 4”

Clamp width – 4” wide minimum for 5” and larger

B. Fixture Branch

Piping: Type M hard drawn copper tubing, ASTM B306

Fittings: Wrought copper drainage type fittings, ANSI B16.29 or cast copper drainage type fittings, ANSI B16.23

Solder: 95-5 tin-antimony solder, ASTM B32

Piping: Cast iron, no-hub, service weight cast iron CISPI 301

Fittings: No-hub drainage pattern type CISPI 301.

Couplings: Sealing sleeve with heavy duty ASTM A666, Type 304 stainless steel shield and clamp assembly – 0.016-inch thick minimum and torque to 80 psi.

Clamp width – 3" wide for 1 ½" to 4"

Clamp width – 4" wide for 5" and larger

Piping: Schedule 40 galvanized steel pipe, ASTM A53

Fittings: Threaded, 150 pound, malleable iron fittings, ANSI B16.3.

Do not use copper for urinal waste.

C. Underground

Piping: Service weight, hub and spigot cast iron soil pipe, ASTM A74.

Fittings: Cast iron, hub and spigot, drainage pattern type, ASTM A74 with neoprene compression type gaskets, ASTM C564.

D. Drain Piping (Condensate, Relief Valve, Indirect Waste, and Backflow Preventer Drain Piping):

Piping: Type "M" hard temper copper tubing, ASTM B88

Fittings: Cast bronze or wrought copper solder end fittings, ANSI B16.18, ANSI B16.22 or ANSI B16.24

Solder: 95-5 tin-antimony solder, ASTM B32

E. Sewage Pump and Sump Pump Discharge Piping:

Piping: Schedule 40 black steel, ASTM A53

Fittings: Threaded malleable iron, ASME B16.3 or forged steel butt welded type, ASTM A234

2.3 FUEL GAS PIPING

A. Aboveground (2-inch and smaller):

Piping: Schedule 40 black steel pipe, ASTM A53

Fittings: Threaded, 150 pound malleable iron fittings, ANSI B16.3

2.4 SLEEVES AND FLOOR PLATES

A. Sleeves in finished areas shall be fitted with chrome plated escutcheons sized to fit securely at the pipe or pipe insulation and shall cover the sleeve and penetration opening.

B. Floor sleeves located in areas with automatic sprinkler protection shall have sleeves extending a maximum of 2-inches above the finish floor. Escutcheons shall accommodate the depth of the sleeve.

C. Sleeves in Non-Rated Construction

1. Interior Partitions - New Construction

24-gauge galvanized sheet metal sleeve

Mineral wool insulation packing between sleeve and piping/piping insulation

2. Floor - New Construction

   Schedule 40 black steel sleeve with retaining collar welded to sleeve

   Mineral wool insulation packing between sleeve and piping/piping insulation

3. Slab on Grade

   Schedule 40 black steel sleeve with retaining collar welded to sleeve

   Expandable modular seals with molded rubber interlocking sections

   Seal Manufacturers:

   Thunderline Corporation

   Metraflex Company

4. Underground Foundation Wall - New Construction

   Schedule 40 black steel sleeve with retaining collar welded to sleeve

   Mineral wool insulation packing between sleeve and piping

5. Underground Under Foundation Wall – All Construction

   Schedule 40 black steel sleeve coated with bitumastic material

   Mineral wool insulation packing between sleeve and piping

D. Sleeves in Rated Construction

1. Piping which penetrates rated construction shall be provided with UL listed through penetration assemblies. Assemblies shall provide protection of the through penetration equal to or greater than the construction rating. Assemblies shall be selected after determining all characteristics of the assembly including piping material and size, construction type, rating (in hours) of the required construction and fill, void or cavity materials.

2.5 SUPPORTS, HANGERS, INSERTS AND FASTENERS

A. Provide all miscellaneous steel required for support of pipes and equipment other than steel shown on Structural Engineer's drawings.

B. Pipe hanger design, materials, and manufacturer shall conform with the requirements defined in MSS SP58-88.

C. The selection and spacing of pipe hangers shall comply with the data included in MSS SP69-91.

D. All hanger materials including clevis hangers, rods, inserts, clamps, stanchions, brackets, shall have a factory applied finish of electro-plated zinc, unless noted otherwise.

E. Hangers, clamps and supports for use on un-insulated copper piping shall be provided with inserts to isolate the copper piping from the hanger. Inserts shall be made of felt or plastic and shall be as manufactured by the hanger manufacturer.

F. Insulated piping shall be provided with insulation shields. Hanger shall be sized to include piping diameter and insulation thickness.

G. Hanger Materials:

1. Horizontal Sanitary, Waste and Vent Piping and Storm water Piping:

   a. 3 inch and smaller:

B-Line	B3100
Grinnell	260

PHD 450

b. 4 inch and larger:

B-Line B3102

Grinnell 590

PHD 420

2. Horizontal Domestic Water Piping:

a. 2 inch and smaller:

B-Line B3100

Grinnell 260

PHD 450

b. 2-1/2 inch and larger:

B-Line B3100

Grinnell 260

PHD 450

c. AWWA piping:

B-Line B3102

Grinnell 590

PHD 420

3. Insulation Shields

a. All Piping:

B-Line B3155

Grinnell 168

PHD 160

4. Vertical Piping (Riser Clamps):

a. Copper Pipe (copper plated with plastic coated formed portion.):

B-Line B3373CT

Grinnell CT-121C

PHD 554

b. Steel Pipe:

B-Line B3373

Grinnell 261

PHD 550

5. Connectors:

a. Beam Clamps:

B-Line B3033, B3050, B3291-B3297

Grinnell 88, 133, 134 or 292S.

PHD 360, 620

b. Concrete inserts:

B-Line	B2500, B3014
Grinnell	282, 285
PHD	950

c. Welded beam attachments:

B-Line	B3083
Grinnell	66
PHD	900

d. Piping adjacent to walls or steel columns, brackets:

B-Line	
Grinnell	No. 194, 195, or 199, depending on weight to be supported.
PHD	

e. Base supports:

B-Line	
Grinnell	Figure No. 259, or 264.
PHD	

6. Hanger Rods:

a. Hanger rod:

B-line	
Grinnell	Figure No. 140.
PHD	

b. Continuous threaded rod:

B-line	
Grinnell	Figure No. 146.
PHD	

c. Eye Rods:

B-line	
Grinnell	Figure No. 248.
PHD	

2.6 VALVES

A. All valves shall be products regularly produced for the specified service and rating in accordance with the manufacturer's catalog or engineering data. All valves shall be marked with the manufacturer's name or trademark. The recommended service pressure and the size, by letters and figures, cast or stamped on the body of the valve. Lead content in brass and bronze used in valves for plumbing systems shall not exceed two (2) percent.

B. All valves shall be standard 200 pounds per square inch (psi) WOG minimum. Valve ends shall be compatible with the piping system served.

C. Composition disks shall be as recommended by the valve manufacturer for hot or cold water service.

D. Gate valves for water main service shall be iron body, bronze mounted, tapered seat non-rising

stem, O-ring packing. AWWA C500, 200 psi working pressure. Open counterclockwise. Mechanical joint valve ends shall conform to AWWA C111. Valves shall be of a design that requires no more than fifty (50) lbs. pull on the standard valve wrench to provide positive shutoff against rated working pressure.

E. All flanges shall be plain faced, smooth finished and shall conform in dimensions and drilling to the American Cast Iron Flange Standard Class l25 (Bl6.l-48).

F. Ring gaskets 1/16 inch thick shall be used with all flanged valves. Basis of design for gaskets shall be Cranite, Garlock. Paint one (l) side of gasket with graphite and oil, or accepted substitution, thread lubricant before installing.

G. Domestic Hot and Cold Water Valves

1. Ball Valves

a. 2-inch and Smaller - 200 psi WOG, full port, two piece construction, bronze body with chrome plated solid brass ball and stem, threaded or sweat ends.

b. Acceptable Manufacturers:

Apollo

Jamesbury

Milwaukee

Nibco

Powell

Watts

2. Gate Valves

a) 2-inch and Smaller - Bronze gate, union bonnet, rising stem, solid wedge disk, threaded or sweat ends

b) 2-1/2-inch and Larger - Iron body bronze mounted OS&Y, solid wedge disk, flanged ends.

c) Acceptable Manufactures:

Kennedy

Milwaukee

Mueller

Nibco

Powell

Stockham

3. Balancing Cocks (Circuit Setters)

a) Bronze body threaded or sweat connection, brass valve, "O" ring sealed, calibrated nameplate, indicator pointer, dual stage orifice, read out ports equipped with integral composition check valve, 125 psi rated, 20 degrees F to 220 degrees F range.

b) Acceptable Manufacturers:

Bell and Gossett

Illinois

Rockwell

Sarco

Taco

4. Check Valves (Swing Type)

a) 2-inch and Smaller - Bronze body, bronze disk for general service, threaded or sweat ends.

b) 2-1/2-inch and Larger - Cast iron body, bronze disk and seat ring; flanged ends.

c) Acceptable Manufacturers:

Kennedy

Milwaukee

Mueller

Nibco

Powell

Stockham

H. Fuel Gas Valves

1. Gas Shutoff Valve - Gas valves shut off purposes shall be cast iron body eccentric action plug type with resilient plug facings composed of nitrile butadiene.

a)Acceptable Manufacturers:

Crane

Conbraco

Mueller

Powell

Rockwell

DeZurik

Worchester

Walworth

2. Gas Solenoid Valve - Explosion proof, normally closed, with a NEMA 1 enclosure, UL listed gas solenoid valve. Aluminum body, Buna N seat and disc valve shall be rated for 120V operation. All switches, wiring, etc. for valve shall be provided as indicated in Division 16.

I Fuel Gas Regulators – All outdoor fuel gas regulators shall be provided by the fuel gas utility. All interior fuel gas regulators shall be provided by the contractor and vented to the outdoors. All fuel gas regulators shall be compliant with ANSI Z21.80.

2.7 PIPE INSULATION

A. All insulation shall have composite surface burning characteristic ratings as tested by ASTM E 84, UL 723, or NFPA 255 not exceeding:

Flame Spread:	25
Smoked Developed:	50

B. Composite shall include insulation, jacketing and adhesive used to secure jacketing or facing. All accessory items such as PVC Jacketing and Fittings, adhesive, mastic, cement, tape and cloth shall have the same component rating as specified above.

C. Insulation shall be molded one (1) piece with a maximum thermal conductivity not exceeding 0.23

BTU-in./hr-sq. ft.-°F at seventy-five (75) degrees F mean temperature (R = 4.3).

D. Insulation shall be heavy density fiberglass, Basis of design is ASJ/SSL-II as manufactured by Owens-Corning Fiberglass Corp., Johns Manville Co. Basis of design for valve and fitting covers shall be Zeston 2000 PVC fitting covers as manufactured by Johns Manville Co. Basis of design for mastic sealer shall be Foster Tite-Fit Coating 30-35 as manufactured by H.B. Fuller Company, nonflammable, solvent based, UL classified.

1. Approved Manufacturers:

   Certain Teed Corporation

   Johns Manville Co.

   Knauf Fiberglass GmbH

   USG Interiors, Inc. – Thermafiber Division

   Owens-Corning Fiberglass Corporation

E. Insulation jackets:

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

   a. 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.

   b. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe and PVC fitting covers.

2. Glass fiber insulated pipes conveying fluids above ambient temperature:

   a. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.

   b. Insulate fittings, joints, and valves with insulation of like material and thickness of adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

3. Pipe Exposed in the Storage Shed: Finish with canvas jacket sized for finish painting.

F. Closed cell foam insulation of 1 inch thickness or less may be substituted for fiberglass type sealed with compatible adhesives. Basis of design for shall be Model AP Armaflex as manufactured by Armstrong.

1. Approved Manufacturers:

   Armstrong World Industries, Inc.

   Halstead Industrial Products

   IMCOA

   Rubatex Corporation

G. Metal shields shall be installed between hangers or supports and the piping insulation. Rigid insulation inserts shall be installed as required between the pipe and the insulation shields.

H. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed.

2.8 PIPE IDENTIFICATION LABELS

A. Labels shall be acrylic faced, wrap-around labels. Labels shall indicate piping contents, direction of flow and shall bear the manufacturer's standard color for the service indicated.

1. Approved Manufacturers:

Brimar

MSI

Seton

2.9 VALVE TAGS

A. Tags shall be brass, 1" in diameter with large stamped numerals and attached by a short link brass chain or brass "S" hook.

2.10 UTILITY MARKING TAPE

A. Minimum 2 inches wide, metalized core plastic foil with the words "Caution - Pipeline Buried Below" printed in bold black letters.

PART 3 EXECUTION

3.1 GENERAL

A. All materials, equipment and accessories specified in this section shall be installed in strict accordance with the manufacturers' recommendations.

3.2 EXCAVATION, COMPACTION, BACKFILL

A. Excavation, compaction and backfill shall be as specified in Section 22 01 00, Plumbing General.

3.3 PIPING INSTALLATION

A. General

1. All piping in finished areas shall be run concealed where possible. The Contractor shall furr in piping or provide soffiting as required and in accordance with the Professional's instructions. All piping shall be installed as required to suit space available in building structure, above suspended ceilings, and other locations found necessary for installation.
2. The Contractor shall not install any piping that will interfere with any lights, openings, doors, windows, ductwork, equipment, and existing or special conditions. Headroom in front of openings, doors, or windows shall not be less than the top of the opening. Provide all piping offsets necessary to avoid interferences with other work. Piping offsets shall include all devices and assemblies necessary to accommodate the change in direction of the piping.
3. All piping shall run straight with no more couplings and joints than necessary, shall be grouped wherever practical and shall be carefully installed to provide for proper alignment slope and expansion
4. Pipes carrying fluids shall not be installed in transformer vaults, electrical equipment rooms, elevator hoistways, elevator equipment rooms, or similar areas having a collection of electrical equipment. Pipes shall not be installed over, around, in front of, in back of, or directly below, electrical controls, panels, switches, terminals, boxes, or similar electrical equipment.
5. All piping shall be installed with a minimum of 2 inches between finish covering of pipe and all other work or piping.
6. All piping shall have shut-off valves at all branch connections to mains.
7. Reduction in sizes of pipes shall be made with reducing fittings. Bushings will not be permitted.

8. The Contractor shall perform excavation of the subgrade where required for the installation of the work, including that for piping and piping enclosures. The backfill shall be stabilized by hand or pneumatic tamping as directed by the Professional and shall be returned to the original subgrade level. Piping shall not be run in cinder fill unless protected by a concrete envelope of 2 inches minimum thickness on all sides of pipe. All steel and copper piping and fittings installed underground shall be protected with two layers of tightly applied spirally wrapped tape. Basis of design shall be 3M number 50.

9. Bullhead connections in any piping service are prohibited.

10. All screwed joints shall be made with a non-corrosive, non-hardening compound or Teflon tape applied on the male thread only. All compounds must be approved for the pipe on which they are used. Pipe ends shall be reamed or filed out to size of bore and all chips and cuttings removed. Ends of pipe must be cut square so as to seat in the bottom of the recess in drainage fittings. In making joints in chromium plated brass pipe no more than one thread shall remain exposed when joint is completed. Caulking of screwed joints is not permitted. Pipe joint cement and paint will be permitted only on external threads.

11. All soldered joints shall be made with fittings specified. Copper tube and brass pipe, valves, unions, flanges, fittings, and connections shall be joined by means of lead free solder. Ends of all pipe and inside surfaces of fittings shall be cleaned, burnished and tinned before solder is applied. All joints in tubing 2 inches and larger shall be tinned and then soldered with a circular type flame torch. Pull joints, saddle type joints, and "T-Drill" type connections are prohibited.

B. Drainage Piping

1. All sewer piping shall be set true to line and even slope using grade boards and targets or grade lines in accordance with ASTM C12, "Recommended Practice for Laying Sewer Pipe". Horizontal sanitary and storm piping shall be installed to pitch towards drain points. Minimum pitch shall be 1/8 inch per foot for piping 4 inch and larger. Pitch for smaller piping shall be 1/4 inch per foot minimum. Minimum pipe size below grade shall be 2 inch. To join screwed pipe to cast iron pipe, provide ring on screwed pipe to form spigot end.

2. All changes in pipe size of soil, waste, and drain lines shall be made with reducing fittings or reducers. Changes in direction, where space permits, shall be made with long sweep bends, Y-fittings, and one-eighth (1/8) or one-sixteenth (1/16) bends, or combination "Y" and 1/8 bends.

3. Cleanouts shall be furnished installed on horizontal runs and at the base of stacks for all soil, waste, drain, and rain conductor lines. A cleanout shall be installed at every change of direction of greater than 45 degrees. Cleanouts shall be installed not more than 50 feet apart for piping 4 inch size and smaller. Cleanouts shall be installed no more than 80 feet apart for piping larger that 4 inch. Cleanouts on horizontal runs above ground, including crawl spaces, shall be cast brass plugs in wye fittings. Cleanouts at the base of each vertical stack shall be cast brass plugs in wye fittings. Cleanouts on buried or concealed lines shall be brought flush with grade or floor level. Cleanouts in walls shall be brought flush with finished face of the wall. Cleanouts on underground lines shall be made with wye and 45 degree fittings. Terminal cleanouts on underground lines shall have a concrete cradle bearing block set against undisturbed earth. 45 degree fittings shall be set against concrete cradle to prevent separation or misalignment of joints. Cleanout plugs shall be full size for pipe up to and including 4 inch diameter and not less than 4 inch diameter for larger size pipe.

4. Cleanouts shall not located in air plenums. Cleanouts shall be extended to the floor or wall in order to locate the cleanout outside of the air plenum.

C. Pressure Piping

1. Branch piping shall be as indicated, but shall be a minimum 3/4 inch in nominal size with the last ten feet to each 1/2 inch outlet fixture a minimum of 1/2 inch in nominal size.

2. Each water piping system within the building shall be properly arranged and graded to low points where the entire system can be emptied through a drain.

3. Drain Valves - Furnish and install a 1/2" rough brass hose bibb with female hose connection at all low points of the domestic water piping systems. The hose bibb shall be located so as to be accessible and easily operable, and so that a hose can be connected to the outlet.

4. Outside water piping shall be so graded and arranged that water can be drained from the underground piping through drains installed in the building served. The drains shall be the same size and type specified for interior piping.

D. Equipment Piping

1. Provide shutoff valves in supply and return to each item of equipment. Valves shall be suitably located to isolate each unit to facilitate maintenance or removal of all equipment and apparatus. Valves shall be flanged or have a union installed between valve and equipment.

2. Provide all piping from backflow preventers to spill over open sight drains, floor drains, or other trapped acceptable discharge points, and terminate with plain end (unthreaded) pipe.

3. Provide thermometer wells and pressure gauge wells for specified thermometers and gauges, and at the inlet and outlet connection of each piece of equipment specified in this contract.

E. Fuel Gas Piping

1. Horizontal fuel gas piping shall slope up in direction of flow not less than 1/4 inch in 15 feet.

2. Provide 6 inch drip leg and cap and shutoff valve at each piece of gas fired equipment, at the ends of horizontal runs and at the base or risers.

3. All fuel gas piping shall be installed in accessible locations. Piping located in or below concrete slabs shall be run in channels in the floor with suitable access panels. Where approved by the local gas utility, gas piping may be embedded in the floor slab. Such piping shall be surrounded by not less than 1-1/2 inches of Portland cement, and piping shall not be permitted to be in physical contact with any other metallic materials.

4. Gas tubing run inside hollow walls or partitions shall be protected with a steel striker barrier at least .0508 inches thick. Striker barriers shall extend 4 inches beyond concealed penetrations or plates, fire stops, etc. Rigidly securing tubing run vertically inside hollow walls or partitions shall be prohibited.

5. Use of polyethylene fuel gas piping is prohibited above ground and under floor slabs. Transition from polyethylene to steel pipe shall be made underground and piping brought Aboveground before entering the building.

3.4 ELECTROLYSIS CONTROL

A. All copper pipe and tubing installed under this Contract shall be installed so that the pipe and tubing will not touch or come in contact with ferrous metals. Where copper tubing or piping for fittings is anchored, guided, supported, secured, or may come in contact with ferrous metal, an insulating nonconductor spacer, similar to rubber or fiber, shall be installed to assure prevention of electrolysis.

B. When copper tubing or piping is connected to ferrous piping or equipment, connections shall be made with dielectric unions, couplings, or isolating flanges.

3.5 SLEEVES AND FLOOR PLATES

A. Sleeves shall be provided for all pipes passing through walls and partitions. Sleeves shall be cut flush with wall, floor or ceiling surfaces except that sleeves through waterproofed roof or floor slabs shall extend one inch (1") above the finished surface. Sleeves shall be sufficient size to allow a sealable annular space between the sleeve and the pipe or between the sleeve and the pipe insulation. All exposed piping passing through floors, walls or ceiling shall be provided with a chrome

escutcheon plate securely fastened around the pipe. The annular space around the pipe in non-water-proof sleeves shall be filled with penetration sealant and smoothed out flush with all surface.

B. All pipe, tube, conduit, or similar through-penetrations of all fire rated walls, floor-ceiling, or roof-ceiling assemblies shall be provided with a fire stopping system to achieve a tight seal that will maintain the fire resistant rating of the assembly containing the through-penetration. Fire stopping system may be sealant or mechanical type.

3.6 PROTECTION AGAINST PHYSICAL DAMAGE

A. In concealed locations, where piping, other that cast-iron or galvanized steel, is installed through holes or notches in studs, joists, rafters or similar members less than 1¼-inches from the nearest edge of the member, the pipe shall be protected by shield plates. Protective shield plates shall be a minimum of 1/16-inch thick steel, shall cover the area of the pipe where the member is notched or bored and shall extend a minimum of 2-inches above sole plates and below top plates.

B. Fuel gas piping shall be protected in accordance with NFPA 54.

3.7 SUPPORTS, HANGERS, INSERTS AND FASTENERS

A. The Contractor shall furnish and install all supports, hangers, inserts and fasteners for the items incidental to the work in the construction of the project. Supports and hangers shall be provided to suit specific conditions for the type of construction. The method adopted shall be subject to the approval of the Professional.

B. Supports shall secure pipes in place, prevent swaying and vibration, maintain required grading, provide free expansion and shall have a neat appearance. Supports shall be selected for strength and service and installed in a manner which will not stress building construction. Supports shall be selected for safety factor of five (5) to one (1) for gross weight of piping system including fluid and installation.

C. Where support is from concrete construction, take care not to weaken concrete or penetrate waterproofing. Only use inserts for suspending hangers from concrete slabs. Use beam clamps for suspending hangers from building steel. Do not hang one pipe from another. Do not use perforated band iron, wire or chain as hangers. Do not use vertical expansion shields. Do not hang from joist bridging.

D. Fastenings required in masonry walls shall be galvanized U-bolts set in the construction during erection.

E. Where several pipes can be installed in parallel at the same elevation, provide trapeze hangers. Trapeze hangers shall be suspended by means of rods or angles. Brace trapeze hangers to prevent motion due to expansion and contraction of pipe. Support individual pipes by hangers or rollers.

F. Where hanger rods are longer than 18 inches, provide lateral bracing at every fourth hanger. Do not support piping by wire, rope, wood or other makeshift device. Provide additional steel supports where building construction does not permit the hanger spacing as specified in the schedules. Location and details shall be submitted to the Professional for review.

G. Where loading exceeds the safe allowable limit for any single insert, then multiple inserts shall be installed spaced no less than 12 inches on centers. The multiple inserts shall be connected with suitable size steel angles and locking bolts.

H. Where inserts in new construction have been omitted or are required in existing construction, the fastening shall be accomplished by means of approved lead sheathed expansion bolts. Wood plugs shall not be used. Expansion shields in precast concrete slabs shall not be loaded more than one-half (1/2) their maximum design capacity and never more than 200 pounds per bolt. Where bolts used with lead expansion bolts are spaced closer than one foot centers, the multiple bolts shall be connected with suitable size steel angles and locking bolts or with single bolts extending through the

slab above with a bearing plate. Where finished floors occur, the welded plate and rod shall be recessed in the slab, finished in an approved manner.

I. Where fastenings are required in steel stud, wire lath or other non-masonry construction, a "J" hook and holding lock washer and nut shall be used which shall fasten to the opposite stud edge to which the item will abut. If the location of the fastening is not a steel stud, a structural steel shape shall be fastened to the wall with bolt and holding nut, with the fastening extension through the wall. The use of toggle bolts will not be permitted.

J. Steel frame Construction

1. Where roofing construction is supported by structural steel members or bar joist, support piping systems, devices, and equipment from structural steel members or secondary fabricated supports. No hanging from corrugated metal deck shall be allowed.

K. Reinforced Concrete Construction

1. Inserts in poured concrete slabs shall be iron or fabricated galvanized iron or steel of the type to receive a machine bolt head or nut after installation. Inserts shall permit adjustment of this bolt in one (1) horizontal direction. Inserts shall be accurately located before the concrete is poured.

2. Piping, tanks and equipment shall be adequately supported either by suspension from the construction above or by means of struts or brackets to the construction below or to the side.

3. Before drilling any concrete for attachments, installer shall carefully check concrete drawings and shop drawings and shall locate drilled holes to avoid reinforcing by at least 1 inch.

HANGER AND ROD SCHEDULE

Nominal Pipe Diameter (Inches)	Steel Pipe Spacing (Feet)	Steel Pipe Rod Size (Inches)	Copper Tubing Spacing (Feet)	Copper Tubing Rod Size (Inches)
1/2	5	3/8	5	3/8
3/4	6	3/8	6	3/8
1	7	3/8	6	3/8
1-1/4	8	3/8	6	3/8
1-1/2	10	3/8	6	3/8
2	10	3/8	10	3/8
2-1/2 & 3	12	1/2	10	1/2
4 & 5	12	5/8	10	5/8
6	12	3/4	10	7/8
8,10,12	12	7/8	10	7/8

HANGER AND ROD SCHEDULE NOTES:

Where unusual concentrated loads of valves and fittings occur, closer spacing shall be required. Submit specific cases for review and comment.

Where piping changes direction, supports shall be placed in each direction adjacent to joints and no more than 12 inches from the joint.

Hanger spacing for copper piping shall conform to the requirements defined in the North Carolina

Building Code – Mechanical- 2002.

M. Cast Iron Pipe Supports

1. In accordance with manufacturer's instructions.
2. Vertical piping supported at each stack be and at each floor. Freestanding vertical pipe should be adequately staked or braced during construction to maintain alignment.
3. Horizontal piping supported within 24 in. each side of the coupling joint at 10 ft. intervals for 10 ft. pipe lengths and at 5 ft. intervals for 5 ft. pipe lengths. Supports or hangers placed to maintain alignment and grade with provision made to prevent shear. Greater than 3 in. diameter pipe braced at changes of direction to prevent horizontal movement.

3.8 VALVES

A. Valves shall be installed at each riser, branch to equipment, at each group of fixtures, at each fixture not equipped with stop valves, and where shown on the drawings. Valves shall be installed with stems at or above the horizontal plane.

B. Where supplies to individual fixtures occur in base cabinets, or in other places where copper tubing supplies are used stops shall be solder end.

3.9 INSULATION

A. Pipe Insulation

1. Piping to be insulated shall include all domestic water piping and above ground horizontal rainwater conductors.
2. All insulation shall be applied by skilled workmen regularly engaged in this type of work. Insulation shall be applied to clean and dry surfaces after tests and approvals required by this specification have been completed.
3. On cold surfaces where a vapor barrier must be maintained, insulation shall be applied with a continuous, unbroken moisture and vapor seal. Insulation and vapor barrier shall be continuous through pipe hangers and supports. Other projections that are secured to cold surfaces shall be insulated and vapor sealed to prevent condensation.
4. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation.
5. All pipe insulation shall be continuous through walls, ceiling, floor openings, or sleeves; except where firestop or firesafing materials are required.
6. Metal shields shall be installed between hangers or supports and the piping insulation. Rigid insulation inserts shall be installed as required between the pipe and the insulation shields. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed.
7. Insulation used on piping systems shall be contoured for the pipe size. Duct wrap or batt insulation on piping systems is not acceptable.

B. Insulation thickness shall conform to the "PIPING INSULATION THICKNESS TABLE".

PIPING INSULATION THICKNESS TABLE

SERVICE	PIPE SIZE	INSULATION THICKNESS
Domestic Cold Water	1/2" to 2"	1/2"
Domestic Cold Water	Larger than 2"	1"
Domestic Hot Water (Branches)	1/2" to 1"	1/2"
Domestic Hot Water	1/2" to 2"	1"
Domestic Hot Water	Larger than 2"	1-1/2"
Rain Leaders	All Sizes	1"
Drainage Piping Installed	All Sizes	1/2"

C. Application

1. All ends shall be firmly butted and secured with an all service jacket or self-sealing lap butt strips of a minimum 3 inches wide. All service jacket laps and butt strips shall be secured by use of a suitable lap adhesive. Exposed end of pipe insulation shall be sealed with vapor retardant mastic at all fittings and valves.
2. All fittings and valves shall be insulated with preformed fiberglass fittings. Insulation shall be of equal thickness to the adjacent pipe insulation.
3. Fitting and valves shall be finished by applying PVC fitting covers. PVC covers shall be secured using solvent type PVC adhesive. All circumferential edges shall be further sealed by an overlap of at least 2 inches onto adjacent pipe insulation using PVC tape or all service jacket/ self-sealing lap butt strip material.

3.10 PAINTING AND IDENTIFICATION

A. Painting

1. All painting shall be done in a careful, neat and workmanlike manner, with particular care being exercised to protect building equipment and finishes. All surfaces shall be thoroughly cleaned or rust, scale, dirt, grease, dust, and like items, and sanded so as to provide a bond for new paint. All painted surfaces under this Contract shall be finished in an acceptable manner.
2. Insulation, galvanized piping, and copper piping in crawl spaces, in sump pits, inaccessible pipe spaces, and above ceilings shall not be painted.
3. All unpainted, uncoated, or non-galvanized steel piping, equipment, supports, hangers and other iron and steel work in crawl spaces, and sump pump pit, installed under this Contract, shall be painted with two (2) coats of Rust-Oleum rust preventative paint, or approved equal. First coat shall be Rust-Oleum No. X-60 red primer, or accepted substitute. The second coat shall be Rust-Oleum No. 634 black gloss, or accepted substitute.

B. Pipe Identification

1. All piping (domestic cold water, de-ionized water, fuel gas, chemical waste, laboratory compressed air and laboratory vacuum piping) shall be provided with identification markers. Markers shall be provided as follows:
   a. On straight runs of piping at intervals not exceeding 20-feet
   b. Within 2-feet of all elbows
   c. Within 2-feet of all piping as it passes through partitions (markers provided on both sides of partitions).

d. Exposed piping shall be identified by a yellow label marked “Gas” in black letters. The marking shall be spaced at intervals not exceeding 5 feet. All piping and tubing systems, greater than 0.5-pounds per square inch (psi) service pressure, shall be identified by a yellow label with black letters indicating the piping system pressure.

C. Valve Tags

1. The Contractor shall tag each valve for the cold water, hot water, hot water circulating, gas lines, laboratory compressed air, laboratory vacuum and de-ionized water systems furnished under this Contract. The Contractor shall prepare three (3) lists on heavy white paper giving the valve number, its location, and the equipment controlled. One (1) list shall be enclosed in a metal frame under glass and mounted in the building where directed by the Owner. The other two (2) copies shall be delivered to the Architect.

2. In buildings where existing piping systems are modified, the new valve tag numbers and list shall be coordinated with existing valve tag numbers and lists and those supplied under other contracts, if applicable.

D. Utility Marking Tape

1. Install detectable utility marking tape above all outside pipelines, 12 inches to 18 inches below grade.

END OF SECTION

SECTION 22 05 48 - SEISMIC RESTRAINT DESIGN

PART 1 GENERAL

1.1 SCOPE

A. Unless otherwise noted, all LP gas piping shall be restrained for this project.

B. Any components that contain flammable or hazardous material or storage racks in occupancies open to the general public and components needed for the continued operation of the facility or whose failure could impair the continued operation of the facility shall be assigned an Importance Factor, (Ip) = 1.5. All other components shall have an Ip =1.0. All seismic restraints, connections, etc. shall be designed for a Seismic Design Category C.

1.2 REQUIREMENTS

A. Responsibilities

1. Contractor shall restrain all components and systems according to the certified drawings received from the design engineering source. All components shall be either mounted to the structure at the base (i.e. on the floor or on the roof), mounted on grade or suspended from the structure. Base mounted components requiring vibration isolation shall be in accordance with this section.

2. Contractor shall as part of the submittal package identify the seismic design source intended to be used to do the seismic restraint design which shall be submitted for approval. A certified seismic design package showing calculations for anchoring and products to be used for anchoring shall be submitted for review by the Engineer of Record.

B. Source

1. The source selected to do the restraint design shall be an independent engineering group with a minimum of five years experience in restraint design.

C. Special Inspections

1. Special inspections will by performed on this project by a Special Inspector employed by the Owner.

2. The contractor’s responsibilities associated with Special Inspections shall include the following:
   a. Timely notification to the Special Inspector for each portion of work requiring inspection.
   b. Submit a written statement of responsibility prior to commencement of work on the system or components requiring special inspections.
   c. Submit copy of approved shop drawings and submittals to the Special Inspector.
   d. Correct deficiencies in the presence of the Special Inspector.
   e. For complex deficiencies identified by the Special Inspector, the contractor shall either stop work until the Engineer of Record has rendered judgment or, f the contractor proceeds regardless, the contractor shall be responsible for complete removal and replacement (and any related forensic costs) of any apparent deficiency that is ultimately judged unacceptable by the Engineer of Record.
   f. Provide access to and means for safe and proper inspection of the work.

1.3 DESCRIPTION

A. Intent

1. It is the intent of the seismic restraint portion of this specification to provide restraint of building system non-structural components irrelevant of fragility levels. Restraint systems are intended to withstand the stipulated seismic accelerations applied through the component center of gravity.

2. All such systems shall be installed in strict accordance with design building code, component manufacturers' and building construction standards. Whenever a conflict occurs between the manufacturer's standards code requirements, the most stringent shall apply.

B. This section is provided for seismic control for the "equipment" as listed below. This section applied to all equipment, systems and material installed as part of the plumbing contract.

C. The work in this section includes the following:

1. Seismic restraints and attachment to the structure for all equipment base mounted, roof mounted and suspended.
2. Seismic design, restraint and attachment of non-building structures used to support equipment on the roof.
3. Certification of seismic restraint designs and installation supervision.
4. Certification of seismic attachment of housekeeping pads.

D. Definitions

1. The term EQUIPMENT used throughout this specification includes ALL non-structural components. These specifications are applicable to components within the facility and components on grade outside the building servicing the facility. Equipment buried underground is excluded but entry of services through the floor or foundation wall is included.

2. POSITIVE ATTACHMENT:

a) Positive attachment location is defined as a location with a cast-in or expansion anchor, a double sided beam clamp, and a welded or bolted connection to structure.

3. TRANSVERSE BRACING:

a) Restraint(s) applied to limit motion perpendicular or angular to the centerline of the pipe, duct or conduit.

4. LONGITUDINAL BRACING:

a) Restraint(s) applied to limit motion along the centerline of the pipe, duct or conduit.

1.4 ORIGINAL EQUIPMENT MANUFACTURER ISOLATION PACKAGES

A. Internal and/or External Systems

1. Substitution of internally or externally restrained equipment in lieu of the restraints specified in this section is acceptable provided all conditions of this section are met. The equipment manufacturer shall provide a letter of guarantee from their engineering department stamped and certified per section 1.5A stating that the seismic restraints are in full compliance with these specifications. Letters from field offices or representatives are unacceptable.

2. All costs for converting to such restraint systems shall be borne by the Contractor.

1.5 SEISMIC CERTIFICATION

A. Seismic Certification and Analysis:

1. Seismic restraint calculations shall be provided for all connections of equipment to the structure. The most stringent of two shall be used for the restraint design. Calculations shall be stamped by an registered professional engineer with at least five years of seismic design experience.

2. Analysis shall indicate calculated dead loads, derived loads and materials utilized for connections to equipment, to non-building structures and to the structure. Analysis shall detail anchoring methods, bolt diameter, embedment and/or weld length.

3. An insurance certificate shall accompany submittals for record prepared by the licensed independent restraint design engineer.

4. The design of the restraints shall be based on the approved equipment submittal for each project.

5. The restraint engineering design source shall provide anchoring size, depth, edge distances, weld design and support design for roof mounted components.

6. The restraint engineering design source shall provide jobsite training for sway brace size, location and method of attachment.

7. The restraint engineering design source shall provide jobsite inspections and installation instructions. Drawings and field supervision shall be provided to insure proper installation and performance of systems.

8. Training, inspections and documentation shall be provided by the design engineering source or by a qualified engineer under the direct guidance of the design engineering source. Documentation shall be prepared and submitted as part of the close out documents certifying the above conditions have been met.

1.6 CODE AND STANDARDS REQUIREMENTS

A. Applicable Codes

1. North Carolina Building Code 2012.
2. ASCE/SEI 7-05 Minimum Design Loads for Buildings and Other Structures
3. All applicable state and local codes.

B. Where conflicts between these documents exist, the more stringent requirement shall apply.

1.7 RELATED WORK

A. Housekeeping Pads

1. Seismic anchoring of and attachment to pads poured separately shall be detailed, designed and certified according to this section by a licensed professional engineer.

2. Housekeeping pads shall be sized to accommodate a minimum of ten (10) bolt diameters of clearance all around the equipment and its mounting package to allow development of full drill-in anchor ratings. If cast-in anchors are to be used, the housekeeping pads shall be sized to accommodate the ACI requirements for bolt coverage and embedment.

B. Attachments

1. Restraint attachment plates cast into housekeeping pads, concrete inserts, double sided beam clamps, etc. are required to be certified under this section. Single sided, or “C” type beam clamps for support rods of overhead piping or any other equipment are not acceptable on this project.

C. Hangers and Supports

1. Products for the support of piping shall be a catalog standard. Where required, hangers shall be U.L. and/or F.M. (Factory Mutual) approved.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. All seismic restraint design shall be by a single design individual or group.

2.2 PRODUCTS DESCRIPTION

A. Seismic Restraint Products

1. Materials used for seismic restraint design shall be with approved manufacturers of specific seismic restraint products and shall include but not be limited to anchor bolts, concrete anchors, A36 steel, pipe clamps, sway bracing and floor mounted restrained isolators. These devices shall bare a recognized approval agency such as UL, ICBO, ASTM or other recognized approval agencies. Devices shall be as manufactured by Loos & Company, Hilti, B-Line, Grinnell, Rawlplug Co., Inc., welding in accordance with AWS, US Steel, Nucor, Grabber Construction Products, Vibration Eliminator, Mason Industries

PART 3 EXECUTION

3.1 GENERAL

A. All vibration isolators and seismic restraint systems shall be installed in strict accordance with the seismic design sources’ written instructions.

B. Installation of seismic restraints shall not cause any change of position of equipment, piping or duct work resulting in stresses or misalignment.

C. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration control system herein specified.

D. The contractor shall not install any equipment, piping, duct or conduit which makes rigid connections with the building unless isolation is not specified. “Building” includes, but is not limited to, slabs, beams, columns, studs and walls.

E. Coordinate work with other trades to avoid rigid contact with the building.

F. Any conflicts with other trades which shall result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions shall be brought to the architects/engineers attention prior to installation. Corrective work necessitated by conflicts after installation shall be at the responsible contractor’s expense.

END OF SECTION

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 GENERAL

1.1 REQUIREMENTS

A. General Conditions of the Contract, Special Conditions, Instructions to Bidders, and other General Requirements contained in Division 1 and 2 are a part of these Specifications.

1.2 SECTION INCLUDES

A. Work in this Section includes the following:

1. Sinks
2. Emergency Shower/Eye-Face Water Tempering System

1.3 RELATED SECTIONS

A. All sections of the Project Manual apply to this section.

1.4 SUBMITTALS

A. Submittals shall be in accordance with Section 22 01 05 – Shop Drawings and Submittals.

B. The Contractor shall submit manufacturer's catalog data for the following:

1. Sinks
2. Emergency Shower/Eye-Face Water Tempering System
3. Fixture Carriers
4. Faucets and Mixing Valves

C. The Contractor shall submit Operation and Maintenance Data per section 22 01 05 for the following:

1. Faucets and Mixing Valves

PART 2 PRODUCTS

2.1 GENERAL

A. All fixtures shall be furnished complete with traps, faucets, wastes, supplies with stops, etc., as required. All exposed metal parts shall be chromium plated.

B. Fixtures and equipment shall be those of reputable manufacturers and shall be new and the best of their respective kinds.

C. All fixtures and equipment of similar types shall be of the same manufacturer unless indicated otherwise on the drawings or specified herein.

D. Fixtures shall be mounted at mounting heights as indicated.

E. If fixtures and equipment indicated in the Contract Documents are not currently manufactured, the manufacturer's current equivalent to the indicated fixtures and equipment shall be provided at no additional cost, subject to review and acceptance by the Professional.

2.2 PLUMBING FIXTURES

A. Janitors Sinks

1. Janitors Sink (Single Compartment)

27-inch x 27-inch x 16-inch freestanding single compartment sink, fourteen (14) gauge, Type 304 stainless steel. Faucet shall have a vacuum breaker gooseneck spout outlet with pail hook, upper support rod and lever handles with color indexes. Provide sink complete with rough chrome plated cast brass drain, chrome plated cast brass P-trap with cleanout, chrome plated brass waste to wall, chrome plated brass escutcheon, chrome plated brass tailpiece, stainless steel crumb cup strainer, and rigid supplies.

Approved Manufacturers

Elkay

Moen

Just

T & S Brass

2. EWS: Combination Emergency Shower / Eyewash

Pedestal mounted, hand or foot treadle operated, (both required), stainless steel pull rod with stay open valve for shower, stainless steel receptor; twin eyewash head, anti-surge type, with soft plastic covers; sty open type ball valve; face spray ring; automatic pressure regulating control; floor flange. Unit shall meet ANSI Standard and ADA requirements.

FIXTURE	
Guardian	GBF 1909
Haws	8309 WC
Speakman	SE 690-WCH

PART 3 EXECUTION

3.1 INSTALLATION

A. Fixtures and equipment shall be installed in a neat and workmanlike manner and in accordance with the manufacturer's recommendations. The quality of installation shall be subject to the approval of the Professional.

B. All wall mounted fixture carriers and supports shall be suitable to the type of construction wherein they are located.

C. All fixtures and equipment must be protected against damage during the progress of construction. Upon completion of construction, all fixtures and equipment must be thoroughly cleaned and left in perfect working order. All piping and accessories having polished, plated or finished surfaces shall be protected to prevent scarring or other damage and protect the finish against damage.

D. Provide isolation valves for all fixtures, equipment, and accessories.

1. Exception: Omit stop valves on supplies to emergency equipment, except where permitted by authorities having jurisdiction. When permitted, install valve locked in OPEN position.

E. All fixture supplies and waste lines shall be run to wall unless construction requires they be run to floor. All supplies through walls shall be provided with angle stops. All supplies through floors shall be provided with straight stops. Unions shall be provided adjacent to all equipment or wherever

necessary to facilitate the removal of equipment for repair or replacement. Unions for copper tubing up to and including 2 inch diameter shall be brass ground joint with socket ends for solder. Unions for copper tubing 2-1/2 inches in diameter and over shall be standard brass flanges with socket ends for solder. Flanges to be drilled for ASA Standard 125 pounds flanges and so stamped. No lip type unions or long screws will be permitted. The Contractor shall furnish and install all structural steel angles, channels, etc. necessary to properly support all fixtures and equipment to the satisfaction of the Professional.

F. Drain piping from all backflow preventers, relief valves and vents, drain down connections, etc. shall be extended to within 4 inches of a floor sink or floor drain.

3.2 MOUNTING HEIGHTS

A. Plumbing fixture mounting heights shall be as indicated on the drawings. Mounting heights for barrier free fixtures shall meet the requirements of the ADA Accessibility Guidelines. These guidelines shall apply unless superseded by more stringent State or Local requirements.

END OF SECTION

MCKIM AND CREED PROJECT NO. 7002-0001

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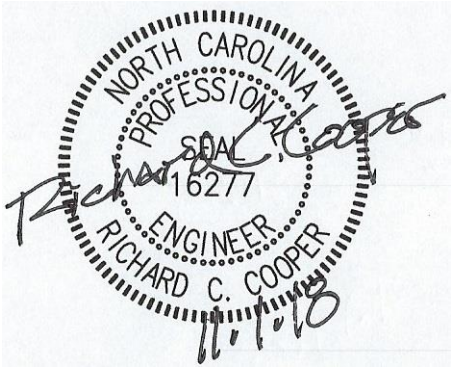

SECTION 23 01 00 - MECHANICAL GENERAL

PART 1 GENERAL REQUIREMENTS

1.1 DEFINITIONS:

A. Piping: Pipe, fittings, flanges, valves, controls, hangers, supports, traps, drains, gauges, insulation, vents and items customarily required in connection with the transfer of fluids.

B. Provide: Furnish and install complete ready for use. Substitutions for specified materials must be approved at least 10 days prior to bidding.

C. Furnish: Purchase and deliver to the project site complete with every necessary appurtenance and fitting for complete installation. Approved shop drawings must be received prior to purchasing any materials.

D. Install: Unload at the delivery point and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project. Coordination with other trades is mandatory.

E. Concealed: Embedded in masonry or other construction, installed behind wall furring, above ceilings, in crawl spaces, in shafts or otherwise not visible.

F. Exposed: Not concealed.

G. By other Trades: Shall mean by persons or parties who are not anticipated to be the Subcontractor for this trade working together with the Prime Contractor. In this context the words “by other trades” shall be interpreted to mean not included in the overall contract.

H. Contractor: As used in this Division of the specification refers to the Mechanical Contractor unless specifically noted otherwise.

1.2 INTERPRETATION OF CONTRACT DOCUMENTS:

A. This section of the specifications and related drawings describe general provisions applicable to every section of Division 23.

B. Attention is directed to, General Conditions, which are binding in their entirely on this portion of the work and in particular to paragraphs concerning materials, workmanship and substitutions.

C. Mention in these specifications, indications and reasonable implications on drawings, whereby articles, materials, operation or methods related to execution of the mechanical work are noted, specified, drawing or described, thereby requires execution of each such item of work and provision of all labor, materials, equipment and appurtenances required for execution thereof.

D. Particular attention is directed to the drawings and other contract documents for information pertaining to required items or work which are related to and usually associated with the work of this Division of the specifications, but which are to be provided as part of the work of other Divisions of the specifications.

E. No exclusions from, or limitations in, the language used in the drawings or specifications shall be interpreted as meaning that the appurtenance or accessories necessary to complete any required system or item of equipment are to be omitted.

F. The drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed, in accordance with the intent diagrammatically expressed on the drawings, and in conformity with the dimensions indicated on

final architectural and structural working drawings and on equipment shop drawings. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded. When abbreviations appear on the drawings or specification in lower case letter with or without periods, their meanings shall be the same as stated above.

G. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do no obviate field coordination for the indicated work.

H. Information as to the general construction shall be derived from structural and architectural drawings and specifications only.

I. The use of words in the singular shall be considered as limited where other indications denote that more than one item is referred to.

J. Submission of a proposal and ultimate acceptance of an agreement or contract for execution of this section of work will be construed as evidence that the Prime Contractor, Subcontractor and Vendor has carefully read and accepts all conditions set forth in each division, insofar as such conditions may affect both the bidding for and execution of this section of work.

1.3 QUALITY ASSURANCE

A. All equipment and materials required for installation under these specifications shall be new and without blemish or defect. All equipment shall bear labels attesting to Underwriters Laboratories approval where subject to Underwriters Laboratories label service. Where no specific indication as to the type or quality of material or equipment is indicated, a first-class standard article shall be furnished. All manufacturers of equipment and materials pertinent to these items shall have been engaged in the manufacturers of said equipment a minimum of three (3) years and, if so directed by the Designer, be able to furnish proof of their ability to delivery this equipment by submitting affidavits supporting their claim.

B. Each major component of equipment shall have the manufacturer's name, address, model number and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent will not be acceptable. UL or other label, or other data which is die-stamped into the surface of the equipment shall be stamped in a location easily visible. Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance.

C. All equipment of one type (such as fans, valves, etc.) shall be the products of one manufacturer unless specifically stated otherwise.

D. Where the specifications do not list a specific model number for a manufacturer, the construction of a product shall be equal to those models specifically listed.

E. All welders shall be certified by the Welding Bureau of the Mechanical Contractors Association of America for the appropriate service, and shall perform all welding in accordance with Welding Bureau's procedures and the ASA Code for pipe welding. Welding and welder qualifications shall be in accordance with ASME Section IX. All welders certifications shall be submitted to the engineer for approval for all materials to be welded.

1.4 REQUIREMENTS OF REGULATORY AGENCIES:

A. Contractors shall submit to the appropriate Regulatory Agencies all items necessary to obtain all required permits obtain such required permits and pay all required fees.

B. All work shall conform to the following Standards and Codes (applicable edition):

1. North Carolina State Building Code.

2. National Fire Protection Association.
3. Uniform Boiler and Pressure Vessel Act of N.C. (Boiler Code)

C. Where applicable, all fixtures, equipment, and materials shall be as approved or listed by the following:

1. Factory Mutual Laboratories (FM).
2. Underwriters Laboratories, Inc. (UL).
3. CSA
4. ETL
5. AGA
6. AWWA

D. All fuel fired equipment shall meet the requirements of the agencies listed and also meet the Owner's insurer requirements.

1.5 STANDARDS AND PROCEDURES:

1. ADC: Air Diffusion Council.
2. AMCA: Air Moving and Conditioning Association, Inc.
3. ANSI: American National Standards Institute.
4. API: American Petroleum Institute.
5. ARI: American Refrigeration Institute.
6. ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers.
7. ASME: American Society of Mechanical Engineers.
8. ASTM: American Society of Testing and Materials.
9. IBR: Institute of Boiler and Radiator Manufacturers.
10. MSS: Manufacturers Standardization Society.
11. NEMA: National Electrical Manufacturer's Association.
12. OSHA: Occupational Safety and Health Administration.
13. SMACNA: Sheet Metal and Air Conditioning Contractors National Association, Inc.

B. Where reference is made to ASA Standards it shall be understood that this reference is to the standards published by ANSI.

C. Include all items of labor and materials required to comply with such standards and codes. Where quantity, sizes or other requirements indicated on the drawings or herein specified are in excess of the standard or code requirements, the specifications or drawings, respectively, shall govern.

1.6 VERIFICATION OF DIMENSIONS AND LOCATIONS:

A. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work, working conditions, verify all dimensions in the field, advise the Designer of any discrepancy, and submit shop drawings of any changes he proposes to make, in quadruplicate for approval, before starting the work. Contractor shall install all equipment in a manner to avoid building interference.

B. The location of duct, pipe, fixture, equipment and appurtenances for existing facilities are shown on plans to indicate the extent of work required. Exact condition shall be field verified.

1.7 COORDINATION WITH OTHER TRADES:

A. Each contractor is to review all drawings and documentation of other trades to ensure all construction requirements are understood and will be provided for a complete installation.
B. Coordinate all work of each section with work of other sections to avoid interference. Bidders are cautioned to check their equipment against space available as indicated on drawings, and shall make sure that proposed equipment can be accommodated. If interferences occur and clearances cannot be maintained as recommended by manufacturer and as required for maintenance and inspection of equipment, Contractor shall bring them to the attention of Designer, in writing, prior to

signing of contract; or, Contractor shall, at his own expense, provide proper materials, equipment, and labor to correct any damage due to defects in his work caused by such interferences.

C. Coordination drawings: Contractor shall prepare coordination drawings showing coordination between trades for all above-ceiling areas, sleeves, and mechanical and electrical equipment rooms. Contractor shall conduct a review meeting with the commissioning team of the coordination drawings prior to commencing any rough-in of commissioned systems, and any comments by the commissioning team shall be addressed and incorporated in the coordination drawings prior to rough-in.

1.8 WORKMANSHIP

A. Workmen to be thoroughly experienced and fully capable of installing assigned work. Work to be in accordance with the best standard practice of the trade. Work that is not of good quality will require removal and reinstallation at no additional expense to Owner and as approved.

B. All material and equipment to be installed in accordance with manufacturer's printed recommendations (using recommended accessories) and/or as approved by the Designer. Retain a copy on job site and submit others for approval when required.

PART 2 PRODUCTS

THIS PART NOT USED.

PART 3 EXECUTION

3.1 LEED PROJECT REQUIREMENTS

A. This is not a LEED certified project.

3.2 SURFACE CONDITIONS:

A. Inspection:

1. Prior to any work, the Contractor shall carefully inspect the installed Work of all other Trades and verify that all such Work is complete to the point where his installation may properly commence.

2. Verify that all equipment may be installed in accordance with all pertinent codes and regulations, the original design and the referenced standards.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Designer.
2. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.

3.3 INSTALLATION

A. Install all equipment and appurtenances in strict accordance with the manufacturer's recommendations.

3.4 PROTECTION AND CLEANING OF SYSTEMS AND EQUIPMENT

A. Protect all materials and equipment from damage during storage at the Site and throughout the construction period. In the event of damage prior to final inspections, the Contractor shall repair or replace damaged items as determined by the Architect/Engineer, at no cost to the Owner.

B. Damage from rain, dirt, sun, and ground water shall be prevented by storing the equipment on elevated supports and covering them on all sides with securely fastened protective rigid or flexible waterproof coverings.

C. Piping shall be protected by storing it on elevated supports and capping the ends with suitable closure material to prevent dirt accumulation in the piping.

D. During construction cap the top of all piping installed vertically.

E. Periodically during construction and prior to Owner acceptance of the building, Contractor shall remove from the premises and dispose of all packing material and debris. All adjacent occupied areas shall be cleaned daily to remove dirt and debris resulting from this work.

3.5 WELDING

A. All welded piping shall be installed by Contractor using NCPWB or ASME Certified Welding Procedures. Welding shall comply with ANSI/ASME B31.1 and Section IX of the ASME Boiler and Pressure Code.

B. All welded piping shall be hydrostatically tested for pressure of 1-1/2 times the working pressure of the line, but not less than 200 psig. This hydrostatic test shall be witnessed by the Designer.

C. Ten days before any welded work is to start, the Contractor shall furnish the Designer copies of the welding procedures approved for the Contractor.

D. Before any welder is put to work in welding any piping for this job, the Designer shall be furnished with duplicate copies of the certification of each welder. If, in the opinion of the Designer, the welding is not done properly, a coupon shall be cut from field welds for inspection and/or the welder may be required to pass a recertification test. Costs of cutting the coupon shall be the responsibility of the Contractor. Also all welds shall be subject to non-destructive x-ray examination by Owner. Contractor will be responsible for all costs of non-destructive x-ray examination, including all remedial repair work and retesting of welding that is determined to be unsatisfactory.

E. No welding is to be covered with insulation or concealed until the welding has been approved by the Designer as outlined above.

F. All welding operations shall be approved by the Designer prior to beginning work. Extreme care shall be exercised to prevent damage to the existing buildings or building or surrounding contents during welding operations.

G. During welding of all piping, contractor shall use fire resistant or equal pad protection to prevent scorching or burning of existing floor and wall finishes, etc. Also, care shall be taken to eliminate sparks from dropping on existing furniture, equipment and flooring material. All damages created by welding flame or sparks shall be repaired to owner’s satisfaction at contractor’s expense.

3.6 SUBSTITUTION OF EQUIPMENT

A. Requests for substitutions of products may be made during the bidding period by submitting completed substitution request accompanied by information sufficient for the Engineer to make a determination as to the equivalency of a product.

B. The Engineer will consider requests utilizing this section for substitution of products in place of those specified.

C. Submit 14 calendar days prior to Bid Date. No substitutions will be reviewed or accepted after this date unless there is an obvious advantage to the Owner.

D. Substitution requests may be submitted by U.S. Postal Service or electronic mail (email).

E. Prime Bidders shall request a substitution on the letterhead stationary of the Prime Bidder submitting the request. Requests from individual manufacturers will not be accepted.

F. Submit separate request for each substitution. Support each request with the following information. All items must be addressed.

G. Complete data substantiating compliance of proposed substitutions with requirements stated in Contract Documents:

1. Product identification, including manufacturer's name and address.

2. Manufacturer's literature, identifying:

a) Product description.
b) Reference standards.
c) Performance and test data.

3. Name and address of similar projects on which product has been used and date of each installation.

4. Itemized comparison of the proposed substitution with product specified, listing significant variations.

5. Data relating to changes in construction schedule, if any.

6. All effects of substitution on separate contracts.

7. List of changes required in other work or products.

8. Designation of availability of maintenance services and sources of replacement parts.

H. Substitutions will not be considered for acceptance when:

1. Acceptance will require substantial revision of Contract Documents.

2. In judgment of Engineer, substitution request does not include adequate information for a complete evaluation.

3. Requests for substitutions not submitted by a Prime Bidder.

4. Where the effect on the schedule will be negative.

I. In making formal request for substitution, the Prime Bidder represents that:

1. The Prime Bidder has investigated proposed product and has determined that it is equivalent to or superior in all respects to that specified.

2. The Prime Bidder will provide the same warranties or bonds for substitution as for product specified.

3. The Prime Bidder will coordinate installation of accepted substitution into the Work and will make such changes as may be required for the Work to be complete in all respects.

3.7 SUBMITTALS

A. Refer to Division 1 for information on submittal requirements. When conflicts exist, Division 1 shall apply.

B. The terms “Submittals” can generally be used to indicate any information which is required to be reviewed by the A/E before further action on that product can be taken by the Contractor. This may include product data sheets, shop drawings, and schedules.

C. Submittals generally not required when equipment is purchased exactly as specified and scheduled. Submit list of such equipment only. Equipment data sheets must be included in project manual prepared for Owner.

D. PRODUCT SUBMITTALS

The following product data information shall be submitted:

PRODUCT	SUBMITTED	APPROVED
Dielectric Fittings	_____	_____
Exhaust Fans	_____	_____
Fire Stop Material	_____	_____
Flexible Pipe Connections	_____	_____
Flow Control Fittings/Valves	_____	_____
Temperature Controls	_____	_____
Unit Heat Transfer Units	_____	_____
Thermometers/Pressure gauges	_____	_____
Welder Qualifications	_____	_____

E. TEST AND REPORT SUBMITTALS:

The following list may be used as a checklist for the Contractor and A/E. All tests may not be listed.

1. TEST

a) System start-up
b) Test and Balance Agency Construction report.
c) Gas piping pressure test
d) Pressurized Systems, including waste, vent, domestic water
e) Water quality test reports

F. CONTROL SUBMITTAL:

Submit drawings on control systems including the following.

1. All control components
2. All information necessary for a clear representative of the system to be provided.

3.8 RECORD DRAWINGS:

A. The Contractor shall keep a record set of drawings on the job and, as construction progresses, shall show the actual installed location of all items, material and equipment of these job drawings.

B. At the time of final inspection, two corrected sets of prints and sepias shall be delivered to the Designer. All drawing costs to be paid by the Contractor.

C. Sepias shall be corrected deleting incorrect locations and showing installed locations in accordance with information transferred from job drawing.

D. Qualified draftsmen shall perform this task.

3.9 OPERATION AND MAINTENANCE MANUALS:

A. The Contractor shall compile and bind three (3) sets of all manufacturer's instructions and descriptive literature on all items of equipment furnished under this work.

B. Binder shall be hard cover, three-ring notebook, 11" x 8-1/2" with heavy duty rings. Maximum binder size shall be 2-1/2".

C. The front of the binder shall be titled "Mechanical Operating and Maintenance Instructions," with the name of the job and documents date under the title.

D. Operating and Maintenance Instructions shall include the following:

1. A sheet in each binder listing the architect, engineer, and all contractors. List addresses and phone numbers.
2. List name, address and phone number of organization responsible for warranty work if other than contractor and the specific work for which he is responsible.
3. List name, address and phone number of the nearest sales and the nearest service organization for each product.
4. Schedules of all equipment indicating identification number shown on plans cross referenced to field applied identification tag number.
5. Performance Curves: For pumps, balance valves and similar equipment at the operating conditions.
6. Lubrication Schedule: Indicating type and frequency of lubrication required.
7. List of Spare Parts: Recommended for normal service requirements. Each piece of equipment shall have this list clearly marked or attached to this submittal.
8. Parts List: Identifying the various parts of the equipment for repair and replacement purposes.
9. Instruction Books: May be standard booklets but shall be clearly marked to indicate applicable equipment and characteristics.
10. Wiring Diagrams: Generalized diagrams are not acceptable, submittal shall be specifically prepared for this Project.
11. Automatic Controls: Diagrams and functional descriptions.
12. Test and Balance Reports.
13. Valve tag list: Identifying valve type, size, service and general location.
14. Filter schedule: Identifying filter type, size efficiency, manufacturer and equipment number.
15. Ceiling marker schedule.

E. The following diagrams, schematics and lists shall be framed under glass and hung adjacent to equipment, in mechanical rooms, or where directed by Owner.

1. Automatic control diagrams.
2. Valve Tag List

3.10 OPERATIONAL AND MAINTENANCE INSTRUCTION:

A. After all final tests and adjustments have been complete, a competent employee of the Contractor shall be provided to instruct the Owner's Representative in all details of operation and maintenance for equipment installed. Supply qualified personnel to operate equipment for sufficient length of time after instructions to assure that Owner's Representative is qualified to take over operation and maintenance procedures. Instruction periods shall be as designated by the Owner and shall not necessarily be consecutive. Minimum instruction periods shall be a follows:

1. Air distribution system and Exhaust Systems (1/2 working day)

B. Instruction period shall be performed during the forty-five (45) days following substantial completion at time periods as approved by Owner.

3.11 CONTROLS OPERATION AND MAINTENANCE INSTRUCTION:

A. Upon completion of Operation and Maintenance instructions, competent employees of the Control Contractor shall be provided to instruct the Owner's representative in all details of operation and maintenance for the controls installed. Supply qualified personnel to operate system for sufficient length of time after instructions to assure the Owner's Representative is qualified to take over operation and maintenance procedures.

B. Instruction periods shall be as designated by the Owner and shall not necessarily be consecutive. Minimum instruction periods shall be one (1) working day for on-site training.

C. Instructional period shall be performed during the forty-five (45) days following substantial completion at time periods as approved by Owner. One (1) day of instructions shall be in a formal classroom setting as determined by the owner.

3.12 GENERAL COMPLETION AND DEMONSTRATION:

A. RESULTS EXPECTED:

1. All systems and controls shall be complete, tested and operational.

2. All start-up and testing and balancing shall be complete.

3. All equipment shall be thoroughly cleaned. All excess materials and all debris shall be removed from the site.

4. All walls, floors, ceilings and other surfaces marred or otherwise damaged as a result of execution of this contract shall be cleaned and repaired to the satisfaction of the Designer and Owner.

END OF SECTION

SECTION 23 05 29 - SUPPORTS AND ANCHORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe and equipment hangers and supports.

B. Sleeves and seals.

C. Flashing and sealing equipment and pipe stacks.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Placement of inserts sleeves in walls and slabs.

B. Placement of roof sleeves, vents, and curbs.

1.3 REFERENCES

A. ASME B31.2 - Fuel Gas Piping

B. ASME B31.9 - Building Services Piping

C. ASTM F708 - Design and Installation of Rigid Pipe Hangers.

D. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

E. MSS SP69 - Pipe Hangers and Supports - Selection and Application.

F. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.4 SUBMITTALS

A. Submit under provisions of Division 1.

B. Product Data: Provide manufacturers catalog data including load capacity.

C. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

D. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable code for support of hydronic piping.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Pipe hangers for insulated piping shall be sized to fit around the pipe covering. Contractor shall provide at each hanger a galvanized insulation protection shield formed to fit the outside of the covering. Shield shall extend above center line on both sides. Shield to be #18 gauge up to 3” pipe, #16 gauge up to 6” pipe and #14 gauge for 8” and larger. Provide rigid insulation under all hangers. See Section 23 07 00, Insulation.

B. Hydronic Piping:
   1. Conform to MSS SP58.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Carbon steel, adjustable swivel, split ring.
   3. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
   4. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
   5. Vertical Support: Steel riser clamp.
   6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

2.3 FLASHING

A. Metal Flashing: 26 gage galvanized steel.

B. Metal Counter-flashing: 22 gage galvanized steel.

C. Lead Flashing:
   1. Waterproofing: 5 lb/sq ft (24.5 kg/sq m) sheet lead
   2. Soundproofing: 1 lb/sq ft (5 kg/sq m) sheet lead.

D. Flexible Flashing: 47mil thick sheet compatible with roofing.

E. Caps: Steel, 22 gage (0.8 mm) minimum; 16 gage (1.5 mm) at fire resistant elements.

2.4 EQUIPMENT CURBS Not Applicable

2.5 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage (1.2 mm thick) galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage galvanized steel.

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

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.2 INSERTS

A. Provide inserts for placement in concrete walls and slabs as noted on plans.

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

3.3 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as scheduled.

B. Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.

C. Place hangers within 12 inches (300 mm) of each horizontal elbow.

D. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment.

E. Support riser piping independently of connected horizontal piping.

F. Provide copper plated hangers and supports for copper piping.

G. Design hangers for pipe movement without disengagement of supported pipe.

H. Prime coat exposed steel hangers and supports. Refer to Division 9. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.4 EQUIPMENT BASES AND SUPPORTS Not Applicable

3.5 FLASHING

A. Provide flexible flashing and metal counterflashing where piping penetrate weather or waterproofed walls and roofs.

B. Adjust storm collars tight to pipe with bolts; calk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.6 SLEEVES

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

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

C. Where piping penetrates floor or wall, close off space between pipe and adjacent work with fire stopping material and calk as per UL approved detail. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

D. Install chrome plated steel escutcheons at finished surfaces.

3.7 SCHEDULES

	PIPE SIZE Inches	MAX. HANGER SPACING Feet (m)	HANGER ROD DIAMETER Inches (mm)
1.	1/2 to 1-1/4	6.5 (2)	3/8 (9)
2.	1-1/2 to 2	10 (3)	3/8 (9)
3.	2-1/2 to 3	10 (3)	1/2 (13)
4.	4 to 6	10 (3)	5/8 (15)
5.	8 to 12	12 (3.7)	7/8 (22)

END OF SECTION

SECTION 23 34 00 - POWER VENTILATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall Exhausters

B. Motors and drives.

C. Fan accessories.

1.2 RELATED SECTIONS

A. All Sections Apply.

1.3 REFERENCES

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

C. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.

D. AMCA 261 - Directory of Products Licensed to Use the AMCA Certified Ratings Seal.

E. AMCA 301 - Method for Calculating Fan Sound Ratings from Laboratory Test Data.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 5 years documented experience.

1.5 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Protect motors, shafts, and bearings from weather and construction dust.

1.7 EXTRA MATERIALS

A. Supply two sets of belts for each fan.

PART 2 PRODUCTS

2.1 ROOF VENTILATORS, SUPPLY AND EXHAUST

A. Manufacturers:
   1. Cook.
   2. Other acceptable manufacturers offering equivalent products.
      a) Greenheck
      b) Twin City.

B. Fan Unit: V-belt or direct driven as indicated, with steel wall sleeves, rain hood, barometric backdraft damper, HOA Switch, Thermostat, resilient mounted motor; 1/2 inch mesh, 16 gage aluminum birdscreen.

C. Electrical Characteristics and Components, Single Phase Motors.

1. Motor: Refer to Section 15170.
2. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
3. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor and solid state speed controller.

D. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with nylon bearings.

E. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position.

F. Fan shaft with self aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Install fans as indicated. Install with resilient mountings and with flexible electrical leads.

C. Provide fixed sheaves required for final air balance.

D. Provide safety screen where inlet or outlet is exposed.

END OF SECTION

SECTION 23 82 39

UNIT HEATERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Unit heaters.

1.2 REFERENCES

A. ARI 443

1.3 SUBMITTALS FOR REVIEW

A. Section 230000 – Mechanical General .

B. Product Data: Provide typical catalog of information including arrangements.

C. Shop Drawings:
1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
2. Submit schedules of equipment and enclosures, typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required vs. actual heat output.
3. Indicate mechanical and electrical service locations and requirements.
4. Include all performance data.

1.4 SUBMITTALS FOR INFORMATION

A. Manufacturer's Instructions: Indicate installation instructions and recommendations.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

A. Division-1: Contract Closeout - Operation and Maintenance Data, Procedures for submittals.

B. Project Record Documents: Record actual locations of components.

C. Operation and Maintenance Data: Include manufacturer’s descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owners name and registered with manufacturer. Include copies of warranties in the O & M Manual with warranty dates included.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.7 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc.

1.8 EXTRA MATERIALS

A. Provide two sets of filters. Provide a written receipt of filters from CMS Maintenance staff and included in the O & M Manual.

PART 2 PRODUCTS

2.1 UNIT HEATERS

A. Manufacturer: Modine

B. Other acceptable manufacturers offering equivalent products.
1. Airtherm.
2. Sterling.
3. Trane.

C. Casing: 0.0478" (1.2 mm) steel with threaded pipe connections for hanger rods.

D. Finish: Factory applied phosphatized baked enamel color.

E. Fan: Direct-drive propeller type, statically and dynamically balanced, with fan guard.

F. Air Outlet: Adjustable pattern diffuser on vertical models and four way louvers on horizontal throw models.

G. Motor: Except as noted, permanently lubricated sleeve bearings on horizontal models, grease lubricated ball bearings on vertical models 1/3 H.P. and larger.

H. Provide FM approved natural gas fuel train complete with valves, regulators, strainers, fittings, etc.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Unit Heaters: Hang from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

3.2 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

END OF SECTION

MCKIM AND CREED PROJECT NO. 7002-0001

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SECTION 26 01 00- BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 REQUIREMENTS

A. General Conditions of the Contract, Special Conditions, Instructions to Bidders, and other General Requirements contained in Division 1 and 2 are a part of these Specifications.

1.2 EXTENT OF THE WORK

A. This Contractor shall furnish all labor, materials, and equipment, and perform all operations necessary for installation of complete electrical work within the intent of, and as indicated on, the drawings and as herein specified.

1.3 REGULATIONS AND COMPLIANCE

A. Latest editions of the National Electrical Code and the North Carolina State Building Code govern this work. All their requirements shall be satisfied. Also the requirements of the N.C. Department of Administration, State Construction Office shall be met.

B. This Contractor shall secure and pay for all permits, fees, inspections, and licenses if any are required. Upon completion of the job he shall present to the Engineer a certificate of inspection and approval from the inspection authorities.

C. Contractor shall coordinate all necessary power outages with Swain County Department of Transportation as required by giving a 30 day written notice. No power shall be applied to facility or equipment until an inspection and certificate is obtained from the State Construction Office Electrical Inspector of the State Construction Office.

D. Contractor shall notify the Swain County Department of Transportation for the location of all underground utilities prior to digging. Contractor must obtain a digging permit prior to beginning work.

E. Contractor shall notify the State Construction Office of the NC Department of Administration to schedule all required inspections with the State Electrical Inspector. A certificate of completion is required on electrical work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials shall be new, with required Underwriter's Laboratories (or other agency approved by the State) label, and with manufacturer's label or nameplate giving complete electrical data.

B. Where a manufacturer's catalog number is used, all parts shall be furnished to make it complete and to fit the construction intended.

C. Within ten days after award, Contractor shall submit to Engineer a complete list in triplicate of all materials he proposes to use. List shall show a single manufacturer with not only major materials and equipment, but also such items as condulet fittings, raceway supports, conductive pipe thread compound, asphaltum, sealing material, clamps, anchors, outlet boxes, gutters, terminal cabinets, wire-pulling compound, splice connectors, tape, wire markers, lamps, etc.

D. Material shall be the make and number given in these Specifications or shown on Drawings, or equivalent where specifically stated as being allowed. Equivalent items or materials will be subject to acceptance by the Engineer at submittal stage. If Contractor wishes to furnish a make or number other than that specified (or equivalent where allowed), he shall furnish complete, detailed data and obtain approval of the substitution in writing from the Engineer no later that 10 days prior to bid. In some cases, at the request of the Engineer, samples of the substitute items shall be submitted for review. Data (and sample if required) shall be submitted in a timely manner such that approval by Engineer can be returned to Contractor no later than 10 days prior to bid date. Data or sample not submitted in sufficient time to allow evaluation by Engineer will be automatically rejected.

E. Engineer's review of samples, cut sheets, shop drawings, and other matter submitted by the Contractor shall not relieve the Contractor of responsibility for full compliance with the Drawings and Specifications. If a submitted item does not comply in any way (color, style, quality, function, or performance), Contractor shall call the specific non-compliance to the attention of the Engineer in writing in a cover letter to the submittals requesting a deviation from specifications. This does not imply that approval of requested deviation will be given, only that it will be reviewed.

F. Engineer's review of submittals is not intended to confirm quantity counts of materials and equipment made by Contractor. Contractor is required to provide quantities of items as necessary for systems to function as described and shown on the plans and in these specifications.

G. Specialty systems such as fire alarm systems, etc., that are included as part of the Electrical Contract shall be furnished and installed by an authorized representative of the manufacturer of the equipment supplied. This includes use of factory trained and authorized installers where required to fulfill manufacturer's warranty provisions.

H. Submit cuts of fixtures, shop drawings on panels, and other descriptive materials requested, in six copies, or as required by the General Requirements section. Submittals will not be accepted or reviewed by the Engineer unless the electrical contractor's stamp signifying his review and approval is evident on the submittals.

I. Materials should be inspected upon their arrival at the site to be sure they are correct. No extension of time for completion will be allowed because materials received are wrong. Completely adequate housing shall be provided on the site for orderly and careful storage of all materials and equipment. Nothing shall be stored outside except conduit, which may be stored in racks so it is at least 12 inches above ground and not subject to mud being spattered on it.

2.2 PAINTING

A. Suitable finish coatings shall be provided under this section of the Specifications on all items of electrical equipment and wiring which are exposed. This shall consist of either an approved factory applied finish or an acceptable finish applied during or after installation. Equipment which is furnished in finishes such as stainless steel or satin aluminum are not to be painted. Exposed equipment and/or wiring in finished areas such as panel covers or surface raceway shall be supplied with factory applied prime coat and shall be professionally painted or enameled as directed to result in a completely coated and attractively finished manner. All such finishing shall be as directed by and shall be satisfactory to the Engineer.

PART 3 - EXECUTION

3.1 COORDINATION WITH OTHER TRADES

A. Coordinate all work of each section with work of other sections to avoid interference. Bidders are cautioned to check their equipment against space available as indicated on drawings and shall make sure that proposed equipment can be accommodated. If interferences occur and clearances cannot be maintained as recommended by the manufacturer and as required for maintenance and inspection of equipment and by NEC, Contractor shall bring them to the attention of Architect/Engineer, in writing, prior to signing of contract; or, Contractor shall, at his own expense, provide proper materials, equipment and labor to correct any damage due to defects in his work caused by such interference.

B. Prepare coordination drawings at scale of ¼"= 1'.0" or larger, detailing major elements, components and systems of electrical and mechanical equipment and materials in relationship with other systems, installations and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the work. The Mechanical Contractor will administer the effort of coordination between various trades. Other trades will use the coordination drawings prepared by the Mechanical Contractor to show their equipment and materials for coordination between trades. The coordination drawings will be prepared before installation of any P, M, E work and will be shown as a task on the project schedule to be prepared by the GC.

3.2 GENERAL INSTALLATION

A. The electrical drawings are diagrammatic only, and are intended to explain system function and define quality of materials and installation. They are not intended to define construction methods.

B. Contractor shall keep on the site at all times one set of electrical drawings and specifications, and one set of drawings and specifications on the work of other trades. In addition, one complete set of all electrical submittals and shop drawings shall be maintained at the site by the electrical contractor.

C. The electrician shall check other trades' drawings, specifications, and shop drawings to see if there are any conflicts. If so, he shall contact the Engineer for instructions.

D. The Contractor shall properly protect his work against damage by weather or other trades. All work shall be left well cleaned, and damaged finishes shall be restored to original condition.

E. The Contractor shall place his own sleeves and notify other trades of chases and openings far enough ahead so they can be properly built in. Where any raceways, supports, etc., installed under the contract pierce the roof, suitable pitch pockets shall be provided and coordinated with the roofing contractor as necessary to be acceptable to the Engineer. Provide suitable fittings where any raceways or equipment cross expansion joints.

F. This contractor shall be responsible for all trenching, backfilling, cutting, core drilling, and patching related to his work.

G. Contractor should not scale drawings for outlet and equipment locations. Unless specifically dimensioned on drawings or defined in specifications, outlets and equipment shall be located as evidently intended or as detailed on Architectural drawings. Lighting outlets are to be centered or spaced symmetrically unless they are dimensioned. Any dimensions shown on the drawings shall be verified in the field by the contractor prior to roughing. All outlet and equipment locations shall be coordinated with the other trades. If any doubt arises, contact the Engineer prior to roughing.

H. Contractor shall keep premises free of debris resulting from this work.

3.3 TESTS AND GUARANTEES

A. All current-carrying phase conductors and neutrals shall be tested as installed, and before connections are made, for insulation resistance and accidental grounds. Each fixture and item of equipment for connection under the Contract shall be tested for insulation resistance from its conductors to its grounded surface or contact. These tests shall be performed with a 500 volt (minimum) high voltage "megger."

B. Minimum readings shall be one million (1,000,000) or more ohms for #6 AWG and smaller wire, 250,000 ohms or more for #4 AWG and larger wire, between conductors and between conductor and the grounding conductor.

C. The contractor shall send a letter to the engineer and the State Construction Office certifying that the above has been done and showing the tabulation of the megger readings for each panel or feeder. This shall be done at least four (4) days prior to final walk-through by engineer and the State Construction Office (SCO).

D. At final walk-through by the engineer and the SCO, the contractor shall furnish a megger and demonstrate that the panels comply with the above requirements. He shall also furnish a clamp-on type ammeter and a voltmeter to take current and voltage readings as directed by the engineer or the SCO representatives.

E. Validity of the ground path shall be assured by constant and careful attention to the thorough tightening of all couplings, connectors, locknuts, screws, bolts, etc., and by frequent checking of the path resistance with a quality low-range ohmmeter. Resistance of the path should not exceed one ohm between any two points. If a reading in excess of this is observed, it shall be discussed with the Engineer for an appraisal of the condition.

F. Contractor shall guarantee that the work is done in accordance with drawings and specifications, and that it is free of imperfect materials or defective workmanship. Anything unsatisfactory shall be corrected immediately and at Contractor's expense.

G. For the period of one year after acceptance by the Owner, the Contractor shall replace, without any expense to the Owner, any imperfect materials or defective workmanship.

3.4 RECORD DRAWINGS/MANUALS

A. Upon completion of the installation, Contractor shall submit to the Engineer marked prints of Drawings showing any changes made in circuits, location of equipment, panelboards, or any other revision in the Contract Drawings, for the Owner's use in maintenance work and for future additions and expansions. Marked changes shall also include changes due to change orders unless already recorded by revised drawing or bulletin drawing.

B. These record drawings shall be submitted in one of two formats: either a clean, legible, marked set of prints with all markings in distinguishable colored pencil such as red; or a set of reverse-run reproducible sepia prints marked in soft pencil so that prints can be reproduced as required. The format to be used shall be as defined in the General Requirements section of the contract documents. If no format is defined, the marked prints shall be submitted.

C. Operation and Maintenance manuals shall be submitted to the Engineer at the end of the project prior to closeout of the project. Information included shall be a copy of all submittal data, shop drawings, and necessary operating and maintenance instructions and wiring diagrams on all major items of equipment and all special systems (fire alarm, intercom, etc.). Submit these manuals in the quantities and format described in the General Requirements Section.

END OF SECTION 26 01 00

SECTION 26 01 01- SHOP DRAWINGS AND SUBMITTALS

GENERAL

1.1 REQUIREMENTS

A. General Conditions of the Contract, Special Conditions, Instructions to Bidders, and other General Requirements contained in Division 1 and 2 are a part of these Specifications.

1.2 DEFINITIONS

A. Shop Drawing: Project shop drawings and other data prepared specifically for fulfillment of the project requirements. Shop drawings include fabrication, layout, wiring diagrams, erection, setting, coordination and similar drawings and diagrams, and include performance data associated therewith, including weights, capacities, speeds, outputs, consumption, efficiencies, voltages, amperages, cycles, phases, noise levels, operating ranges and similar information.

B. Samples: Units of typical work, materials or equipment items, showing the workmanship, pattern, trim and similar qualities proposed for the work to be provided, as designated.

C. Manufacturer's Data: Product manufacturer's standard printed product information, including promotional brochures, product specifications, installation instructions and diagrams, statements of compliance with standard performance charts or curves, and similar information concerning the standard portions of the manufacturer's products.

D. Test Reports: Specific reports prepared by independent testing laboratories and others, showing the results of specified testing on either the material/equipment provided or on identical material/equipment, and on installed electrical systems.

E. Industry Standards: Printed copies of the current standards recognized in the industry. Current means the latest issue as of the date of these specifications, unless otherwise indicated; within the text of these specifications the date-suffix frequently shown with identification numbers has been omitted.

F. Manufacturer's Product Warranties: Manufacturer's standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be performed for the Purchaser or Owner by the Manufacturer, when and if the product fails within certain operational conditions and time limits.

G. Operating Instructions: The written instructions by the manufacturers, fabricators, or installer of equipment or systems, detailing the procedures to be followed by the Owner in operation, control and shut-down of each operating item of the equipment and each electrical system.

H. Maintenance Manuals: The compiled information provided for the Owner that certain acts of restitution will be performed when and if certain portions of electrical work fail within certain operational conditions and time limits.

1.3 SUBMITTAL FORM AND PROCEDURES:

A. General: Comply with Division 1 requirements for identification, quantities processing, scheduling and similar general requirements applicable to electrical submittals, except as otherwise indicated.

B. Quantities: Provide quantities as listed in the General Conditions or as otherwise indicated in the Division 26 Specifications.

C. Substitutions: Electrical submittals are not opportunities for gaining acceptance of substitutions. Where three or more manufacturers are specified by name, or by catalog reference, Contractor shall select for use any of those so specified.

D. Should contractor desire to substitute another manufacturer's equipment for one specified by name, the contractor shall apply in writing at least 10 days prior to bid date for such permission. He shall provide supporting data and samples for Engineers consideration. No substitution shall be made for any material, article, or process required under the contract unless approved by the Engineer.

E. Operating Instructions: The written instructions by the manufacturer, fabricator, or installer of equipment or systems, detailing the procedures to be followed by the Owner in operation.

F. Response to Submittals: Where standard product data have been submitted in fulfillment of project requirements, it is recognized that the submitter has already determined that the products fulfill the specified requirements, and that the submittals are for the Architects' or Engineers' information only, but will be returned without action where observed to be non-complying with the requirements. Where uniquely prepared information is submitted, it is recognized to represent the preparer's interpretation or solution to the specified requirements, subject to the Architects', or Engineers' concurrence and appropriate action as indicated in Division 1.

G. Shop Drawings and Samples: After checking and verifying all field measurements, the Contractor shall submit to the Engineer for review, in accordance with the accepted schedule of shop drawings submissions, copies of all shop drawings, which shall have been checked by and stamped with the approval of the Contractor and identified as the Engineer may require. The data shown on the shop drawings shall be complete with respect to dimensions, design criteria, materials of construction and the like to enable the Engineer to review the information as required.

H. The Contractor shall also submit to the Engineer for review, with such promptness as to cause no delay in work, all samples required by the Contract Documents. All samples shall have been checked by and stamped with the approval of the Contractor, identified clearly as to material, manufacturer, any pertinent catalog numbers and the use for which intended.

I. At the time of each submission, the Contractor shall in writing call the Engineer's attention to any deviations that the shop drawings or sample may have from the requirements of the Contract Documents.

J. No work requiring a shop drawing or sample submission shall be commenced until the submission has been reviewed by the Engineer. A copy of each shop drawing and each approved sample shall be kept in good order by the Contractor at the site and shall be available to the Engineer.

K. The Engineer's review of shop drawings or samples shall not relieve the Contractor from his responsibility for any deviations from the requirements of the Contract Documents unless the Contractor has in writing called the Engineer's attention to such deviation at the time of submission and the Engineer has given written approval to the specific deviation, nor shall any review by the Engineer relieve the Contractor from responsibility for errors or omissions in the shop drawings.

L. The Contractor's shop drawing stamp shall indicate that the shop drawings have been checked for conformity to the Contract Documents and appropriate means have been taken to insure that the material and /or equipment will fit into the space available. Shop drawings will be returned without review if the submittals do not have the Contractor's stamp or the submittals have not been reviewed by the Contractor.

M. The Engineer's review of shop drawings is for general conformance with design concept only. The Contractor is responsible for all quantities, dimensions and coordination of the work of all trades. Corrections or comments made on the shop drawing during this review do not relieve the contractor from compliance with requirements of the contract documents. The Contractor is responsible for selecting fabrication processes and techniques of construction and for performing all work in a safe and satisfactory manner.

N. The Contractor shall stamp the shop drawings and submittals and verify by his/her signature that the shop drawings and submittals have been checked for compliance with the contract documents.

O. The Contractor shall provide TABLE 1.3 as a cover letter with the submittals. The "Date Submitted" column shall be filled in by the Contractor. The remaining three columns are for the Engineer's use.

P. Table 1.3 may not identify all required submittals. Contractor to refer to individual specification sections and provide shop drawings in addition to those required in Table 1.3.

TABLE 1.3 - Shop Drawings Required

Shop Drawings and Submittals Required for this Project	Date Submitted by Contractor	Date Received by Engineer	Date Returned by Engineer	Status (Approved, Approved as Noted, Rejected, etc…
26 05 03 – Equipment Connections				
26 05 19 – Wires and Cables				
26 05 48 – Seismic Requirements				
26 09 23 – Occupancy Sensors				
26 24 16 – Panelboards				
26 27 26 – Electrical Distribution System				
2 643 13 – Surge Protective Devices				
26 50 00 - Lighting				

I have reviewed the shop drawings and submittals listed above for compliance with the contract documents.

_____
Contractor's Signature

1.4 GENERAL SUBMITTAL REQUIREMENTS:

A. Applicability: Wherever it is indicated that a shop drawing, sample, manufacturer's brochure, certification, test, copy of standard operating instruction, manual, extra stock, guarantee or warranty is required, the appropriate submittal is required regardless of whether it is specified as a "submittal"; the Architects' or Engineers' decision shall be final.

END OF SECTION 26 01 01

SECTION 26 05 03- EQUIPMENT CONNECTIONS

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Motors, controllers, and other special equipment are provided and installed by other trades. This section specifies typical connections to that equipment.

B. All individual motor starters or VFD's for mechanical equipment (fans, pumps, etc.) shall be furnished and installed by the Mechanical Contractor. Under Division 26, power wiring shall be provided to starters or disconnect switch line side. Power wiring on the load side shall be by Division 23 or the division supplying equipment. All control wiring shall be furnished by the Mechanical Contractor or division supplying the equipment.

PART 2 - PRODUCTS

2.1 EXHAUST FANS

A. Exhaust fans are indicated by special symbol on plans. Unless otherwise noted, they will be furnished and set by others and connected by the Electrical Contractor. Controller will be provided by others. Electrical Contractor shall provide a local disconnect switch at fan if unit is not provided with one. Wiring on the load side of Disc SW is by Division 23.

2.2 UNIT HEATERS

A. Unit heater, ventilator, cooler, or similar outlets - designated by special symbol - are located approximately on drawings. Exact location of outlet shall be obtained from Heating, Ventilating, and Air Conditioning Contractor. Unless indicated otherwise, outlet shall be a 4" box fitted with an oversized blank cover with 1/2" center knockout, mounted in wall or ceiling, and fed on circuit shown beside symbol. These outlets shall be located behind or within equipment cabinets where possible and still be accessible. Provide local disconnect switch if one is not provided with unit. Unless specified otherwise herein or on drawings, power connection to the outlet will be by the Electrical Contractor and from outlet to equipment will be by the Mechanical Contractor. Control wiring will be done by the Mechanical Contractor.

2.3 TROUGHS

A. Electrical troughs, junction boxes, switches, or breakers for air conditioning, heating, or plumbing equipment are indicated on drawings. Exact locations shall be obtained from Heating and Air Conditioning or Plumbing Contractors but Code clearances shall be maintained. Unless specifically noted otherwise, all power wiring for equipment and controllers beyond these points will be done by Heating and Air Conditioning or Plumbing Contractors. Control wiring will be by Heating and Air Conditioning or Plumbing Contractors.

2.4 OTHER

A. Other equipment connections are generally indicated on drawings by a special symbol. These are then defined in notes or details. Where catalog numbers, models, or types, and manufacturer's name are given, these items of equipment shall be furnished and installed by the Electrical Contractor, unless specifically noted otherwise. Provide disconnect switch if one is not furnished with equipment.

B. Junction box - designated as a circled J. Size of such boxes is generally noted on drawings. Where this is not done, they shall be sized in accord with NEC and purpose evidently intended.

C. Where unscheduled junction boxes are used by Contractor to facilitate wiring or to comply with limits of elbows and bends, they shall be concealed if at all possible to do so and still be left accessible. If this is impossible, they shall be recessed in walls or ceilings and provided with an oversized cover which shall be painted out to match adjacent surfaces. If it is necessary to mount such boxes exposed, the location shall be approved by the Engineer.

D. All contactors, motor starters and combination type starters specified under this contract shall be equipped with Hand-Off-Automatic switches, pilot (run indicating) light, 120 volt control transformer, and two sets of auxiliary contacts. The switch and light shall be located on the unit cover. Starters shall be Square D, Cutler-Hammer, General Electric Co., or equivalent by others.

A. All safety switches shall be heavy-duty type, NEMA 1 for indoor and NEMA 3R for outdoor use unless specifically stated otherwise. They shall be fused type unless specifically indicated otherwise on plans. Fused type shall be equipped with Bussmann Fusetron type fuses, or approved equivalent. Fused type (600 volts or less) shall be equipped with the following: Service Entrance and Feeder Circuits over 600A – Class L, UL Listed, current limiting with 200K interrupting rating; Service Entrance and Feeder Circuits 600A and less – Class RK1 or J, UL Listed, current limiting with 200K interrupting rating; Motor, Motor Controller and Transformer Circuits – Class RK5, UL Listed, current limiting time delay with 200K interrupting rating; and individual Equipment where fault current does not exceed 50kA – Class K5, UL Listed, with 50K interrupting rating. Fusible safety switches with short circuit withstand rating of 100K or 200K shall include Class R or Class J rejection fuse block feature. Switches shall be equipped with defeatable door interlocks and padlocking provisions in the on and off positions. Padlocks shall be provided for switches located in public areas. Switches shall be by Square D, Cutler-Hammer, General Electric Co., or equivalent by others. In addition, safety switches shall be provided with the following requirements or features:

1. Safety switches shall be third party listed.
2. Switches shall have door interlocks that prevent the door from opening when the operating handle is in the “on” position.
3. Switches shall have handles whose positions are easily recognizable in the “on” or “off” position. For safety reasons, padlock shall be provided for switches unless they are located in a locked electrical room.
4. Switches shall have positive quick make-quick break mechanisms.
5. Switches shall be properly labeled. Refer to Specification 260553.

E. The Electrical contractor is to provide to the Owner as spares, 10% of the quantity of fuses used of each type and rating, with a minimum of one (1) set of each type.

F. All safety switches, motor starters, or other boxes or panels, designated as NEMA 3R or otherwise intended for outdoor use or use in wet areas, shall use rain-tight conduit hub fittings with bonding screw.

G. Control wiring shall not be installed in the same raceways as power wiring.

PART 3 - EXECUTION

3.1 NOT USED

END OF SECTION 26 05 03

SECTION 26 05 19- WIRES AND CABLES

PART 1 - GENERAL

1.1 REQUIREMENTS

A. All material shall be U.L. listed and shall be installed in conformance with the National Electrical Code.

B. All conductors and cables specified in 260519 shall be defined for use at 600 volts and below.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufactured by American/Leviton, Hi-tech, Rome, or Triangle, General Cable, Prysmian, Southwire, United, Cerro or Encore.

B. Normal trade standard "building wire" of copper.

C. Number 10 and smaller shall be solid; number 8 and larger shall be stranded.

D. Maximum conductor size shall be 500 kcmil.

E. All sizes shall bear easily readable size and insulation grade marking along entire length.

F. Insulation on #6 and smaller shall be suitably colored in manufacturing. Conductors #4 and larger may be identified with bands of proper color plastic tape near each termination and in each junction box.

G. Insulation on service and feeders shall be 600 volt Type XHHW or THHN/THWN unless shown otherwise on the drawings.

H. Branch circuits shall be a minimum of #12, with 600 volt THHN/THWN insulation unless Code requires another type. Circuit wires carried through rows of fluorescent fixtures shall be at least Type RHH or THHN.

I. Conductors in any location subject to temperatures higher than 60^{O}C shall have insulation of a type approved by NEC for temperature encountered.

J. Control and signal conductors shall be type and size indicated in those sections of the Specifications, or as indicated on drawings.

K. Fire alarm and control wiring shall have stranded copper conductors.

2.2 VFD CABLE REQUIREMENTS

A. Provide and install VFD rated cable installed in conduit between variable frequency drive and motor.

B. Cable:

1. The cable shall be 600V/1000V rated, with stranded tinned copper conductors, shielded, suitable for use with Variable Frequency Drives and UL listed for the purpose.

2. The insulation shall be rated for 90 degrees Celsius Wet/Dry operating temperature.

3. Cable shall be suitable for use in wet/dry locations, indoors and outdoors for use in conduits and in underground ducts.

C. Conductor: The conductor shall be annealed stranded tinned copper per ASTM B3, B8, and B33.

D. Insulation:

1. The insulation thickness shall have a minimum average wall thickness of 30 mils. The insulation material shall be XLPE with a XHHW-2 listing per UL44. Each insulated conductor shall be identified by color code.

2. The insulated conductors are to be cabled together with a three (3) ground wires symmetrically placed in the interstices between the phase conductors each touching the shield.

3. Fillers shall be included as necessary to make the cable round.

E. Shielding: The cables assembly shall be shielded by applying helically two (2)-mil copper tapes. The shield shall provide 100% coverage over the assembly.

F. Jacket:

1. All cables shall have a continuous overall outer sheath of Polyvinyl Chloride (PVC), suitable for 90°C use.

2. The jacket shall have identification with permanent markings that shall be clearly embossed or printed at approximately 2 foot intervals on the outer jacket for the entire length of the cable as follows: Manufacturer's name and/or Trade Mark; Number of Conductors and size (--AWG); Type of Insulation (XLPE) or NEC Listed Conductor Type (XHHW-2); Voltage Rating.

G. Submittals: Submit manufacturer's product data for cables to the Engineer. Cable data shall include both physical and electrical characteristics of conductor and insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All wiring shall be color coded:

1. On 120/208 volt, 3 phase, 4 wire systems - phase A, black; phase B, red; phase C, blue; neutral, white. On 277/480 volt, 3 phase, 4 wire systems - phase A, brown; phase B, orange; phase C, yellow; neutral, natural gray. Ground conductor on all systems shall be green.

2. Unless noted or accepted otherwise, busses in panels and switchgear shall be considered "A", "B", and "C" from left to right, top to bottom, or front to back when facing equipment.

3. Control wiring shall not use black, red, or blue; but shall use white for neutrals and green for grounding. Any other colors may be used but the coding shall provide same color between any two terminals being joined.

4. Switchlegs, including "travelers" in 3-way and 4-way switching systems, shall be same color as phase leg.

B. Joints in #10 and smaller wire may be either made with approved twist-type connectors such as Ideal, Buchanan, T&B, Scotch, etc. “Stakon” or other permanent type crimp connectors shall not be used for branch circuit wiring.

C. Joints in #8 and larger wire shall be made with approved Burndy, T&B, or O.Z. Manufacturing Co., mechanical pressure type connectors or lugs along with their UL approved insulating covers.

D. Manufactured insulators for connectors may be used, provided they cover completely and securely all exposed metal. If joints and splices are taped, they shall be carefully covered with top-grade Okonite, Scotch Brand, or approved equivalent plastic or rubber and friction, laid on with half laps to result in a joint insulation equivalent to that of the conductor insulation.

E. Circuit joints shall not be made on twin screws of convenience receptacles. Make joints as described above and run single leads to receptacle.

F. All wiring lugs throughout the project, including, but not limited to, breakers, panelboard/switchboard lugs, safety switch lugs, and transformers lugs, shall be rated for use with 75 degree conductors sized in accordance with NEC Table 310-16.

G. Wm. Brady Co., or approved equivalent, labels or the type made with a punch on plastic tape, giving the circuit number, shall be securely fastened to each branch circuit conductor within panelboards. They shall also be installed on all conductors within junction boxes, pull boxes, gutters, wireways, cabinets, or equipment where two or more wires of the same color occur.

H. Where connected under screw or bolt heads, stranded wire shall be fitted with a lug of proper size. Make solid conductor loops clockwise so as to be forced closed as screw is tightened. Only one solid wire loop may be held under a single screw.

I. Make all connections tight.

J. Wires within panelboards, terminal cabinets, and similar equipment shall be neatly squared, "bunched" together, and held so with plastic ties at several places.

K. Where paralleling of conductors is shown for feeders or service entrance, it is absolutely required they be exactly the same length between points of bonding together. Lay out side by side and cut to same length before drawing into raceways. Provide for each end of run a Burndy Q2A or W3A lug, or approved equal, and terminate parallels in these without cutting.

L. Provide and install shielded cable from VFD to the motor installed in conduit. Terminate all cable in accordance with the manufacturer’s recommendations.

M. Voltage Drop Requirements:

1. Conductors for branch circuits shall be sized to prevent a voltage drop exceeding three percent (3%) at the farthest outlet of power, heating and lighting loads, or any combination of such loads. The maximum total voltage drop on both feeders and branch circuits to the farthest outlet shall not exceed five percent (5%).

2. Where the conductor length from the panel to the first outlet on a 277-volt circuit exceeds 125 feet, the branch circuit conductors from the panel to the first outlet shall not be smaller than #10 AWG.

3. Where the conductor length from the panel to the first outlet on a 120-volt circuit exceeds 50 feet, the branch circuit conductors from the panel to the first outlet shall not be smaller than #10 AWG.

N. All wire and cable shall be run in raceway.

END OF SECTION 26 05 19

SECTION 26 05 26- GROUNDING AND BONDING

PART 1 - GENERAL

1.1 REQUIREMENTS

A. All systems and equipment shall be grounded in accordance with NEC Article 250.

B. The raceway system shall not be relied on for ground continuity. A green grounding conductor, properly sized per NEC Table 250-122, shall be run in ALL raceways except for telecommunications, data, audio conductors raceways and PVC conduits installed for services.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufactured by Thomas & Betts, Burndy, OZ Gedney, Steel City or approved equivalent. Thomas & Betts model numbers are used herein to establish quality and type of product required for project.

B. Bonding shall be done with #3800 series insulated bonding bushings and compression type lugs.

C. Grounding conductor shall be Type THHN/THWN run in heavy wall conduit, and of size shown on drawings or required by NEC.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The main service ground clamp shall be attached to the cold water main at an accessible point and before its size is reduced immediately, within five (5) feet, after it enters the building. Clamp shall be accessible after construction is complete. Grounding conductor shall be without splice into the service enclosure where it shall be connected to main service neutral.

B. In addition to the clamp on the water main, a supplemental electrode shall be provided. This supplemental electrode shall consist of the following:

1. Three (3) 10 foot minimum copper clad ground rods, 3/4" in diameter, driven to a depth so top of rod is below finished grade. Grounding conductor shall be continuous and sized as shown on plans. The grounding conductor conduit shall be fastened to service enclosure with double locknuts and bonding bushing.

C. In addition, the metal frame of the building shall be bonded to the grounding electrode system using a conductor sized the same as the main grounding conductor on the drawings.

D. Upon completion of installation of the grounding electrode and bonding system, the ground resistance shall be tested with a ground resistance tester. Resistance to ground shall be less than 25 ohms. If test indicates a greater resistance, appropriate measures shall be taken, including driving additional ground rods, to reduce the resistance to less than 25 ohms.

Contractor shall send a letter to the engineer and State Construction Office certifying that the ground resistance test has been performed and stating the resistance measured. Also, a copy of the ground resistance test report shall be sent to the Engineer and the State Construction Office.

E. The size of ground rods shall not be less than 3/4” in diameter and 10 feet in length.

F. Any feeder raceway anywhere in the system which enters a box or cabinet through part of a concentric or oversized knockout shall be fitted with an insulated bonding bushing and jumper. These bushings shall also be used wherever conduits stub into switchboards or transformer cabinets. Grounding type insulated bushings shall always be used on both ends of conduits feeding panelboards. The bonding jumper shall be sized by NEC Section 250 and lugged to the box.

G. Ground all fixed and portable appliances and equipment connected under this Contract with a green grounding conductor. This wire shall be carried inside the raceway and flex from equipment to nearest grounded portion of raceway system. Connect at both ends with suitable lugs.

H. All grounding type receptacles shall have a green wire jumper from their grounding terminal to box in which mounted. Attach jumper to box, not plaster ring, with a bolt or Steel City #"G" grounding clip or approved equal. Jumper shall be sized by NEC with #12 minimum.

I. Bond the aboveground portion of the gas piping system upstream from equipment shutoff valve to the building electrical service ground. The bonding jumper shall be sized per NEC Table 250-66.

END OF SECTION 26 05 26

SECTION 26 05 33- RACEWAY, BOXES, AND SUPPORTS

PART 1 - GENERAL

1.1 REQUIREMENTS

A. All material shall be U.L. listed and shall be installed in conformance with the National Electrical Code.

PART 2 - PRODUCTS

2.1 RACEWAYS

A. Galvanized steel manufactured by Allied, Triangle, Wheatland or approved equivalent.

B. All conduits shall be provided with insulated throat.

C. Rigid metal conduit (RMC) shall be used for feeders leaving all freestanding switchboards, switchgears, and all panel feeders. Raceways used in service entrance concrete ductbanks shall be PVC Schedule 40, except for the stub-ups and elbows which shall be RMC. RMC shall be used for feeder or branch circuits exposed to weather unless shown otherwise on plans. RMC shall also be used where indicated on plans. RMC shall be used in all mechanical rooms and masonry partitions. Where exposed and subject to damage RMC shall be used below 8' AFF, Above Finished Floor, in the balance of the facility and Electric Metallic Tubing, EMT, can be used above 8' AFF for general branch circuits in the balance of the facility. Provide RMC for any metal raceway larger than 2 inches in diameter.

D. Electric metallic tubing (EMT) may be used for general branch circuits unless indicated otherwise on plans or stated otherwise in these specifications. Provide a junction box for transition between EMT and rigid conduits. EMT shall not be installed in any location where exposed or subject to severe physical damage, severe corrosive influence, underground, in/below slab-on-grade, in earth or in concrete, cinderblock or brick walls.

E. EMT couplings and connectors shall be compression-gland type of malleable steel, galvanized or sherardized. Connectors shall be insulated-throat type. Set screw, indentor, or cast type fittings are not acceptable.

F. All service entrances shall be concrete encased schedule 40 PVC.

G. Use PVC conduit underslab and underground only as noted on the drawings, or specified here-in. No exposed PVC allowed. Fittings for PVC shall be U.L. listed for the use, and shall be installed per the manufacturer's instructions. Underslab PVC conduit runs shall utilize RMC elbows and RMC up through slab, and transition to EMT in drywall partitions or RMC in masonry walls. Use PVC for underground outdoor branch circuits and underslab branch circuits. Bends in PVC shall be made by methods approved by the manufacturer and the NEC. PVC schedule 40 shall not be used exposed or concealed in gypsum walls, but may be used in CMU walls. PVC schedule 40 may be used in elevated floor slabs and in the foundation slabs. The minimum concrete cover shall be ¾ inches at finished or formed surface and shall be 3 inches at concrete surface cast against earth or for slabs placed on grade. Greater amounts of concrete cover shall be used in areas subject to demage or correction. Installed system shall comply with the

minimum requirements of ACI 1318 Chapter 6.

H. Galvanized "flex" in dry and "sealtite" in wet locations shall be used for connection to mechanical equipment or transformers, or for lighting fixture whips. Green ground wire shall be installed and NEC followed. Flex runs shall be no greater than six feet in length.

2.2 BOXES

A. Manufactured by Midland Ross/Steel City, T&B, Raco, or Appleton.

B. Galvanized or aluminum of gauge required by NEC.

2.3 FASTENINGS AND SUPPORTS

A. Shall be of good quality, galvanized steel or other non-corroding material.

PART 3 - EXECUTION

3.1 RACEWAY INSTALLATION

A. Minimum raceway size shall be 1/2" unless noted otherwise. Minimum raceway size for raceways run underground external to the building shall be 3/4” and shall be approved by the NEC as “suitable for direct burial”.

B. All runs of empty conduit only shall have a 100# nylon pull rope installed in the conduit.

C. Rigid metal conduit shall be made up with full threads to which T&B "Kopre-Shield" compound has been applied, and butted in couplings.

D. Z. Split or "Erickson" couplings where necessary.

E. Where it is necessary to run underneath a concrete slab poured on-grade, conduit shall be buried in trench beneath gravel base and turned up through slab.

F. Underground runs, except under concrete floor slabs, shall have a minimum of 24" cover. Backfill shall be made in 6" layers - tamping each layer to a density of 95% of maximum possible.

G. Raceways run external to building foundation walls, with the exception of branch circuit raceways, shall be encased with a minimum of 3” of concrete on all sides. Unless noted otherwise encased raceways shall have a minimum cover of 18”, except for raceways containing circuits with voltages above 600 volts, which shall have a minimum cover of 30”.

H. Encased raceways shall be of a type approved by the NEC as “suitable for concrete encasement”.

I. Branch circuit raceways run underground external to building foundation shall be run in raceways installed in accordance with the NEC, and shall be of a type approved by the NEC as “suitable for direct burial”.

J. All underground raceways shall be identified by underground line marking tape located directly above the raceway at 6” to 8” below finished grade. Tape shall be permanent, bright colored, continuous printed, plastic tape compounded for direct burial not less than 6” wide and 4 mils

thick. Printed legend on tape shall indicate general type of underground line below.

K. Where underground raceways are required to turn up to cabinets, equipment, etc., and on to poles, the elbow required and the stub-up through the slab or earth to equipment shall be of rigid steel conduit.

L. Where passing through a “below grade” wall from a conditioned interior building space , raceways shall be sealed utilizing fittings similar and equivalent to OZ Gedney type “FSK” through-wall fitting with “FSKA” membrane clamp adapter if required.

M. Attach rigid metal conduits with double locknuts - one inside and one outside - and fiber bushing.

N. Grounding type insulated bushings shall be used where raceway enters boxes with concentric or oversized knockouts. These bushings shall also be used wherever conduits stub into switchboards or transformer cabinets. Grounding type insulated bushings shall always be used on both ends of conduits feeding panelboards.

O. Provide suitable fittings where raceway crosses building expansion joints.

P. Securely fasten in place using approved strap or hanger within three feet of each termination and not over ten feet apart in runs.

Q. Run concealed in finished areas unless otherwise noted.

R. All PVC conduits, except those installed for services, shall contain green grounding conductor.

S. Make all cuts square with hacksaw. Remove any burrs or shoulders by reaming.

T. Installation shall meet seismic requirements of Section 260548 of these specifications.

U. All runs exposed and all runs above accessible ceilings shall be neat and square with building structure such as walls and ceiling/roof structures. Multiple parallel runs shall use trapeze supports where possible.

V. "Flex" and "Sealtite" connections with T&B "Tite-Bite" and "Super-Tite" or approved equivalent fittings. Shall have insulated throats.

W. The use of “LB’s” shall be limited where possible. Where necessary to use “LB’s” sized above 2 inches, mogul units shall be installed.

X. Conduits, JB’s, Troughs and any enclosure when mounted outside shall be mounted off the walls by one inch.

3.2 EMT conduit provided below roof deck shall be installed 1-1/2 inches away from the deck to avoid penetration from reroofing screws.

3.3 BOX INSTALLATION

A. Attach EMT with connector only.

B. Outlet boxes shall be sized in accord with NEC Section 370. All lighting outlet boxes shall have fixture studs. Device boxes shall be sectional type or 4" square equipped with plaster rings as required to mount the device. Set edge flush with finished surface. Boxes may be installed at top or bottom of a masonry course. Raco masonry boxes in sawed block. 1-1/4" and deeper plaster rings may be of die-cast aluminum of Steel City make.

C. Where installed in metal stud partitions, wall boxes shall be supported from two adjacent studs using a system such as Caddy Bar Hanger Assembly, or equivalent. Support on a single stud is not acceptable.

D. Fixtures weighing more than six pounds shall be supported from the fixture stud.

E. Where not shown differently on the drawings, mount:

1. Switch boxes 46" from finished floor to center. Boxes beside doors shall be mounted so edge of trim plate is 2" from edge of door trim on strike side.

2. Telephone boxes 18" from finished floor to center and vertical. Boxes for wall phones shall be 46" from finished floor and vertical.

3. Bracket light boxes as indicated on plans or as directed by Engineer .

4. Panel cans 6'-4" ($\pm$4" in concrete block construction) from finished floor to top of can.

F. Where not shown differently on the drawings, mount boxes for receptacles to receive device in a vertical position and be:

1. Centered 18" above finished floor.

2. Centered 6" above counters, shelves, or cabinets where apparently intended to be so placed.

3. Centered 4" above high edge of backsplashes.

4. Where devices are to be ganged, provide boxes to receive devices trimmed with a gang plate.

G. As soon as installed, all raceway openings shall be closed with plastic inserts to prevent entrance of foreign matter during construction. All enclosures shall be kept clean of any foreign matter. Install Jordan "Kover-All" plastic covers over outlet boxes ahead of plastering or painting.

H. All outlet boxes, junction boxes and pull boxes shall have their covers and exterior visible surfaces painted with colors to match color scheme outlined in Section 260553. This includes covers on boxes above all type ceilings. Junction and pull boxes for branch circuits and signal or communication systems also shall be identified by spray painting the interior of the box. In addition, the box cover shall be labeled using a permanent, black marking pen to identify circuits or systems in box.

3.4 FASTENINGS AND SUPPORTS INSTALLATION

A. Inserts in masonry shall be lead, fiber, or plastic types installed in drilled holes. Wooden plugs shall not be used. Lead only shall be used on all exterior masonry or interior masonry subject to permanent moisture. Hung raceways shall be supported from the structure with rod supports at least 5/16" in diameter.

B. All equipment and flat raceways attached to outside wall or interior walls subject to permanent moisture shall be shimmed out with non-corrodible material so as to provide 1/4" air space between wall and equipment or raceway.

C. All materials, whether exposed or concealed, shall be firmly and adequately held in place. Fastening and support shall afford safety factor of three or higher.

D. All fixtures, raceways, and equipment shall be supported from the structure. Nothing may be supported on suspended ceilings, including the hanger wires, unless definitely noted so on the drawings or specifically permitted by the Engineer.

E. Other devices using octagonal or 4" square ceiling boxes, such as smoke detectors, dome lights, exit signs, etc., where installed in suspended ceilings shall be supported from the ceiling system using Caddy, or other, hangers specifically designed for such support. In addition, each of the four corners of the grid block enclosing the box shall be supported from the structure using 10 gauge steel wires run perpendicular to the ceiling plane.

END OF SECTION 26 05 33

SECTION 26 05 48- SEISMIC REQUIREMENTS FOR ELECTRICAL EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Electrical installation shall meet the seismic requirements as specified by Section 1621 of the North Carolina State Building Code. Section 1621 states that the project shall be classified by Seismic Hazard Exposure Group and Seismic Category and shall meet the requirements of Section 1621 of the North Carolina State Building Code for seismic design of electrical components. See Appendix B in the set of drawings for references to these criteria either in the Architectural or Structural drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All free standing electrical equipment such as switchboards, transformers, generators, cable trays, etc., shall be anchored to the structure in a manner that will satisfy the requirements of the NC State Building Code. Manufacturer of the equipment shall detail methods to be used to meet these requirements on the shop drawings of the equipment. Design calculations for the restraint methods used shall be included with the shop drawings. Drawings with these details, as well as the design calculation sheets, shall carry the seal of a registered Professional Engineer. Manufacturer shall make provisions for a field visit by his Engineer to verify that the installation conforms to the design. A certifying letter shall be sent to the Electrical Engineer stating that the installation does conform to the manufacturer's design and does meet the requirements of the NC State Building Code.

B. Mounting methods of internal components of manufactured equipment shall be certified by the manufacturer that the methods used meet the seismic requirements. Certification compliance information shall be submitted with shop drawings.

C. Raceway, busduct, and other hung or suspended components of the electrical installation shall be installed in compliance with the NC State Building Code. Seismic restraint systems shall be Unistrut, Kindorf, B-Line, or approved equivalent. Seismic restraint systems shall be designed by the vendor. Submit to the Engineer record copies of all calculations and system information. Calculations and details shall be sealed by a registered professional engineer. Where specific pre-engineered systems are not readily available, the contractor may use the latest edition of "Seismic Restraint Manual Guidelines for Mechanical Systems" published by SMACNA for determining correct restraint systems to be used. Submit SMACNA systems to be used at same time as shop drawings of other pre-engineered systems. Either the vendor or the contractor, as applicable, shall make provisions for a field visit by a registered professional engineer to verify that the installation conforms to the vendor's design or the SMACNA design, as appropriate, and that the installation meets the requirements of the State Building Code.

D. Housekeeping pads specified for equipment shall be mechanically connected to the structural floor.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Review of the seismic design and shop drawings by the Engineer shall not relieve the Contractor of his responsibility to comply with the seismic or any other requirements of the NC State Building Code.

END OF SECTION 26 05 48

SECTION 26 05 53- EQUIPMENT IDENTIFICATION LABELS

PART 1 - GENERAL

1.1 NAMEPLATES

A. Furnish and install engraved laminated phenolic nameplates for all safety switches, panelboards, transformers, switchboards, low voltage systems, medium voltage cables, medium voltage switches, underground 15kV duct and other electrical equipment supplied for the project for identification of equipment controlled or served, phase, voltage, etc.

B. All lighting switch and receptacle device box cover plates shall be provided with label indicating panelboard and circuit serving the device (Example: A-1, PPM-5, etc.). Contractor to submit sample of label for Owner approval.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Nameplate material colors shall be:

1. Blue surface with white core for 120/240 volt equipment.

2. Black surface with white core for 277/480 volt equipment.

3. Bright red surface with white core for all equipment related to fire alarm system.

4. Dark red (burgundy) surface with white core for all equipment related to security and CCTV systems.

5. Green surface with white core for all equipment related to "Emergency" systems.

6. Orange surface with white core for all equipment related to telephone systems.

7. Brown surface with white core for all equipment related to data systems including underground telecom duct bank.

8. Yellow surface with black core for all equipment related to medium voltage power including underground power duct bank.

B. All empty conduit runs and conduit with conductors for future use shall be identified for use and shall indicate where they terminate. Identification shall be by phenolic tags with wire attached to conduit or outlet.

C. All empty/spare underground ducts (telecom and power) shall be identified for future use and shall indicate where they terminate. Identification shall be by phenolic tags with wire attached to duct in each manhole.

D. All outlet boxes, junction boxes and pull boxes shall have their covers and exterior visible surfaces painted with colors to match color scheme outlined above. This includes covers on boxes above all type ceilings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Nameplates shall be securely attached to equipment with self-tapping stainless steel screws, and shall identify equipment controlled, attached, etc. Letters shall be 1/2 inch high minimum. Embossed, self-adhesive plastic tape is NOT acceptable for marking equipment and shall not be used.

B. Nameplates shall be attached to medium voltage cabling with plastic tie-wraps (2 per nameplate). Nameplates for medium voltage cabling shall indicate the circuit designation, phase and the “from and to” location information, i.e. ‘CKT I, PHASE B, FROM S-35A WAY 2 TO S-34 WAY C1”. Place labels on cables inside switches and manholes (at entry and exit points).

C. Furnish and install engraved laminated plastic nameplates for each “way” on the new medium voltage switches. Each nameplate shall indicate the location controlled or feeding and circuit number, i.e. “TO S-34, CIRCUIT I”. Also furnish and install engraved plastic nameplate for exterior of switch enclosure indicating “Switch 35A”.

END OF SECTION 26 05 53

SECTION 26 09 23- OCCUPANCY SENSORS

PART 1 - GENERAL REQUIREMENTS

1.1 SCOPE

A. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.

B. Contractor shall examine all general specification provisions and drawings for related electrical work required as work under Division 16.

C. Contractor must submit data sheets on sensors, control units and all junction boxes and mounting accessories, including all wiring diagrams.

1.2 EQUIPMENT QUALIFICATION

A. All components shall be U.L. listed and offer a five (5) year warranty.

1.3 OBJECTIVE DESCRIPTION

A. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.

B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

C. Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications. The Contractor's obligation shall include repair or replacement, and testing without charge to the Owner, all or any parts of equipment which are found to be damaged, defective or non-conforming and returned to the supplier. Warranty on sensors and controls units will be for a period of five (5) years. The warranty shall commence upon the owner's acceptance of the project. Warranty on labor shall be for a minimum period of one (1) year.

D. The Contractor shall provide, at the owner's facility, the training necessary to familiarize the Owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

PART 2 - PRODUCTS

2.1 SPECIFIC REQUIREMENTS

A. OCCUPANCY SENSORS

1. Wall switch sensors shall be capable of detection of motion at desk top level up to 300 square feet.

2. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1000 watts at 277 volts.

3. Bi-level wall switch sensors shall accommodate up to two loads from 50 to 800 watts at 120 volts; 50 to 1000 watts at 277 volts, for each load.

4. Wall switch sensors shall have a 180° coverage capability.

5. Passive Infrared sensors shall have a multiple segmented Lodif Fresnel lens with grooves-in to eliminate dust and residue build-up.

6. Passive Infrared and Dual Technology sensors shall have fully automatic operation, offer daylighting foot-candle adjustment control and be able to accommodate dual level lighting.

7. Ceiling mount sensors shall provide a minor motion coverage range of 150 to 1300 square feet with an overall 1/2 step coverage range from 300 to 2000 square feet.

8. Occupancy sensors shall provide coverage of 90 to 100% of the controlled area.

9. All sensors shall be capable of operating normally with electronic ballasts and PL lamp systems.

10. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

11. All sensors shall have readily accessible, user adjustable controls for time delay and sensitivity. Controls shall be recessed to limit tampering.

12. In the event of failure, a bypass manual "override on" feature shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. The override feature shall be designed for use by building maintenance personnel and shall not be readily achieved by building occupants.

13. Ultrasonic operating frequency shall be crystal controlled to within plus or minus 0.005% tolerance to assure reliable performance.

14. Ultrasonic microphone receiver frequency shall be 25 KHz or greater and shall be temperature and humidity resistant.

15. All sensors shall provide an LED indication light to verify that motion is being detected and that the unit is working. Acceptable vendors are WattStopper, Leviton and Sensor Switch. All sensors shall be equal to Watt Stopper model numbers:

    a. Ceiling sensors: W-500A, W-1000A, W-2000A, W-2000H, WPIR, DT-100L, CI-100, CI-200

    b. Wall Sensors: WI-120A, WI-277A, WI-120-4, WI-277-4, WS-120, WS-277

    c. Power Packs: A-120E, A-277E, S-120/277/347E

16. Decibel levels for ultrasonic sensors shall comply with the following criteria:

	Mid frequency of Sound Pressure Third Octave Band (KHz) micropascals)	Maximum dB level within Third Octave Band in dB reference 20
a.		

Less than 20	80	
or more to less than 25		105
or more to less than 31.5	110	
or more	115	

17. All sensors shall have no leakage current in OFF mode and shall have voltage drop protection.

18. All sensors shall have UL rated, 94V-0 plastic enclosures.

19. Sensors shall be suitable for N.E.C. 725 Class 2 wiring and use plenum cable when required.

2.2 CIRCUIT CONTROL HARDWARE - CU

A. Control Units - For ease of mounting, installation and future service, control unit(s) shall be able to mount on external J boxes and be integrated self-contained unit consisting internally of load switching control relay and a transformer to provide low-voltage power to a minimum of two (2) sensors.

B. Relay Contacts shall have ratings of:

1. 10A - 120 VAC Tungsten

2. 20A - 120 VAC Ballast

3. 20A - 277 VAC Ballast

C. Relay contacts shall be isolated.

D. Control units shall be UL listed.

E. Between sensors and controls units shall be three (3) conductors, 18 AWG, stranded UL Classified, PVC insulated or TEFLON jacketed cable approved for use in plenums.

PART 3 - EXECUTION

3.1 It shall be the Contractor's responsibility with the supplier's assistance to locate and aim sensory in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location with in the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room. Proper judgment must be exercised in executing the work so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. “No emergency lighting is to be connected to an occupancy sensor”.

END OF SECTION 26 09 23

SECTION 26 24 16- DISTRIBUTION AND BRANCH CIRCUIT PANELBOARDS

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Equipment shall be built to NEMA Standards where such standards exist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Square D panelboards are specified. Equivalents by Siemens, Cutler-Hammer or General Electric Co. or approved equal may also be provided. Square D models and types are listed herein to establish type and quality required for the project.

B. Types, sizes, capacities and characteristics shall be as shown on riser diagram or in schedules. Service equipment shall be labeled "UL Approved for Service Entrance Use".

C. Branch circuit panelboards shall be bolt-on type, Square D NQOD or NF types, or equivalent. Distribution panelboards shall be Square D I-Line types HCN, HCM, HCW, as indicated on plans, or equivalent.

2.2 CONSTRUCTION FEATURES

A. Housing shall be constructed of Code gauge galvanized sheet steel and shall be securely fabricated with screws, bolts, rivets or by welding. Housings for branch circuit panelboards shall be 20" wide and 5-3/4" deep. Housings for distribution panelboards shall be no larger than the panelboard specified or as shown on the plans. Space is at a premium and oversized panelboards, in most cases, will not allow for proper Code clearances. Panels shall be sized so that they will pass through door openings and hatch openings, be assembled if required within the room that they are located/mounted, installed to meet NEC clearance requirements and installed for maintainability.

B. Top or bottom space shall be increased six inches where feeder loops through panel. End plates shall be galvanized Code gauge (minimum) and shall be supplied without knockouts.

C. Covers shall be constructed of high grade flat sheet steel of Code gauge minimum with the following:

1. Door flush with face and closed against a full inside trim stop. Hinges shall be inside type.

2. A combination flush latch and Yale, Corbin or equivalent, tumbler-type lock, so panel door may be held closed without being locked. All such locks on same job shall be keyed alike. Plastic lock type trims are not acceptable.

3. Finish of manufacturer's standard color of top-grade enamel over a phosphatized or other approved rust inhibitor treatment and prime coat, or as specified in Section 260100.

4. Four or more cover fasteners of a type which will permit mounting plumb on box. Cover shall also have inside support studs to rest on lower edge of can while being fastened.

5. Distribution and lighting type panelboards shall be furnished with covers hinged to backbox. Hinge shall be continuous “piano” hinge type permanently spot welded to the panelboard cover. Hinge shall in turn bolt securely to the backbox. Hinge cover shall not be required for flush mounted distribution panelboards.

D. A means of readily adjusting projection of panel interior assembly with all connections in place shall be provided. A method requiring stacking of washers is not acceptable.

E. Interior trim shall fit neatly between interior assembly and cover - leaving no gaps between the two.

F. For lighting panels:

1. Individual breakers shall be securely and tightly mounted on their supporting structure so they do not depend upon the current-carrying bus for support, unless a combination support/bus is considered adequately strong by the Engineer.

2. Breakers shall be "Quicklag" type bolted to the supply bus. Plug-in types are not acceptable unless specifically called for on plans.

G. Supply lugs shall be installed on busses and neutral bar so they may be readily and securely tightened from the front with panel in place and wired. A suitable arrangement shall limit their movement out of plumb. It shall not be possible to move the lugs so that metal parts between phases are closer than 3/8".

H. All panels shall have copper busses, with substantial connections where breakers bolt to busses.

I. All wiring lugs in panelboards and all breakers shall be rated for use with 75 degree conductors sized in accordance with NEC Table 310-16.

J. All branch circuit panels shall be equipped with copper ground busses.

K. Breakers in lighting or branch circuit power panelboards shall be physically arranged in locations shown in panel schedules and be connected to the phases shown. Any deviation shall be approved by the engineer in advance. Panelboards shall be equipped with directory cards mounted behind heavy clear plastic shields in substantial frames attached to inside face of doors. Cards shall be a minimum of three inches wide.

L. Submittals: All panel submittals shall be in the form of a panel schedule showing the physical location, layout and bus position of each circuit breaker. Lists showing numbers of circuit breakers will not be acceptable. Submittals that are not in accordance with this section will be rejected without review.

M. All panelboards on building exterior shall be rated NEMA 3R (weatherproof) and lockable.

N. Maximum numbers of breakers in a panelboard shall not exceed 42 poles.

O. The number of the branch circuit shall be identified with permanent wire tag attached to the wire.

2.3 METERING AND INSTRUMENTATION – NOT USED

2.4 COORDINATION AND ARC FAULT STUDIES

A. As a part of this contract, the gear manufacturer shall provide a device coordination and arc fault studies complete with settings for all breakers and labels for all electrical equipment. Available fault current at point of delivery shall be obtained from the Construction Documents (Riser Diagram).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Flush-mounted panel housings shall be flush with finished wall.

B. Mount equipment plumb and level.

C. Openings in boxes, cabinets, or gutters shall be cut or sawed. Burning of openings is prohibited.

D. Only one (1) solid wire is allowable under a screw. Use lug for connecting stranded wire or more than one (1) solid conductor.

E. Label all equipment in conformance with Section 260553.

F. Panelboard directory card shall be neatly typed with circuits assigned as shown on schedules. Space typing on card so all is visible when inserted into frame. Use room names and numbers as provided by Owner, not those shown on schedule. Names and numbers on schedule relate to plans only for construction. Indicate spare breakers in pencil (not typed) so that Owner can erase as necessary in the future.

G. Next to each breaker within the main or distribution panelboards, attach a label indicating what it feeds. Wording shall be as shown on its diagram or schedule. Labeling shall also be attached to separately mounted breakers, switches, transformers, wiring gutters and controllers of all types.

H. Centered above the door on the panel cover, attach a label indicating panel designation – for example, “PANEL A”; voltage – “120/208 VOLTS”; and from where served – “FED FROM PANEL MDP”. See Section 260553 for label requirements and details.

I. Interrupting capacities shall be as indicated on the panel schedules. All ratings are for fully rated panels and breakers; series rating are not acceptable.

J. The equipment manufacturer shall provide as a part of this contract a device coordination study complete with settings for all breakers. Available fault current at the point of delivery shall be obtained from the design documents.

K. The contractor shall provide an arc-flash study and label each panel with appropriate label.

L. The E.C. shall set breakers in accordance with the coordination and arc flash studies.

3.2 SUBMITTALS

A. Submittal shall include complete information which addresses all features specified here-in and indicated on the drawings. Interrupting capacities of all breakers, bus ratings,

dimensions, etc. shall be clearly shown. Submittal shall include equipment elevation complete with all dimensions, and proposed breaker layout. Incomplete submittals will be rejected. Coordination study shall be included with the gear submittal, or submittal will be rejected.

B. All panel submittals shall be in the form of a panel schedule showing the physical location, layout and bus position of each circuit breaker. Lists showing numbers of circuit breakers will not be acceptable. Submittals that are not in accordance with this section will be rejected without review.

END OF SECTION 26 24 16

SECTION 26 27 26- ELECTRICAL DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 WIRING METHOD FOR BRANCH CIRCUITS

A. Outlets in the same general area are circuited together. Circuit numbers are shown as noted in symbol schedule.

B. Provide dedicated neutrals for each branch circuit. Sharing of neutrals is not allowed.

C. Three phase circuits shall be limited to one circuit per raceway (three different phase wires and a neutral if needed).

D. The neutral carrying all or any part of the current of any specific load or run shall be contained in the same raceway or enclosure with the phase wire or wires also carrying that current. No split neutrals permitted.

E. Circuits shall be connected to panels as shown in the panel schedule. Any deviation shall be approved in advance by the engineer.

F. Under the above requirements and with required color coding system no feeder or branch circuit raceway will contain more than one wire of the same color, except for switch legs and control circuits.

G. Conductors feeding lighting outlets may be combined in the same raceway with conductors feeding convenience receptacles; but lighting outlets and convenience receptacles shall not be put on the same circuit unless specifically indicated.

PART 2 - PRODUCTS

2.1 WIRING DEVICES

A. Switches considered equivalent are as follows:

1. Single Pole:
   Hubbell 1221
   P & S 20AC1
   Leviton 1221

2. Three Way:
   Hubbell 1223
   P & S 20AC3
   Leviton 1223

3. Four Way:
   Hubbell 1224
   P & S 20AC4
   Leviton 1224

B. Duplex receptacles considered equivalent are as follows:
NEMA 5-20R, 20A, 125V

1. Heavy Duty, Specification Grade:
Hubbell 5362
P & S 5362
Leviton 5362

2 Ground Fault Interrupt: (Specification Grade)
Hubbell GFR5362
P & S
Leviton 6898-HG

3 Ground Fault Interrupter type duplex receptacles shall be heavy duty specification grade. Where used outdoors, they shall also be weather resistant type and have a “while in use”, lockable protective cover.

C. All devices on normal power circuits shall be ivory in color. Samples will be required prior to acceptance of any proposed equivalents not specifically mentioned above. All like devices shall be by the same manufacturer (i.e.; all switches, all duplex receptacles, etc.).

D. Unless noted or specified otherwise, device trim plates shall be type 302 stainless steel to suit device. All plates in the job shall be same make and match throughout.

E. Wiring devices shall be 20 amp minimum and shall be of the grounding type, with hex-head green grounding screw, to be connected to the green ground conductor. Self-grounding type is not acceptable.

F. All receptacles in wet locations shall be “weather resistant while in-use” and GFI. Weather resistant while-in use cover shall be die cast Alloy 360 copper-free aluminum for maximum corrosion resistance and durability. The finish shall be aluminum lacquer. Hubbell #WP26M, Thomas & Betts #CKSGV or equal.

G. All receptacles in damp locations shall be weather resistant and GFI.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Devices shall be mounted tightly to boxes and be adjusted plumb and level.

B. Two or more devices ganged shall be trimmed with gang plate.

END OF SECTION 26 27 26

SECTION 26 43 13- SURGE PROTECTION DEVICE

PART 1 - GENERAL

1.1 REQUIREMENTS

A. PROVIDE THE WORK OF THIS SECTION as indicated and specified.

B. ALL REFERENCED manufacturer's requirements and specifications and nationally recognized and accepted standards and specifications shall be the latest edition unless specified otherwise and shall be used as they are applicable for products and craftsmanship incorporated in the Contract Drawings and this Section only. The references to these standards and specifications do not imply acceptance of any and all products described in the standards and specifications.

C. THE MANUFACTURER SHALL REVIEW the use, details, and method of installation of his product as indicated in the Contract Documents and shall disclose to the Architect any and all deviations therein from the manufacturer's recommended use and method of installation and shall also disclose to the Architect the manufacturer's acceptance or rejection of the deviation, or his recommendation for an alternative use and method of installation of his product, still guaranteeing to achieve the intended purpose and result. Such disclosures shall be made within the time stipulated for submission of shop drawings.

1.2 APPLICABLE STANDARDS AND TESTING

A. Underwriters Laboratories: UL1449-4th edition (2014) and all applicable most recent UL standards
B. ANSI/IEEE C62.41.1-2002, C62.41.2-2002, C62.45-2002
C. National Electrical Code: Article 285
D. NEMA LS-1(rescinded)

1.3 SUBMITTALS:

A. GENERAL: Submit the following for Architect's review:

B. MUST HAVE FIFTEEN DAY PRIOR APPROVAL to bid on project. Request for submittal must be in writing and attached with independent documentation of the following items.

C. PRODUCT DATA: Submit manufacturer's data on transient surge protection devices and components, to include rated capacities, dimensions, and accessories.

D. SHOW DRAWINGS: Electrical and mechanical drawings shall be provided by the manufacturer which show unit dimensions, weights, mounting provisions, connection notes, wire size and wiring diagram.

E. EQUIPMENT MANUAL: The manufacturer shall furnish an installation manual with installation notes, start-up and operating instructions for the specified system. Installation instructions shall clearly state whether the system requires an external overcurrent device to maintain the system's UL 1449, 4th edition listing.

F.

A. Submittals shall include UL 1449 4th edition listing documentation verifying:
   1. Short Circuit Current Rating (SCCR)
   2. Voltage Protection Ratings (VPRs) for all modes

3. Maximum Continuous Operating Voltage rating (MCOV)
4. I-nominal rating (I-n)
5. Type 1 Device Listing

VPR, MCOV, I-n, and Type 1 information is posted at www.UL.com, under Certifications, searching using UL Category Code: VZCA. SCCRs are posted in manufacturer's UL docs. UL data and visual inspection takes precedence over manufacturer's published documentation.

B. Submittals shall include shop drawings including manufacturer installation instruction manual and line drawings detailing dimensions and weight of enclosure, internal wiring diagram illustrating all modes of protection in each type of SPD required, wiring diagram showing all field connections and manufacturer's recommended wire and circuit protection device size.
C. Upon request, an unencapsulated but complete SPD shall be presented for visual inspection; proprietary technology included. MOV type & quantity shall reflect kA ratings on cutsheets, verification of diagnostic monitoring, thermal & overcurrent protection, etc.
D. Any product submittals containing Asbestos or Selenium are to be accompanied by proof of insurance to indemnify and hold harmless the engineer, contractor, and the end use facility owner and operator.

Minimum of ten (10) year warranty for service entrance, transfer switch, distribution panelboard, and motor control center applications.

1.4 QUALITY ASSURANCE:

A. QUALITY: Shall mean the meticulous attention to the detail of installation and workmanship necessary to the assemblage of products in the highest grade of excellence by skilled craftsmen of the trade.

B. MANUFACTURER'S QUALIFICATIONS: Shall be firms who are regularly engaged in manufacture of transient voltage suppression equipment and ancillary equipment, of types, ratings and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

C. LISTING AND LABELING: Provide electrically operated equipment specified in this Section that is listed and labeled by a "Nationally Recognized Laboratory" as defined in OSHA regulation 1910.7.

D. SYSTEM shall be in accordance with NFPA 70.

1.5 DELIVERY, STORAGE AND HANDLING:

A. DELIVER EQUIPMENT AND COMPONENTS in factory-fabricated type containers or wrappings, which properly protect equipment from damage.

B. STORE EQUIPMENT in original packaging and protect from weather and construction traffic. Wherever possible, store indoors; where necessary to store outdoors, store above grade and enclose with watertight wrapping.

C. HANDLE EQUIPMENT carefully to prevent physical damage to equipment and components. Do not install damaged equipment; remove from site and replace damaged equipment with new undamaged equipment.

PART 2 - PRODUCTS

2.1 SERVICE ENTRANCE/SWITCHBOARD/SWITCHGEAR/PANEL

A. Acceptable Manufacturers and Models:

Mersen
Advanced Protection Technologies
Siemens

A. SPD shall be UL labeled with at 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.
B. SPD shall be UL labeled as Type 1 (verifiable at UL.com), intended for use without need for external or supplemental overcurrent devices. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal over-temperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.
C. SPD shall be UL labeled with 20kA $I_{nominal}$ (I_n) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.
D. Suppression components shall be heavy duty 'large block' 50kA surge-rated MOVs, each exceeding 30mm diameter.
E. Minimum surge current capability (single pulse rated) per phase shall be:
Service Entrance 200kA

F. SPD shall provide surge current paths for all modes of protection:
   1. L-N, L-G, L-L and N-G for Wye systems
   2. L-N, L-G, and L-L for Wye systems when N-G bonding is specified at SPD application point
   3. L-L, L-G in Delta and impedance grounded Wye systems.

G. UL 1449 Listed Voltage Protection Ratings (VPRs) shall not exceed the following:

System Voltage	L-N	L-G	L-L	N-G
480Y/277	1200V	1200V	2000V	1200V

(Mode VPRs must be verifiable at UL.com. Numerically lower is allowed/preferred; old-style Suppressed Voltage Ratings(SVRs) shall not be submitted, nor evaluated due to outdated testing)

H. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
480Y/277	15%	320V

I. Service Entrance SPD shall have EMI/RFI filtering up to -50dB from 10Khz to 100MHz.
J. SPD shall include visual LED diagnostics including a minimum of one LED indicator per phase, and one red service LED.
K. OPTIONS
   1. SPD shall be provided with 1 set of NO/NC dry contacts

PART 3 - EXECUTION

3.1 COORDINATION

A. Please verify all voltages and quantities on drawings, one-line and panelboard schedules.

3.2 INSTALLATION

A. The specified service entrance system shall be installed with the shortest lead length possible not to exceed twelve (12”) inches from the power conductor(s) it is protecting, must have a grounding of 25 Ohms (NEC Article 250.56) or less and shall avoid any unnecessary or sharp bends. Utilize a 3 pole 60 amp breaker for connection means.

3.3 WARRANTY

A. Manufacturer shall provide a product warranty for a period of not less than ten (10) years from date of installation. Warranty shall cover unlimited replacement of SPD modules during the warranty period. Those firms responding to this specification shall provide proof that they have been regularly engaged in the design, manufacturing and testing of SPD for not less than twenty five (25) years.

END OF SECTION 26 43 13

SECTION 26 50 00- LIGHTING

GENERAL

1.1 SUMMARY

A. Section Includes:
   1. LED Interior lighting fixtures, and drivers.
   2. Emergency lighting units.
   3. Exit signs.
   4. Lighting fixture supports.

1.2 RELATED SECTIONS

A. Section 26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

B. Section 26 05 33 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

C. Section 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS

D. Section 26 27 26 WIRING DEVICES

1.3 REFERENCES

A. Definitions
   1. CCT: Correlated color temperature.
   2. CRI: Color-rendering index.
   3. LED: Light emitting diode
   4. LER: Luminaire efficacy rating.
   5. Lumen: Measured output of luminaire.
   6. Luminaire: Complete lighting fixture, including driver housing if provided.
   7. UV: Ultraviolet

B. American National Standards Institute, Inc. (ANSI)
   1. ANSI C78.377 Specification for the Chromaticity of Solid State Lighting Products
   2. ANSI RP-16-10 Nomenclature and definitions for Illuminating Engineering

C. American Society for Testing and Materials (ASTM)
   1. ASTM A580/A580M - Standard Specification for Stainless Steel Wire
   2. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire

D. Institute of Electrical and Electronics Engineers (IEEE)
   1. IEEE PAR1789 A Review of Literature on Light Flicker: Ergonomics, Biological Attributes, Potential Health Effects, and Methods in Which Some LED Lighting May Introduce Flicker
   2. C62.41.1 - IEEE Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits
   3. IEEE C62.41.2 - Standard for Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits

E. Illuminating Engineering Society of North America (IESNA)
   1. IES LM-79 IESNA Approved Method for the Electrical and Photometric Measurements of Solid-Sate Lighting Products
   2. IES LM-80 IESNA Approved Method for Measuring Lumen Maintenance of LED Light Sources
   3. IES TM-21-01 Projecting Long Term Lumen Maintenance of LED Light Sources

F. National Electrical Manufacturers Association (NEMA)
   1. NEMA SSL-1 Electric Drivers for LED Devices, Arrays, or Systems
   2. NEMA SSL-3 High-Power White LED Binning for General Illumination
   3. NEMA SSL-6 Solid State Lighting for Incandescent Replacement - Dimming

G. National Fire Protection Association (NFPA)
   1. NFPA 70 - National Electrical Code

H. Underwriters Laboratories (UL)
   1. UL 924 - Emergency Lighting and Power Equipment
   2. UL 1598 - Luminaires

1.4 SUBMITTALS

A. Action Submittals
   1. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
      a. Physical description of lighting fixture including dimensions.
      b. Emergency lighting units including battery and charger.
      c. Driver, including heat Rejection.
      d. Energy-efficiency data.
      e. Life, output (lumens, CCT, and CRI), and energy-efficiency data for LEDs.
      f. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for LED, Driver, and accessories identical to those indicated for the lighting fixture as applied in this Project.
         1) Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

   2. Installation instructions.

B. Informational Submittals
   1. Field quality-control reports.
   2. Warranty: Sample of special warranty.

C. Closeout Submittals
   1. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
      a. Provide a list of all luminaire types used on Project; use ANSI and manufacturers' codes.

D. Maintenance Material Submittals
   1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
      a. LED Fixtures: 10 extra high bay LED fixtures for every 100 of each type and rating installed. Furnish at least one extra fixture of each type.

b. LED drivers: 10 for every 100 of each type and rating installed. Furnish at least one for each type.
c. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
d. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.5 SYSTEMS DESCRIPTION

A. Provide complete and operable lighting system as indicated on Drawings.

1.6 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

D. Coordination
1. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including structural members, HVAC equipment, piping, and partition assemblies.

PRODUCTS

1.7 MATERIALS

A. Manufacturers
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

B. General Requirements For Lighting Fixtures And Components
1. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
2. Metal Parts: Free of burrs and sharp corners and edges.
3. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
4. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit repair without use of specialty tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during repair and when secured in operating position.
5. Diffusers and Globes:
a. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
1) Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
2) UV stabilized.

b. Glass: Annealed crystal glass unless otherwise indicated.

6. Factory-Applied Labels: Comply with UL 1598. Include recommended LED and drivers. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when LEDs are in place.
   a. Label shall include the following LED and driver characteristics:
      1) "USE ONLY" and include specific LED type.
      2) LED nominal wattage for luminaires.
      3) Driver type for luminaires.
      4) CCT and CRI for all luminaires.
7. Luminaires controlled by occupancy sensors shall have drivers rated for control by occupancy sensors.

8. LED Fixed Output Drivers Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

C. LED Fixed Output Driver Products
1. Drivers shall operate LEDs at a frequency of 60 Hz.
2. Driver shall operate from 60 Hz input source of 120 V through 277 V with sustained variations of (+/- 10% voltage and frequency) with no damage to the Driver.
3. Driver shall have a Power Factor greater than 0.95 for primary applications.
4. Driver input current shall have Total Harmonic Distortion (THD) of less than 20%.
5. Driver shall have a Class A sound rating.
6. Driver shall have a minimum operating temperature of -40C (-40F).
7. Driver shall tolerate sustained open circuit and short Circuit output conditions without fail and without need for external fuses or trip devices.
8. Driver shall carry IP66 rating to protect against dust and intermittent flooding.
9. Driver shall meet the RoHS Directive 2002/95EC on the restriction of hazardous substances such as lead, cadmium, mercury, hexavalent chromium, PBBs and PBDEs.
10. shall be Underwriters Laboratories (UL) listed,
11. Driver shall be Underwriters Laboratories (UL) listed Class 2 Outdoor.

D. LED Boards LED
1. LED boards shall be RoHS (Restriction of Hazardous Substances) compliant
2. LED boards shall offer lumen maintenance of L85 at 50,000 hours
3. LED boards shall provide <3 SDCM (Standard Deviation Color Matching)
4. LED boards shall operate to minimum -30C ambient
5. LED boards shall be dimmable to 1%
6. LED boards shall operate at maximum 1.050 Amps
7. LED boards shall provide minimum of 115 lumens per watt at 3500K
8. LED boards shall be field replaceable and upgradable

E. Exit Signs
1. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
2. Internally Lighted Signs:
   a. LED for AC Operation: LEDs, 70,000 hours minimum rated life.
      1) Battery: Sealed, maintenance-free, nickel-cadmium type.
      2) Charger: Fully automatic, solid-state type with sealed transfer relay.
      3) Operation: Relay automatically energizes luminaire from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects luminaire from battery, and battery is automatically recharged and floated on charger.
      4) Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

5) LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6) Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

F. Emergency Lighting Units
1. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
a. Battery: Sealed, maintenance-free, nickel metal hydride.
b. Charger: Fully automatic, solid-state type with sealed transfer relay.
c. Operation: Relay automatically turns luminaire on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Luminaire automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects luminaire from battery, and battery is automatically recharged and floated on charger.
d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
f. Integral Time-Delay Relay: Holds unit on for fixed interval of 5 minutes when power is restored after an outage.
g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

G. Luminaire Support Components
1. Comply with Section 26 05 33 RACEWAY, BOXES AND SUPPORTS for channel- and angle-iron supports and nonmetallic channel and angle supports.
2. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
3. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
4. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.
5. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.
6. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

1.8 FABRICATION

A. Factory-assembled lighting fixtures and associated devices.

1.9 INSPECTION AND TESTING

A. Perform tests and inspections and prepare test reports.

1.10 WARRANTY

A. Special Warranty for LED drivers and LED luminaires. LED’s shall be listed for 70,000 hours and drivers shall be warrantied for 5 years from the date of final acceptance by owner and State Construction office.

B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
   2. Warranty Period for Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

EXECUTION

1.11 GENERAL

A. Comply with typical, administrative, and procedural requirements of Section 01 73 00 EXECUTION.

1.12 PRE-INSTALLATION

A. Complete raceway installation before starting conductor installation.

B. Comply with requirements in Section 26 05 33 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS for raceway requirements.

1.13 INSTALLATION

A. Lighting fixtures:
   1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
   2. Provide mounting hardware per manufacturer’s recommendations.

B. Temporary Lighting: If it is necessary, and approved by Owner's Representative, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly and reinstall.

C. Remote Mounting of LED Drivers: Distance between the driver and fixture shall not exceed that recommended by luminaire manufacturer. Verify, with driver manufacturers, maximum distance between driver and luminaire.

D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
   1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than (6 inches) from lighting fixture corners.
   2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
   3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two - 3/4-inch metal channels spanning and secured to ceiling tees.
   4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

E. Suspended Lighting Fixture Support:
   1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
   2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
   3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
   4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

F. Connect wiring according to Section 26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

G. Identification
   1. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 26 05 53 EQUIPMENT IDENTIFICATION LABELS.

H. Adjusting
   1. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
      a. Adjust aimable luminaires in the presence of City's Representative.

1.14 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 26 50 00

DIVISION 14, SWAIN COUNTY STORAGE SHED

SCO ID# 14-11264-01A

MCKIM AND CREED PROJECT NO. 7002-0001

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McKim & Creed, Inc.
8020 Tower Point Drive
Charlotte, North Carolina 28227
NC License No. F-1222

SECTION 301000 – SITE WORK

PART 1 – GENERAL

1.1 SUMMARY:

A. The General Conditions, Supplementary General Conditions of the Specifications shall be included as a part of these Specifications.

B. The Specifications and drawings shall be considered as supplementary to each other, requiring materials and labor indicated, specified, or implied by either specifications or drawings and shall be supplied and installed as through specifically called for by both.

C. Reference herein to Engineers shall be the firm of McKim & Creed Engineers, Asheville, North Carolina.

1.2 EXAMINATION OF SITE:

A. Before submitting a proposal, the contractor shall examine the site, familiarize himself with all existing conditions and obtain such information as is required to enable him to carry out installation. The contractor's failure to comply with this requirement will not relieve him of the responsibility of any errors which might have been avoided by his compliance.

1.3 CONFORMANCE TO SPECIFICATIONS AND SUBMITTAL OF MATERIALS:

A. A typed listing of all materials hereinafter specified or shown on the drawing or required for the complete and proper installation of the Site/Civil contract involved shall be furnished to the architects and engineers within two weeks after the date of contract signing. The list shall include all specified and proposed substitute items as acceptable under A. & C. above. At the time the list is submitted, complete submittal data on any proposed substitute items shall be furnished. Contractor shall furnish any additional information, data and shop drawings required by the architects and engineers to establish conformation with the specifications and drawings. At discretion of the architects and engineers, no substitutions will be considered which are submitted after said two-week period has elapsed.

B. After approval of the list of materials, one copy shall be returned to the contractor, who shall then proceed with submittal data not submitted with list, including resubmittal of disapproved items. All submittal data shall be furnished within 30 days after the date of contract signing by this contractor.

C. A minimum of five (5) copies of submittal data shall be furnished, plus any additional copies the contractor may wish above one.

D. All time required to evaluate substitute items after time constraints set forth above will be billed to the contractor at the Engineer's hourly billing rate; whether the proposed substitute is accepted or not. In no case shall additional renumeration be allowed because of the rejection of a proposed substitute.

1.4 APPROVAL:

A. Wherever the words "approved" or "approval" are used, they shall mean "approved by the architects or engineers" or "approval of the architects and engineers."

1.5 DIAGRAMS:

A. The drawings are diagrammatic and shall be followed as closely as possible. However, the contractors shall be responsible to coordinate their installation and work out interferences that might occur among themselves. Should interferences occur, the engineers will assist in working them out in the best interests of all contractors concerned and with as little change in the systems as originally planned as possible.

B. The drawings indicated major offsets but by no means indicate all such situations. Should contractor elect to proceed beyond the pace of other trades, he shall do so at the risk of having to make field changes to avoid structure or other trades at his own expense. Owners, architects, and engineers shall not be liable for extra expenses involved because of the contractor's failure to include adequate allowance in his price for such field problems.

C. Contractor shall consult architectural, plumbing and mechanical drawings for all dimensions, building locations, equipment locations, utility routing, existing conditions to remain, existing conditions to be removed, etc.

1.6 PERMITS:

A. The Site Contractor shall obtain and pay for all permits, arrange for necessary inspection and furnish a certificate of inspection and approval from the public authority and underwriters having jurisdiction where the apparatus is installed. All fees and charges in connection with the above shall be paid for by the Site Contractor.

1.7 LAWS AND ORDINANCES:

A. N. C. State Department of Transportation Standards and Guidelines, latest edition, is hereby incorporated into and made a part of these specifications and their provisions shall be carried out by the contractor. Anything contained in the specifications or shown on the drawings which conflicts with the code shall be installed in accordance with the code and such conflicts shall be brought to the attention of the engineers during bid period for clarification. Installation shall also meet local building inspection department approval.

1.8 SHOP DRAWINGS:

A. Shop drawings of all equipment, materials, or fabricated work shall be submitted for approval. Five sets of such prints must be presented, and no work shall be done until such approval has been obtained.

B. The approval of shop drawings will be general and shall not relieve the contractor from the responsibility for adherence to the contract nor shall it relieve him of the responsibility for any error which may exist, including quantities.

1.9 COORDINATION:

A. Contractor shall coordinate his work and the installation of his work with the other contractors and should any condition arise where the work of this contractor shall interfere with, or prevent proper and satisfactory installation, the contractor shall be responsible for working out such problems to allow proper installation. Should such interference involve changes in the plans and/or specifications, the contractor shall notify the architect and engineers in writing before proceeding with changes.

1.10 PROTECTION OF EQUIPMENT:

A. The contractor shall be responsible for all work damaged by him in executing contract. All work damaged by the contractor shall be replaced by him and placed in the pre-damaged condition without extra cost. Any construction work damaged shall be made acceptable to architects, engineers, and owners. The contractor shall at all times be responsible for any damaged equipment or work in conjunction with executing contract.

1.11 EXCAVATING AND BACKFILLING:

A. The contractor shall be responsible for all excavating in connection with his work. All such excavating shall be done in a manner as not to endanger the stability of the structure or any work in place by other contractors. All backfilling shall be thoroughly tamped as directed. Special care shall be taken with PVC piping, since it must be solidly bedded to prevent sagging and cracking of pipe and joints, and tightly tamped to prevent washouts and settlement. This contractor shall coordinate this tamping with general contractor to insure protection and positive slope on his piping.

1.12 CUTTING AND PATCHING:

A. Various cutting and patching will be required for the installation of the drives, parking, building pads and site work, and this contractor shall provide such work.

1.13 CLEANING UP:

A. The contractor shall keep the premises and points at the building free of rubbish and waste material due to the installation of the work included in this specification and shown on the plans.

B. After completion of the work and all tests have been made, the contractor shall remove all rubbish incidental to contract and shall leave all portions of the work in a clean condition.

1.14 INSPECTION:

A. The contractor must at all times lend any assistance necessary for architects or engineers or their authorized representative to make tests, inspections, etc. Provide all materials, equipment and labor necessary for tests or inspection as required.

1.15 TESTS:

A. Upon completion of the installation, all systems shall be properly and tested by the contractor and placed in perfect operating condition, subject to the approval of the architects and engineers. Provide all labor and equipment to perform this work

B. Any defects indicated by the tests shall be corrected immediately by this contractor without cost to the owners.

1.16 PROGRESS:

A. The work must be installed as fast as the progress of the other trades will permit and when directed by the architects and engineers.

1.17 WORKMANSHIP:

A. All materials shall be installed and completed in a first class workmanlike manner. The architects and engineers reserve the right to reject any unsuitable materials and to direct the removal and replacement of any items, which in their opinion shall not represent acceptable workmanship. Such removal and replacement shall be done when directed in writing by the architects and engineers at the contractor's expense and without additional cost to the owners.

1.18 GUARANTEE:

A. Contractor shall guarantee all materials and workmanship for a period of 12 months after date of final acceptance of building by architects, engineers, and owners, or for 12 months after occupancy of owners, or their tenants, should occupancy precede acceptance. All guarantee failures shall be corrected or replaced by contractor as soon as possible after notification of such failure.

1.19 WORK INCLUDED:

A. All labor and materials to provide complete site preparation and improvement systems as shown on the drawings and as specified hereinafter. This shall include the following:

1. Demolition and Removal

2. Clearing, Grubbing, Grading, Excavation and Filling

3. Subgrade Preparation for Roads, Drives and Parking Areas.

4. Aggregate Base Course

5. Control of Erosion, Siltation and Pollution.

6. Seeding and Mulching

7. Water Mains

8. Storm Drains and Appurtenances

9. Sanitary Sewers

10. Landscaping

11. Concrete Paving

12. Handrails and Railings

13. All other accessory and incidental items not itemized above, but specified or implied hereinafter.

14. Provision for all contingencies and supply of all labor, materials, light electrical energy, temporary wiring, scaffolding, fixtures, tools, transportation, etc. necessary for the proper installation of all work described in this section of the specification and indicated on the drawings.

1.20 MATERIALS VARIATION:

A. Should contractor submit substitutes which vary in quality, physical size, texture etc. from those specified, this contractor shall bear any and all expenses that may arise in other contractor's work that must be altered to allow use of such substitute equipment. Approval of any such equipment shall be voided should contractor fail to bear any such expense.

END OF SECTION 301000

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Temporary erosion- and sedimentation-control measures.

1.2 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.3 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

B. Utility Locator Service: Notify owner) before any excavation. Contact ULOCO (800) 632-4949 for locating existing utilities.

Do not commence site clearing operations until temporary erosion and sedimentation control and plant protection measures are in place.

C. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 Section "Earth Moving." Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.

D. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to Civil Grading/Drainage/EC Plan Sheet C103 and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. General: Protect trees and plants remaining on-site according to Plans.

B. Protect all trees that are to be retained with tree protection fencing. Place fencing as shown on Plans or as director by Owner.

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

B. Stumps and root mat shall be removed completely.

C. Use only hand methods for grubbing within protection zones.

D. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

E. Place fill material in horizontal layers not exceeding a loose depth of **8 inches**, and compact each layer to a density equal to adjacent original ground.

All debris from tree pruning and removal shall be disposed of lawfully.

3.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to a depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off-site in accordance with local, state, and/or federal regulations governing such operations.

B. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparing subgrades for walks, pavements, turf and grasses and plants.

2. Excavating and backfilling for buildings and structures.

3. Drainage course for concrete slabs-on-grade.

4. Subbase course for concrete walks.

5. Subbase course and base course for asphalt paving.

6. Excavating and backfilling for utility trenches.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.

2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and proposed gravel lot.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Owner. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Owner. Unauthorized excavation, as well as remedial work directed by Owner, shall be without additional compensation.

3. Additional fill material is required and shall be provided as part of the contract in quantities as required to achieve finish grade.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 QUALITY ASSURANCE

A. Preexcavation Conference: Conduct conference at the Project site.

1.4 PROJECT CONDITIONS

A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations. Some existing utilities were located by SUE survey. Contractor to verify location of all existing utilities.

B. Do not commence earth moving operations until plant-protection measures specified on Plans are in place.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487 or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Acceptable PL and LL as recommended by geotechnical engineer.

C. Unsatisfactory Soils: All materials having greater than 5% organic material content, all miscellaneous construction debris and those materials which are highly plastic or deemed to be unacceptable by the geotechnical engineer shall be undercut to firm bearing material and replaced with suitable on-site material or off-site borrow material. The on-site geotechnical engineer shall observe all undercut operations. No work related to undercut shall be undertaken without prior approval of SAID material by an approved testing agency or the engineer.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of washed, crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 EXCAVATION, GENERAL

A. All excavation is unclassified unless noted otherwise. Contractor is required to accept actual conditions at site and do work specified without additional compensation for possible variation from grades and conditions shown, whether surface or subsurface.

B. Rock excavation includes removal and disposal of rock material and obstructions encountered that cannot be removed by the following heavy-duty rock excavating equipment without blasting or ripping.

C. Rock material includes boulders ½ cu. Yd. or more in volume and rock in beds, ledges, unstratified masses, and conglomerate deposits.

D. Rock excavating equipment for footings, trenches, and pits shall be equivalent to a Caterpillar 325DL or equivalent track-mounted hydraulic excavator, equipped with a short-tip radius rock bucket, with new rock teeth, rated at 0.81 cubic yard (heaped) capacity placed on a machine rated at not less than 204 HP fly wheel power and 55,977 pounds drawbar pull.

3.3 EXCAVATIONS AT EDGES OF TREE- AND PLANT-PROTECTION ZONES

A. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

B. Cut and protect roots according to requirements on Plans and Section 015639 “Tree Protection and Trimming”. After trenching in exposed tree toot area, contractor shall request inspection of root protection by Owner and Engineer prior to backfilling. Contractor shall give a minimum of 24 hours notice for this inspection.

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.5 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course, if required.

3.6 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees. Stockpile soil shall remain within limits of construction at all times.

3.7 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Roadways: Provide 4-inch-thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course

D. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

E. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Place and compact final backfill of satisfactory soil to final subgrade elevation.

3.8 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.

2. Under walks and pavements, use satisfactory soil material.

3. Under steps and ramps, use engineered fill.

4. Under building slabs, use engineered fill.

5. Under footings and foundations, use engineered fill.

3.9 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content and/or as directed by the geotechnical engineer.

B. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

C. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight, as directed by the geotechnical engineer.

3.10 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

1. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

2. Under structures, building slabs, steps, and pavements, scarify and recompact top 6 inches of existing subgrade and each layer of backfill or fill soil material at 98 percent.

3. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.

4. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.

5. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.11 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.

2. Walks: Plus or minus 1 inch.

3. Pavements: Plus or minus 1/2 inch.

3.12 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Shape subbase course and base course to required crown elevations and cross-slope grades.

2. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.

3. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.14 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

D. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.15 TRENCH SAFETY

A. Contractor to coordinate construction sequence to provide shortest practical time that trenches will be open to avoid hazard to the public. There shall be no trenches left open unattended or after working hours.

B. Contractor to provide proper construction work zone signage and fencing to notify public. In areas of pedestrian traffic, contractor shall provide signage to direct pedestrians around construction zones. Particular attention should be placed in areas of pedestrian traffic within the project site. Signs shall conform to the MUTCD and all federal, state and local codes.

C. Contractor shall ensure that all Occupational Safety and Health Administration (OSHA) regulations and standards are followed during all phases of the construction project.

D. The contractor and any subcontractors shall be responsible for the total compliance with all federal, state and local ordinances, laws and regulations as related to safe construction practices and to protecting the and employees and public's health and safety.

E. DISPOSAL OF SURPLUS AND WASTE MATERIALS

1. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off-site in accordance with all local, state, and/or federal regulations governing such activities.

END OF SECTION 312000

SECTION 312500 – EROSION AND SEDIMENTATION CONTROLS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Drawings, general provisions of Contract, and other Division 31 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes the following: Soil Erosion and sedimentation control for all areas of the site that are graded or disturbed by any construction operations and elsewhere as indicated on the Drawings or specified herein. Erosion control shall be as specified herein and as may be required by actual conditions and governing authorities.

B. The Contractor is fully responsible for all applicable permits and approvals for off-site borrow and waste areas.

C. The Contractor shall have full responsibility for the construction and maintenance of erosion control and sedimentation control facilities as shown on the Drawings and as specified herein. The Contractor shall at all times provide the operation and maintenance necessary to operate the permitted sediment and erosion controls at optimum efficiency.

D. All swales, ditches, perimeter slopes and all slopes steeper than 3:1 shall be provided temporary or permanent stabilization with ground cover as soon as practicable but in any event within seven (7) calendar days from the last land-disturbing activity. All other disturbed areas shall be provided temporary or permanent stabilization as soon as practicable but in any event within fourteen (14) calendar days from the last land disturbing activity.

E. Related Sections: The following Sections contain requirements that relate to this Section:

1. Site Clearing
2. Earth Moving

1.3 PRODUCT HANDLING

A. Deliver seed, fertilizer and other packaged material in unopened original packages with labels legible and intact. Seed packages shall bear a guaranteed analysis by a recognized authority.

B. On-site storage of materials shall be kept to a minimum. Wet or damaged seed or other material shall be removed from the project immediately.

1.4 MONITORING AND RECORD KEEPING

A. All sediment and erosion control devices and facilities shall be inspected at least once every seven (7) calendar days or within 24 hours after any storm event of greater than 0.5 inches of rain per 24 hour period.

B. Stormwater discharges shall be inspected by observation for stormwater discharge characteristics (as listed below) at the above frequency to evaluate the effectiveness of the sediment control facilities, devices or practices. Observations shall be made at all stormwater

discharge outfalls and other locations were concentrated stormwater discharges from the site. Observations shall be qualitative, no analytical testing or sampling is required. If any visible off-site sedimentation is leaving the site, corrective action shall be taken to reduce the discharge of sediments.

1. Color
2. Odor
3. Clarity
4. Floating solids
5. Suspended solids
6. Foam
7. Oil sheen
8. Other obvious indicators of stormwater pollution

C. The contractor shall perform and keep records of the above inspections on the attached form entitled “Stormwater Inspections for General Permit NCG010000 – Land Disturbing Activities”. Visible sedimentation found off the site shall be recorded with an explanation of the measures taken to prevent future release as well as any measures taken to clean up the sediment that has left the site. This record shall be made available to the Owner, Designer, and governmental authorities.

2.1 PRODUCTS

A. SOIL AMENDMENTS AND SEED

1. Refer to Construction Drawings

2.2 MISCELLANEOUS

Gravel for stone filters: Washed No. 57 stone or as indicated on the drawings.

Silt Fabric: A synthetic filter fabric or a previous sheet of polypropylene, nylon, polyester, or polyethylene yarn, which is certified by the manufacturer or supplier as conforming to the following requirements.

1. Filtering efficiency: 85% min.
2. Tensile Strength at 20% (max.) elongation: 30lb./lin in (min.)
3. Slurry Flow Rate: 0.3 gal/sq-ft/min. (min.)
4. Fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected useable construction life.

Filter Fabric (for installation under riprap): Woven geotextile fabric, apparent opening size no larger than US Standard Sieve No. 70, min. grad strength of 120lbs.

Riprap: Provide riprap of the class and quantity indicated on the Drawings. While no specific gradation is required, the various sizes of the stone shall be equally distributed within the required size range. The size of an individual stone shall be determined by measuring its long dimension. Stone shall meet the requirement of the following table for class and size distribution. No more than 5% of the material furnished can be less than the minimum size specified nor no more than 10% of the material can exceed the maximum size specified.

REQUIRED STONE SIZES – INCHES			
CLASS	MINIMUM	MIDRANGE	MAXIMUM
A	2	4	6
B	5	8	12
1	5	10	17
2	9	14	23

PART 3 EXECUTION

3.1 GENERAL

A. Existing Structures and Facilities

1. Existing structures, facilities, and water courses shall be protected from sedimentation.
2. The Contractor shall be responsible for the construction of necessary measures, and all costs shall be at the expense of the Contractor.
3. Items to be protected from sedimentation deposits shall include, but are not limited to, all down stream property, natural waterways, streams, lakes and ponds, catch basins, drainage ditches, road gutters, and natural buffer zones.
4. Control measures such as the erection of silt fences, barriers, dams, or other structures shall begin prior to any land disturbing activity. Additional measures shall be constructed as required during the construction.
5. All facilities installed shall be maintained continuously during construction until the disturbed areas are stabilized. Contractor shall remove all erosion control measures at the end of the project at his expense unless otherwise directed by the Owner or his representative.
6. Perform monitoring and record keeping as specified in this section.

B. PROTECTIVE MEASURES

1. Protective measures shall conform to all State and Local requirements.

2. Construction and maintenance of sediment and erosion control measures shall be in accordance with all applicable laws, codes, ordinances, rules and regulations.

2. Silt Fence: Hog wire or wire mesh fastened to posts as recommended by the Manufacturer, and covered with silt fabric.
3. Mulching: Mulching shall be used to prevent erosion and to hold soil and seed in place during establishment of vegetation.
4. Matting: Temporary matting shall be used for temporary stabilization during the established of seeded cover in all grassed ditches, channels, long slopes, and steep banks (6:1 or greater) as indicated on plans. Matting shall be installed on any area on site as needed to provide temporary stabilization whether or not matting is indicated on the plan.
5. Construction Entrances: Construct all entrances in accordance with plans. Maintain all ingress/egress points to prevent tracking of soil onto the Owner's. public or private roads. Any soil that is tracked onto the roads shall be removed immediately.
6. Riprap: Stone shall be graded so that the smaller stones are uniformly distributed throughout the mass. Stone may be placed by mechanical methods, augmented by hand placing where necessary, provided that when the riprap is completed it forms a properly graded, dense, neat layer of stone.
7. Other Measures: Other methods of protecting existing structures and facilities, such as vegetative filter strips, diversions, riprap, baffle boards, and ditch checks used for reduction of sediment movement and erosion, may be used at the option of the

Contractor when approved by the Engineer and the appropriate State or Local authorities.

C. STABILIZATION

1. Permanently protect stabilized areas prior to the removal of protective devices.
2. After the final establishment of permanent stabilization, remove temporary sediment control measures. Respread accumulated sediments as specified.

3. Permanently stabilize all areas disturbed by the removal and re-spreading operations immediately.

D. TEMPORARY SEEDING

1. In accordance with the schedule required by NCDENR.

E. PERMANENT SEEDING

1. In accordance with the schedule required by NCDENR.

F. MULCHING AND MATTING

1. Apply mulch or matting to retain soil and grass.

2. Mulch areas with slope greater than 5% by spreading a light cover of mulch over seeded area at the rate of not less than 85lbs. per 1000 sq. ft.

3. Install temporary matting in all grassed ditches, channels, long slopes, and steep banks (6:1 or greater) and other areas indicated on plans or where extra protection from erosion is needed.

END OF SECTION 312500

STORMWATER INSPECTIONS FOR GENERAL PERMIT NCG010000 – LAND DISTURBING ACTIVITIES

PROJECT:_____ **MONITORING FOR THE WEEK BEGINNING:**_____

All erosion and sedimentation control facilities and stormwater discharge outfalls must be inspected at least once (twice, if on 303(d) listed stream for construction related parameters*) per seven calendar days and within 24 hours of a rainfall of 0.5 inches per 24 hours. Pe rmittee must keep a record of inspections.

RAINFALL: Gauge must be maintained on site

Date Of Rain	Amount (inches)	Name

By this signature, I certify (in accordance with Part II Section B, 10 of the NCG010000 permit) that this report is accurate and complete to the best of my knowledge:

_____

(Signature of Permittee or Designee)

EROSION AND SEDIMENTATION CONTROL FACILITIES INSPECTED: Identification of all facilities may require additional pages.

Facility Identification (all measures)	Date of inspection	Time of inspection	Name of inspector	Operating Properly (Y/N)	Describe corrective actions taken (may need to attach additional information)

E. OBSERVATIONS OF RUNOFF AT STORMWATER DISCHARGE OUTFALLS: Take immediate corrective action to control the discharge of sediments outside the F. disturbed limits of the site. May require additional pages.

Stormwater F. Discharge Outfall Identification	Date of inspection	Time of inspection	Name of inspector	Clarity (1-10)	Floating solids (1-10)	Suspended Solids (1-10)	Oil sheen (Y/N)	Other obvious indicators of stormwater pollution (list & describe)	Visible sediment leaving the site? (Y/N)	If yes, describe actions taken to prevent future releases (may need to attach additional information)	Describe measures taken to clean up sediment outside of the disturbed limits (may need to attach additional information)

Clarity: Choose the number which best describes the clarity of the discharge where 1 is clear and 10 is very cloudy
Floating Solids: Choose the number which best describes the amount of floating solids in the discharge where 1 is no solids and 10 the surface is covered in floating solids
Suspended Solids: Choose the number which best describes the amount of suspended solids in the discharge where 1 is no solids and 10 is extremely muddy

Has all land disturbing construction been completed? _____ **(Y/N) Has the final permanent ground cover been completed & established?** _____ **(Y/N)**

* 303(d) listed streams for construction related parameters – The latest approved list may be obtained from the Division of Water Quality, or from the following website location:
http://h2o.enr.state.nc.us/su/construction303d

SECTION 321313 – CONCRETE PAVING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, general provisions of Contract, and Division 32 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes work required to install all concrete walks and paving, together with related items necessary to complete work indicated on the Drawings and described in the Specifications.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Earth Moving

1.3 SUBMITTALS

A. Furnish Samples, Manufacturer's Product Data, Test Reports, and Material Certifications as required in Division 32.

B. Furnish Drawings indicating jointing pattern proposed for all areas of concrete pavement for approval by the Engineer. Only information completely checked by the manufacturer and the General Contractor will be considered by the Engineer.

1.4 STANDARDS

A. Products and methods of execution are specified by reference to North Carolina State Department of Transportation and Highway Safety's "Standard Specifications for Roads and Structures" (latest edition). The abbreviation NCDOT is used to designate this publication. Equivalent alternate products and methods of execution as defined by the specifications. All methods and substitutions must be approved by the Engineer.

1.5 QUALITY ASSURANCE

A. Codes and Standards: Comply with local governing regulations.

B. Testing: The Owner shall employ and pay for the services of an Independent Testing Laboratory (ITL) to evaluate concrete delivered to and placed at the site in accordance with requirements of Division 32.

2.1 MATERIALS

A. Forms: 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. Forms shall remain in place for a minimum of 24 hours after concrete placement or until concrete is secure. Use straight forms, free of distortion and defects, extending the full depth of concrete. All forms shall receive a form coating the full depth of concrete. All forms shall receive a form coating per Division 32 of these specifications prior to placing concrete.

B. Expansion Joint Fillers: Expansion joint fillers shall be 1/2 inch thick unless otherwise shown on Drawings, equivalent to Celotex "Flexcell", "Fibre", by W.R. Meadows, or "Tex-Lite", by J & P

Petroleum Products or equivalent, and shall conform to NCDOT Section 1028.

C. Concrete: Concrete and equipment, workmanship and materials for forming shall conform to applicable requirements of Division 32, unless otherwise specified. Concrete shall be standard-weight with minimum compressive strength as specified on the construction drawings for the various concrete paving and walkway applications.

D. Joint Dowel Bars: Plain steel bars, ASTM A-615, Grade 60. Cut bars true to length with ends square and free of burrs.

E. Reinforcing Bars: Deformed steel bars, ASTM A-615, Grade 60.

F. Curing Compound: Shall be "Clear Bond" by Guardian Chemical Company, "Sealkure" by Toch Brothers, Inc., "Klearseal" by Penn-Dixie or equivalent.

G. Backer Rod: Shall be closed cell polyethylene foam as manufactured by ITP, Nomaco, RoAn Corporation or equivalent.

H. Joint Sealer: Silicone sealant as manufactured by Surebond Inc., Dow Corning, Silka Corporation or equivalent.

I. Welded Wire Fabric: ASTM A-185.

J. Automatic Machine Curb and Gutter

1. Automatic machine may be used for curb and gutter placement at Contractor's option. If machine placement is to be used, Contractor shall submit revised mix design and laboratory test resulted which meet or exceeds minimums specified.
2. Machine placement must produce curb and gutters to required cross-section, line grades, finish, and jointing as specified for formed concrete. If results are not acceptable, Contractor shall remove and replace with formed concrete as specified.

K. Filter Fabric: Filter fabric is non-woven drainage geo-textile, minimum 4-mil thickness. Use Propex 4546 manufactured by Ikex Company or comparable product.

L. ABC Aggregate: The aggregate base course shall comply with Section 520 of the NCDOT Specifications. Aggregate shall be a maximum diameter of 1-1/2” and conform to the graduation requirements of ASTM D-2940. See Aggregate Base Course Gradation Acceptance Ranges below:

Sieve Size	% Passing
1 1/2"	100
1”	75-97
1/2”	55-80
#4	35-55
#10	25-45
#40	14-30
#200a	4-12
#200b	4-10

M. Contractor must submit to owner proof that the aggregate for base is:
1. from a NC DOT certified quarry
2. a test certificate from the quarry indicating 100% maximum dry density
3. a batch ticket from the quarry certifying that aggregate is ABC

3.1 EXECUTION

3.2 INSPECTION

A. Examine the areas and conditions under which concrete walks are to be installed and notify the Engineer in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

3.3 INSTALLATION

A. Subgrade

Bring subgrades, after final compaction, to required grades and section.

Deposit fill material under paving for final 24" in horizontal layers not exceeding 6" in depth before compacting. Spread fill evenly and compact each layer by uniformly rolling, pneumatic tamping or use of other approved equipment to 100 percent density as defined by ASTM D 698. If necessary, soil shall be moistened, or allowed to dry to the correct moisture content before compaction.
Subgrade for curbs shall extend 1'-0" behind back of the curb and shall be moist when concrete is placed, free from frost.

B. Reinforcement:

1. Reinforcement shall be as specified on the construction drawings for the concrete paving, sidewalks or curb and gutter sections.

2. Placing Concrete: In concrete paving areas, utilize a vibratory screed capable of consolidating 10 inches of concrete. Utilize hand vibrator along form faces, rigid structures, and in areas vibratory screed cannot access. Concrete shall be placed in accordance with requirements of Owner and the construction details for the various types of concrete installation (curb and gutter section, sidewalk section and concrete pavement section).

3. Joints: Construct expansion, contraction, and construction joints true to line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

4. Contraction Joints: For concrete walks provide contraction joints at 6'0" o.c. For concrete paving provide contraction joints into 15'0" squares maximum, unless otherwise shown on the plans or details. All contraction joints should be constructed to a minimum depth of 25% of the slab thickness. For curb and gutter, joints shall be in accordance with the construction detail on the plans. Joints may be formed by the following methods:

5. Tooled Joints: Form in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.

6. Sawed Joints: Use 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.

7. Inserts: Use embedded strips of metal, plastic zip strip or sealed wood. Set strips into

plastic concrete and carefully remove strips after concrete has hardened.

8. Planned Construction Joints: Place construction joints where placement operations will be stopped for more than 1/2 hour except where such pours terminate at expansion joints.

9. Construction joints shall be doweled, saw cut at butt joint face to 1- 1/4" depth minimum, and sealed in accordance with these specifications and the detailed drawings.

10. Emergency Construction Joints: Place emergency construction joints where concrete placement operations will be stopped for more than 1/2 hour at locations, which as a minimum, are 5 feet away from planned contraction joints. If placement operations are interrupted for more than 1/2 hour within 5 feet of a planned contraction joint, remove placed concrete back to nearest joint and repour section. If an emergency construction joint is required, allow concrete and required bars to set for 24 hours before placement operations are resumed at joint face. Contractor may resume placement operations at next planned construction joint and infill emergency construction joint after the 24 hour period.

11. Joint Sealing: All joints shall be sealed with a silicone sealant, Model 888 by Dow Corning or equivalent. All joints shall be thoroughly cleaned with jet of water and sand blasted prior to sealing in accordance with the requirements of NCDOT Section 700. All excess joint sealer shall be removed from pavement as soon as possible after joint sealing. Traffic shall not be allowed on pavement until excess joint sealer has been removed and the joints have been allowed to cure in accordance with manufacturer's recommendations.

C. Expansion Joints (Concrete Walks and Paving)

1. Expansion joints shall be 1/2" asphalt saturated felt expansion joint filler and will be placed flush with finished surface. Provide expansion joints for concrete abutting concrete curbs, catch basins, manholes structures, walks or other fixed objects. Place joints at 18' intervals in all walks with kerfs at 6’ intervals. Joint fillers shall be furnished in one-piece lengths where possible and where more than one piece is required, joint fillers shall be clipped together. Protect top edge of joint filler during concrete placement with metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

2. Curb and Gutter: In accordance with the construction drawing Plan Sheet C106.

3. Removal of Forms: Remove forms carefully. Do not damage concrete. Concrete forms shall remain in place for a minimum of 24 hours or until concrete is secure.

4. Cutting and Patching: When cutting and patching existing concrete paving, remove pavement to an existing control or expansion joint and re-pour the section to avoid small or linear patches through existing expanse of pavement.

5. Brick Pavers: Match existing brick unless otherwise directed. Contractor shall provide brick samples to Owner and Engineer for approval.

   a. Widths of walks are nominal and do not require the cutting of brick to comply. Actual brick width of walk must be within one brick width, plus or minus.
   b. Brick pavers shall be set 1/8” to 1/4” above finished grade.
   c. Pavers shall be laid with a maximum 1/8” joint between pavers.
   d. All pavers to be cut with a diamond-bladed brick saw or brick snapping tool

specifically designed to produce an accurate clean straight cut. Broken edges caused by masonry hammers will not be acceptable. Do not use less than ½ brick in any pavement area.

e. The edges of adjacent pavers shall be flush.
f. Standing water in any brick area is unacceptable.
g. Where sidewalk abuts curb and gutter, no edge restraint is required.
h. Edge restraints consist of a brick sailor course, either level with adjacent sidewalk where lawn abuts sidewalk, or 2” above adjacent sidewalk where a mulched area abuts the sidewalk, set in a bed of mortar.
i. Edge restraints shall not restrict flow of water off the walk.
j. Edge restraints shall be installed before pavers are installed.
k. Irregular lines inconsistent with specified pattern will not be permitted.
l. Where existing brick pavers are to be reused, the bricks are to be carefully removed, stored on pallets, and reinstalled as needed. Bricks that are chipped, cracked, broken, or otherwise marred are not to be reused.

3.4 CONCRETE FINISHING

A. Concrete Walks and Concrete Paving:

Install concrete walks and paving to thicknesses indicated on plans where shown on Drawings in widths indicated on carefully graded, well compacted base, using sound forming, true to lines shown. Wood float to indicated levels and planes and test surface trueness with a 10 foot straightedge. Inspect surface and remove any irregularities and refloat repaired areas to provide continuous smooth finish. Surface shall conform to a 1/8" smoothness tolerance from any two contact points on the straight edge. Apply broom finish and tool-finish edges to 1/2" radius. No water shall be added to concrete surface to facilitate finishing. No finishing shall be conducted while bleedwater is on surface. Finishing operations shall conform to the requirements of NCDOT Section 710.

B. Curing: Immediately after finishing operations, cure exposed concrete surfaces in accordance with NCDOT Section 700.

C. Protection: After curing, remove debris and backfill area adjoining sidewalk and paving. Grade and compact to conform to surrounding area in accordance with lines and grades indicated. Remove damaged concrete or concrete that does not drain properly and reconstruct at no additional cost to Owner.

3.5 REPAIR AND PROTECTION

A. Repair or replace broken or defective walks and paving, as directed by the Engineer.

Sweep concrete walks and paving, and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

END OF SECTION 321313

SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work shall include, but not be limited to, the following:

1. Surface preparation of subsoil.
2. Placing topsoil.
3. Addition of lime and fertilizer.
4. Seeding.
5. Maintenance to produce a permanent stand of grass.

1.2 PAYMENT PROCEDURES

A. Base bid for the work on the specified quantities of lime, fertilizer, and seed. After the specified soil tests have been made, Engineer may vary specified quantities. Should the actual quantities applied in the field vary appreciably from those specified, an adjustment in the contract price may be made.

1.3 RELATED SECTIONS

A. The following Sections have work that is directly related to this Section. This does not relieve the Contractor of his responsibility of proper coordination of all the work:

1. Section 311000 Site Clearing
2. Section 312000 Earth Moving
3. Section 330500 Reclaimed Utility Piping

1.4 REFERENCES

A. N.C. Department of Agriculture – NCDA

B. U.S. Department of Agriculture – USDA

1.5 PERFORMANCE REQUIREMENT

A. Grassed area shall be considered established when it presents a green appearance from eye level 50 feet away and the grass is vigorous and growing well in each square foot of seeded area. It is not required that the seeded area be thick and heavy as an old established lawn.

B. Should the permanent seed not germinate and produce a strand of grass, reseed affected areas until a permanent stand is established.

1.6 SUBMITTALS

A. Not less than 6 weeks prior to seeding, obtain representative soil samples from areas to be seeded and deliver the properly packaged samples with an information sheet for each sample properly filled out to the Soils Division of the NC Department of Agriculture or a private laboratory. Based on the test results, submit to the Engineer a recommendation as to the quantity and type of lime, fertilizer and seed for the area covered by the test.

1.7 QUALITY ASSURANCE

A. Quality of fertilizer, lime, and seed, and operations in connection with the furnishing of this material, shall comply with the requirements of the N.C. Fertilizer, Lime and Seed Law; and with the requirements of the rules and, regulations adopted by the NC Department of Agriculture in accordance with the provisions of the said law.

B. Seed containers shall bear an official "Certified Seed" label as inspected by the N.C. Crop Improvement Association.

C. Packages for soil conditioners and fertilizer shall bear manufacturer's guaranteed analysis.

D. Do not apply lime, fertilizer or seed in strong wind, when the soil is extremely wet, or otherwise unworkable. No rolling shall be done if precipitation after seeding would make the operation detrimental to the seed bed.

1.8 DELIVERY, STORAGE, AND PROTECTION

A. Deliver grass seed mixture in sealed containers showing percentage of seed mix, year of production, net production, net weight, date of packaging, and location of packaging.

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.9 MAINTENANCE SERVICE

A. Maintain seeded areas until grass is well established and exhibits a vigorous growing condition for a minimum of two cuttings. Mow grass at regular intervals to a maximum height of 3 inches. Hand clip where necessary.

B. Control growth of weeds. Apply herbicides in accordance with manufacturer’s instructions.

C. Water areas seeded between May 1 and July 15 at such intervals as to maintain the seeded area in a moist condition until the grass is established and accepted by the Engineer. Provide equipment to transport and distribute the water to the seeded areas. Areas seeded between September 1 and November 1 need not be irrigated beyond the initial watering specified above except that the Contractor may apply water at his own discretion.

PART 2 - PRODUCTS

2.1 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; pH value of minimum 5.4 and maximum of 7.0.

B. Lime: Ground Dolomitic agricultural limestone, not less than 85 percent total carbonates, ground so that 50 percent passes 100 mesh sieve and 90 percent passes 30 mesh sieve. Coarser material will be acceptable, provided the specified rates of application are increased proportionately on the basis of quantities passing No. 100 mesh sieve.

C. Fertilizer: Mixed, commercial, fertilizer containing 10-10-10 percentages of available nitrogen, phosphoric acid, and potash respectively, plus superphosphate with 20 percent P2O5 content. Fertilizer shall be dry, in granular (pellet) form, shall be delivered to the site in the manufacturer's original bag or container which shall be plainly marked as to formula.

D. Seed: Fresh seed guaranteed 95 percent pure with a minimum germination rate of 85 percent within one year of tests. Provide the following seed mixtures with lime and fertilizer in disturbed areas including NCDOT Rights-of-Way:

1. Permanent Seeding (Maximum slope 3:1)

Planting Dates	Grass Type	Pounds/Acre
Aug. 15 – Nov. 1	Tall Fescue	300
Nov. 1 – Mar. 1	Tall Fescue	300
&	Abruzzi Rye	25
Mar. 1 – Apr. 15	Tall Fescue	300
Apr. 15 – Jun. 30	Hulled Common Bermuda grass	25
Jul. 1 – Aug. 15**	Tall Fescue	120
&	Browntop Millet	35
&	Sorghum-Sudan Hybrids	30
Lime		4,000
Fertilizer	10-10-10	1,000
Mulch	Straw	4,000

** Temporary seeding, reseed according to optimum season for permanent seeding.

2. Permanent Seeding (Slopes from 3:1 to 2:1)

Planting Dates	Grass Type	Pounds/Acre
Mar 1 – June 1	Sericea Lespedeza	50
	&	
Mar. 1 – Apr. 15	Add Tall Fescue	120
Mar. 1 – Jun. 30	or Add Weeping Lovegrass	10
Mar. 1 Mar. 1 – Jun. 30	or Add Hulled Common Bermudagrass	25
Jun. 1 – Sept. 1**	Tall Fescue	120
&	Browntop Millet	35
&	Sorghum -Sudan Hybrids	30
Sept. 1 – Mar. 1	Sericea Lespedeza (unhulled - unscarified)	70
&	Tall Fescue	120
	&	
Nov. 1 – Mar. 1	Add Abruzzi Rye	25
Lime		4,000
Fertilizer	10-10-10	1,000
Mulch	Straw	4,000

** Temporary seeding, reseed according to optimum season for permanent seeding.

3. The Contractor shall provide seeding and follow fertilizing methods as required by the U.S. Army Corps of Engineers to reestablish disturbed areas in designated wetlands.

E. Matting / Erosion Control Fabric (ECF): Matting and ECF shall be a 100% straw mulch encased in a medium weight plastic netting (both sides) with a minimum permissible shear stress of 1.75 lbs/ft2. Matting shall be fully degradable but suitable until vegetation has been established. Installation of ECF shall be done with staples per temporary liner detail in the Drawings. Commercially available ECFs may be used upon approval of the engineer. Approval of fabrics will require manufacturer's design data regarding velocity, shear strength, ditch slopes, method of installation, decay cycle, repair techniques, and grass growth enhancement characteristics.

F. Wire Staples: 16 gauge steel wire, with minimum of 3" top and 4" long legs.

G. Mulch: Threshed straw of oats, wheat, or rye; free from seed of obnoxious weeds; or clean salt hay. Straw which is fresh and excessively brittle or straw which is in such an advanced stage of decomposition as to smother or retard growth of grass will not be acceptable.

H. Water: Water shall be free from substances harmful to growth of grass.

PART 3 - EXECUTION

3.1 PREPARATION OF SUBSOIL

A. Complete operations in the area to be seeded and prepare subsoil to eliminate uneven areas and low spots. Bring surface to the approximate design contours.

B. Scarify subsoil to a depth of 3 inches. Remove weeds, roots, stones and foreign materials 1-1/2 inches in diameter and larger.

3.2 PLACING TOPSOIL

A. Place topsoil during dry weather and on dry unfrozen subsoil where indicated on Drawings.

B. Spread topsoil to a minimum depth of 4 inches. Remove vegetable matter and foreign non-organic material from topsoil while spreading. Grade surface to provide positive drainage and prevent water ponding. Lightly compact topsoil with at least one pass of a cultipacker or similar equipment

C. Maintain the finished surfaces by protecting, and replacing topsoil and subsoil as necessary until the area is accepted under the contract.

3.3 APPLICATION OF LIME

A. Liming shall be done immediately after grading has reached the fine grading stage, even though actual seeding may not be done until several months later.

B. Spread lime evenly by means of a mechanical distributor.

C. When lime is distributed by commercial liming dealers, sales slips showing the tonnage delivered shall be filed with the Engineer and shall show the full tonnage required for the acres treated.

D. Incorporate lime in the top 2 to 3 inches of soil by harrowing, disking, or other approved means.

3.4 APPLICATION OF FERTILIZER

A. Spread fertilizer not more than 2 weeks in advance of seeding.

B. To verify application rate, determine acreage to be fertilized and provide Engineer with total weight of fertilizer applied to the area.

C. Provide mechanical spreader for even distribution and spread half of the rate in one direction, and the other half at right angles to the first. Mix thoroughly into upper 2 to 3 inches of soil by disking, harrowing or other approved methods.

3.5 SEEDING

A. Accomplish seeding by means of an approved power-drawn seed drill, combination corrugated roller-seeder, approved hand operated mechanical seeder, or other approved methods to provide even distribution of seed.

B. Do not seed when ground is excessively wet or excessively dry. After seeding, roll area with a roller, not less than 18 inches in diameter and weighing not more than 210 pounds per foot of width. Upon completion of rolling, water area with a fine spray.

C. Immediately following seeding apply mulch or matting as listed below. Do not seed areas in excess of that which can be mulched on same day.

D. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil depth

3.6 MULCHING AND MATTING

A. Apply mulch or matting as required to retain soil and grass, but no less then the following:

1. Slopes from 0 to 20 percent by spreading a light cover of mulch over seeded area at the rate of not less than 85 lbs. per 1000 sq. ft. Use tack to prevent disruption of mulch.
2. Slopes greater than 20 percent mulch with matting. Pin matting to the ground with wire staples at 5 foot intervals, immediately after seeding.

B. For tack use an asphalt tie-down of emulsified asphalt grade AE-3 or cut-back asphalt grade RC-2 or other approved equal. The application rate shall be 0.10 gal/sy (11 gal / 1000 sq ft). An approved jute mesh or net may be used in lieu of tacking straw mulch.

C. Other types of mulch and anchoring methods may be used upon approval by the Engineer.

3.7 PROTECTION

A. Protect seeded areas from damage by barricades, signs, and other appropriate means. Maintain and protect slopes from weather damage.

3.8 STABILIZATION TIMELINE

A. All disturbed areas must be vegetated or otherwise stabilized after being disturbed in accordance with the table below:

GROUND STABILIZATION*		
SITE AREA DESCRIPTION	STABILIZATION TIME FRAME	STABILIZATION TIME FRAME EXCEPTIONS
Perimeter Dikes, Swales, Ditches and Slopes	7 Days	None
High Quality Water (HQW) Zones	7 Days	None
Slopes Steeper than 3:1	7 Days	If slopes are 10’ or less in length and are not steeper than 2:1, 14 days are allowed
Slopes 3:1 or Flatter	14 Days	7 days for slopes greater than 50 feet in length
All Other Areas with Slopes Flatter than 4:1	14 Days	None (except for perimeters and HQW zones)

*"EXTENSIONS OF TIME MAY BE APPROVED BY THE PERMITTING AUTHORITY BASED ON WEATHER OR OTHER SITE-SPECIFIC CONDITIONS THAT MAKE COMPLIANCE IMPRACTICABLE." (SECTION II.B (2)(B))

END OF SECTION

SECTION 331100 – WATER DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for fire-service mains.

1.2 SUBMITTALS

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

B. Shop Drawings: Ductile iron pipe, valves, fittings, fire department connection, fire hydrant, post indicator valve, double check backflow preventer, above ground enclosures, tapping sleeve, valve box.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

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A. Regulatory Requirements:

Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.

Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.

Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

D. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

1.4 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

B. Notify Construction Manager no fewer than two days in advance of proposed interruption of service.

C. Do not proceed with interruption of water-distribution service without Construction Manager's written permission.

1.5 COORDINATION

A. Coordinate connection to water main with the Town of Bryson City.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Ductile-Iron Pipe:

1. All ductile iron pipe shall be minimum Class 50, designed in accordance with AWWA Standard C-150 as manufactures by American Cast Iron Pipe Company, United States and Foundry Company or Griffin Pipe Products or equivalent. The minimum thickness shall be pressure class 350 for all piping. This ductile iron pipe shall be manufactured with all applicable requirements of AWWA Standard C-151. The ductile pipe shall be cement-mortar lined with a sealcoat in accordance with AWWA C-104. Ductile iron pipe shall be bituminous coated in accordance with AWWA C-151.
2. All materials used in the production of the pipe are to be tested in accordance with AWWA Standard C-151 for their adequacy within the design of the pipe, and certified test results are to be provided to the Owner upon request. All certified tests, hydrostatic and material are to be performed by an independent testing laboratory at the expense of the pipe manufacturer.
3. Each joint of ductile iron pipe shall be hydrostatically tested before the outside coating and inside lining are applied at the point of manufacture to 500 psi. Testing may be performed prior to machining bell and spigot. Failure of ductile iron pipe shall be defined as any rupture or leakage of the pipe wall.

B. Ductile-Iron Fittings:

1. All fittings shall be manufactured in accordance with AWWA C-110 or C-153 for ductile iron compact fittings. The fittings shall be tested and the manufacturer shall provide certified test results when requested by the Owner. This testing shall include hydrostatic proof testing of the fittings.
2. All fittings shall be mechanical joint. Mechanical joints shall be manufactured in accordance with AWWA Standard C-111. Where applicable, flanged fittings shall be ductile iron 250 pressure rated in accordance with C-110-A-21.10 and ANSI B16.1, Class 125.
3. All fittings shall be ductile iron and shall have a minimum working pressure rating of 250 psi and minimum iron strength of 30,000 psi.
4. All fittings interiors shall be cement-motor lined in accordance with AWWA Standard C-104, and the outside shall be bituminous coated.
5. Where restraint is needed restrained mechanical glands may be used except when welded restraining rings are required. Glands provide additional restraint but do not take the place of required concrete blocking.

Ductile Iron Pipe Joints:

1. Pipe joints shall be mechanical or “push-on” in accordance with AWWA C-111/A-21.11 and shall be as manufactured by American Cast Iron Pipe Company, United States Pipe and Foundry Company, Griffin Pipe Products, McWane Cast Iron Pipe Company or equivalent.

2.2 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:

Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.

Standard: AWWA C219.

2.3 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

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

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

Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

American AVK Co.; Valves & Fittings Div.
American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
McWane, Inc.; Kennedy Valve Div.
McWane, Inc.; M & H Valve Company Div.
Mueller Co.; Water Products Div.

Nonrising-Stem, Resilient-Seated Gate Valves:

Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

Standard: AWWA C509.
Minimum Pressure Rating: 175 psig
End Connections: Mechanical joint.
Interior Coating: Complying with AWWA C550.

2.4 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

American Cast Iron Pipe Co.; Uniseal
McWane, Inc.; Clow Valve Co. Div. (Oskaloosa) – F5205 or F5207
McWane, Inc.; Kennedy Valve Div.
Mueller Co.; Water Products Div.

100% Stainless Steel:
Ford
JCM
Rockwell
Romac

Description: Sleeve and valve compatible with drilling machine.

Standard: MSS SP-60.

Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.

Valve: AWWA, cast-iron, nonrising-stem, metal resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

Valve Boxes: Comply with ASTM A48 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter. Valve boxes to be equipped with lockable valve covers.

Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve. Posts shall have a minimum diameter of two inches and a minimum bury of three feet with a minimum of three feet exposed. The exposed portion shall be painted red and shall be placed so that a valve operating tool has free operation.

2.5 BACKFLOW PREVENTERS

A. Double-Check Detector Assembly, Backflow-Prevention Assemblies:

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

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

Backflow shall be Watts 70QACDA or see most recently published Town of Bryson City Backflow Preventer Approval List.

Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

See most recently published Town of Bryson City Backflow Preventer Approval List.

Standard: AWWA C510.

Operation: Continuous-pressure applications, unless otherwise indicated.

Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

Size: 6-inch

Body: Fusion bond epoxy coated ductile iron for NPS 2-1/2 and larger.

End Connections: Flanged for NPS 2-1/2 and larger.

Configuration: Designed for horizontal, straight through flow.
Accessories: Ball valves with threaded ends on inlet and outlet of NPS 1/4 and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

2.6 ABOVE GROUND ENCLOSURE

A. Insulated Above Ground Enclosure:

Available Manufactures: Subject to compliance with requirements, manufactures offering product that may be incorporated into the work included, but are not limited to, the following:

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

See most recently published Town of Bryson City Insulated Above Ground Enclosures

- Enclosure shall have a low temperature sensor.
- Enclosure shall have two Tamper Switches.

2.7 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connections:

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

See most recently published Town of Bryson City Backflow Preventer Approval List

Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Plan Sheet C105 or a comparable product by one of the following:

See most recently published Town of Bryson City Backflow Preventer Approval List

Description: Fire department connection is to be a Yard FDC as shown on Plans. Fire Department connection is to be a 5” storz connection. See construction drawing details.

2.8 IDENTIFICATION DEVICES

A. Identification Tape (non-detectable warning tape): The 1st stage of identification shall be a buried non-detectable warning tape. This tape shall provide an early warning at shallow depth excavation. The tape shall be 6" wide, and buried approximately 18" to 30" above the service pipe, but a minimum of 10" below finished grade. It shall consist of multiple layers of polyethylene with an overall thickness of 3 to 5 mils. It shall be installed continuous from valve box to valve box or manhole to manhole, and shall terminate just outside of valve box or manhole wall. The black colored lettering on the warning tape shall be abrasion resistant and be imprinted on a color-coded background that conforms to APWA color code standards.

B. Warning Tape (detectable warning tape): The 2nd stage of identification shall be a detectable warning tape. This tape shall provide pipeline identification, be fully detectable from above grade utility locators, and be able to provide a depth reference point to top of pipe. It shall be 6" wide, installed directly on top of the pipeline and permanently secured to the pipeline at 10' intervals. The tape shall consist of aluminum foil core or stainless steel tracer wires laminated between multiple layers of polyethylene tape with an overall thickness of 4 to 6 mils. Detectable core or tracer wire "circuit" shall be continuous from valve box to valve box or manhole to manhole for complete pipeline detection and location. Tape manufacturers' approved splice kits shall be used for long runs. Warning tape shall terminate just inside of valve box cover or manhole ring cover and be easily accessible for "clip-on" type utility location meters. The black colored lettering on the warning tape shall be abrasion resistant and be imprinted on a color-coded background that conforms to APWA color code standards.

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PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground Fire-Service-Main Piping NPS 6 to NPS 8 shall be the following:

Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed mechanical-joint pipe; ductile-iron, mechanical-joint fittings; ductile-iron-pipe appurtenances.

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, metal high-pressure, resilient-seated gate valves with valve box.

Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.

3.4 PIPING INSTALLATION

A. Water-Main Connection: Arrange with the Town of Bryson City for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of the Town of Bryson City and of size and in location indicated.

C. Make connections larger than NPS 2 with tapping machine according to the following:

Install tapping sleeve and tapping valve according to MSS SP-60.

Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.

Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Comply with NFPA 24 for fire-service-main piping materials and installation.

E. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

F. Bury piping with depth of cover over top at least 36 inches with top at least 12 inches below level of maximum frost penetration.

G. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.5 JOINT CONSTRUCTION

A. Make pipe joints according to the following:

Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.

3.6 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

Concrete thrust blocks.
Locking mechanical joints.
Set-screw mechanical retainer glands.
Bolted flanged joints.
Heat-fused joints.
Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. The Town of Bryson City Fire Protection is to inspect thrust block when poured. Include anchorages for the following piping systems:

Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.7 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

C. MSS Valves: Install as component of connected piping system.

3.8 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

B. Do not install bypass piping around backflow preventers.

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C. Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.9 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install fire department connection per construction drawing details.

3.10 CONNECTIONS

A. Construction Drawings indicate general arrangement of piping, fittings, and specialties.

3.11 FIELD QUALITY CONTROL

A. Coordinate all pipe testing with the Town of Bryson City Fire Marshal.

B. Prior to Covering the Pipe:

Cover the main pipe with dirt but leave all joints exposed for inspection.

Contact the Project Manager and the Engineer to set up a test date and time. The Project Manager will contact the Town of Bryson City Fire Protection to schedule this test.

On test date, all parties shall walk the underground pipe and inspect it to ensure all joints are exposed. Drawings shall be available for review.

Test procedures shall be reviewed by all parties present.

C. Flushing of Piping:

Underground piping, from the water supply to the system riser, and lead-in connections to the system riser shall be completely flushed before the connection is made to downstream fire protection system piping. (NFPA 24, Section 10.10.2.1*)

The flushing operation shall be continued for a sufficient time to ensure thorough cleaning. (NFPA 24, Section 10.10.2.1.2)

The minimum rate of flow shall be not less than one of the following:

1. Hydraulically calculated water demand flow rate of the system, including any hose requirements.
2. Flow necessary to provide a velocity of 10 ft/sec in accordance with Table 10.10.2.1.3.
3. Maximum flow rate available to the system under fire conditions.

Table: 10.10.2.1.3
Flow required to produce velocity of 10 ft/sec in pipe

Pipe Size (in)	Flow Rate (gpm)
4	390
6	880
8	1,560
10	2,440
12	3,520

D. Test Procedures:

All piping and any attached devices subjected to system working pressure shall be hydrostatically tested at 200psi or 50psi in excess of the system working pressure, whichever is greater, and shall maintain that pressure without loss for 2 hours. (NFPA 24, Section 10.10.2.2.1*)

Pressure loss shall be determined by a drop in gauge pressure or visual leakage. (NFPA 24, Section 10.10.2.2.2)

The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested. (NFPA 24, Section 10.10.2.2.3)

The permitted amount of underground piping leakage shall be as follows (allowable leakage shall be determined prior to test):

1. The amount of leakage at the joints shall not exceed 2qt./hr per 100 gaskets or joints, irrespective of pipe diameter. The number of gaskets / joints shall be predetermined.
2. The amount of leakage specified in 10.10.2.2.4(1) shall be permitted to be increased by 1 fl.oz. per inch valve diameter per hour for each metal-seated valve isolating the test section.
3. If dry barrel hydrants are tested with the main valve open so the hydrants are under pressure, an additional 5 fl. Oz. / min. of leakage shall be permitted for each hydrant.
4. The amount of leakage in buried piping shall be measured at the specified test pressure by pumping from a calibrated container.

E. Starting and Ending the Test:

The pressure shall be increased in 50psi increments until the test pressure described in Section 10.10.2.2.1 is attained.

Each joint is checked between the 50 psi increments for stability, protrusion or extrusion of the gasket, leakage or other factors that may effect the continued use of a pipe in service. The next increment shall not be added until the joint is determined to be stable.

Upon reaching the desired test pressure, it shall be held for 1 hour without loss of pressure (200psi).

At the end of the first hour with no pressure loss, the system shall be decreased to 0psi and checked for leaks.

After checking the system for leaks at 0psi, slowly increase the system to the desired test pressure of 200psi minimum and held for 1 more hour without loss at 200psi and checked for leaks. (NFPA 24, Section A.10.10.2.2.1)

Prepare reports of testing activities.

3.12 TRENCH SAFETY

A. Contractor to coordinate construction sequence to provide shortest practical time that trenches will be open to avoid hazard to the public. There shall be no trenches left open unattended or after working hours.

B. Contractor to provide proper construction work zone signage and fencing to notify public. In areas of pedestrian traffic, contractor shall provide signage to direct pedestrians around construction zones. Particular attention should be placed in areas of playgrounds within the project site. Signs shall conform to the MUTCD and all federal, state and local codes.

C. Contractor shall ensure that all Occupational Safety and Health Administration (OSHA) regulations and standards are follows during all phases of the construction project.

D. The contractor and any subcontractors shall be responsible for the total compliance with all federal, state and local ordinances, laws and regulations as related to safe construction practices and to protecting the and employees and public's health and safety.

END OF SECTION 311020

SECTION 333100 – SANITARY UTILITY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Work consists of furnishing all materials, equipment, and labor for the installation of sewer lateral and cleanouts. All construction shall conform to requirements of these Specifications and construction drawing details.

1.3 SUBMITTALS

A. Provide manufacturer's data on all pipe material, manholes and cleanouts. Only information completely checked by the manufacturer and the General Contractor will be considered by the Designer.

1.4 PROTECTION

A. Existing Utilities: Locate existing underground utilities in the areas of work. If utilities are to remain in place, provide adequate means of protecting during excavation operations.
   1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, notify the Designer and consult the utility representatives immediately for directions. Cooperate with the Owner and public and private utility companies in keeping their respective services and facilities in operation. Repair damaged utilities to the satisfaction of the Owner and the utility owner.
   2. Do not interrupt existing utilities servicing facilities occupied and used by the Owner or others, except when permitted in writing by the Designer and then only after acceptable temporary utility services have been provided.

PART 2 PRODUCTS

2.1 MATERIALS

A. Sewer Laterals and Cleanouts: Pipe for sewer laterals and cleanouts shall be Schedule 40 PVC unless otherwise shown on the plans. A minimum grade as specified by the North Carolina Plumbing Code, plumbing shall be maintained. Each lateral shall be sealed at the end with an approved watertight plug. Cleanout stack and cap shall be in accordance with the Construction Detail Drawings.

B. Manholes shall be standard precast concrete reinforced at depth indicated on plans. Manholes shall be in conformance with ASTM C478. Manhole shall be 48" diameter unless otherwise indicated. Contractor to add concrete to case section as needed to prevent flotation.

C. Trench support, bedding and backfill for laterals shall be in accordance with the Construction Detail Drawings. The Contractor shall properly backfill under the WYE and lateral connections.

D. Underground – Markers:

1. Identification Tape (non-detectable warning tape): The 1st stage of identification shall be a buried non-detectable warning tape. This tape shall provide an early warning at shallow depth excavation. The tape shall be 6" wide, and buried approximately 18" to 30" above the service pipe, but a minimum of 10" below finished grade. It shall consist of multiple layers of polyethylene with an overall thickness of 3 to 5 mils. It shall be installed continuous from valve box to valve box or manhole to manhole, and shall terminate just outside of valve box or manhole wall. The black colored lettering on the warning tape shall be abrasion resistant and be imprinted on a color-coded background that conforms to APWA color code standards.

2. Warning Tape (detectable warning tape): The 2nd stage of identification shall be a detectable warning tape. This tape shall provide pipeline identification, be fully detectable from above grade utility locators, and be able to provide a depth reference point to top of pipe. It shall be 6" wide, installed directly on top of the pipeline and permanently secured to the pipeline at 10' intervals. The tape shall consist of aluminum foil core or stainless steel tracer wires laminated between multiple layers of polyethylene tape with an overall thickness of 4 to 6 mils. Detectable core or tracer wire "circuit" shall be continuous from valve box to valve box or manhole to manhole for complete pipeline detection and location. Tape manufacturers' approved splice kits shall be used for long runs. Warning tape shall terminate just inside of valve box cover or manhole ring cover and be easily accessible for "clip-on" type utility location meters. The black colored lettering on the warning tape shall be abrasion resistant and be imprinted on a color-coded background that conforms to APWA color code standards.

PART 3 EXECUTION

3.1 TRENCH PREPARATION

A. Trench excavation shall conform to the line and depth shown on the plans. Maintenance of a safe trench shall be the sole responsibility of the Contractor.

B. Maintain a minimum of 10 feet horizontal and 18 inches vertical separation between waste and sewer mains at all times. A minimum of 24 inches vertical separation between storm and sewer mains is to be maintained at all times.

C. The width and type of trench may vary with the depth of cut, and the trench shall be constructed in accordance with the dimensions and other information shown on the construction drawing details.

3.2 BACKFILLING

A. Backfilling: The backfilling of the trench after the pipe installation and testing shall be in accordance with the standard construction drawing detail.

B. The initial and final backfill shall be with suitable native material. No rocks, boulders or stones four inches or larger shall be included in the backfill for at least two feet above the top of the pipe.

C. The bedding and backfilling shall be in conformance with ASTM D-2321 and the various soil classes are defined below:

1. Class I – Angular 6 to 40 mm (¼ to 1-½ inch), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone and crushed shells.

2. Class II – Coarse sands and gravels with maximum particle size of 40 mm (1-½ inch), including variously graded sands and gravels containing small percentages of fines,

generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW and SP are included in this class.

3. Class III – Fine sand and clayey gravels, including fine sands, sand clay mixtures and gravel-clay mixtures. Soil Types GM, GC, SM and SC are included in this class.

4. Class IV – Silt, silty clays and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. Soil Types MH, ML, CH and CL are included in this class. These materials are not recommended for bedding, hunching or initial backfill on PVC pipes.

END OF SECTION 333100