**SPECIFICATIONS**

Contents

[SECTION A: CONTRACTOR QUALITY CONTROL PROGRAM 2](#_Toc10608907)

[1. GENERAL 2](#_Toc10608908)

[2. DESCRIPTION OF PROGRAM: 2](#_Toc10608909)

[3. QUALITY CONTROL ORGANIZATION 3](#_Toc10608910)

[4. PROJECT PROGRESS SCHEDULE 5](#_Toc10608911)

[5. SUBMITALS SCHEDULE 5](#_Toc10608912)

[6. INSPECTION REQUIREMENTS 5](#_Toc10608913)

[7. QUALITY CONTROL TESTING PLAN 6](#_Toc10608914)

[8. DOCUMENTATION 6](#_Toc10608915)

[9. CORRECETIVE ACTION REQUIREMENTS 8](#_Toc10608916)

[10. SURVEILLANCE BY THE ENGINEER 8](#_Toc10608917)

[11. NONCOMPLIANCE 8](#_Toc10608918)

[SECTION B: SPECIFICATIONS 9](#_Toc10608919)

[1. SUBMITTALS 9](#_Toc10608920)

[2. VALVES, GATES AND APPURTENANCES 14](#_Toc10608921)

[3. TEMPORARY CONTROLS 23](#_Toc10608922)

[4. CLEARING AND GRUBBING 28](#_Toc10608923)

[5. GENERAL EXCAVATION, FILLING, AND BACKFILLING 30](#_Toc10608924)

[6. EARTHWORK FOR STRUCTURES AND PAVEMENTS 40](#_Toc10608925)

[7. EXCAVATION, BACKFILLING AND COMPACTING FOR UTILITIES 53](#_Toc10608926)

[8. EXTERIOR WATER DISTRIBUTION SYSTEM (MINOR CONSTRUCTION) 64](#_Toc10608927)

[9. FENCE, CHAIN LINK 78](#_Toc10608928)

[10. CAST-IN-PLACE CONCRETE 83](#_Toc10608929)

[11. PAINTING 98](#_Toc10608930)

[12. FILTRATION EQUIPMENT 107](#_Toc10608931)

[13. MECHANICAL GENERAL REQUIREMENTS 111](#_Toc10608932)

[14. ELECTRICAL GENERAL REQUIREMENTS 116](#_Toc10608933)

# SECTION A: CONTRACTOR QUALITY CONTROL PROGRAM

## GENERAL

The Contractor shall establish, provide, and maintain an effective Quality Control Program that details the methods and procedures that will be taken to assure that all materials and completed construction required by this contract conform to contract plans, technical specifications and other from subcontractors or vendors. Although guidelines are established and certain minimum requirements are specified herein and elsewhere in the contract technical specifications, the Contractor shall assume full responsibility for accomplishing the stated purpose.

The intent of this section is to enable the Contractor to establish a necessary level of control that will:

 A) Adequately provide for the production of acceptable quality materials.

B) Provide sufficient information to assure both the Contractor and the Engineer that the specification requirements can be met.

C) Allow the Contractor as much latitude as possible to develop his/her own standard of control.

The Contractor shall be prepared to discuss and present, at the preconstruction conference, his/her understanding of the quality control requirements. The Contractor shall not begin any construction or production of materials to be incorporated into the completed work until the Quality Control Program has been reviewed by the Engineer. No partial payment will be made for materials subject to specific quality control requirements until the Quality Control Program has been reviewed.

The quality control requirements contained in this section and elsewhere in the contract technical specifications are in addition to and separate from the acceptance testing requirements. Acceptance testing requirements are the responsibility of the Contractor’s Engineer.

## DESCRIPTION OF PROGRAM:

 A). General Description. The Contractor shall establish a Quality Control Program to perform inspection and testing of all items of work required by the technical specifications, including those performed by subcontractors. This Quality Control Program shall ensure conformance to applicable specifications and plans with respect to materials, workmanship, construction, finish, and functional performance. The Quality Control Program shall be effective for control of all construction work performed under this Contract and shall specifically include surveillance and tests required by the technical specifications, in addition to other requirements of this section and any other activities deemed necessary by the Contractor to establish an effective level of quality control.

 B). Quality Control Program. The Contractor shall describe the Quality Control Program in a written document which shall be reviewed by the Engineer prior to the start of any production, construction or off site fabrication. The written Quality Control Program shall be submitted to the Engineer for review at least 15 calendar days before the start of any production, construction or off-site fabrication.

The Quality Control Program shall be organized to address, as a minimum, the following items:

 a. Quality control organization;

 b. Project progress schedule;

 c. Submittals schedule;

 d. Inspection requirements;

 e. Quality control testing plan;

 f. Documentation of quality control activities; and

g. Requirements for corrective action when quality control and/or acceptance criteria are not met.

The Contractor is encouraged to add any additional elements to the Quality Control Program that he/she deems necessary to adequately control all production and/or construction processes required by this contract.

## QUALITY CONTROL ORGANIZATION

Control Program shall be implemented by the establishment of a separate quality control organization. An organizational chart shall be developed to show all quality control personnel and how these personnel integrate with other management production and construction functions and personnel. The organizational chart shall identify all quality control staff by name and function, and shall indicate the total staff required to implement all elements of the Quality Control Program, including inspection and testing for each item of work. If necessary, different technicians can be utilized for specific inspection and testing functions for different items of work. If an outside organization or independent testing laboratory is used for implementation of all or part of the Quality Control Program, the personnel assigned shall be subject to the qualification requirements of paragraph D-03a and D-03b. The organization shall indicate which personnel are Contractor employees and which are provided by an outside organization.

The quality control organization shall consist of the following minimum personnel:

 a. Program Administrator. The Program Administrator shall be a full-time employee of the contractor, or a consultant engaged by the Contractor. The Program Administration shall have a minimum of 5 years of experience in electrical power generation and building construction and shall have had prior quality control experience on a project of comparable size and scope as the contract.

Additional qualifications for the program Administrator shall include at least 1 of the following requirements:

 (1). Professional engineer with 1 year of civil utilities in public works and building experience acceptable to the Engineer.

 (2). Engineer-in-training with 2 years of civil utilities in public works and building experience acceptable to the Engineer.

 (3). An individual with 3 years of civil utilities in public works and building experience acceptable to the Engineer, with a Bachelor of Science Degree in Civil Engineering Technology or Construction.

 (4). Construction materials technician certified at Level III by the National Institute for Certification in Engineering Technologies (NICET).

 (5). A NICET certified engineering technician in Civil Engineering Technology with 5 years of experience acceptable to the Engineer.

The Program Administrator shall have full authority to institute any or all actions necessary for the successful implementation of the Quality Control Program to ensure compliance with the contract plans and technical specifications. The Program Administrator shall report directly to a responsible office of the construction firm.

The Program Administrator may supervise the Quality Control Program on more than one project provided that person can be at the job site within 2 hours after being notified of a problem.

 b. Quality Control Technicians. A sufficient number of quality control technicians necessary to adequately implement the Quality Control Program shall be provided. These personnel shall be engineers, engineering technicians, or experienced craftsman with qualifications in the appropriate field equivalent to NICET Level II or higher construction materials technician or highway construction technician and shall have a minimum of 2 years of experience in their area of expertise.

The quality control technicians shall report directly to the Program Administrator and shall perform the following functions:

 (1). Inspection of all materials, construction, plant, and equipment for conformance to the technical specifications, and as required by Section 100-06.

 (2). Performance of all quality control tests as required by the technical specifications and Section D-07.

Certification at an equivalent level, by a state or nationally recognized organization will be acceptable in lieu of NICET certification.

 c. Staffing Levels. The Contractor shall provide sufficient qualified quality control personnel to monitor each work activity at all times. Where material is being produced in a plant for incorporation onto the work, separate plant and field technicians shall be provided at each plant and field placement location. The scheduling and coordinating of all inspection and testing must match the type and pace of work activity. The Quality Control Program shall state where different technicians will be required for different work elements.

## PROJECT PROGRESS SCHEDULE

The Contractor shall submit a coordinated construction schedule for all work activities. The schedule shall be prepared as a network diagram in Critical Path Method (CPM), PERT, or other format, or as otherwise specified in the contract. As a minimum, it shall provide information on the sequence of work activities, milestone dates, and activity duration.

The Contractor shall maintain the work schedule and provide an update and analysis of the progress schedule on a twice monthly basis, or as otherwise specified in the contract. Submission of the work schedule shall not relieve the Contractor of overall responsibility for scheduling, sequencing, and coordinating all work to comply with the requirements of the contract.

## SUBMITALS SCHEDULE

The Contractor shall submit a detailed listing of all submittals (e.g., mix designs, material certifications) and shop drawings required by the technical specifications. The listing can be developed in a spreadsheet format and shall include:

 a. Specification item number;

 b. Item description;

 c. Description of submittal;

 d. Specification paragraph requiring submittal; and

 e. Schedule date of submittal.

## INSPECTION REQUIREMENTS

Quality control inspection functions shall be organized to provide inspections for all definable features of work, as detailed below. All inspections shall be documented by the Contractor as specified by Section D-07.

Inspections shall be performed daily to ensure continuing compliance with contract requirements until completion of the particular features of work. These shall include the following minimum requirements:

 a. During plant operation for material production, quality control test results and periodic inspections shall be utilized tonsure the quality of aggregates and other mix components, and to adjust and control mix proportioning to meet the approved mix design and other requirements of the technical specifications. All equipment utilized in proportioning and mixing shall be inspected to ensure its proper operating condition. The Quality Control Program shall detail how these and other quality control functions will be accomplished and utilized.

 b. During field operations, quality control test results and periodic inspection shall be utilized to ensure the quality of all materials and compacting shall be inspected to ensure its proper operating condition and to ensure that all such operations are in conformance to the technical specifications and are within the plan dimensions, lines, grades, and tolerances specified. The Program shall document how these and other quality control functions will be accomplished and utilized.

## QUALITY CONTROL TESTING PLAN

As a part of the overall Quality Control Program, the Contractor shall implement a quality control testing plan shall include the minimum tests and test frequencies required by each technical specification item, as well as any additional quality control tests that the Contractor deems necessary to adequately control production and/or construction processes.

The testing plan can be developed in a spreadsheet fashion and shall, as a minimum, include the following:

 a. Specification item number (e.g., P-401);

 b. Item description (e.g., Plant mix Bituminous Pavements);

 c. Test type (e.g., gradation, grade, asphalt content);

 d. Test standard (e.g., ASTM or AASHTO test number, as applicable);

 e. Test frequency (e.g., as required by technical specifications or minimum frequency when requirements are not stated);

 f. Responsibility (e.g., plant technician); and

 g. Control requirements (e.g., target, permissible deviations).

The testing plan shall contain a statistically-based procedure of random sampling for acquiring test samples in accordance with ASTM D 3665. Engineer shall be provided the opportunity to witness quality control sampling and testing.

All quality control test results shall be documented by the Contractor as required by Section D-08.

## DOCUMENTATION

The Contractor shall maintain current quality control records of all inspections and tests performed. These records shall include factual evidence that the required inspections or tests have been performed, including type and number of inspections or tests involved; result of inspections or tests, nature of defects, deviations, causes for rejection, ect.; proposed remedial action; and corrective actions taken.

These records must cover both conforming and defective or deficient features, and must include a statement that all supplies and materials incorporated in the work are in full compliance with the terms of the contract. Legible copies of these records shall be furnished to the Engineer daily. The records shall cover all work placed subsequent to the previously furnished records and shall be verified and signed by the Contractor’s Program Administrator.

Specific Contractor quality control records required for the contract shall include, but are not necessarily limited to, the following records:

 a. Daily Inspection Reports. Each Contractor quality control technician shall maintain a daily log of all inspections performed for both Contractor and Subcontractor operations on a form acceptable to the Engineer. These technician’s daily reports shall provide factual evidence that continuous quality control inspections have been performed and shall, as a minimum, include the following:

 (1). Technical specification item number and description;

 (2). Compliance with approved submittals;

 (3). Proper storage of materials and equipment;

 (4). Proper operation of all equipment;

 (5). Adherence to plans and technical specifications;

 (6). Review of quality control tests; and

 (7). Safety inspection.

The daily inspection reports shall identify inspections conducted, results of inspections, location and nature of defects found, causes for rejection, and remedial or corrective actions taken or proposed.

The daily inspection reports shall be signed by the responsible quality control technician and the Program Administrator. The Engineer shall be provided at least one copy of each daily inspection report on the work day following the day of record.

 b. Daily Test Reports. The Contractor shall be responsible for establishing a system which will record all quality control test results. Daily test reports shall document the following information:

 (1). Technical specification item number and description;

 (2). Test designation;

 (3). Location;

 (4). Date of test;

 (5). Control requirements;

 (6). Test results;

 (7). Causes for rejection;

 (8). Recommended remedial actions; and

 (9). Retests.

Test results from each day’s work period shall be submitted to the Engineer prior to the start of the next day’s work period. When required by the technical specifications, the Contractor shall maintain statistical quality control charts. The daily test reports shall be signed by the responsible quality control technician and the Program Administrator.

## CORRECETIVE ACTION REQUIREMENTS

The Quality Control Program shall indicate the appropriate action to be taken when a process is deemed, or believed, to be out of control (out of tolerance) and detail what action will be taken to bring the process into control. The requirements for corrective action shall include both general requirements for operation of the Quality Control Program as a whole, and for individual items of work contained in the technical specifications.

The Quality Control Program shall detail how the results of quality control inspections and tests will be used for determining the need for corrective action and shall contain clear sets of rules to gauge when a process is out of control and the type of correction to be taken to regain process control.

When applicable or required by the technical specifications, the Contractor shall establish and utilize statistical quality control charts for individual quality control tests. The requirements for corrective action shall be linked to the control charts.

## SURVEILLANCE BY THE ENGINEER

All items of material and equipment shall be subject to surveillance by the Engineer at the point of production, manufacture or shipment to determine if the Contractor, producer, manufacturer or shipper maintains an adequate quality control system in conformance with the requirements detailed herein and the applicable technical specifications and plans. In addition, all items of materials, equipment and work in place shall be subject to surveillance by the Engineer at the site for the same purpose.

Surveillance by the Engineer does not relieve the Contractor of performing quality control inspections of either on-site or off-site Contractor’s or Subcontractor’s work.

## NONCOMPLIANCE

 a. The Engineer will notify the Contractor of any noncompliance with any of the foregoing requirements. The Contractor shall, after receipt of such notice, immediately take corrective action. Any notice, when delivered by the Engineer or his/her authorized representative to the Contractor or his/her authorized representative at the site of the work, shall be considered sufficient notice.

 b. In case where quality control activities do not comply with either the Contractor’s Quality Control Program or the contract provisions, or where the Contractor fails to properly operate and maintain an effective Quality Control Program, as determined by the Engineer, the Engineer may:

 (1). Order the Contractor to replace ineffective or unqualified quality control personnel or subcontractors.

 (2). Order the Contractor to stop operations until appropriate corrective actions is taken.

#  SECTION B: SPECIFICATIONS

## SUBMITTALS

PART 1 GENERAL

* 1. DEFINITIONS
		1. Types of Submittals

The following four groupings of submittals into which all submittal descriptions are classified, as designated in the paragraph entitled “Schedule of Submittal Descriptions.”

1. Shop Drawings: As used in this Section, drawings, schedules, diagrams, and other data prepared specifically for this Contract, by the Contractor or through the Contractor by way of a subcontractor, manufacturer, supplier, distributor, or other lower tier contractor, to illustrate a portion of the work.
2. Product Date: Pre-printed material such as illustrations, standard, schedule, performance charts, instructions, brochures, diagrams, manufacturer’s descriptive literature, catalog data, and other data to illustrate a portion of the work, but not prepared exclusively for this contract.
3. Samples: Physical examples of products, materials, equipment, assemblies, or workmanship that are physically identical to a portion of the work, illustrating a portion of the work or establishing for evaluating the appearance of the finished work or both.
4. Administrative and Closeout Submittals: Data presented for review and approval to ensure that the administrative requirements of the project are adequately met but not to ensure directly that the work is in accordance with the design concept and in compliance with the Contract documents.
	1. FORMAT OF SUBMITTALS

Transmit each submittal, except sample installations and sample panels, to the office of the approving authority. Transmit submittals with a transmittal form prescribed by the Contracting Officer and standard for the project. The submittal form shall identify the Contractor, indicate the date of the submittal and include information prescribed by the transmittal form and required in the paragraphed entitled “Identifying Submittals.” Process transmittal forms to record actions regarding sample installations.

1.2.2 Identifying Submittals: Identify submittals, except sample panel and sample installation, with the following information permanently adhered to or noted on each separate component of each submittal and noted on the transmittal form. Mark each copy of each submittal identically, with the following:

1. Project title and location.
2. Construction Contract Number.
3. The Section number of the specification Section by which the submittal is required.
4. The submittal description (SD) number of each component of the submittal.
5. When a resubmission, an alphabetic suffix on the submittal description, for example, SD – IOA, to indicate the resubmission.
6. The name, address, and telephone number of the subcontractor, supplier, manufacturer and any other second tier contractor associated with the submittal.
7. Product identification and location in project.

1.2.3 Format for Product Data

1. Present product data submittals for each Section as a complete, bound volume. Include a table of contents listing page and catalog item numbers for product data.
2. Indicate, by prominent notation, each product is being submitted; indicate the specification section number and paragraph number which it pertains.
3. Supplement product data with material prepared for the project to satisfy submittal requirements for which product data does not exist. Identify this material as developed specifically for the project.

1.2.4 Format for shop Drawings

1. Shop drawings shall not be less than 8 ½ by 11 inches nor more than 30 x 42 inches.
2. Present 8 ½ x 11 – sized shop drawings as a part of the bound volume for the submittals required by the Section. Present larger drawings in sets.
3. Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to the information required in the paragraph entitled “Identifying Submittal.”
4. Dimension drawings, except diagrams and schematic drawings; prepare drawing demonstration interfere with other trades to scale. Identify materials and products for work shown.

1.2.5 Format of Samples

1. Furnished samples in the sizes below, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately the same as specified:
2. Sample of Equipment or device: Full size.
3. Sample of Materials less that 2 by 3 inches: Built up to 8 ½ by 11 inches.
4. Sample of Materials Exceeding 8 ½ by 11 inches: Cut down to 8 ½ by 11 inches and adequate to indicate color, texture, and material variations.
5. Sample of Linear Devices or Materials: 10-inch length or length to be supplied, if less that 10 inches. Examples of linear devices or materials are conduit and handrails.
6. Sample of Non-Solid Materials: Print. Examples of non-solid materials are sand and paint.
7. Color Selection samples: 2 inches by 4 inches.
8. Sample Panels: 4 feet by 4 feet.
9. Sample Installation: 100 square feet.
10. Samples Showing Range of Variation: Where variations are unavoidable due to the nature of the materials, submit sets of samples of not those three units showing the extremes and middle of the range.
11. Reusable Samples: Incorporate returned samples into the work only if so specified or indicated. Incorporated samples shall be in undamaged condition at the time of use.
12. Recording of Samples Installation: Note and preserve the notation of the area constituting the sample installation but remove the notation at the final clean up of the project.
13. When a color, texture or pattern is specified in naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

1.2.6 Format of Administrative and Closeout Submittals

When the submittal includes a document which is to be used in the project or become a part of the project record, other that as submittal, do not apply the Contractor’s approval stamp to the document, but to a separate sheet accompanying the document.

* 1. QUANTITY OF SUBMITTALS
		1. Number of Copies of Product Data

Submit four copies of submittals of product data requiring review and approval.

* + 1. Number of Copies of chop Drawings
1. For shop drawings presented on sheets larger than 8 ½ inches by 14 inches, submit one reproducible and three prints of each shop drawing prepared for this project.
2. Transmit reproducible rolled in mailing tubes.
3. After review, the approving authority will retain the prints and return only the reproducible with notation resulting from the review.
4. For shop drawings presented on sheet 8 ½ inches by 14 inches or less, conform to the quantity requirements for product data.
	* 1. Number of Samples
5. Submit four samples, or four sets of samples showing range of variation, of each required item. One approved sample or set of samples will be retained by the approving authority and one will be returned to the Contractor.
6. Submit one sample panel. Include components listed in technical section or as directed.
7. Submit one sample installation, where directed.
8. Submit one sample of non-solid materials.
	* 1. Number of copies of Administrative and Closeout Submittals
9. Unless otherwise specified, submit administrative and closeout submittals which are 8 ½ inches by 14 inches of smaller in size in the quality required for product data.
10. Unless otherwise specified, submit administrative and closeout submittals larger than 8 ½ inches by 14 inches in size in the quantities required for shop drawings

1.4 SCHEDULE OF SUBMITTAL DESCRIPTIONS (SD)

SD-01 Data

Submittals which provide calculations, descriptions or other documentation regarding the work.

SD-02 Manufacturer’s Catalog Data

Data composed of catalog cuts, brochures, circulars, specifications and product data, and printed information in sufficient detail and scope of verify compliance with requirements of the contract documents. A type of product data.

SD-03 MANUFACTURER’S Standard Color Charts

Preprinted illustration displaying choices of color and finish for a material or product. A type of product data.

SD-04 Drawings

Submittals which graphically show relationship of various components of the work, schematic diagrams of systems, detail of fabrications, layout of particular elements, connections, and other relational aspects of the work. A type of shop drawing.

SD-05 Design Data

Design calculations, mix designs, analysis, or other data, written in nature and pertaining to a part of the work. A type of shop of shop drawing.

SD-06 Instructions

Pre-printed material describing installation of a product, system, or material, including special notices and Materials Safety Data Sheets, if any, concerning impedances, hazards, and safety precautions. A type of product data.

SD-07 Schedules

A tabular list of data or tabular list including location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work. A type of shop drawing.

SD-08 Statements

A document, required of the Contractor, or through the contractor by the way of a supplier, installer, manufacturer, or other lower tier contractor, the purpose of which is to further the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods of personnel, qualifications, or other verification of quality. A type of shop drawing.

SD-09 Test Reports

A report signed by an authorized official of a testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accordance with requirements specified by naming the test method and material. The test report must state the test performed in accordance with the test requirements; state the test results; and indicate whether the material, product or system has passed or failed the test. Testing must have been within three years of the data of award of this contract. A type of product data.

SD-10 Factory Test Reports

A written report which includes the findings of a test required to be performed by the contractor on an actual portion of the work or prototype prepared for this project before it is shipped to the job site. The report must be signed by an authorized official of a testing laboratory and must state the test was performs in accordance with the test requirements; state the test results; and indicate whether the material, product, or system has passed or failed the test. A type of Shop Drawing.

SD-11 Field Test Reports

A written report which includes the findings of a test made at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation. The report must be signed by an authorized official of a testing laboratory or agency and must state the test was performed in accordance with the test requirements; state the test results; and indicate whether the material, product, or system has passed or failed the test. A type of Shop Drawing.

SD-12 Certificates

Statements signed by responsible officials of manufacturer of a product, system, or material attesting that the product, system, or material meet specified requirements. The statements must be dated after the award of this contract, name the project, and list the specific requirements which it is intended to address. A type of shop drawing.

SD-13 Samples

Samples, including both fabricated and unfabricated physical examples of materials, products, and units of work as complete units or as portions of units of work. A type of sample.

SD-14 Sample Installations

A portion of an assembly or material constructed where directed, and, if approved, retained as part of the work. A type of sample.

SD-15 Records

Documentation to ensure compliance with an administrative requirement or to establish an administrative mechanism. A type of administrative and closeout submittal.

SD-16 Operation and Maintenance Manuals

Data intended to be incorporated in an Operations and Maintenance Manual. A type of Administrative and closeout submittal.

## VALVES, GATES AND APPURTENANCES

PART 1 – GENERAL

1.01 SCOPE OF WORK

Work required under this section consists of furnishing and installing valves, gates and appurtenances of the following types.

1. Gate valves
2. Check valves
3. Butterfly valves
4. Globe and angle valves
5. Ball valves
6. Pressure regulator valves
7. Pressure relief valves
8. Pressure sustaining valves
9. Flow control valves
10. Float valves
11. Air release and vacuum valves
12. Hose valves
13. Stop gates
14. Water meters
15. Water strainers
16. Standpipe hydrant valves
17. Tapping sleeves
18. Service saddles
19. Corporation stops
20. Curb and meter stops
21. Valve and meter boxes
22. Pressure gauges

1.02 SUBMITTAL REQUIREMENTS

The Contractor shall submit shop drawings, manufacturer’s literature, samples, certificates and guarantees in accordance with applicable provisions contained in the “General Provisions” “Special Provisions” and the “General Mechanical Requirements” sections of these specifications. A detailed list of submittal requirements is included in the Special Provisions.

1.03 OPERATING AND MAINTENANCE INSTRUCTION

The Contractor shall furnish operating and maintenance instructions and parts lists in accordance with applicable provisions contained in the “Special Provisions” and “General Mechanical Requirements” sections of these specifications. A detailed list of operating and maintenance instructions required is included in the Special Provisions.

PART 2 – MATERIALS

2.01 GENERAL

All valves 2-1/2” and smaller in diameter shall be provided with screwed ends. All valves larger than 2-1/2” in diameter shall have flanged or bell ends unless otherwise indicated on the Drawings or in these Specifications. Flanges shall be dimensioned, faced and drilled in accordance with ANSI B16.1 for Class 125 unless stated otherwise on the Drawings or the Specifications. All necessary caulking materials, gaskets, bolts, and nuts shall be provided.

Valves shall be carefully installed in their respective positions, accessible for operation and repair, and free from all distortion and strain, with joints made as specified, and shall be left in satisfactory operating condition. The valves or gates shall be connected to floor stands where required. All stem guides shall be accurately aligned.

All valves, gates, hydraulic and electric operators, and all other materials shall be protected from damage and corrosion before installation and until completion of work. After installation, all valves except bronze valves and those underground shall be painted in accordance with the painting requirements and color code for the pipe lines of which they are part. Bright or rubbing surfaces shall not, however, be painted, but shall be protected with an approval lubricant.

Valve and gates shall be supplied with suitable operating keys, levers, extension rods, floor boxes, hand wheels or chain operators as indicated on the Drawings or in these Specifications.

2.02 GATE VALVES

All double disc gate valves shall have their stems in a vertical position or be designed for proper operations in the positions shown on the Drawings and shall have the same clear internal diameter as the pipe on which they are placed.

All gate valves 2-1/2 inches in diameter and similar shall be all brass or bronze, except he handwheel, which shall be of die cast aluminum. Valves shall be of the double disc type with rising stems and shall be rated for 200 psi non-shock cold water. Valves shall be Kennedy 251, Stockham Figure B106, or approved equal.

Gate valves 3-inches in diameter and larger shall be iron-body, bronze mounted (IBBM), double disc, parallel seat, non-rising stem type and shall conform to AWWA Specifications C500-80. The stuffing box shall be “0” ring type with at least two “0” rings. The spreaders between the 2 discs shall be bronze or other no-corrosive material approved by the Contracting Officer. Gate rings shall be rolled or pressed into grooves machined in the discs. Valves shall have a 2-inch operating unit and OPEN LEFT. An operating handwheel shall be provided with each flanged gate valve installed above ground. A permanently attached extension rod with operating nut shall be installed on all valves deeper than 4 feet below finished grade to bring the nut to within 1 foot of the surface. Valves shall be Dresser, Mueller, Clow or equivalent.

2.03 CHECK VALVES

All check valves furnished shall be of a type intended for service in the position shown on the Drawings.

All check valves 2-inches in diameter and smaller for water service applications shall be Stockham Figure B345, Kennedy No. 444 designed for a working pressure of 200 psi.

On water lines larger than 2”, check valves shall be iron-body, full bronze mounted, quiet closing, tilting disc type. The ends shall be flanged, ASA Class 125. The valves shall be designed for 175 psi working pressure and shall be Chapman List 23, Stockham or Mueller equivalent.

Chemical line check valves shall be ball-type PVC, with Viton seal and ball seat, and union-type end connection.

2.04 BUTTERFLY VALVES

Butterfly valves shall be tight closing with rubber seats which are recess mounted and securely fastened to the valve body. They shall be bubble tight at rated pressures and shall be satisfactory for applications involving frequent operation in a throttled position. Valve discs shall rotate 90 degrees from the full open position to the tight shut position.

All butterfly valves shall be furnished with a certificate from the manufacturer stating that the valve are new, of current manufacture and conform to the test requirements for materials and to the standards for completed valves as stated in AWWA C504-80.

The valve bodies shall be wafer type, constructed of cast or ductile iron conforming to ASTM A-126. Class B unless shown otherwise on the Drawings.

Discs shall be constructed of alloy cast iron conforming to ASTM A436, Type 1 (Ni-resist), of cast iron conforming to ASTM A48, Class 40 or ductile iron conforming to ASTM A536, Grade 65-45-12. Shafts shall be one piece or the “stub shaft” type fabricated from wrought stainless steel or Monel. Carbon steel shafts will not be permitted.

Seats shall be of a natural rubber or a synthetic rubber compound secured or bonded to the body of the valve. Disc mounted seats will not be allowed. Valve seats on valves 30-inches and larger shall be field adjustable and replaceable without dismantling operator, disc or shaft and without removing the valve from the line.

Valves shall be fitted with sleeve type, corrosion-resistant and self-lubricated bearings.

Valve operators shall be capable of holding the valve in any position between open and closed without creeping or fluttering. Buried valves shall have sealed grease-packed gear-operating nuts with suitable stem extensions to extend the stem to within one foot of the ground surface, and tee wrenches. Exposed valves shall be equipped with gear units and handwheels.

Valves shall be as manufactured by Henry Pratt Company, B.I.F. or other equivalent.

2.05 GLOBE AND ANGLE VALVES

Globe and angle valves shall be bronze with threaded ends, composition disc, designed for a working pressure of 200 pounds cold water. The design of the valves shall be such that the area of the port opening, when the valve is wide open, is not less than the area of the pipe in which the valve is installed. The valves shall be Crane Company No. 1 and No. 2, Stockham No. B-16 or B-216, or equivalent.

2.06 BALL VALVES

Ball valves of polyvinyl chloride (PVC) construction shall be rated for a working pressure of 150 psi. The valves shall be socket weld with union type end construction. The valves shall be Hills-Mc Canna Series P153-PV, Hayward Valve Co. or other equivalent.

Ball valves of brass or bronze body and ball construction shall have a straight-through flow pattern and be so designed as to permit disassembly without removing the valve body from the line. Seats and all “0” ring seals shall be Buna-N. The capsule shall resist formation of scale by wiping the ball clean of foreign matter during operation. Valves shall be lever indicate whether the valve is in the open or closed position. Valves shall have threaded ends and be rated for 200 psi cold water. Valves shall be Crane Company No. 2180, ITT Grinnell or other equivalent.

2.07 PRESSURE REGULATOR VALVES

Pressure regulator valves, 2-1/2 inches smaller shall be self-contained, spring-loaded, diaphragm type. The inlet pressure rating shall be 250 psi. The adjustable outlet pressure range shall be as indicated on the Drawings or tabulated in the valve schedule. A bronze strainer shall be installed with each regulator. Regulators shall be Mueller Model H-9300. ITT Grinnell or other equivalent.

Pressure regulator valves, 3 inches in diameter and larger shall be pilot-controlled, single seated, hydraulically-operated, diaphragm type. The pressure ratings class of the valve, and the adjustable outlet pressure range shall be as indicated on the Drawings or as tabulated in the valve schedule. Valve shall be supplied with special wear resistant trim per manufacturer’s recommendation where valve service requirements so warrant. The valve shall be angle or globe pattern as indicated. Regulators shall be Clayton Model 90, Bailey or other equivalent.

2.08 PRESSURE RELIEF VALVES

Pressure relief valves shall be of the hydraulically operated, pilot-controlled diaphragm type with single removable seat and resilient disc and without external packing glands. The pilot control shall be a direct-acting, adjustable, spring-loaded, diaphragm valve and shall act to relieve excess upstream pressure and gradually close to a positive drip-tight seating. The valve shall be furnished with flanged ends and bronze trim. The pressure rating class, adjustable pressure range, and configuration shall be indicated on the Drawings or tabulated in the valve schedule. Valves shall be Clayton Model 50, Bailey or other equivalent.

2.09 PRESSURE SUSTAINING VALVES

Pressure sustaining valves shall be of the hydraulically operated, pilot controlled, diaphragm type with single removable seat and resilient disc, and without external packing glands. The pilot control shall be a direct-acting, adjustable, spring-loaded, diaphragm valve and shall act to maintain constant upstream pressure regardless of fluctuations in flow rate. The valve shall be furnished with flanged ends and bronze trim, the pressure rating class, adjustable pressure range, and configuration shall be indicated on the Drawings or tabulated in the valve schedule. Valve shall be supplied with special wear resistant trim per manufacturer’s recommendations where valve service requirements so warrant. Valves shall be Clayton Model 50, Bailey or other equivalent.

2.10 FLOW CONTROL VALVES

Flow control valves of sizes smaller than 2-inches shall be of the internal orifice plate and perforated, spring-loaded piston type. The piston travel shall vary, within a range of differential pressures across the valve, to maintain a constant flow rate. Valves shall have screwed ends. Valves shall have a pressure rating of 200 psi and a differential pressure range as indicated on the Drawings or tabulated in the valve schedule. Valves shall be Griswold Model 428X or equivalent.

Flow control valves 2-inches and larger shall be hydraulically-operated, pilot-controlled, diaphragm type. The pilot control shall be actuated by differential pressure produced across an orifice plate installed downstream of the valve. The orifice plate, and pilot line shall be supplied with the valve. The valve assembly shall operate to maintain a constant flow rate regardless of fluctuations in upstream pressure. Rate of flow shall be adjustable by varying the spring loading on the control. The pilot control shall be a direct-acting diaphragm valve designed to close when the actuating differential increase beyond the spring setting. Valves shall be globe pattern with flanged ends. The pressure rating class and flow range shall be indicated on the Drawings or tabulated in the valve schedule. Valves shall be Clayton Model 40J, Bailey or other equivalent.

2.11 FLOAT VALVES

Non-modulating float valves shall be self-contained plunger type with integral float and arm mechanism. The valves shall be for hot or cold-water service and be globe or angle pattern as indicated on the Drawings. The valves shall be slow closing and non-chattering and have an adjustable float. Valves shall be Clayton No. 124, Bailey No. 27P or equivalent.

Modulating float valves shall be of the hydraulically-operated, pilot-controlled diaphragm type with single removable seat and resilient disc without external packing glands. The pilot control system shall be comprised of a variable orifice pilot control mounted on the valve cover and remote float control. The valve shall be furnished with flanged ends and bronze trim. The pressure rating, valve configuration, need for external operating water and need for pressure sustaining capability shall be as indicated in the valve schedule. Valves shall be Clayton Model 427G, Bailey or other equivalent.

2.12 AIR RELEASE AND VACUUM VALVES

Air release and vacuum valves for water distribution service shall be ball-and-cup type and shall be of the size and pressure rating indicated on the Drawings or in the valve schedule.

Air release valves shall be capable of positive action in releasing air entrained in water under pressure. The valve body and cover shall be cast iron, trim shall be bronze and float shall be stainless steel. Cast iron parts shall be coated to retard corrosion.

Combination air and vacuum release valves shall consist of an air and vacuum valve with air release valve connected to its chamber. The valve shall be capable of (1) venting large quantities of air when not under pressure. The valve body and cover shall be cast iron, trim shall be bronze and float shall be stainless steel. Cast iron parts shall be coated to retard corrosion.

Air release and vacuum valves for water service shall be APCO as manufactured by the Valve and Primer Corporation, Crispin by Multiplex Mfg. Co., or equivalent.

2.13 HOSE VALVES

Hose valves ¾-inch in size shall be rough brass or bronze with composition disc and hand wheel. Valves shall be Crane No. 58, Kennedy or other equivalent.

Hose valves one (1) inch in size and larger shall be wedges disc, 200 psi cold water class with full diameter seat openings. Valves shall be Crane No. 451, Lunkenheimer or other equivalent.

Free-standing yard type hose valves shall be 1-inch size, 40-inch high non- freeze post hydrants; J. R. Smith No. 5913, Murdock M-100, Zurn or other equivalent.

2.14 WATER STRAINERS

Manually cleaned basket type water strainers shall be single or double basket construction as indicated on the Drawings. Size and design requirements shall be as shown on the Drawings and or stated in the schedule appended to this section. Strainers 2-inches and smaller shall have screwed ends. Strainers larger than 2-inches shall have flanged ends.

Straining basket media shall be Type 316 stainless steel. Preformation size shall be as shown on the Drawings and or schedule.

The strainer capacity, working pressure and maximum pressure drop shall be as shown on the Drawings and or schedule. The strainer shall be hydrostatically tested to 1.5 times the rated operating pressure.

Double basket strainers shall be capable of maintaining continuous flow through one basket while the other basket is removed for cleaning. An integral lever-operated valve shall provide for switching flow between basket elements.

Manually cleaned basket strainers shall be Zurn Industries, Bailey, or equivalent.

Pipeline “Y” strainers shall be galvanized iron or bronze body construction with stainless steel or bronze cylindrical screen. The clean-out plug and screen shall be easily removed permitting the strainer to be cleaned without removing the strainer from the line. Strainers shall have pipe threaded ends and be rated for 400 psi water, 200 psi steam service “Y” strainers shall be Mueller, Bailey, or equivalent.

2.15 STANDPIPE HYDRANTS VALVES

Standpipe Hydrant valve shall be all bronze, screwed bonnet angle fire hydrant valves, 2-1/2” IPT x 2-1/2” National Standard Fire Hose Coupling Screw Threads, with Cap and Chain.

Standpipe hydrant valves shall be Jones Model No. J-344 or equivalent.

2.16 TAPPING SLEEVES

Tapping sleeves for existing asbestos-cement, PVC, steel or cast-iron water mains shall be steel, split sleeve, bolt-on type with O-ring seal. Outlets shall be flanged. The length of outlet shall be compatible with the tapping machine used. Tapping sleeves shall be Rockwell No. 622, or equivalent.

2.17 SERVICE SADDLES

On asbestos cement, cast iron, ductile iron, and steel pipe with nominal pipe size 6-inches and smaller, service saddles shall be malleable iron, single strap (pipe Class 150-and-less) or double strap (pipe class greater than 150) construction, saddles shall be Rockwell Types 311, 313, Mueller or other equivalent.

On asbestos cement, cast iron, ductile iron, concrete and steel pipe with nominal pipe size 8-inches and larger, service saddles shall be malleable iron, double or triple strap construction. Saddles shall be Rockwell Type 362 or 366, Mueller, Dresser or other equivalent.

On PVC pipe, service saddles shall be nylon coated malleable or ductile iron, stainless steel double band or hinged body construction, and shall be compatible with the outside diameter of the pipe used. Saddles shall be Ford 202N Series saddles or other equivalent.

On ductile iron service saddles shall be used on Class 250 pipe only. Service saddles shall be Apac Manufacturing SG107 series, Rockwell No. 313, or equivalent.

2.18 CORPORATIONS STOPS

Corporation stops shall be compatible with the type and class of service piping and service saddle used or the connection. For plastic service piping a stainless steel insert shall be provided with each corporation stop. Corporation stops shall be Mueller, Hayes, Crane, or equivalent product.

2.19 CURB AND METER STOPS

Curb stops and meter stops shall be compatible with the type and class of service piping used. For plastic service piping stainless steel inserts shall be provided with each curb stop and meter stop.

Curb stops shall be Mueller H-10201 or H-15207, Hayes or other equivalent.

Meter stops shall be angle or straight-through pattern, with lock wing and outlet nut drilled for wire seal. Meter stops shall be Mueller, Hayes, or equivalent product.

2.20 VALVE AND METER BOXES

Valve boxes shall be furnished and installed on all buried valves in the locations shown on the Drawings.

Valve boxes shall be traffic-type boxes with cast iron frame and cover. The cast iron cover shall be marked “WATER”. Cast iron extension pieces shall be provided with each box as required. Cast iron or PVC pipe extensions may be used for deep bury conditions for valve boxes. Valve box frame, cover and extension piece dimensions shall be as indicated on the drawings.

Meter boxes shall be concrete, equipped with reinforced concrete cover and 6-inch diameter (minimum) cast iron reading cover with chain. For ¾-inch meters, minimum inside box dimensions shall be 17-1/4” by 10-1/5” at the base.

Box height shall be 12” minimum. For ¾-inch meters, meter boxes shall be Christy Model B9 with F9 lid, Brooks Model 36RC (CI) or equivalent.

2.21 PRESSURE GAUGES

All pressure gauges shall be 3-1/2” dial with black enamel finish with chrome plated ring. Accurately shall be ½ of 1 percent of scale range. The movement shall be constructed of stainless steel and Monel, rustproof and corrosion resistant and equipped with recalibration mechanism. Mounting and range of instrument shall be as indicated on the Drawings or in these Specifications. Gauges shall be furnished with suitable mounting brackets when flush or wall mounted. All gauge mounting locations shall have ¼”, female connection, tee handle shut-off cocks installed between gauge and gauge tap.

Gauges shall be marsh Type 103 “Mastergauge”, Marshalltown Figure 23, Ashcraft Duragauge equivalent, or approved equal.

Each gauge used for sewage, chemical or untreated water applications shall be furnished with cast iron flanged diaphragm attachment with ¼” pipe size connections. Diaphragms shall be stainless steel unless specified otherwise. All diaphragm attachments shall be equipped with flushing connections with double female cock.

PART 3 – PERFORMANCE

3.01 INSTALLATION OF VALVES AND GATES

Valves and gates shall be carefully installed in their respective positions, free from all distortion and strain, with joints made as specified, and shall be left in satisfactory operating condition. Valves and gates shall be connected to floor strands where required. All stem guides shall be accurately aligned.

Before installation, all valves and appurtenances shall be thoroughly cleaned of all foreign material, and shall be inspected for proper operation, both opening and closing and to verify that the valves seat properly. Valves shall be installed so that the stems are vertical, unless otherwise approved by the Contracting Officer.

All valves shall be tested in place so far as practicable under the conditions specified and any defects revealed in valves or connections tested shall be corrected.

Valves and gates shall be protected both before and after erection, from rust or other damage. After installation, all valves except bronze valves and those underground shall be painted in accordance with the painting requirements and color code of the pipe lines of which they are apart. Bright or rubbing surfaces shall not be painted, but shall be protected with a suitable lubricant.

3.02 INSTALLATION OF VALVE BOXES

Valve boxes shall be centered and set plumb over the wrench nuts of the valves and shall not transmit shock or stress to the valves. Valve box covers shall be set flush with the surface of the finished pavement or such other level as may be approved by the Contracting Officer. For valves not located in pavement, a steel marker post 3’-0” above grade shall be furnished an installed adjacent to the valve and painted as shown on the Drawings. Backfill shall be placed around the valve box and thoroughly compacted to a density equal to that of the undisturbed ground and in such a manner that will not damage or displace the valve box from proper alignment or grade. Misaligned valve boxes shall be excavated, plumbed, and backfilled at the Contractor’s expense.

3.03 SERVICES

Reconnected, relocated and new services shall be installed in conformance with details shown on the Drawings.

3.04 INSTALLATION OF METERS

Meters shall be set level, out of the traveled way of vehicles and above near-by drainages swales. Meter installation shall be facilitated by use of meter yokes when necessary to prevent stress on the meter fittings. All meter installations shall include a meter stop and a meter box with lid as specified. Service piping shall be plugged prior to meter installation to prevent foreign matter from entering the meter. All completed meter installation shall be tested for leakage and proper meter operation prior to acceptance.

3.05 INSTALLATION OF FIRE HYDRANTS

Fire hydrants shall be plumbed vertical and installed in accordance with the Drawings. All hydrants shall be flushed and test operated after installation to assure a sound setting and smooth operation. All valves shall close drip-proof tight. Hydrants shall be painted in accordance with the “Painting and Coatings” section of these specifications a color approved by the Contracting Officer.

3.06 INSTALLATION OF WATER STRAINERS

Water strainers shall be installed securely to minimize vibration and without stress on the fittings, and shall be aligned properly for effective operation. All strainers shall be tested after installation to assure proper operation.

3.07 INSTALLATION OF TAPPING SLEEVES AND SERVICES SADDLES

Tapping sleeves and service saddles shall be installed in accordance with the manufacturer’s recommendations and shall be of the proper type for the pipe material.

3.08 INSTALLATION OF PRESSURE GAUGES

Pressure gauges shall be installed in the vertical position unless otherwise indicated on the Drawings. Gauges shall be installed with suitable mounting brackets when flush or wall mounted. All gauge mounting locations shall have ¼”, female connection, tee handle shut-off cocks installed between gauge and gauge tap. All installed gauges shall be tested for proper operation and protected from corrosion and damage prior to and after installation until placed in operation.

## TEMPORARY CONTROLS

* 1. SUMMARY

PART 1 GENERAL

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

40 CFR 261 Identification and Listing of Hazardous Waste

40 CFR 262 Generators of Hazardous Waste

40 CFR 263 Transporters of Hazardous Waste

40 CFR 264 Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

40 CFR 265 Interim Status Standard for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

40 CFR 300 National Oil and Hazardous Substances Pollution Contingency Plan

49 CFR 178 Shipping Container Specification

COE EM-385-1-1 1992 Safety and Health Requirements Manual

NFPA 241 1989 Safeguard Construction, Alternation, and Demolition Operations

1.3 Asbestos

Remove, handle and dispose of asbestos in accordance with local and federal requirements

1.4 DEFINITIONS

1.4.1 Sediment

Soil and other debris that have eroded and have been transported by runoff water or wind.

1.4.2 Solid Waste

Rubbish, debris, garbage, and other discarded solid materials, expect hazardous waste as defined

In paragraph entitled “Hazardous Waste”, resulting from industrial, commercial, and agricultural operations and from community activities.

1.4.3 Rubbish

Combustible and noncombustible wastes such as paper, boxes, glass, crockery, metal, lumber, cans, and bones.

1.4.4 Debris

Combustible and noncombustible wastes such as ashes and waste materials resulting from construction or maintenance and repair work, leaves, and tree trimmings.

1.4.5 Chemical Waste

This includes salts, acids, alkalies, herbicides, pesticides, and organic chemicals.

1.4.6 Garbage

Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.4.7 Hazardous Waste

Hazardous substances as defined in 40 CFR 261 or as defined by applicable state and local regulations.

1.4.8 Oily Waste

Petroleum products and bituminous materials.

1.5 SUBMITTALS

Submit the following in accordance with Section 01300, “Submittals.”

1.5.1.1 SD-18, Records

 a. Solid waste disposal permit

 b. Disposal permit for hazardous waste

1.5.1.1 Solid Waste Disposal Permit

Submit one copy of the applicable EQPB and State permits, manifests or license for transportation, treatment, storage, and disposal of hazardous waste by permitted facilities.

1.6 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with Federal, state, and local regulations pertaining to the environment, including but not limited to water, air, and noise pollution.

PART 2 PRODUCTS

 Not used.

PART 3 EXECUTION

3.1 PROTECTION OF NATURAL RESOURCES

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work. Confine construction activities to within the limits of the work indicated or specified.

3.1.1 LAND RESOURCES

Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without the Contracting Officers permission. Do not fasten or attach ropes, cables, or guys to existing nearby tress for anchorages unless authorized by the Contracting Officer. Where such use of attach ropes, cables, or guys is authorized, the Contractor shall be responsible for any resultant damage.

3.1.1.1 Protection

Protect existing trees which are to remain and which may be injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. By approved excavation, remove trees with 30 percent or more of their root systems destroyed.

3.1.1.2 Replacement

Remove tress and other landscape features scarred or damaged by equipment operations, and replace with equivalent, undamaged tress and landscape features. Obtain Contracting Officer’s approval before replacement.

3.2 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

Carefully protect in-pace and report immediately to the Contracting Officer historical and archaeological items or human skeletal remains discovered in the course of work. Stop work in the immediate area of the discovery until directed by the Contracting Officer to resume work.

3.3 EROSION AND SEDIMENT CONTROL MEASURES

3.3.1 Burn off

Burn off of the ground cover is not permitted.

3.3.2 Protection of Erodible Soils

Immediately finish the earthwork brought to a final grade, as indicated or specified. Immediately protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize the duration of exposure of unprotected soils.

3.3.3 Temporary Protection of Erodible Soils

Use the following methods to prevent erosion and control sedimentation:

3.3.3.1 Mechanical Retardation and Control of Runoff

Mechanically retard and control the rate of runoff from the construction site. This includes construction of diversion ditches, benches, berms, and use of silt fences and straw bales to retard and divert runoff to protected drainage courses.

3.3.3.2 Vegetation and Mulch

Provide temporary protection on sides and back slopes as soon as rough grading is completed or sufficient soil is exposed to require erosion protection. Protect slopes by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Stabilize slopes by hydro seeding, anchoring mulch in place, covering with anchored netting, sodding, or such combination of these and other methods necessary for effective erosion control.

3.4 General Work Requirements

Provide and maintain erosion control measures in accordance with the Guam EPA Standards and regulations.

3.5 CONRTOL AND DISPOSAL OF SOLID WASTES

Pick up solid wastes, and place in covered containers which are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean.

3.5.1 Disposal of Rubbish and Debris

Dispose of rubbish and debris in accordance with the requirements specified below:

3.5.1.1 Removal from Government Property

Remove and dispose rubbish and debris in Government landfill.

3.5.2 Garbage Disposal

Place garbage in approved containers, and move to a pick point or disposal area, where directed.

3.5.3 Sewage, Odor, and Pest Control

Dispose of sewage through connection to base sanitary sewage system. Where such system is not available, use chemical toilets or comparable effective units, and periodically empty wastes in to the base sanitary sewage system, or construct and maintain an approved type of adequate sanitary convenience for the use of persons employed on the work in accordance with the General Paragraph titled, “SANITATION”. Include provisions for pest control and elimination of odors.

3.6 CONTROL AND DISPOSAL OF HAZARDOUS WASTE

3.6.1 Hazardous Waste Generation

Handle generated waste in accordance with 40 CFT 262.

3.6.2 Hazardous Waste Disposal

Dispose of hazardous waste in accordance with CFR 263, 40 CFR, 264 and 40 CFR 265.

3.6.3 Hazardous Waste Storage

Store hazardous waste in containers in accordance with 49 CFR 178. Hazardous waste shall be identified in accordance with 40 CFR 261 and 40 CFR 262.

3.6.4 Spills of Oil and Hazardous Materials

Take precautions to prevent spills of oil and hazardous material. In the event of a spill, immediately notify the Contracting Officer. Spill response shall be in accordance with 40 CFR 300 and applicable state regulations.

3.7 DUST CONTROL

Keep dust down at all times, including during nonworking periods. Sprinkle or treat. With dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning non-particulate debris such as steel reinforcing bars. Only wet cutting will be permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not unnecessarily shake bags of cement, concrete mortar, or plaster.

3.8 NOISE

Make the maximum use of low-noise emission products, as certified by the Federal EPA.

3.8.1 Radio Transmitter Restrictions

Conform to the restrictions and procedures for the use of radio transmitting equipment, as directed. Do not use transmitters without prior approval.

3.9 FIRE PROTECTION

3.9.1 Compliance

COE EM-385-1-1, NFPA 241, and activity fire regulations. Obtain approval from the activity Fire Chief prior to commencement of hot work operations.

3.9.2 Fired Kettles

Melt kettles for tar, asphalt, and similar materials shall not be closer than 25 feet to buildings or combustible materials. Provide a minimum of two 20-pound ABC all-purpose type extinguishers at the melting kettle and the area of hot material application. Equip kettles with proper heat controls and means of agitation to assure controlled uniform temperatures throughout contents to prevent spot heating. Do not heat contents above flash point.

3.9.3 Notification of Fire

Post the activity fire poster in conspicuous locations and at telephones in construction shacks.

## CLEARING AND GRUBBING

Part 1 – General

* 1. REFERENCES

(Not Used)

* 1. SUBMITTALS

Submit the following in accordance with Section “Submittals”

* + 1. SD-14, Samples
1. Tree wound paint (Not Used)
2. Herbicide (Not Used)

Submit samples in cans with manufacturer’s label.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to, store at site, and handle in a manner which will maintain the materials in their original manufactured or fabricated condition until ready for use.

Part 2 Products

2.1 TREE WOUND PAINT (Not Used)

Bituminous based paint of standard manufacture specially formulated for tree wounds.

2.2 HERBICIDE (Not Used)

Comply with Federal Insecticide, Fungicide, and Rodenticide Act (Title 7 U.S.C. Section 136) for requirements on contractor’s licensing, certification and record keeping. Contact the command Pest Control Coordinator prior to starting work.

Part 3 Execution

3.1 PROTECTION

3.1.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

3.1.2 Trees, Shrubs, and Existing Facilities

Protection shall be in accordance with Section “Temporary Controls”.

3.1.3 Utility Lines

Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer immediately of damage to or an encounter with an unknown existing utility line. The Contractor shall be responsible for the repairs of damage to existing utility lines that are indicated or made known to the Contractor prior to the start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, the Contractor shall notify the Contracting Officer in ample time to minimize interruption of the service. Refer to Section “Temporary Controls” for additional utility protection.

3.2 CLEARING

Shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within the areas to be cleared. Cut off flush with or below the original ground surface trees, stumps, roots, brush, and other vegetation in the areas to be cleared, except for trees and vegetation indicated or directed to be left standing. Apply herbicide in accordance with the manufacturer’s label to the top surface of stumps designated not to be removed.

3.3 TREE REMOVAL

Where indicated, remove designated trees and stumps and grub roots.

3.4 PRUNNING

Prune individual trees as indicated. Trim trees designated to be left standing within the cleared areas of dead branches 1 ½- inches or more in diameter; and trim branches to heights and in a manner as indicated. Neatly cut limbs and branches to be trimmed close to the bole of the tree or main branches. Paint cuts more than 1 ¼-inches in diameter with an approved tree wound paint.

3.5 GRUBBING

Remove and dispose of roots larger than 3 inches in diameter, matted roots, and designated stumps from the indicated grubbing areas. Excavate this material together with logs, organic and metallic debris, brush, and refuse and remove to a depth of not less than 18 inches below the original soil surface in areas indicated to be grubbed and in areas indicated as construction areas under the Contract. Fill depressions made by grubbing with suitable material and compact in accordance with the requirements specified to make the new surface conform with the existing adjacent surface of the ground.

3.6 DISPOSAL OF CLEARED AND GRUBBED MATERIALS

3.6.1 Saleable Timber (Not Used)

Consider felled timber from which saw logs, pulpwood, posts, poles, ties, or fuel wood can be produced as saleable timber. Trim limbs and tops, and saw into saleable lengths and stockpile adjacent to the site. The stockpile timber will remain the property of the Government.

3.6.2 Nonsalable Materials

Remove from the project site and dispose of timber scrub, vegetation, and debris considered as nonsalable. Burning will not be permitted.

## GENERAL EXCAVATION, FILLING, AND BACKFILLING

Part 1 – General

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 33 1992 (Rev. A) Concrete Aggregates

ASTM C 136 1992 Sieve Analysis of Fine and Coarse Aggregates

ASTM D 698 1991 Laboratory Compaction

 Characteristics of Soil Using Standard Effort

 (12,400 ft-lbf/ft (600 kN-m/m))

ASTM D 1140 1992 Amount of Material in Soil Finer

 Than the No. 200 (75-Micrometer) Sieve

ASTM D 1556 1990 Density and Unit Weight of Soil in

 Place by the Sand Cone Method

ASTM D 1557 1991 Laboratory Compaction

 Characteristics of Soil Using Modified Effort

 (56,000 ft-lbf/ft (2,700 kN-m/m))

ASTM D 2321 1989 Underground Installation of Thermoplastic Pipe for Sewers and other Gravity-Flow Applications

ASTM D 2487 1992 Classification of Soils for Eng’g. Purposes

ASTM D 2922 1991 Density of Soil and Soil Aggregate in Place by

 Nuclear Methods (Shallow Depth)

ASTM D 3017 1988 Water Content of Soil and Rock in Place

 By Nuclear Methods (Shallow Depth)

ASTM D 4318 1984 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C600 1987 Installation of Ductile-Iron Water Mains and their Appurtenances

CORPS OF ENGINEERS (COE)

COE EM-385-1-1 1992 Safety and Health Requirements Manual

1.2 DEFINITIONS

1.2.1 Hard Materials

Weathered rock, dense consolidated deposits, or conglomerate materials which are not included

in the definition of “rock” but which usually require the use of heavy excavation equipment,

ripper teeth, or jack hammers for removal.

1.2.2 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated

masses or conglomerate deposits, neither of which can be removed without systematic drilling

and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe

mounted pneumatic punchers or rock breakers; also large boulders, buried masonry, or concrete

other than pavement exceeding ½ cubic yard in volume. Removal of hard material will not be

considered rock excavation because of intermittent drilling and blasting that is performed merely

to increase production.

1.2.3 Cohesive Materials

Materials ASTM D 2487 classified as GC, SC, ML, CL, MH, and CH. Materials classified as

GM and SM will be identified as cohesive only when the fines have a plasticity index greater

than zero.

1.2.4 Cohesionless Materials

Materials ASTM D 2487 classified as GW, GP, SW, and SP. Materials classified as GM and SM

will be identified as cohesionless only when the fines have a plasticity index of zero

1.3 SUBMITTALS

Submit the following in accordance with Section 01300, “Submittals”.

1.3.1 SD-04, Drawings

1. Supporting system drawings

1.3.1.1 Required Drawings

Submit drawings and calculations by a registered professional Engineer. Drawings shall include material sizes and types, arrangement of members, and the sequence and method of installation and removal.

1.3.2 SD-05, Design Data

1. Supporting System calculations`

1.3.2.1 Required Data

Submit drawings and calculations by a registered professional Engineer. Calculations shall include data and references used.

1.3.3 SD – 08, Statements

1. Supporting systems work plan
2. Dewatering work plan

Submit 15 days prior to starting work.

1.3.4 SD-12, Field Test Reports

1. Fill and backfill test
2. Select material test
3. Porous fill test for capillary water barrier
4. Density Tests

1.4 DELIVERY, STORAGE, AND HANDLING

Perform in a manner to prevent contamination or segregation of materials.

1.5 CRITERIA FOR BIDDING

Base bids on the following criteria:

1. Surface elevations are as indicated.
2. Pipes or other artificial obstructions, except those indicated, will not be encountered.
3. Hard materials and rock may be encountered in some excavation.
4. Blasting will not be permitted. Remove material in an approved manner.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

Free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, and deleterious, or objectionable materials. Unless specified otherwise, the maximum particle diameter shall be one-half the lift thickness at the intended location.

2.1.1 Common Fill

Approved, unclassified soil material with the characteristics required to compact to the soil density specified for the intended location.

2.1.2 Backfill and Fill Material

ASTM D 2487, classification GW, GP, GM, GC, SW, SP, SM, SC with a maximum ASTM D 4318 liquid limit of 35, maximum ASTM D 4318 plasticity index of 12, and a maximum of 25 percent by weight passing ASTM D 1140, No. 200 sieve.

2.1.3 Topsoil

Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than one inch diameter, brush , weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH to obtain a pH of 5.5 to 7.

2.1.4 Select material

ASTM D 2487, classification GW, GP, SW, SP with a maximum of 10 percent by weight passing ASTM D 1140, No. 200 sieve.

2.2 POROUS FILL FOR CAPILLARY WATER BARRIER

ASTM C 33 fine aggregate grading with a maximum of 3 percent by weight passing ASTM D 1140, No. 200 sieve, or coarse aggregate size 57, 67, or 77 and conforming to the general soil material requirements specified in paragraph entitled “Soil Materials”.

2.3 BORROW

Obtain borrow materials required in excess of those furnished from excavations from sources outside of Government property.

2.4 BURIED WARNING AND IDENTIFICATION TAPE

Polyethylene plastic and metallic core or metallic-faced, acid-and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3-inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read “CAUTION, BURIED (intended service) LINE BELOW” or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

Warning Tapes Color Codes

 Yellow Electric

 Yellow Gas, Oil; Dangerous Materials

 Orange Telephone and other Communications

 Blue Water Systems

 Green Sewer Systems

2.4.1 Warning Tape for Metallic Piping

Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum strength of 1,500 psi lengthwise, and 1,250 psi crosswise, with a minimum 350 percent elongation.

2.4.2 Detectable Warning Tape for Non-Metallic Piping

Polyethylene plastic conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1,500 psi lengthwise and 1,250 psi crosswise. The tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.5 DETECTION WIRE FOR NON-METALLIC PIPING

Detection wire shall be insulated single strand, solid copper with a minimum of 12 AWG.

Part 3 EXECUTION

3.1 SURFACE PREPARATION

3.1.1 Clearing and Grubbing

Unless indicated otherwise, remove trees, stumps, logs, shrubs, and brush within the clearing limits. Remove stumps entirely. Grub out matted roots and roots over 2 inches in diameter to at least 18 inches below existing surface.

3.1.2 Stripping

Strip existing top soil to a depth of 4 inches without contamination by subsoil material. Stockpile topsoil separately from other excavated material and locate convenient to finish grading area.

3.1.3 Unsuitable Material

Remove vegetation, debris, decayed vegetables matter, sod, mulch, and rubbish underneath paved areas or concrete slabs.

3.1.3.1 Proof Rolling

Proof rolling shall be done on an exposed sub-grade free of surface water (wet conditions resulting from rainfall) which would promote degradation of and otherwise acceptable subgrade. After stripping, proof roll the existing subgrade with six (6) passes of a 15-ton, pneumatic-tired roller. Operate the roller in a systematic manner to ensure the number of passes over all areas, and at speeds between 2 ½ to 3 ½ miles per hour. Notify the Contracting Officer a minimum of 3 days prior to proof rolling. Proof rolling shall be performed in the presence of the Contracting Officer. Rutting or pumping of material shall be undercut as directed by the Contracting Officer and replaced with select material.

3.2 PROTECTION

3.2.1 Protection Systems

Provide shoring, bracing, cribbing, underpinning, and sheeting in accordance with COE EM-385-1-1, except that banks may be sloped only when approved by the Contracting Officer. Provide additional supporting systems where indicated.

3.2.2 Drainage and Dewatering

Provide for the collection and disposal of surface and subsurface water encountered during construction.

3.2.2.1 Drainage

So that construction operations progress successfully, completely drain construction site during periods of construction to keep soil materials sufficiently dry. Provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein.

3.2.2.2 Dewatering

Ground water flowing toward or into excavation shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material.

While the excavation is open, the water level shall be maintained continuously, at least 2 feet below the working level.

Operate dewatering system continuously until construction work below existing water level is complete. Submit performance records weekly. Measure and record performance of dewatering system at same time each day by use of observation wells or piezometers installed in conjunction with the dewatering system. Relieve hydrostatic head in previous zones below subgrade elevation in layered soils to prevent uplift.

3.2.3 Underground Utilities

Location of the existing utilities indicated is approximate. The Contractor shall physically verify the location and elevation of the existing utilities indicated prior to starting construction. The Contractor shall contact the Bureau of Public Works for assistance in locating existing utilities.

3.2.4 Machinery and Equipment

Movement of construction machinery and equipment over pipes during construction shall be at the Construction’s risk. Repair, or remove and provide new pipe for existing or newly installed pipe that has been displaced or damaged.

3.3 EXCAVATION

Excavate to contours, elevation, and dimensions indicated. Reuse excavated materials that meet the specified requirements for the material type required at the intended location. Keep excavations free from water. Excavate soil disturbed or weakened by Contractor’s operations, soils softened or made unsuitable for subsequent construction due to exposure to weather. Refill with select material and compact to 95 percent of ASTM D 698 maximum density. Unless specified otherwise, refill excavations cut below indicated depth with backfill and fill material and compact to 95 percent of ASTM D 698 maximum density.

3.3.1 Structures with Spread Footings

Ensure that footing subgrades have been inspected and approved by the Contracting Officer prior to concrete placement. Fill over-excavations with concrete during foundation placement.

3.3.2 Pipe Trenches

Excavate to the dimension indicated. Grade bottom of trenches to provide uniform support for each section of pipe after pipe bedding placement.

3.3.3 Hard Material and Rock Excavation

Remove hard material and rock to elevation indicated in a manner that will leave foundation material in an unshattered and solid condition. Roughen level surfaces and cut sloped surfaces into benches for bond with concrete. Protect shale from conditions causing decomposition along joints or cleavage planes and other type of erosion. Removal of hard material and rock beyond lines and grades indicated, unless previously authorized by the Contracting Officer will not be grounds for a claim for additional payment.

3.4 FILLING AND BACKFILLING

Fill and backfill to contours, elevations, and dimensions indicated. Compact each lift before placing overlaying lift.

3.4.1 Common Fill Placement

Provide for general site. Place in 6-inch lifts. Compact areas not accessible to rollers or compactors with mechanical hand tampers. Aerate material excessively moistened by rain to a satisfactory moisture content. Finish to a smooth surface by blading, rolling with a smooth roller, or both.

3.4.2 Backfill and Fill Material Placement

Provide for paved areas and under concrete slabs, except where select material is provided. Place 6-inch lifts. Place backfill material adjacent to structures as the structural elements are completed and accepted. Backfill against concrete only when approved. Place and compact material to avoid loading upon or against structure.

3.4.3 Select Material Placement

Provide under porous fill of structures not pile supported. Place in 6-inch lifts. Backfill adjacent to structures shall be placed as structural elements are completed and accepted. Backfill against concrete only when approved. Place and compact material to avoid loading upon or against structure.

3.4.4 Porous Fill Placement

Provide under floor slab on a compacted subgrade. Place in 4-inch lifts.

3.4.5 Trench Backfilling

Backfill as rapidly as construction, testing, and acceptance of work permits. Place and compact backfill under structures and paved areas in 6-inch lifts to top of trench and 6-inch lifts to one foot over pipe outside structures and paved areas.

3.4.5.1 Bedding Requirements

Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D 698 maximum density. Plastic piping shall have bedding to spring line of pipe. Provide ASTM D 2321 materials as follows:

1. Class I: Angular, 6 to 40 mm (0.25 to 1.5 inches), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, crushed shells.
2. Class II: Coarse sands and gravels with maximum particle size of 40 mm (1.5 inches), including various graded sands and gravels containing small percentages of fines, generally granular and non- cohesive, either wet or dry. Soil Type GW, GP, SW, and SP are included in this class as specified in ASTM D 2487.

3.5 BURIED WARNING AND IDENTIFICATION TAPE

Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6inches below top of subgrade.

3.6 BURIED DETECTION WIRE (not used)

Bury detection wire directly above non-metallic piping at a distance not to exceed 12 inches above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 3 feet of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.

3.7 COMPACTION

Expressed as a percentage of maximum density. Determine in-place density of existing subgrade; if required density exists, no compaction of existing subgrade will be required. Density requirements specified herein are for cohesionless materials. When cohesive materials are encountered or used, density requirements may be reduced by 5 percent.

3.7.1 General Site

Compact underneath areas designated for vegetation and areas outside the 5-foot line of the structure to 85 percent of ASTM D 698.

3.7.2 Structures, Spread Footings, and Concrete Slabs

Compact top 12 inches of subgrades to 95 percent of ASTM D 698.

Compact select material to 95 percent of ASTM D 698.

3.7.3 Porous Fill for Capillary Water Barrier

Compact with two passes of a hand-operated, plate type vibratory compactor.

3.7.4 Adjacent Area

Compact areas within 5 feet of structures to 90 percent of ASTM D 698.

3.7.5 Paved Areas

Compact top 12 inches of subgrades to 95 percent of ASTM D 1557.

Compact fill and backfill materials to 95 percent of ASTM D 1557

3.8 FINISH OPERATIONS

3.8.1 Grading

Finish grades as indicated within one-tenth of one foot. Grade areas to drain water away from structures. For existing grades that will remain but which were disturbed by Contractor’s operations, grade as directed.

3.8.2 Seed (not used)

Scarify existing subgrade. Provide 4 inches of topsoil for newly graded finish earth surfaces and areas disturbed by the Contractor. Additional topsoil will not be required if work is performed in compliance with stripping and stockpiling requirements. If there is insufficient on-site topsoil meeting specified requirements for topsoil, provide topsoil required in excess of that available. Seed shall match existing vegetation. Provide seed at 5 pounds per 1,000 square feet. Provide mulch and water to establish an acceptable stand of grass.

3.8.3 Protection of Surfaces

Protect newly graded areas from traffic, erosion, and settlements that may occur. Repair or reestablish damaged grades, elevations, or slopes.

3.9 DISPOSITION OF SURPLUS MATERIAL

Remove from project site or Government property surplus or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber.

3.10 FIELD QUALITY CONTROL

3.10.1 Sampling

Take the number and size of samples required to perform the following tests.

3.10.2 Testing

Perform one each of the following tests for each material used.

Provide additional tests for each source change.

3.10.2.1 Fill and Backfill Material Testing

Test fill and backfill material in accordance with ASTM C 136 for conformance to ASTM D 2487 gradation limits; ASTM D 1140 for material finer than the No. 200 sieve; ASTM D 4318 for liquid limit and for plastic limit; ASTM D 698 or ASTM D 1557 for moisture density relations, as applicable.

3.10.2.2 Select Material Testing

Test select material in accordance with ASTM C 136 for conformance to ASTM D 2487 gradation limits; ASTM D 1140 for material finer than the No. 200 sieve; ASTM D 698 or ASTM D 1557 for moisture density relations, as applicable.

3.10.2.3 Porous Fill Testing

Test porous fill in accordance with ASTM C 136 for conformance to gradation specified in ASTM C 33.

3.10.2.4 Density Tests

Test density in accordance with ASTM D 1556, or ASTM D 2922 and ASTM D 3017. When ASTM D 2922 and ASTM D 3017 density tests are used, verify density test results by performing an ASTM D 1556 density test at a location already ASTM D 2922 and ASTM D 3017 tested as specified herein. Perform ASTM D 1556 density test at the start of the job, and for every 10 ASTM D 2922 and ASTM D 3017 density tests thereafter. Test each lift at randomly selected locations every 2,000 square feet of existing grade in fills for structures and concrete slabs, and every 2,500 square feet for other fill areas and every 2,000 square feet of subgrade in cut.

## EARTHWORK FOR STRUCTURES AND PAVEMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referred. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 33 1992 (Rev. A) Concrete Aggregates

ASTM C 136 1992 Sieve Analysis of Fine and Coarse Aggregates

ASTM D 698 1991 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft (600 kN-m/m))

ASTM D 1140 1992 Amount of Material in Soils Finer Than the No. 200 (75-Micrometer) Sieve

ASTM D 1556 1990 Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 1557 1991 Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft (2,700 kN-m/m))

ASTM D 1586 1984 (R 1992) Penetration Test and Split-Barrel Sampling of Soils

ASTM D 2434 1968 (R 1974) Permeability of Granular Soils (Constant Head)

ASTM D 2487 1992 Classification of Soils for Engineering Purposes

ASTM D 3786 1987 Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics-Diaphragm Bursting Strength Tester Method

ASTM D 4318 1984 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

ASTM D 4355 1992 Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)

ASTM D 4491 1992 Water Permeability of Geotextiles by Permittivity

ASTM D 4533 1991 Trapezoid Tearing Strength of Geotextiles

ASTM D 4632 1991 Grab Breaking Load and Elongation of Geotextiles

ASTM D 4751 1987 Determining the Apparent Opening Size of a Geotextile

ASTM D 4759 1988 (R 1992) Determining the Specification Conformance of Geosynthetics

ASTM D 4833 1988 Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

1.2 DEFINITIONS

1.2.1 Backfill

A specified material used in refilling a cut, trench, or other excavation, placed at a specified degree of compaction.

1.2.2 Capillary Water Barrier

A layer of clean, poorly graded crushed rock, stone, or natural sand or gravel having a high porosity which is placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below a slab.

1.2.3 Cohesive Materials

Cohesive materials include materials classified by ASTM D 2487 as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesive only when the fines have a plasticity index greater than zero.

1.2.4 Cohesionless Materials

Cohesionless materials include materials classified by ASTM D 2487 as GW, GP, SW, and SP. Materials classified as GM and SM will be identified as cohesionless only when the fines have a plasticity index of zero.

1.2.5 Compaction

The process of mechanically stabilizing a material by increasing its density at a controlled moisture condition. “Degree of Compaction” is expressed as a percentage of the maximum density obtained by the test procedure described in ASTM D 698 or for general soil types abbreviated in this specification as “(\_\_\_\_\_\_\_\_\_\_) percent ASTM D 698 maximum density.”

1.2.6 Controlled Fill and Controlled Backfill

A specified soil mix or gradation of materials constructed to attain maximum bearing strength and minimize consolidation or differential settlement under a load. Controlled fill is sometimes called “structural fill.”

1.2.7 Embankment

A “fill” having a top that is higher than adjoining ground.

1.2.8 Excavation

The removal of soil, rock, or hard material to obtain a specified depth or elevation.

1.2.9 Fill

Specified material placed at a specified degree of compaction to obtain an indicated grade or elevation.

1.2.10 Hard Material

Weathered rock, dense consolidated deposits or conglomerate materials, (excluding manmade materials such as concrete) which are not included in the definition of “rock” but which usually require the use of heavy excavation equipment with ripper teeth or the use of jack hammers for removal.

1.2.11 In Situ Soil

Existing in place soil.

1.2.12 Lift

A layer (or course) of soil placed on top of a previously prepared or placed soil.

1.2.13 Rock

Solid, homogeneous, interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement, exceeding ½ cubic yard in volume. Material indicated in the soil boring logs as having a standard penetration resistance as determined by ASTM D 1586 greater than 600 blows per foot is arbitrarily defined herein as “Rock.” Removal of “hard materials” will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.2.14 Soil

The surface material of the earth’s crust resulting from the chemical and mechanical weathering of rock and organic material.

1.2.15 Sub-grade

The material in excavation (cuts) and fills (embankments) immediately below any sub-base, base, pavement, or other improvement. Also, as a secondary definition, the level below which work above is referenced.

1.2.16 Topsoil

In natural or undisturbed soil formations, the fine-grained, weathered material on the surface or directly below any loose or partially decomposed organic matter. Topsoil may be a dark-colored, fine, silty, or sandy material with a high content of well decomposed organic matter, often containing traces of the parent rock material. Gradation and material requirements specified herein apply to all topsoil references in this contract. The material shall be representative of productive soils in the vicinity.

1.2.17 Unsatisfactory Material

Existing, in situ soil or other material which can be identified as having insufficient strength characteristics or stability to carry intended loads in fill or embankment without excessive consolidation or loss of stability.

Materials classified as, PT, OH, or OL by ASTM D 2487 are unsatisfactory. Unsatisfactory materials also include man-made fills, refuse, and uncompacted backfills from previous construction, unsound rock or soil lenses, or other deleterious or objectionable material.

1.2.18 Working Platform

A layer of compacted crushed rock or natural stone that replaces the in situ soil to provide a stable, uniform bearing foundation for construction equipment to facilitate further site construction.

1.3 SUBMITTALS

Submit the following in accordance with Section 01300, “Submittals.”

* + 1. SD-08, Statement
1. Dewatering system

Submit 15 days prior to starting work.

1.3.1.1 Dewatering System

Describe methods to be employed in removing water from exposed surfaces and diverting surface water from other areas or structures. Describe the basic components of the dewatering system proposed and its planned method of operation. Dewatering plan, as a minimum, shall address those requirements outlined in paragraph entitled “Drainage and Dewatering.”

1.3.2 SD-12, Field Test Reports

1. Capillary water barrier granular fill tests
2. Subsurface drains granular fill tests
3. Controlled fill and Controlled backfill material tests
4. Topsoil tests

1.4 REGULATORY REQUIREMENTS

Materials and workmanship specified herein with reference to Local Standards shall be in accordance with the referenced articles, sections and paragraphs of the standards except that contractual and payment provisions do not apply. Where the term “Engineer” is used, it shall mean the Contracting Officer. Where the term “state” is shall mean “Federal Government.”

1.5 DELIVERY AND STORAGE

Deliver and store materials in a manner to prevent contamination or segregation. (Store synthetic fiber filter cloth to prevent exposure to direct sunlight in accordance with the manufacturer’s recommendations).

1.6 CRITERIA FOR BIDDING

Base bids on the following criteria:

1. Surface elevations as indicated.
2. No pipes or other man-made obstructions, except those indicated, will be encountered.
3. Suitable backfill and fill material in the quantities required may not be available at the project site.
4. Blasting will not be permitted. Remove material by drilling and use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers, or as approved by the Contracting Officer.
	1. SITE CONDITIONS

1.7.1 Dewatering Plan

Base on site surface and sub-surfaces conditions and available soils and hydrological data.

1.7.2 Utilities

Contact the Contracting Officer 72 hours prior to construction for the location of all existing underground utilities. Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor’s risk. Contact the Bureau of Public Works for location(s) of their utilities. Perform work adjacent to privately owned utilities in accordance with procedures outlined by the Bureau of Public Works. Excavation made with power –driven equipment is not permitted within two feet of known Government-owned utility or subsurface construction.

For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work as affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Granular Fill

2.1.1.1 Capillary Water Barrier

Provide a capillary water barrier indicated as (\_\_\_\_\_\_\_\_\_\_\_\_) under concrete floor slabs consisting of clean crushed stone, crushed gravel, or uncrushed gravel conforming to ASTM C 33 coarse aggregate grading size 57, 67, or 7. Underlay the capillary water barrier by a 2 inch thick course of granular filter material consisting of clean concrete sand conforming to grading size no. 6 in accordance with ASTM C 33.

2.1.2 Soil Materials

Provide materials free from debris, roots, wood, scrap materials, vegetable matter or refuse. Maximum particle size permitted is 3 inches. Use excavated material from the site for the work indicated when material falls within the requirements specified herein.

2.1.2.1 Controlled Fill and Controlled Backfill

Provide materials classified as GW, GP, SW, or SP, by ASTM D 2487 where indicated. The liquid limit of such material shall not exceed 35 percent when tested in accordance with ASTM D 4318. The plasticity index shall not be greater than 12 percent when tested in accordance with ASTM D 4318, and not more than 35 percent by weight shall be finer than No. 200 sieve when tested in accordance with ASTM D 1140. Coefficient of permeability shall be a minimum of 0.002 feet per minute when tested in accordance with ASTM D 2434.

2.1.2.2 General Backfill Beside Structures

Soft, spongy, highly plastic, or otherwise unstable material is prohibited. Material shall be unclassified but shall contain sufficient fines to ensure proper compaction. Material shall be classified as GP, GM, GC, SP, or SM by ASTM D 2487. If more material is required than is available from on-site excavation, then provide that material from approved sources.

2.1.2.3 General Site Fill, Backfill and Embankment Material

Provide a soil material from the site or borrow that can be readily compacted to the specified densities. Materials shall be unclassified.

2.1.2.4 Working Platform

Material and thicknesses of working platform for support of construction equipment shall be at the discretion of the construction contractor. The gradation and placement of such material shall not create large void spaces upon which overlying work is indicated to be placed.

2.1.2.5 Topsoil

Provide material free of subsoil, stumps, rocks larger than ¾ inch diameter (with maximum 3 percent retained on ¼ inch screen), brush, weeds, toxic substances, and other material or substance detrimental to plant growth. Topsoil shall be a natural, friable soil representative of productive soils in the vicinity.

2.1.2.6 Borrow

Provide materials meeting requirements for general site fill, controlled fill and controlled backfill, general backfill, granular fill, and topsoil. Obtain borrow materials in excess of those furnished from excavations described herein from sources off Government property.

2.2 FILTER FABRIC

Provide a pervious sheet of polyester, nylon, glass or polypropylene, ultraviolet resistant filaments woven, spun bonded, fused, or otherwise manufactured into a nonraveling fabric with uniform thickness and strength. The fabric shall have the following manufacturer certified minimum average roll properties as determined by ASTM D 4759:

 Class A Class B

1. Grab tensile strength (ASTM D 4632) min. (180) lbs.

machine and transverse direction

1. Grab elongation (ASTM D 4632) min. (15) percent

machine and transverse direction

1. Puncture resistance (ASTM D 4833) min. n (80) lbs.
2. Mullen burst strength (ASTM D 3786) min. (290) psi.
3. Trapezoidal tear strength (ASTM D 4533) min. (50) lbs.
4. Apparent opening size (ASTM D 4751) See Criteria Below
5. Soil with 50% or less particles by weight passing US No. 200 Sieve, AOS less than 0.6 mm (greater than #30 US Std. Sieve)
6. Soil with more than 50% particles by weight passing US No. 200 Sieve, AOS less than 0.297mm (greater than #50 US Std. Sieve)
7. Permeability (ASTM D 4491) (k fabric > k soil)
8. Ultraviolet Degradation (ASTM D 4355) 70% Strength Retained at 150 hours

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Drainage and Dewatering

Plan for and provide the structures, equipment, and construction for the collection and disposal of surface and subsurface water encountered in the course of construction.

3.1.1.1 Drainage

Dispose of surface water which may accumulate in open excavations, unfinished fills, or other low areas. Remove water by trenching where approved, pumping, or other methods to prevent softening of exposed surfaces. Surface dewatering plan shall include rerouting of any storm water runoff or natural drainage if necessary and shall comply with requirements specified in Section 01560, “Temporary Controls.” Collect and dispose of surface and subsurface water encountered in the course of construction.

3.1.1.2 Dewatering

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing or excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps ditches or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least 3 feet below the working level.

Operate the dewatering system continuously, 24 hours per day, 7 days per week until construction work below existing water levels is complete. Measure and record the performance of the dewatering system at the same time each day by use of observation wells and piezometers installed in conjunction with the dewatering system. Have a back-up pump and system available for immediate use. See Section 01560, “Temporary Controls” for additional requirements.

3.1.2 Protection and Restoration of Surfaces

Protect newly graded areas from traffic, erosion, and settlements. Repair and reestablish damaged or eroded slopes, elevations or grades and restore surface construction prior to acceptance. Protect existing streams, ditches and storm drain inlets from water-borne soil by means of filter fabric dams. Conduct work in accordance with requirements specified in Section 01560, “Temporary Controls.”

3.1.2.1 Disposal of Excavated Material

Dispose of excavated material in such a manner that it will not obstruct the flow of runoff, streams, endanger a partly finished structure, impair the efficiency or appearance of facilities, or be detrimental to the completed work.

3.1.2.2 Stockpile Rock

Stockpile rock from on-site excavations and use to construct slopes or embankments adjacent to streams, or side and bottoms of channels (rip-rap) and for protection against erosion. Remove excess stockpiled rock upon completion of construction.

3.2 SURFACE PREPARATION

3.2.1 Clearing and Grubbing

Perform as specified in Section 02102, “Clearing and Grubbing.”

3.2.2 Stockpiling Topsoil

Strip approved topsoil to a depth of 4 inches from the site where excavation or grading is indicated and stockpile separately from other excavated material. Locate topsoil so that the material can be used readily for the finished grading. Protect and store in segregated piles until needed.

3.2.3 Unsatisfactory Material

Remove organic matter, sod, muck, rubbish, and unsuitable soils under embankments which are less than 3 feet in thickness and under pavements or slabs on grade. Typical depth of removal of such unsuitable material shall be as indicated.

3.2.3.1 Subgrade Proof Rolling

After removal of topsoil or other overburden, proof roll the existing subgrade with six passes of a minimum 15-ton pneumatic-tired roller. Operate the roller in a systematic manner to assure the number of passes over all areas, and at speeds between 2.5 and 3.5 miles per hour. When proof rolling under structures, one-half of the passes made with the roller shall be in a direction perpendicular to the other passes. Proof rolling shall be done in the presence of the Contracting Officer. Rutting or pumping shall indicate unsatisfactory material and that material shall be undercut as directed by the Contracting Officer and replaced with the appropriate fill material.

Perform proof rolling only when weather conditions permit. Do not proof roll wet or saturated subgrades. Materials degraded by proof rolling a wet or saturated subgrade shall be replaced by the Contractor as directed by the Contracting Officer at no cost to the Government. Notify the Contracting Officer 3 days prior to proof rolling.

3.3 EXCAVATION

Excavate to contours and dimensions indicated. Keep excavations free from water while construction is in progress. Notify the Contracting Officer immediately in writing I the event that it becomes necessary to remove rock, hard material, or other material defined as unsatisfactory to a depth greater than indicated and an adjustment in contract price will be considered in accordance with the Contract clause entitled “Differing Site Conditions.” Refill excavations cut below the depths indicated with (controlled fill and compact as specified herein. Excavate soil disturbed or weakened by construction operations or soils soften from exposure to weather. Refill with controlled fill and compact as specified herein.

3.3.1 Excavations for Structures and Spread Footings

Excavate to depth indicated. If excavation is deeper than indicated, then fill with controlled backfill material prior to placement of footings.

3.3.2 Rock

Remove rock to elevations indicated by approved methods in such a manner that will leave foundation rock in an unshattered and solid condition. Blasting will not be permitted. Roughen level surfaces and cut sloped surfaces into benches for bonding with concrete. Protect shale from conditions causing decomposition along joints or cleavage planes and other types of erosion. Removal of rock beyond the lines and grades indicated unless previously authorized by the Contracting Officer will not be grounds for a claim for additional payment.

3.3.3 Subsurface Drain Trenches

Excavate in accordance with lines, grades, and sections indicated.

3.4 BORROW MATERIALS

Select borrow materials to meet requirements and conditions of the particular fill or backfill materials to be used. Perform necessary clearing, grubbing, disposal of debris, and satisfactory drainage of borrow pits as incidental operations to the borrow excavation. Obtain borrow materials from sources off of Government property.

3.4.1 Borrow Pits

Do not open borrow pits without approval of the Contracting Officer or before elevations and measurements are completed on the undisturbed surface. Excavate borrow pits to afford adequate drainage. Overburden and other soil materials shall be stockpiled for refilling the borrow area as indicated.

3.5 FILLING AND BACKFILLING

3.5.1 Subgrade Preparation

Scarify the underlying subgrade surface to a depth of 6 inches before the fill is started. Step, bench, or break up slopes surfaces steeper than one vertical to 4 horizontal so that the fill material will bond with or be securely keyed to the existing material. Scarify existing surface to a minimum depth of 6 inches if subgrade density is less than the degree of compaction specified and recompact. When the subgrade is part fill and part excavation or natural ground, scarify the excavated or natural ground portion to a depth of 6 inches and recompact as specified for the adjacent or overlying fill. Compact with equipment well suited to the soil being compacted. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.

3.5.2 Fill and Backfill Beside Structures

Place required backfill material adjacent to structures and compact in a manner that prevents wedging action or eccentric loading upon or against the structures. Step or serrate slopes bounding or within areas to be backfilled to prevent sliding of the fill. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Do not place material on surfaces that are muddy. Do not use equipment for backfilling operations or for the formation of embankments against structures that will overload the structure. Backfilling against concrete will be done only after approval has been obtained from the Contracting Officer.

3.5.3 Controlled Fill and Controlled Backfill

Place controlled fill and controlled backfill under spread footing, and concrete slabs in loose lifts of 6 inches. Do not place material on surfaces that are muddy. Compact with equipment well suited to the soil being compacted.

Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Compact each lift as specified herein before placing the overlaying lift. Compaction shall be accomplished continuously over the entire area. Sufficient passes shall be made to ensure that specified density is obtained.

3.5.4 General Fill and General Backfill

Construct fill, backfill and embankment at the locations and to lines and grades indicated. Use only approved materials in constructing fill on the prepared subgrade. Place satisfactory material in horizontal lifts not exceeding 8 inches in loose depth. Do not place material on surfaces that are muddy. Compact with equipment well suited to the soil being compacted. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Compact each lift as specified before placing the overlaying lift.

3.5.5 Final Backfill for Utilities

Construct backfill (final backfill) for storm drains, manholes, utility lines, and other utility appurtenances using the material and compaction requirements specified herein for the adjacent or overlying work. Bedding and initial backfill requirements are specified in Section 02225, “Excavation, Backfilling, and Compacting for Utilities.” Backfilling against concrete will be done only after approval has been obtained from the Contracting Officer.

3.5.6 Fill for Capillary Water Barrier

Place granular fill on a 2 inch layer of filer material synthetic fiber filter fabric over compacted subgrade. Compact granular fill in lifts of 4 inches with a minimum of two passes of a hand operated plate type vibratory compactor per lift.

3.5.7 Weather Limitations

Fill and backfill shall not be constructed when weather conditions detrimentally affect the quality of the finished course. Do not construct fill and backfill in the rain or on saturated subgrades. If weather conditions are windy, hot with high rate of evaporation, schedule the placement in cooler portions of the day and furnish equipment to add moisture to the fill or backfill during and after placement.

3.6 COMPACTION

Compact each layer or lift of material specified so that the in place density tested is not less than the percentage of maximum density specified in Table III.

 TABLE III

 Percent ASTM D 1557ASTM D

 Maximum Density

 Cohesive Cohesionless

 Material Material

Fill, Embankment and Backfill

(General Fill) (and)(General Backfill (90) (95)

Under steps and parking lots

(General Fill)(and)(General Backfill) (85) (90)

Under sidewalks and grassed areas

(General Backfill (and General Fill) (90) (95)

beside structures)

(Controlled fill and (Controlled (95) (100)

backfill) under footings, pavements and structures)

Refill (overblasts) (and) (undercut) materials (N/A) (100)

Under Roadways, top 12 Inches) (95) (100)

Subgrade (Top of fill, backfill or cut)

Under (building slabs,) (steps) (93) (98)

(and) (parking lots,) top (12) inches

Under footings, top (12) inches (95) (100)

Under sidewalks, and grass areas, top (6) inches (85) (90)

3.7 FINISH OPERATIONS

3.7.1 Site Grading

Grade to finished grades indicated within 0.10 foot. Grade areas to drain water away from structures and to provide suitable surfaces for mowing machines. Existing grades which are to remain but are disturbed by the Contractor’s operations shall be restored as specified herein.

3.7.2 Finishing Subgrades Under Structures and Pavements

Finish surface of top lift of fill or top of subgrade to the elevation and cross section indicated. Finished surface shall be smooth and of uniform texture. Lightly scarify or blade the finished surface to bring the finished surface to within 0.05 foot of the indicated grade and to eliminate imprints made by compaction and shaping equipment. Surface shall show no deviations in excess of 3/8 inch when tested with a 10 foot straightedge.

3.7.3 Spreading Topsoil

Clear areas indicated or specified to receive topsoil of materials interfering with planting and maintenance operations. Do not place topsoil when subgrade is extremely wet or in other conditions detrimental to seeding, planting, or grading. Spread topsoil to a uniform depth of 4 inches over the designated area.

3.7.4 Disposition of Surplus Material

Surplus or other soil material not required or suitable for filling, backfilling, or embankment shall be removed from Government Property. Comply with the requirements of Section 01560, “Temporary Controls.”

3.7.5 Protection of Surfaces

Protect newly graded areas from traffic, erosion, and settlements that may occur and as required in the Section 01560, “Temporary Controls” and as specified in the paragraph entitled “Protection and Restoration of Surfaces.” Repair or reestablish damaged grades, elevations, or slopes prior to acceptance of work.

3.8 FIELD QUALITY CONTROL

3.8. Sampling

Furnish one 50-pound composite sample taken at random times daily of subgrade being compacted and fill material being placed. Submit samples, in the number directed, whenever the source or character of the fill, backfill, or embankment material changes. Contain each sample in a clean container and fasten to prevent loss of material. Tag each sample for identification. Tag shall contain the following information:

 Contract No. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Sample No. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Date of Sample \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Sampler \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Source \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Intended Use \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3.8.2 Tests

Test backfill using ASTM C 136 for conformance to ASTM C 33, and ASTM D 2487 gradation limits. Test backfill for material finer than the No. 200 sieve using ASTM D 1140. Test backfill for liquid limit and plasticity index using ASTM D 4318. Test backfill materials for moisture density relations using ASTM D 698. Test backfill for permeability in accordance with ASTM D 2434. Perform one of each of the required tests for each material used when directed. Provide additional tests as specified above for each source change. Perform density tests in randomly selected locations using ASTM D 1556 as follows: one test per 18,000 square feet in each layer of lift. 500 cubic yards placed. Determine moisture content of soil material in place at every location where in-place density is tested.

3.8.3 Controlled Fill

Method of in-place density tests shall be in accordance with paragraph “Tests.” Acceptance of the compacted material shall be determined in each location by the results of a minimum of two consecutive tests. The average of two tests shall equal or exceed the specified density. The location of the tests for each compacted layer will be randomly selected by the Contracting Officer. Acceptance of the compacted material shall be determined in each unit by the results of a series of three consecutive field in-place density tests.

Method of in-place tests shall be in accordance with paragraph “Tests.” The average of three tests shall equal or exceed the specified average density requirement. Fill shall be accepted or rejected by units with a complete unit being reworked in the event of rejection. A unit shall consist of 2000 cubic yards of fill or 20 percent of the total embankment fill (\_\_\_\_\_\_\_\_\_\_) quantity, whichever is less and have a minimum of 2 feet of fill.

## EXCAVATION, BACKFILLING AND COMPACTING FOR UTILITIES

PART 1 GENERAL

 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN CONCRETE PIPE ASSOCIATION (ACPA)

ACPA 01-103 1990 Concrete Pipe Installation Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 422 1963 (R 1990) Particle-Size Analysis of Soils

ASTM D 698 1978 (R 1990) Moisture-Density Relation of Soils and Soil Aggregate Mixture Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop

ASTM D 1140 1954 (R 1990) Amount of Material in Soils Finer Than the No. 200 (75-Micrometer) Sieve

ASTM D 1556 1990 Density of Soil in Place by the Sand-Cone Method

ASTM D 1557 1978 (R 1990) Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop

ASTM D 1586 1984 Penetration Test and Split-Barrel Sampling of Soils

ASTM D 2487 1990 Classification of Soils for Engineering Purposes

ASTM D 2922 1981 (R 1990) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

ASTM D 3017 1988 Water Content of Soil and Rock in place by Nuclear Methods (Shallow Depth)

ASTM D 4253 1983 Maximum Index Density of Soils Using a Vibratory Table

ASTM D 4254 1983 Minimum Index Density of Soils and Calculation of Relative Density

ASTM D 4318 1984 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

CORPS OF ENGINEERS (COE)

COE EM-385-1-1 1987 Safety and Health Requirements Manual

DEPARTMENT OF AGRICULTURE (DOA)

DOA SSIR April 1984 Soil Survey Investigation Report No. 1, Soil Survey Laboratory Methods and Procedures for Collecting Soil Samples, Soil Conservation Service

NATIONAL ELECTRICAL MANUFACTURES ASSOCIATION (NEMA)

NEMA TC 6 1990 PVC and ABS Plastic Utilities Duct for Underground Installation

* 1. DEFINITIONS

1.2.1 Backfill

A specified material used in refilling a cut, trench, or other excavation, places at a specified degree of compaction.

1.2.2 Compaction

The process of mechanically stabilizing a material by increasing its density at a controlled moisture condition. “Degree of Compaction” is expressed as a percentage of the maximum density obtained by the test procedure described in ASTM D 698 or ASTM D 1557 for general soil types or ASTM D 4253 and ASTM D 4254 (Relative Density) for isolated cohesionless materials, abbreviated in this specification as “ \_\_\_\_\_\_ percent ASTM D \_\_\_\_\_\_\_\_\_ maximum density.”

1.2.3 Controlled Fill and Controlled Backfill

A specified soil mix or gradation of materials constructed to attain maximum bearing strength and minimize consolidation or differential settlement under a load. Controlled fill is sometimes called “structural fill.”

1.2.4 Excavation

The removal of soil, rock, or hard material to obtain a specified depth or elevation.

1.2.5 Fill

Specified material placed at a specified degree of compaction to obtain an indicated grade or elevation.

1.2.6 In Situ Soil

Existing in place soil.

1.2.7 Lift

A layer (or course) of soil placed on top of a previously prepared or placed soil.

1.2.8 Rock

Solid, homogeneous, interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement, exceeding 1 cubic yard in volume. (Material indicated in the soil boring logs as having a standard penetration resistance as determined by ASTM D 1586 greater than 600 blows per foot is arbitrarily defined herein as “Rock.” Removal of “hard material” will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.2.9 Soil

The surface material of the earth’s crust resulting from the chemical and mechanical weathering of rock and organic material.

1.2.10 Subgrade

The material in excavation (cuts) and fills (embankments) immediately below any subbase, base, pavement, or other improvement. Also, as a secondary definition, the level below which work above is referenced.

1.2.11 Topsoil

In natural or undisturbed soil formations, the fine-grained, weathered material on the surface or directly below any loose or partially decomposed organic matter. Topsoil may be a dark-colored, fine, silty, or sandy material with a high content of well decomposed organic matter, often containing traces of the parent rock material. Gradation and material requirements specified herein apply to all topsoil references in this contract. The material shall be representative of productive soils in the vicinity.

1.2.12 Granular Pipe Bedding

A dense, well-graded aggregate mixture of sand, gravel, or crushed stone (mixed individually, in combination with each other, or with suitable binder soil) placed on a subgrade to provide a suitable foundation for pipe. Granular bedding material may also consist of poorly graded sands or gravels where fast draining soil characteristics are desired.

* 1. SUBMITTALS

Submit the following in accordance with Section 01300 and Section 02221 other than those indicated in this section.

* + 1. SD-08, Statements
1. Shoring and sheeting plan (required only if trench is deeper than 5’)
2. Dewatering plan (required only if groundwater is encountered)
3. Welder’s qualifications
	* + 1. Shoring and Sheeting Plan

Described materials of shoring system to be used. Indicate whether or not components will remain after filling or backfilling. Provide plans, sketches, or details along with calculations by a professional engineer registered in any jurisdiction. Indicate sequence and method of installation and removal.

* + - 1. Dewatering Plan

Describe method for removing collected water from open trenches and diverting surface water or piped flow away from work area. Describe equipment and procedures for installing and operating the dewatering system indicated. Describe the basic components of the dewatering system proposed for use and its planned method of operation. Record performance and effectiveness of method or system in use and submit weekly.

* + 1. SD-11, Factory Test Reports
1. Underdrainage backfill material tests
2. Concrete tests
3. Trench backfill material tests
4. Pipe bedding material tests
5. Topsoil Tests
	* 1. SD-12, Field Test Reports
6. Test for moisture-density relation
7. Topsoil Tests
8. Density and moisture tests

Submit field test data not listed above sufficiently in advance of construction so as not to delay work.

* + - 1. Test for Moisture-Density Relation

Submit 7 days prior to commencing utility excavation.

* + - 1. Topsoil Tests

Submit topsoil tests verifying conformance to required parameters prior to commencing seeding and planting operations.

* + - 1. Density and Moisture Tests

Submit within 14 days of test date.

* 1. DELIVERY, STORAGE AND HANDLING

Deliver and store materials in a manner to prevent contamination, segregation, and other damage. Store synthetic fiber filter fabric to prevent exposure to direct sunlight.

* 1. CRITERIA FOR BIDDING

Base bids on the following criteria:

1. Surface elevations are as indicated.
2. No pipes or other man-made obstructions, except those indicated will be encountered.
3. Rock as defined in paragraph entitled: Definitions,” will not be encountered.
4. Ground water is not encountered.
5. Suitable backfill and bedding material in the quantities required is not available at the project site.
6. Blasting will not be permitted.
	1. PROTECTION
		1. Dewatering Plan

Base on site surface and subsurface conditions, and available soil and hydrological data.

* + 1. Utilities

Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor’s risk. Perform work adjacent to Non-Government utilities as indicated in accordance with procedures outlined by utility company. Excavation made with power-driven equipment is not permitted within 2 feet of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

Provide soil materials as specified below free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, or other deleterious and objectionable materials.

2.1.1 Backfill

Trenches to grade indicated on the drawings using material classified as GM, SM, or SC by ASTM D 2487 with a maximum particle size of 3 inches.

2.1.2 Special Backfill for Structures and Pavements

Backfill trenches under roads, structures, and paved areas as specified in Section 02221, “Earthwork for Structures and Pavements.” With material conforming to the requirements stated above except that the liquid limit of the material cannot exceed 35 percent when tested in accordance with ASTM D 4318, the plasticity index cannot exceed 12 percent when tested in accordance with ASTM D 4318, and not more than 35 percent by weight can be finer than the No. 200 sieve when tested in accordance with ASTM D 1140.

2.1.3 Sand

Clean, coarse-grained sand classified SW or SP by ASTM D 2487 for bedding.

2.1.4 Gravel

Clean, coarsely graded natural gravel, crushed stone or a combination thereof having a classification of GW or GP in accordance with ASTM D 2487 for bedding and backfill. Maximum particle size shall not exceed 3 inches.

2.1.5 Topsoil Material

Salvaged topsoil from stockpile. Prior to spreading, test topsoil, and add necessary soil modifiers to bring material within the ranges specified in Table 2. Furnish additional topsoil if stockpiled material is insufficient to complete work indicated. Free of subsoil, stumps, rocks larger than ¾ inch in diameter with maximum 3 percent retained on ¼ inch sieve, brush, weeds, toxic substances, and other material or substance detrimental to plant growth. Topsoil shall be a natural, friable soil representative of productive soils in the vicinity. Modify the topsoil provided if necessary to meet the requirements specified in Table 2.

TABLE 2

DOA SSIR Soil Survey Investigation Acceptable

-Report No. 1, Laboratory Test for: - -Limits-

Sand Content 20 – 45 percent by weight

Silt Content 25 – 50 percent by weight

Clay Content 10 – 30 percent by weight

Organic Material (Walkley-Block) 5 percent

pH 5.0 to 7.6

Soluble Salts 600 ppm maximum

Absorption Rate 0.5 inch per hour minimum

2.1.6 Borrow

Provide materials meeting requirement for pipe bedding, general site fill, fill, special backfill, sand, gravel, backfill, granular fill, and topsoil. Obtain borrow materials in excess of those furnished from excavations specified herein from sources off Government property.

2.1.7 Pipe Bedding

Provide material for pipe bedding consisting of sand as classified in accordance with ASTM D 2487.

2.2 BURIED WARNING AND INDENTIFICATION TAPE

Polyethylene plastic and acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, “CAUTION, BURIED (intended service) LINE BELOW” or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

Warning Tape Color Codes

 Red: Electric

 Yellow: Gas, Oil, Dangerous Materials

 Orange: Telephone and other

 Communications

 Blue: Water Systems

 Green: Sewer Systems

2.2.1 Detectable Warning Tape for Non-Metallic Piping

Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Shoring and Sheeting

Provide shoring and sheeting in addition to Section XXIII A and B of COE EM-385-1-1 and other requirements set forth in this contract, include provisions in the shoring and sheeting plan that will accomplish the following:

1. Prevent undermining of pavements, foundations and slabs.

b. Prevent slippage or movement in banks or slopes adjacent to the excavation.

 c. Allow for the abandonment of shoring and sheeting materials in place in critical areas

 as the work is completed. In these areas, backfill the excavation to within 3 feet of the

 finished grade and remove the remaining exposed portion of the shoring before

 completing the backfill.

3.1.2 Dewatering

Plan for and provide the structures, equipment, and construction for the collection and disposal of surface and subsurface water encountered in the course of construction.

3.1.3 Water Removal

Remove water by pumping or other methods to prevent the softening of surfaces exposed by excavation, prevent hydrostatic uplift, and provide a stable trench condition for installation of the utility. Use screens and gravel packs or other filtering systems on the dewatering devices to prevent the removal of fines from the soil.

3.1.4 Operation and Performance

Operate the dewatering system until construction work below existing water levels is complete. Measure and record be allowed to rise but at no time allow it to rise higher than one foot below the prevailing level of excavation or backfill.

3.1.5 Structures and Surfaces

Protect newly backfilled areas and adjacent structures, slopes, or grades from traffic, erosion settlement, or any other damage. Repair and reestablish damaged or eroded grades and slopes and restore surface construction prior to acceptance. Perform work in accordance with requirements specified in Section 01560 “Environmental Protection.”

3.1.5.1 Disposal of Excavated Material

Dispose of excavated material so that it will not obstruct the flow of runoff, streams, endanger a partly finished structure, impair the efficiency or appearance of any facilities, or be detrimental to the completed work.

3.2 SURFACE PREPARATION

3.2.1 Stockpiling Topsoil

Strip suitable soil from the site where excavation or grading is indicated and stockpile separately from other excavated material. Material unsuitable for use as topsoil shall be wasted. Locate topsoil so that the material can be used readily for the finished grading. Where sufficient existing topsoil conforming to the material requirements is not available on site, provide borrow materials suitable for use as topsoil. Protect topsoil and keep in segregated piles until needed.

3.2.2 Cutting Pavement, Curbs, and Gutters

Saw cut with neat, parallel, straight lines one foot wider than trench width on each side of trenches and one foot beyond each edge of pits.

3.3 GENERAL EXCAVATION AND TRENCHING

Keep excavations free from water while construction is in progress. Notify the Contracting Officer immediately in writing if it becomes necessary to remove rock or hard, unstable, or otherwise unsatisfactory material to a depth greater than indicated. Make trench sides as nearly vertical as practicable except where sloping of sides is allowed. Sides of trenches shall not be sloped from the bottom of the trench up to the elevation of the top of the pipe. Excavate ledge rock, boulders, and other unyielding material to an overdepth at least 6 inches below the bottom of the pipe unless otherwise indicated or specified. Blasting will not be permitted. Over-excavate soft, weak, or wet excavations as indicated.

Use gravel placed in 6 inch maximum layers to refill overdepths to the proper grade. At the Contractor’s option, the excavations may be cut to an overdepth of not less than 4 inches and refilled to required grade as specified. Grade bottom of trenches accurately to provide uniform bearing and support for each section of pipe on undisturbed soil, or bedding material as indicated or specified at every point along its entire length except for portions where it is necessary to excavate for bell holes and for making proper joints. Dig bell holes and depressions for joints after trench has been graded. Dimension of bell holes shall be as required for properly making the particular type of joint to ensure that the bell does not bear on the bottom of the excavation. Trench dimensions shall be as indicated.

3.3.1 Shoring and Sheeting

Shore and sheet excavations as described in the plan submitted with various member sizes arranged to prevent injury to persons and damage to structures. Arrange shoring and sheeting to preclude injurious caving during removal. Obtain approval from the Contracting Officer prior to removing shoring, sheeting, or bracing in excavations adjacent to on-grade slabs, foundations, or other structural elements.

3.4 BEDDING

Of materials and depths as indicated for utility lines and utility line structures. Place bedding in 6 inch maximum loose lifts. Provide uniform and continuous support for each section of structure except at bell holes or depressions necessary for making proper joints.

3.5 BURIED WARNING AND IDENTIFICATION TAPE

Install tape in accordance with manufacturer’s recommendations except as modified herein. Bury tape 12 inches below finished graded; under pavements and slabs, bury tape 6 inches below top of subgrade.

3.6 BACKFILLING

Construct backfill in two operations as indicated and specified in this section. Place initial backfill in 6 inch maximum loose lifts to one foot above pipe, conduit, and duct unless otherwise specified. Ensure that initially placed material is tamped firmly under pipe haunches. Bring up evenly on each side and along the full length of the pipe, conduit, or duct structure. Ensure that no damage is done to the utility or its protective coating. Place the remainder of the backfill (final backfill) in 9 inch maximum loose lifts unless otherwise specified. Compact each loose lifts as specified in the paragraph entitled “General Compaction” before placing the next lift. Do not backfill where the material in the trench is muddy, except as authorized. Provide a minimum cover from final grade of 3 feet for water piping, storm drains and sewer mains unless otherwise noted. Where settlements greater than the tolerance allowed herein for grading occur in trenches and pits due to improper compaction, excavate to the depth necessary to rectify the problem, then backfill and compact the excavation as specified herein and restore the surface to the required elevation. Coordinate backfilling with testing of utilities. Testing for the following shall be complete before final backfilling: water distribution, storm drainage, and sanitary sewer systems. Provide buried warning and identification tape installed in accordance with the manufacturer’s recommendation.

3.7 COMPACTION

Use hand-operated, plate-type, vibratory, or other suitable had tampers in areas not accessible to larger rollers or compactors. Avoid damaging pipes and protective pipe coatings. Compact material in accordance with the following unless otherwise specified. If necessary, alter, change, or modify selected equipment or compaction methods to meet specified compaction requirements.

3.7.1 Compaction of Material in Sub-cuts or Over-excavations

In rock, compact to 95 percent of ASTM D 1557 maximum density. In soft, weak, or wet soils, tamp refill material to consolidate to density of adjacent material in trench wall. In stable soils, compact to 90 percent of ASTM D 1557 maximum density.

3.7.2 Compaction of Pipe and Conduit Bedding

In rock, compact to 95 percent and in soil, compact to 90 percent of ASTM D 1557 maximum density.

3.7.3 Compaction of Backfill

Compact initial backfill material surrounding pipes, cables, conduits, or ducts, to 90 percent of ASTM D 1557 maximum density except where bedding and backfill are the same material. Where bedding and backfill are the same material, compact initial backfill to the density of the bedding. Under areas to be seeded or sodded, compact succeeding layers of final backfill to 85 percent of ASTM D 1557 maximum density. For utilities under structures and pavements, compact succeeding layers of final backfill as specified under section 02221 “Earthwork for Structures and Pavements.”

3.8 SPECIAL EARTHWORK INSTALLATION REQUIREMENTS

3.8.1 Manholes and Other Appurtenances

Provide at least 12 inches clear from outer surfaces to the embankment or shoring. Remove rock as specified herein. Remove rock as specified herein. Remove unstable soil that is incapable of supporting the structure to an overdepth of one foot and refill with gravel to the proper elevation. Stabilize soft, weak, or wet excavations as indicated. Refill overdepths with gravel to the required grade and compact to 90 percent of ASTM D 1557 maximum density.

3.9 FINISH OPERATIONS

3.9.1 Grading

Finish to grades indicated within one-tenth of a foot. Provide sod or topsoil in areas to be seeded or sodded as indicated. Grade areas to drain water away from structures and to provide suitable surfaces for mowing machines. Grade existing grades that are to remain but have been disturbed by the Contractor’s operations.

3.9.2 Spreading – Topsoil

Clear areas to receive topsoil for the finished surface of materials that would interfere with

planting and maintenance operations. Scarify subgrade to a depth of 2 inches. Don not place topsoil when the subgrade is extremely wet or dry, or in other conditions detrimental to seeding, planting, or grading.

3.9.3 Borrow Area

Grade to drain properly. Maintain and restore borrow pits as specified in Section 01560,

“Environmental Protection.”

3.9.4 Disposition of Surplus Material

Surplus or other soil material not required or suitable for filling, backfilling, or grading shall be removed from Government property. Comply with requirements of Section 01560, “Environmental Protection.”

3.9.5 Protection of Surfaces

Protect newly graded areas from traffic, erosion, and settlements that may occur and as required in Section 01560, “Environmental Protection.” Repair or reestablish damaged grades, elevations, or slopes.

3.9.6 Pavement Repair

 Repair pavement, curbs, and gutters as indicated. Do not repair pavement until trench or pit has been backfilled and compacted as specified herein. Provide a temporary road surface of crushed stone over backfilled portion until permanent pavement is repaired. Remove and dispose of temporary road surface material when permanent pavement is placed. As a minimum, maintain one-way traffic on roads and streets crossed by trenches.

3.10 FIELD QUALITY CONTROL

Test sand, gravel, bedding, backfill and topsoil for conformance to specified requirements. Test bedding and backfill for moisture-density relations in accordance with ASTM D 1557 and ASTM D 4253 as specified herein. Perform at least one of each of the required tests for each material provided. Provide additional tests as specified above for each change of source.

1. Bedding and Backfill in Trenches: One test per 50 linear feet in each lift.
2. Appurtenance Structures: One test per 100 square feet or fraction thereof in each lift.

Where ASTM D 2922 and ASTM D 3017 are used to test field compaction densities, verify test results by performing at least one test per day using ASTM D 1556 at a location already tested in accordance with ASTM D 2922. Perform at least one additional test using ASTM D 1556 for every ten tests performed with a nuclear device, at locations checked in accordance with ASTM D 2922.

## EXTERIOR WATER DISTRIBUTION SYSTEM (MINOR CONSTRUCTION)

PART 1 GENERAL

 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B16.18 1984 Cast Copper Alloy Solder Joint Pressure

 Fittings

ANSI B18.5.2.1M 1981 Metric Round Head Short Square Neck Bolts

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME/ANSI B16.1 1989 Cast Iron Pipe Flanges and Flanged Fittings

ASME/ANSI B16.22 1989 Wrought Copper and Copper Alloy Solder

Joint Pressure Fittings

ASME/ANSI B16.26 1988 Cast Copper Alloy Fittings for Flared Copper

 Tubes

ASME/ANSI B18.2.2 1987 Square and Hex Nut (Inch Series)

ASME/ANSI B18.5.2.2M 1982 Metric Round Head Square Neck Bolts

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47 1990 Ferritic Malleable Iron Casting

ASTM A 48 1992 Gray Iron Castings

ASTM A 307 1992 (Rev. A) Carbon Steel Bolts and Studs,

 60,000 psi Tensile Strength

ASTM A 536 1984 Ductile Iron Castings

ASTM A 563 1992 (Rev. A) Carbon and Alloy Steel Nuts

ASTM B 32 1992 Solder Metal

ASTM B 61 1990 Steam or Valve Bronze Castings

ASTM B 62 1990 Composition Bronze or Ounce Metal Castings

ASTM B 88 1992 Seamless Copper Water Tube

ASTM C 94 1992 Ready-Mixed Concrete

ASTM D 1785 1991 Poly Vinyl Chloride (PVC) Plastic Pipe,

Schedules 40, 80, and 120

ASTM D 2241 1989 Poly Vinyl Chloride (PVC) Pressure-Rated

 Pipe (SDR Series)

ASTM D 2466 1990 (Rev. A) Poly Vinyl Chloride (PVC) Plastic

 Pipe Fittings, Schedule 40

ASTM D 2564 1991 (Rev. A) Solvent Cements for Poly Vinyl

 Chloride (PVC) Plastic Piping Systems

ASTM D 2774 1972 (R 1983) Underground Installation of

 Thermoplastic Pressure Piping

ASTM D 2855 1990 Making Solvent-Cemented Joints with Poly

 Vinyl Chloride (PVC) Pipe and Fittings

ASTM D 3139 1989 Joints for Plastic Pressure Pipes Using

 Flexible Elastomeric Seals

ASTM F 402 1988 Safe Handling of Solvent Cements, Primers,

 and Cleaners Used for Joining Thermoplastic Pipe

 and Fittings

ASTM F 477 1990 Elastomeric Seals (Gaskets) for Joining Plastic

 Pipe

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4 1990 Cement-Mortar Lining for Ductile-Iron Pipe

 and Fittings for Water

AWWA C105/A21.5 1988 Polyethylene Encasement for Ductile – Iron

 Piping for Water and Other Liquids

AWWA C110/A21.10 1987 Ductile-Iron and Gray-Iron Fittings, 3in.

 Through 48in., for Water and Other Liquids

AWWA C111/A21.11 1990 Rubber-Gasket Joints for Ductile-Iron

 Pressure Pipe and Fittings

AWWA C115/A21.15 1988 Flanged Ductile-Iron Pipe with Threaded

 Flanges

ANSI/AWWA C151/A21.51 1991 Ductile-Iron Pipe, Centrifugally Cast,

 for Water or Other Liquids

AWWA C153/A21.53 1988 Ductile-Iron Compact Fittings, 3 in. Through

 16 in., for Water and Other Liquids

AWWA C500 1986 Gate Valves for Water and Sewerage Systems

AWWA C502 1985 (Errata 1985) Dry-Barrel Fire Hydrants

AWWA C503 1988 Wet Barrel Fire Hydrants

AWWA C509 1987 Resilient-Seated Gate Valves for Water and

 Sewerage Systems

AWWA C600 1987 Installation of Ductile-Iron Water Mains and

 Their Appurtenances

AWWA C651 1992 Disinfecting Water Mains

AWWA C800 1989 Underground Service Line Valves and Fittings

AWWA C900 1989 (Addendum 1992) Polyvinyl Chloride (PVC)

 Pressure Pipe, 4 in. through 12 in., for Water

 Distribution

AWWA M23 1980 PVC Pipe – Design and Installation

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND

FITTINGS INDUSTRY, INC. (MSS)

MSS SP-80 1987 Bronze Gate, Globe, Angle and Check Valves

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 24 1992 Installation of Private Fire Service Mains and

 Their Appurtenances

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-3 1988 Installation of Polyvinyl Chloride (PVC)

 Pressure Pipe

UBPPA UNI-B-8 1986 Direct Tapping of Polyvinyl Chloride (PVC)

 Pressure Water Pipe

UNDERWRITERS LABORATORIES INC. (UL)

UL 246 1979 (R1987) Hydrants for Fire-Protection Service

UL 262 1988 (R 1991) Gate Valves for Fire-Protection

 Service

* 1. DESIGN REQUIREMENTS

1.2.1 Water Distribution Mains

Provide water distribution mains indicated as 6-inch diameter of ductile-iron pipe or polyvinyl chloride (PVC) plastic water main pipe at the Contractor’s option. Provide valves and water main accessories where indicated. Submit design calculations for water piping.

1.2.2 Water Service Lines

Provide water service lines indicated as less than 4-inch diameter, from water distribution main to existing building service as indicted. Water service lines shall be copper tubing or polyvinyl chloride (PVC) plastic pipe. Provide water service line appurtenances where specified and where indicated. Submit design calculations for water piping.

1.3 UTILITY CONFLICTS

Contractor will be required to pot hole all utilities along planned route of new pipelines in advance of trenching operations. Where such pot holing reveals conditions different from details provided or where no detail is provided, contractor shall provide shop drawings detailing proposed solution for mitigating grade and alignment conflicts with existing utilities and/or structures.

1.4 SUBMITTALS

Submit the following in accordance with Section 01300, “Submittals.”

1.4.1 SD-02, Manufacturer’s Catalog Data

1. Water distribution main piping, fittings, joints, valves and couplings
2. Water service line piping, fittings, joints, valves and couplings
3. Hydrants
4. Corporation stops
5. Valve boxes
6. Meter boxes
7. Air release valves

Submit manufacturer’s standard drawings or catalog cuts for the listed items, except submit both drawings and cuts for push-on joints. Include information concerning gaskets with submittal for joints and couplings.

* + 1. SD-05, Design Data

a. Design calculations for water piping

* + 1. SD-06, Instructions

a. Installation procedures for water piping

* + 1. SD-13, Certificates

a. Water distribution main piping, fittings, joints, valves and couplings

b. Water service line piping, fittings, joints, valves and couplings

c. Fire hydrants

Certificates shall attest that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise and that production control tests have been performed at the interval or frequency specified in the publication. Other tests shall have been performed within 3 years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project.

* 1. DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery and Storage

Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store plastic piping and jointing materials, and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

* + 1. Handling

Handle pipe, fittings, valves, hydrants, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take special care to avoid injury to coatings and linings on pipe and fittings; make satisfactory repairs if coatings or linings are damaged. Carry, do not drag pipe to the trench. Store rubber gaskets and plastic piping and jointing materials that are not to be installed immediately, under cover out of direct sunlight.

PART 2 PRODUCTS

2.1 WATER DISTRICUTION MAIN MATERIALS

2.1.1 Piping Materials

* + - 1. Ductile-Iron Piping
1. Pipe and Fittings: Pipe, except flanged pipe, shall conform to ANSI/AWWA C151/A21.51 and shall be Pressure Class 200. Flanged pipe shall conform to AWWA C115/A21.15. Fittings shall conform to AWWA C110/A21.10 or AWWA C153/A21.53; fittings with push-on joint ends shall conform to same requirements as fittings with mechanical-joint ends, except that the bell design shall be modified, as approved, for push-on joint. Fittings shall have pressure rating at least equivalent to that of the pipe. Ends of pipe and fittings shall be suitable for the specified joints. Pipe and fittings shall have cement-mortar lining conforming to AWWA C104/A21.4, standard thickness.

 b. Joints and Jointing Material

(1) Joints: Joints for pipe and fittings shall be pushed-on or mechanical joints, except that, where indicated, joints shall be flanged type joints and insulting joints. In lieu of push-on or mechanical joints, the joint may be mechanically coupled type using a sleeve-type mechanical coupling, as specified in paragraph entitled, “Sleeve-Type Mechanical Couplings,” subject to the limitations specified therein.

(2) Push-On Joints: Shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly shall conform to AWWA C111/A21.11.

(3) Mechanical Joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA C111/A21.11.

(4) Flanged Joints: Bolts, nuts, and gaskets for flanged connections shall be as recommended in the Appendix to AWWA C115/A21.15. Flange for set-screwed flanges shall be of ductile iron, ASTM A 536, Grade 65-45-12, and shall conform to applicable requirements of ASME/ANSI B16.1, Class 250. Setscrews for set-screwed flanges shall be 190,000 psi tensile strength, heat treated and zinc-coated steel. Gasket for set-screwed flanges shall conform to the applicable requirements for mechanical-joint gaskets specified in AWWA C111/A21.11. Design of set-screwed gasket shall provide for confinement and compression of gasket when joint to adjoining flange is made.

(5) Insulating Joints: Designed to prevent metal-to-metal contact at the joint between adjacent sections of piping. Joint shall be of the flanged type with insulating gasket, insulating bolt sleeves, and insulating washers. Gasket shall be of the dielectric type, full face, and in other respects as recommended in the Appendix to AWWA C115/A21.15. Bolts and nuts shall be as recommended in the Appendix to AWWA C115/A21.15.

(6) Mechanically Coupled Joints Using a Sleeve-Type Mechanical Coupling: Sleeve-type mechanical couplings shall be as specified in paragraph entitled “Sleeve-Type Mechanical Couplings.”

* + - 1. PVC Plastic Water Main Pipe and Associated Fittings

a. Pipe and Fittings: Pipe shall conform to AWWA C900 and shall be plain end or gasket bell end, Pressure Class 200 (DR 14) with cast-iron-pipe-equivalent OD. Fittings shall be gray-iron or ductile-iron conforming to AWWA C110/A21.10 or AWWA C153/A21.53, and shall have cement-mortar lining conforming to AWWA C104/A21.4, standard thickness. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except that bell design shall be modified for push-on joint for use with specified PVC plastic pipe.

b. Joints and Jointing Material: Joints for pipe shall be push-on joints as specified in ASTM D 3139. Joints between pipe and metal fittings, valves, and other accessories shall be push-on joints as specified in ASTM D 3139 or shall be compression-type joints/mechanical-joints as respectively specified in ASTM D 3139 and AWWA C111/A21.11. Provide each joint connection with an elastomeric gasket suitable for the bell or coupling with which it is to be used. Gaskets for push-on joints for pipe shall conform to ASTM F 477. Gaskets for push-on joints and compression-type joints/mechanical joints for joint connections between pipe and metal fittings, valves, and other accessories shall be as specified in AWWA C111/A21.11 for push-on joints and mechanical joints. Mechanically coupled joints using a sleeve type mechanical coupling, as specified in paragraph entitled “Sleeve-Type Mechanical Couplings,” may be used as an optional jointing method in lieu of push-on joints on plain-end PVC plastic pipe, subject to limitations specified for mechanically coupled joints using a sleeve-type mechanical coupling and to the use of internal stiffeners as specified for compression-type joints in ASTM D 3139.

2.1.2 Valves, Hydrants, and other Water Main Accessories

2.1.2.1 Gate Valves on Buried Piping

AWWA C500, AWWA C509, or UL 262. Unless otherwise specified, valves conforming to AWWA C500 shall be non-rising stem type with double-disc gates and mechanical-joint ends or push-on joint ends as appropriate for the adjoining pipe. Unless specified otherwise, valves conforming to AWWA C509 shall be non-rising stem type with mechanical joint ends. Unless otherwise specified, valves conforming to UL 262 shall be inside-screw type with operating nut, double-disc or split wedge type gate, designed for a hydraulic working pressure of 175 psi, and shall have mechanical joint ends or push on joint ends as appropriate for the pipe to which it is joined.

Materials for UL 262 valves shall conform to the reference standards specified in AWWA C500. Valves shall open by counter-clockwise rotation of the valve stem. Stuffing boxes shall have O-ring stem seals and shall be bolted and constructed so as to permit easy removal of parts for repair. In lieu of mechanical-joint ends and push-on joint ends, valves may have special ends for connection to sleeve-type mechanical coupling. Valve ends and gaskets for connection to sleeve-type mechanical coupling shall conform to the applicable requirements specified for the joint or coupling. Valves shall be of one manufacturer.

2.1.2.2 Gate Valves in Valve Pits or Above Grade

AWWA C500, to AWWA C509, or to UL 262. Valves conforming to AWWA C500 shall be outside-screw-and-yoke rising-stem type with double disc gates and flanged ends. Valves conforming to AWWA C509 shall be outside-screw-and-yoke rising-stem type with flanged ends. Valves conforming to UL 262 shall be outside-screw-and-yoke type, have double-disc or split-wedge type gate and flanged ends, and be designed for a hydraulic working pressure of 175 psi. Materials for UL 262 valves shall conform to the reference standards specified in AWWA C500. Provide valves with hand-wheels that open by counter-clockwise rotation of the valve stem. Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair. Valves shall be of one manufacturer.

2.1.2.3 Fire Hydrants

Wet-barrel type. Wet barrel type hydrants shall conform to AWWA C503 or to UL 246, “Wet Barrel” design, and shall have 6 inch inlet, one 4 ½ inch pumper connection, and two 2 ½ inch hose connections. Pumper connection and hose connections shall be individually valved with independent nozzle gate valves. Inlet shall have mechanical-joint or push-on joint end, except where flanged end is indicated; end shall conform to the applicable requirements as specified for the joint. Size and shape of operating nut, cap nuts, and threads on hose and pumper connections shall be as specified in AWWA C502 or AWWA C503 or UL 246. Hydrants indicated as “traffic type,” shall have breakable features as specified in AWWA C503. Traffic type hydrant shall have special couplings joining upper and lower sections of hydrant barrel and upper and lower sections of hydrant stem and shall be designed to have the special couplings break from a force not less than that which would be imposed by a moving vehicle; hydrant shall operate properly under normal conditions.

2.1.2.4 Valve Boxes

Provide a valve box for each gate valve on buried piping. Valve boxes shall be of cast iron or precast concrete of a size suitable for the valve on which it is to be used and shall be adjustable. Provide a round head. Cast the word “WATER” on the lid. The least diameter of the shaft of the box shall be 5 ¼ inches. Each cast-iron box shall have a heavy coat of bituminous paint.

2.1.2.5 Sleeve-Type Mechanical Couplings

Design to couple plain-end piping by compression of a ring gasket at each end of the adjoining pipe sections. Coupling shall consist of one middle ring flared or beveled at each end to provide a gasket seat; two follower rings; two resilient tapered rubber gaskets; and bolts and nuts to draw the follower rings toward each other to compress the gaskets. The middle ring and the follower rings shall be true circular sections free from irregularities, flat spots, and surface defects; the design shall provide for confinement and compression of the gaskets. Middle ring shall be of cast iron and the follower rings shall be of malleable iron or ductile iron. Cast iron shall conform to ASTM A 48 and shall be not less than Class 25. Malleable iron shall conform to ASTM A 47. Ductile iron shall conform to ASTM A 536. Gaskets shall be designed for resistance to set after installation and shall meet the applicable requirements specified for gaskets for mechanical joint in AWWA C111/A21.11. Bolts shall be tracked-head type; bolts and nuts shall be either of the following: bolts conforming to tensile requirements of ASTM A 307, Grade A, with nuts conforming to tensile requirements of ASTM A 563, Grade A; or round-head square-neck type bolts conforming to ANSI B18.5.2.1M and ANSI/ASME B18.5.2.2M with hex nuts conforming to ASME/ANSI B18.2.2. Bolts shall be 5/8 inch in diameter. Bolt holes in follower rings shall be of a shape to hold fast the necks of the bolts used. Do not use mechanically coupled joints using a sleeve-type mechanical coupling as an optional method of jointing except where pipeline is adequately anchored to resist tension pull across the joint.

2.1.2.6 Air Release Valves

Air release valves shall be the ball type, with cast iron body and cover, bronze trim and stainless steel float suitable for a minimum working pressure of 175 psi. They shall have an inlet of not less than ¾ inch and an outlet orifice size of not less than 3/16 inch. The valves shall automatically remove air from the lines when the lines are being filled with water, shall admit air into the lines when water is being withdrawn in excess of the inflow, and shall allow accumulating air to escape while the line is in operation and under pressure.

2.2 WATER SERVICE LINE MATERIALS

2.2.1 Piping Materials

2.2.1.1 Copper Tubing and Associated Fittings

Tubing shall conform to ASTM B 88, Type K. Fittings for solder-type joint shall conform to ANSI B16.18 or ASME/ANSI B16.22; fittings for compression-type joint shall conform to ASME/ANSI B16.26, flared tube type.

2.2.1.2 Plastic Piping

Plastic pipe and fittings shall bear the seal of approval of the National Sanitation Foundation for potable water service. Plastic pipe and fittings shall be supplied from the same source.

a. Polyvinyl Chloride (PVC) Plastic Piping: ASTM D 1785, Schedule 40; or ASTM D 2241, with SDR as required to provide 150 psi minimum pressure rating. Fittings shall conform to ASTM D 2466. Pipe and fittings shall be of the same PVC plastic material and shall be one of the following pipe/fitting combinations, as marked on pipe and fitting, respectively: PVC 1120/PVC I; PVC 1220/PVC 12; PVC 2120/PVC II; PVC 2116/PVC II. Solvent cement for jointing shall conform to ASTM D 2564.

2.2.1.3 Insulating Joints

Joints between pipes of dissimilar metals shall have a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact between adjacent sections of piping.

2.2.2 Water Service Line Appurtenances

2.2.2.1 Corporation Stops

Ground key type; made of bronze conforming to ASTM B 61 or ASTM B 62; and suitable for the working pressure of the system. Ends shall be suitable for solder-joint, or flared tube compression type joint. Threaded ends for inlet and outlet of corporation stops shall conform to AWWA C800; coupling nut for connection to flared copper tubing shall conform to ASME/ANSI B16.26.

2.2.2.2 Goosenecks

Type K copper tubing. Joint ends for goosenecks shall be appropriate for connecting to corporation stop and service line. Where multiple gooseneck connections are required for an individual service, connect goosenecks to the service line through a brass or bronze branch connection; the total clear area of the branches shall be at least equal to the clear area of the service line. Length of goosenecks shall be in accordance with standard practice.

2.2.2.3 Gate Valves 3 Inch Size and Smaller on Buried Piping

MSS SP-80, Class 150, solid wedge, inside screw, rising stem. Valves shall have flanged end connections, or threaded end connections with a union on one side of the valve and a handwheel operator.

2.2.2.4 Gate Valves Smaller Than 3-inch Size in Valve Pits

MSS SP-80, Class 150, solid wedge, inside screw, rising stem. Valves shall have flanged end connections, or threaded end connections with a union on one side of the valve and a handwheel operator.

2.2.2.5 Valve Boxes

Provide for each gate valve on buried piping. Valve boxes shall be of cast iron or precast concrete of a size suitable for the valve on which it is to be used and shall be adjustable. Provide a round head. Cast the word “WATER” on the lid. The least diameter of the shaft of the box shall be 5 ¼ inches. Each cast-iron box shall have a heavy coat of bituminous paint.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES

3.1.1 General Requirements for Installation of Pipelines

These requirements shall apply to pipeline installation except where specific exception is made in the “Special Requirements…” paragraphs.

3.1.1.1 Location of Water Lines

The work covered by this section shall terminate as indicated on the drawings. Where the location of the water line is not clearly defined by dimensions on the drawings, do not lay water line closer horizontally than 10 feet from any sanitary sewer line. Lay water lines which cross sanitary sewer force mains and inverted siphons at least 2 feet above these sewer lines; when joints in the sanitary sewer line are exposed, encase these joints in concrete. Connections to existing building service laterals shall be at five feet from the building.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 02225, “Excavation Backfill and Compacting for Utilities.”

3.1.1.3 Pipe Laying and Jointing

Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Do not under any circumstances drop or dump pipe, fittings, valves, or other water line material into trenches. Cut pipe accurately to length established at the site and work into place without springing or forcing. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material.

Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with bell end pointing in the direction of laying. Grade pipeline in straight lines; avoid formation of dips and low points. Support pipe at proper elevation and grade, and secure firm, uniform support. Wood support blocking will not be permitted. Lay pipe so that the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where indicated and where necessary for fastening work into place. Make proper provisions for expansion and contraction of pipelines. Keep trenches free of water until joints have been properly made. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevents installation. Depth of cover over top of pipe shall not be less than 24 inches.

3.1.1.4 Connections to Existing Water Lines

After approval is obtained, make connections to existing water lines with a minimum interruption of service on the existing line. Where indicated, use tapping or drilling machine valve and mechanical joint type sleeves for connections to be made under pressure. Bolt sleeves around mains; bolt valve conforming to AWWA C500 to the branch. Open valve, attach drilling machine, make tap, close valve, and remove drilling machine, all without interruption of service. Notify the Contracting Officer in writing at least 15 days prior to the date the connections are required; receive approval before any service is interrupted. Furnish all materials required to make connections into the existing water supply systems and perform all excavation, backfilling, and other incidental labor as required.

Connection to existing building service shall occur only after mains are flushed, tested, disinfected and approved. Provide temporary cap on new services within three feet of connection point and pressure test new services with mains.

3.1.2 Installation of Water Mains

* + - 1. Special Requirements for Ductile-Iron Piping

a. Installation, General: Unless otherwise specified in the following subparagraphs, install pipe and fittings in accordance with paragraph entitled “General Requirements for Installation of Pipelines” and with the requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.

b. Jointing:

(1) Make push-on joints with the gaskets and lubricant previously specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly.

(2) Make mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and with the recommendations of Appendix A to AWWA C111/A21.11.

(3) Make flanged joints with gaskets, bolts, and nuts previously specified for this type joint. Make flanged joints up tight; avoid strain on flanges, fittings, and valves. Align bolt holes for each flanged joint. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted.

Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without straining the flange. When any flanged pipe or fitting has dimensions that do not allow the making of a proper flanged joint as specified, replace it by one of proper dimensions. Use setscrewed flanges to make flanged joints where conditions prevent use of full length flanged pipe; assemble in accordance with the recommendations of the setscrewed flange manufacturer.

(4) Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer.

(5) Make insulating joints with gaskets, sleeves, washers, bolts, and nuts specified for this type joint. Assemble insulating joints as specified for flanged joints, except that bolts with insulating sleeves shall be full size for the bolt holes. Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled.

c. Pipe Anchorage: Provide concrete thrust blocks, reaction backing, for pipe anchorage, except where metal harness is indicated. Thrust blocks shall be in accordance with the requirements of AWWA C600 for thrust restraint, except that size and positioning of thrust blocks shall be as indicated. Use concrete conforming to ASTM C 94 having a minimum compressive strength of 2,000 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 ½ parts sand, and 5 parts gravel, having the same minimum compressive strength. Metal harness shall be in accordance with requirements of AWWA C600 for thrust restraint, using tie rods and clamps as shown in NFPA 24, except as otherwise indicated.

d. Exterior Protection: Completely encase buried ductile iron pipelines with polyethylene tube or sheet, using Class A polyethylene film, in accordance with AWWA C105/A21.5.

* + - 1. Special Requirements for PVC Plastic Water Main

a. Installation, General: Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled “General Requirements for Installation of Pipelines: and requirements of UBPPA UNI-B-3 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings; and with recommendations for pipe joint assembly and appurtenance installation in AWWA M23, Chapter 7, “Installation.”

b. Jointing: Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel; for push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel; for push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pie joint connections in accordance with the requirements of UBPPA UNI-B-3 for laying the pipe and the recommendations in AWWA M23, Chapter 7, “Installation,” for pipe joint assembly. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the requirements of UBPPA UNI-B-3 for joining PVC pipe to fittings and accessories and with the applicable requirements of AWWA C600 for joint assembly. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners specified for this type joint; assemble in accordance with the requirements of UBPPA UNI-B-3 for joining PVC pipe to fittings and accessories, with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111/A21.11. Cut of spigot end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as specified for compression-type joints.

c. Pipe Anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage, except where metal harness is indicated. Thrust blocks shall be in accordance with the requirements of UBPPA UNI-B-3 for reaction or thrust blocking and plugging of dead ends, except that size and positioning of thrust blocks shall be as indicated. Use concrete conforming to ASTM C 94 having a minimum compressive strength of 2,000 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 12/ parts sand, and 5 parts gravel, having the same minimum compressive strength. Metal harness shall be as indicated.

* + - 1. Installation of Valves and Hydrants

a. Installation of Valves: Install gate valves conforming to AWWA C500 and UL 262 in accordance with AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix (“Installation, Operation, and Maintenance of Gate Valves”) to AWWA C500. Install gate valves conforming to AWWA C509 in accordance with AWWA C600 for valve-and-fitting installation and with the recommendations of the AWWA M23 for appurtenance installation in AWWA M23, Chapter 7, “installation” Make and assemble joints to gate valves as specified for making assembling the same type joints between pipe and fittings.

b. Installation of Hydrants: Install hydrants, except for metal harness, in accordance with the requirements of AWWA C600 for hydrant installation and as indicated. Make and assemble joints as specified for making and assembling the same type joints between pipe and fittings. Provide metal harness as specified under pipe anchorage requirements for the respective pipeline material to which hydrant is attached.

3.1.3 Installation of Water Service Piping

3.1.3.1 Location

Connect water service piping to the building service where the building service has been installed at a point directed by the Contracting Officer or at the points indicated.

3.1.3.2 Service Line Connections to Water Mains

Connect service lines to the main as indicated. Connect service lines to ductile-iron water mains in accordance with AWWA C600 for service taps. Connect service lines to PVC plastic water mains in accordance with UBPPA UNI-B-8 and the recommendations of AWWA M23, Chapter 9, “Service Connections.”

* + - 1. Special Requirements for Installation of Metallic Piping

a. Metallic Piping Installation, General: Install pipe and fittings in accordance with paragraph entitled, “General Requirements for Installation of Pipelines” and with applicable requirements of AWWA C600 for pipe installation, unless otherwise specified.

b. Jointing:

(1) Threaded Joints: Make threaded joints up tight with a stiff mixture of graphite and oil, inert filler and oil, or an approved graphite compound; apply to male threads only. Threads shall be full cut; do not leave more than three threads on the pipe exposed after assembling joint.

(2) Joints for Copper Tubing: Cut copper tubing with square ends; remove fins and burrs. Handle tubing carefully; replace dented, gouged, or otherwise damaged tubing with undamaged tubing. Make solder joints using ASTM B 32, 95-5 tin-antimony or Grade Sn96 solder. Solder and flux shall not contain lead. Before making joint, clean ends of tubing and inside of fitting or coupling with wire brush or abrasive. Apply a rosin flux to tubing end and on recess inside of fitting or coupling. Insert tubing end into fitting or coupling for the full depth of the recess and solder. For compression joints on flared tubing, insert tubing through the coupling nut and flare tubing with a flaring tool.

* + - 1. Special Requirements for Installation of Plastic Piping

a. Plastic Piping Installation, General: Install pipe and fittings in accordance with paragraph entitled “General Requirements for Installation of Pipelines: and with the applicable requirements of ASTM D 2774 and ASTM D 2855, unless otherwise specified. Handle solvent cements used to join plastic piping in accordance with ASTM F 402.

b. Jointing: Make solvent-cemented joints for PVC plastic piping using the solvent cement specified for this material; assemble joints in accordance with ASTM D 2855. Make plastic pipe joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

c. Plastic Pipe Connections to Appurtenances: Connect plastic pipe service lines to corporation stops and gate valves in accordance with the recommendations of the plastic pipe manufacturer.

3.1.4 Disinfection

Flush and disinfect new potable water lines and affected portions of existing potable water lines in accordance with AWWA C651. Apply chlorine by the continuous feed method. Flush the solution from the systems with clean water until maximum residual chlorine content is not greater than 0.2 parts per million or residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit results prior to new water piping, analyze by a certified laboratory, and submit results prior to new water piping being placed into service.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests, and provide labor, equipment, and incidentals required for testing. The Contractor shall produce evidence, when required, that any item of work has been constructed properly in accordance with the drawings and specifications.

Do not begin testing on any section of a pipeline where concrete thrust blocks have been provided until at least 5 days after placing of the concrete.

3.2.2 Testing Procedure

Test water mains and water service lines in accordance with the applicable specified standard, except for the special testing requirements given in paragraph entitled “Special Testing Requirements.” Test ductile-iron water mains in accordance with the requirements of AWWA C600 for hydrostatic testing. The amount of leakage on ductile-iron pipelines with mechanical joints or push-on joints shall not exceed the amounts given in AWWA C600; no leakage will be allowed at joints made by any other method. Test PVC plastic water mains in accordance with UBPPA UNI-B-3 for pressure and leakage tests. The amount of leakage on pipelines made of PVC plastic water main pipe shall not exceed the amounts given in UBPPA UNI-B-3, except that at joints made with sleeve-type mechanical couplings, no leakage will be allowed. Test water service lines in accordance with applicable requirements of AWWA C600 for hydrostatic testing. No leakage will be allowed at copper tubing joints (soldered, compression type, brazed) plastic pipe joints flanged joints and threaded joints.

3.2.3 Special Testing Requirements

For pressure test, use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system, except that for those portions of the system having pipe size larger than 2 inches in diameter, hydrostatic test pressure shall be not less than 200 psi. Hold this pressure for not less than 2 hours. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

## FENCE, CHAIN LINK

Part 1 – General

* 1. REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 117 1990 Salt Spray (Fog) Testing

ASTM F 883 1990 Padlocks

FEDERAL SPECIFICATIONS (FS)

FS RR-F-191 (Rev. K) Fencing, Wire and Post Metal

(and gates, Chain-Link Fence Fabric, and Accessories) (General specification)

FS RR-F-191/1 (Rev. D) Fencing, Wire and Post, Metal

(Chain-Link Fence Fabric) (Detail Specification)

FS RR-F-191-3 (Rev. D) Fencing, Wire and Post, Metal

(Chain-Link Fence Posts, Top Rails and Braces) (Detail Specification)

FS RR-F-191-4 (Rev. D) Fencing, Wire and Post, Metal (Chain-Link Fence Accessories) (Detail

Specification)

* 1. SUBMITTALS

Submit the following in accordance with Section “Submittals”

* + 1. SD – 02, Manufacturer’s Catalog Data
1. Chain-Link fencing components
2. Accessories
	* 1. SD – 06, Instructions
3. Fence
	* 1. SD -10, test Reports
4. Weight in ounces for zinc coating
5. Thickness of PVC coating
6. Chemical Composition and thickness of aluminum alloy coating
	* + 1. Required Report Data

Submit reports of listing of chain-link fencing and accessories regarding weight in ounces for zinc coating, thickness of PVC coating, and chemical composition and thickness of aluminum alloy coating.

* + 1. Certificates
1. Fabric
2. Posts
3. Braces
4. Framing
5. Rails
6. Tension Wires
7. Gates
8. Padlocks
	1. DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in an undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact.

Part 2 PRODUCTS

2.1 CHAIN-LINK FENCING AND ACCESSORIES

FS RR-191 and detailed specifications as referenced and other requirements as specified.

2.1.1 Fabric

FS RR-F-191/1; Type IV, polyvinyl chloride (PVC) coated over zinc-or aluminum coated-coated steel. Mesh size, 2inches. Provide selvage knuckled at both selvages. Height of fabric, as indicated.

2.1.2 Posts, Top Rails, Bottom Rails and Braces

FS RR-F-191/3 line posts; Class 1, steel pipe, Grade A. End, corner, and pull posts; Class 1, steel pipe, Grade A. Braces and rails; Class 1, steel pipe, Grade A. Steel pipe, Class 1, Grade B shall meet the following performance criteria when subjected to salt spray testing in accordance with ASTM B 117;

1. Exterior 1,000 hours with maximum 5% red rust.
2. Interior 650 hours with maximum 5% red rust.

2.1.3 Fencing Accessories

FS RR-F-191/4. Provide wire ties constructed of the same material as the fencing fabric. Provide accessories with polyvinyl (PVC) coatings similar to that specified for chain-link fabric or framework.

2.1.4 Concrete

Provide as specified in Section “Cast-in-place Concrete”.

2.1.5 Grout

Provide grout of proportions one part Portland cement to three parts clean, well-graded sand and a minimum amount of water to produce a workable mix.

2.1.6 Padlocks

ASTM F 883, chain.

Part 3 EXECUTION

3.1 SITE PREPARATION

3.1.1 Clearing and Grading

Clear fence line of trees, brush, and other obstacles to install fencing. Establish a graded, compacted fence line prior to fencing installation. Compact fill used to establish fence line.

3.1.2 Excavation

Excavate to dimensions indicated for concrete-embedded items, except in bedrock. If bedrock is encountered, continue excavation to depth indicated or 18 inches into bedrock, whichever is less, with a diameter in bedrock a minimum of 2 inches larger than outside diameter of post. Clear post holes of loose material. Dispose of waste material as directed.

3.2 FENCE INSTALLATION

Install fence on prepared surfaces to line and grade indicated. Install fence in accordance with fence manufacturer’s written installation instructions except as modified herein.

3.2.1 Post Spacing

Provide line posts spaced equidistantly apart, not exceeding 10 feet on center. Provide gate posts spaced as necessary for size of gate openings. Provide corner or pull posts, with bracing in both directions, for changes in direction of 15 degree or more, or for abrupt changes in grade. Provide drawings showing location of gate, corner, end, and pull posts.

3.2.2 Post Setting

Set posts plumb. Allow concrete and grout to cure a minimum of 72 hours before performing other work on posts.

3.2.2.1 Earth and Bedrock

Provide concrete bases of dimensions indicated except in bedrock. Compact concrete to eliminate voids, and finish to a dome shape. In bedrock, set posts with a minimum of 1-inch of grout around each post. Work grout into hole to eliminate voids, and finish to a dome shape.

3.2.3 Bracing

Brace gate, corner, end, and pull posts to nearest post with a horizontal brace used as a compression member, placed at least 12 inches below top of fence, and a diagonal truss rod and truss tightener used as a tension member.

3.2.4 Top Rails

Install top rails before installing chain-link fabric. Pass top rail through intermediate post caps. Provide expansion coupling spaced as indicated.

3.2.5 Top Tension Wires

Install top tension wires before installing chain-link fence, and pull wires taut. Place top and bottom tension wires within 8 inches of respective fabric line.

3.2.6 Fabric

Pull fabric taut and secure fabric to top rail and top wire, close to both sides of each post and at a maximum intervals of 24 inches on center. Secure fabric to posts using stretcher bars, ties or clips spaced 15 inches on center, or by integrally weaving to integral fastening loops of end, corner, pull, and gate posts for full length of each post. Install fabric on opposite side of posts from area being secured. Install fabric so that bottom of fabric is 2 inches above ground level. Install fence fabric to provide approximately 2 inch deflection at center of fabric span between two posts, when a force of approximately 30 pounds is applied perpendicular to fabric. Fabric should return to its original position when force is removed.

3.3 ACCESSORIES INSTALLATION

3.3.1 Post Caps

Install post caps as recommended by the manufacturer.

3.3.2 Supporting arms

Design supporting arms to accommodate top rail. Install supporting arms as recommended by manufacturer. In addition to manufacturer’s standard connections, permanently secure supporting arms to posts. Studs driven by low-velocity powder-actuated tools may be used with steel, wrought iron, or malleable iron. Do not use studs driven by powder-actuated tools with gray iron or other material that will fracture.

3.3.3 Padlocks

Provide padlocks for gate openings and provide chains that are securely attached to gate or gate posts. Provide padlocks keyed alike, and provide two keys for each padlock.

3.4 SECURITY

Install new security fencing, remove existing security fencing (if any), and perform related work to provide continuous security for facility. Schedule and fully coordinate work with Contracting Officer and cognizant Security Officer.

3.5 CLEANUP

Remove waste fencing materials and other debris from the project site.

## CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M182 1990 (R 1991) Burlap Cloth Made for Jute or Kenaf

 AMERICAN CONCRETE INSTITUTE (ACI)

ACI 211.1 1991 Selecting Proportions for Normal, Heavyweight, and Mass Concrete

ACI 211.2 1991 Selecting Proportions for Structural Lightweight Concrete

ACI 213R 1987 Structural Lightweight Aggregate Concrete

ACI 301 1989 Structural Concrete for Buildings

ACI 302.1R 1989 Concrete Floor and Slab Construction

ACI 304R 1989 Measuring Mixing, Transporting, and Placing Concrete

ACI 304.2R 1991 Placing Concrete by Pumping Methods

ACI 305R 1991 Hot Weather Concreting

ACI 315 1980 (R 1986) Details and Detailing of Concrete Reinforcement

ACI 318 1989 (R 1992) Building Code Requirements for Reinforced Concrete

ACI 347R 1989 Formwork for Concrete

 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 82 1990 (Rev. A) Steel Wire, Plain, for Concrete Reinforcement

ASTM A 185 1990 (Rev. A) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

ASTM A 496 1990 (Rev. A) Steel Wire, Deformed, for Concrete Reinforcement

ASTM A 497 1990 (Rev. B) Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement

ASTM A 615/A 615M 1992 (Rev. A) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM A 706/A 706M 1992 (Rev. B) Low-Alloy Steel Deformed Bars for Concrete Reinforcement

ASTM C 31 1991 Making and Curing Concrete Test Specimens in the Field

ASTM C 33 1992 Concrete Aggregates

ASTM C 39 1986 Compressive Strength of Cylindrical Concrete Specimens

ASTM C 42 1990 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

ASTM C 94 1992 Ready-Mixed Concrete

ASTM C 143 1990 (Rev. A) Slump of Hydraulic Cement Concrete

ASTM C 150 1992 Portland Cement

ASTM C 171 1992 Sheet Materials for Curing Concrete

ASTM C 172 1990 Sampling Freshly Mixed Concrete

ASTM C 260 1986 Air-Entraining Admixtures for Concrete

ASTM C 309 1991 Liquid Membrane-Forming Compounds for Curing Concrete

ASTM C 494 1992 Chemical Admixtures for Concrete

ASTM C 595 1992 (Rev. A) Blended Hydraulic Cements

ASTM C 618 1992 (Rev. B) Fly Ash and Row or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete

ASTM C 881 1990 Epoxy-Resin-Base Bonding Systems for Concrete

ASTM C 920 1987 Elastomeric Joint Sealants

ASTM C 989 1989 Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars

ASTM C 1017 1992 Chemical Admixtures for Use in producing Flowing Concrete

ASTM C 1107 1992 Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

ASTM D 1190 1974 (R 1980) Concrete Joint Sealer, Hot-Poured Elastic Type

ASTM D 1751 1983 (R 1991) Performed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

ASTM D 1752 1984 (R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

ASTM D 4397 1991 Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications

AMERICAN WELDING SOCIETY, INC. (AWS)

AWS D1.4 1992 Structural Welding Code Reinforcing Steel

 U.S DEPARTMENT OF COMMERCE PRODUCT STANDARDS (PS)

PS-1 1983 Construction and Industrial Plywood

1.2 DEFINITIONS

 a. “Cementitious material” as used herein shall include all Portland cement, pozzolan, fly ash, ground iron blast-furnace slag, and silica fume.

 b. “Exposed to public view” means situated so that it can be seen from eye level from a public location after completion of the building. A public location is accessible to person not responsible for operation or maintenance of the building.

1.3 SUBMITTALS

Submit the following in accordance with Section 01300, “Submittals.”

1.3.1 SD-02, Manufacturer’s Catalog Data

 a. Materials for curing concrete

 b. Joint Sealants

 c. Joint filler

 d. Vapor barrier

1.3.2 SD-04, Drawings

 a. Reinforcing steel

Reproduction of contract drawings are unacceptable.

1.3.2.1 Reinforcing Steel

ACI 315. Indicate bending diagrams, assembly diagrams, splicing and laps of bars, shapes, dimensions, and details of bar reinforcing, accessories, and concrete cover. Do not scale dimensions from structural drawings to determine lengths of reinforcing bars.

1.3.3 SD-05, Design Data

 a. Concrete mix design

Thirty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Submit a complete list of materials including type; brand; source and amount of cement, fly ash, pozzolans, silica fume, ground slag and admixtures; and applicable reference specifications. Submit additional data regarding concrete aggregate if the source of aggregate changes. Submittal shall clearly indicate where each mix design will be used when more than one mix design is submitted. An identical concrete mix design previously approved within the past 12 months by the Government, may be used without further approval, if copies of the previous approval and fly ash, silica fume, and pozzolan test results are submitted. The approval of fly ash, silica fume, and pozzolan tests results shall have been within 6 months of submittal date. Obtain acknowledgement of receipt prior to concrete placement.

3.3.4 SD-10, Test Reports

 a. Concrete mix design

 b. Fly ash

 c. Pozzolan

 d. Ground iron blast-furnace slag

1.3.4.1 Concrete Mix Design

Submit copies of test reports showing that the mix has been successfully tested to produce concrete with the properties specified and that mix will be suitable for the job conditions. Test reports shall be submitted along with the concrete mix design. Obtain approval before concrete placement.

1.3.4.2 Fly Ash and Pozzolan

Submit test results in accordance with ASTM C 618 for fly ash and pozzolan. Submit test results performed within 6 months of submittal date.

1.3.4.3 Ground Iron Blast-Furnace Slag

Submit test results in accordance with ASTM C 989 for ground iron blast-furnace slag. Submit test results performed within 6 months of submittal date.

1.4 MODIFICATION OF REFERENCES

Accomplish work in accordance with ACI publications except as modified herein. Consider the advisory or recommended provisions to be mandatory, as though the word “shall” had been substituted for the words “should” or “could” or “may.” Wherever they appear. Interpret reference to the “Building Official,” the “Structural Engineer,” and the “Architect/Engineer” to mean the Government.

1.5 DELIVERY, STORAGE, AND HANDLING

Do not deliver concrete until vapor barrier, forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement. ACI 301 for job site storage of materials. Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting. Protect materials from contaminants such as grease, oil, and dirt. Ensure materials can be accurately identified after bundles are broken and tags removed.

PART 2 PRODUCTS

2.1 CONCRETE

2.1.1 Contractor-Furnished Mix Design

ACI 211.1, ACI 301, and ACI 318 and ACI 211.2 ACI 304.2R and ACI 213R except as otherwise specified. The comprehensive strength (f’c) of the concrete for each portion of the structure (s) shall be as indicated and as specified below.

 f’c

 (Min. 28- Range Water-

 Day Comp. ASTM C 33 of Cement Air

 Strength) Aggregate Slump Ratio Entr.

Location (psi) (Size No.) (Inches) (by weight) (Percent)

Foundation,

Walls and

footings 3000 67 3-5 0.68 2-4

Columns,

Beams and

Roof Slabs 4000 67 3-5 0.45 2-4

All other

 areas 3000 67 4-6 0.64 2-4

Maximum slump shown above ma y be increased one inch for methods of consolidation other than vibration. Slump may be increased to 7 inches when superplasticizers are used. Provide air entrainment using air-entraining admixture. The water-soluble chloride ion concentrations in hardened concrete at ages from 28 to 42 days shall not exceed 0.15.

2.1.1.1 Required Average Strength of Mix Design

The selected mixture shall produce an average compressive strength exceeding the specified strength by the indicated in ACI 301. When a concrete production facility has a record of at least 15 consecutive tests, the standard deviation shall be calculated and the required average compressive strength shall be determined in accordance with ACI 301. When a concrete production facility does not have a suitable record of tests to establish a standard deviation, the required average strength shall be as follows:

a. For f’c less than 3000 psi, 1000 psi plus f’c.

b. For f’c between 3000 and 5000 psi plus f’c

2.2 MATERIALS

2.2.1 Cement

ASTM C 150, Type I or II or ASTM C 595, Type IP IMS) or IS (MS) blended cement except as modified herein or Japanese Industry Standard (JSI) Type I cement or equivalent. The blended cement shall consist of a mixture of ASTM C 150 cement and one of the following materials: ASTM C 618 pozzolan or fly ash, ASTM C989 ground iron blast-furnace slag shall not exceed 50 percent by weight of total cementitious materials. For exposed concrete, use one manufacturer for each type of cement, ground slag, fly ash, and pozzolan.

2.2.1.1 Fly Ash and Pozzolan

ASTM C 618, Type N, F, or C, except that the maximum allowable loss on ignition shall be 6 percent for Types N and F. Add with cement.

2.2.1.2 Ground iron Blast-Furnace Slag

ASTM C 989, Garde 120.

2.2.2 Water

Water shall be fresh, clean, and potable.

2.2.3 Aggregates

ASTM C 33, except as modified herein. Furnish aggregates for exposed concrete surfaces from one source. Aggregates shall not contain any substance which may be deleteriously reactive with the alkalies in the cement.

2.2.4 Nonshrink Grout

ASTM C 1107.

2.2.5 Admixtures

Calcium chloride shall not be used as an admixture.

2.2.5.1 Air-Entraining

ASTM C 260.

2.2.5.2 Accelerating

ASTM C 494, Type C.

2.2.5.3 Retarding

ASTM C 494, Type B, D, or G.

2.2.5.4 Water Reducing

ASTM C 494, Type A, E, or F.

2.2.5.5 High Range Water Reducer (HRWR) (Superplasticizers)

ASTM C 494, Type F and ASTM C 1017.

2.2.6 Materials for Forms

Provide wood, plywood, or steel. Use plywood or steel forms where smooth for finish is required. Lumber shall be square edges or tongue-and-groove boards, free of raised grain, knotholes, or other surface defects. Plywood: PS-1, B-B concrete form panels or better. Steel form surfaces shall not contain irregularities, dents, or sags.

2.2.6.1 Form Ties and Accessories

The use of wire alone is prohibited. Form ties and accessories shall not reduce the effective cover of the reinforcement.

2.2.7 Reinforcement

2.2.7.1 Reinforcing Bars

ACI 3.1 Unless otherwise specified. ASTM A 615/A 615M Grade 60; or ASTM A 706/A 706M.

2.2.7.2 Mechanical Reinforcing Bar Connectors

ACI 301. Provide 125 percent minimum yield strength of the reinforcement bar.

2.2.7.3 Welded Wire Fabric

ASTM A 185 or ASTM A 497. Provide flat sheets of welded wire fabric for slabs and toppings.

2.2.7.4 Wire

ASTM A 82 or ASTM A 496.

2.2.8 Vapor Barrier

ASTM D 4397 polyethylene sheeting, minimum 6 mil thickness.

2.2.9 Materials for Curing Concrete

2.2.9.1 Impervious Sheeting

AASHTO M182.

2.2.9.2 Liquid Chemical Sealer-Hardener Compound

Compound shall be magnesium fluosilicate which when mixed with water seals hardens the surface of the concrete. Do not use on exterior slabs exposed to freezing conditions. Compound shall not reduce the adhesion of resilient flooring, tile, paint, roofing, waterproofing, or other materials applied to concrete.

2.2.10 Expansion/Contraction Joint Filler

ASTM D 1751 or ASTM D 1752, ½ inch thick, unless otherwise indicated.

2.2.11 Joint Sealants

2.2.11.1 Horizontal Surfaces, 3 Percent Slope, Maximum

ASTM D 1190 or ASTM C 920, Type M, Class 25, use T.

2.2.11.2 Vertical Surfaces Greater Than 3 Percent Slope

ASTM C 920, Type M, Grade NS, Class 25, Use T.

2.2.12 Epoxy Bonding Compound

ASTM C 881. Provide Type I for bonding hardened concrete to hardened concrete; Type II for bonding freshly mixed concrete to hardened concrete; and Type III as a binder in epoxy mortar or concrete, or for use in bonding skid-resistant materials to hardened concrete. Provide Grade 1 or 2 for horizontal surfaces and Grade 3 for vertical surfaces. Provide Class A if placement temperature is below 40 degrees F; Class B if placement temperature is above 60 degrees F.

PART 3 EXECUTION

3.1 FORMS

ACI 301. Provide forms, shoring, and scaffolding for concrete placement unless indicated or specified otherwise. Concrete for footings may be placed in excavations without forms inspection and approval by the Government. Excavation width shall be a minimum of 4 inches greater than indicated. Set forms mortar-tight and true to line and grade. Chamfer above grade exposed joints, edges, and external corners of concrete 0.75 inch unless otherwise indicated. Provide formwork with clean-out openings to permit inspection and removal of debris. Forms submerged in water shall be watertight.

3.1.1 Coating

Before concrete placement, coat the contact surfaces of forms with a nonstaining mineral oil, nonstaining form coating compound, or two coats of nitrocellulose lacquer. Do not use mineral oil on forms for surfaces to which adhesive, paint, or other finish material is to be applied.

3.1.2 Removal of Forms and Supports

After placing concrete, forms shall remain in place for the time periods specified in ACI 347R. Prevent concrete damage during form removal.

3.1.2.1 Special Requirements for Reduced Time Period

Forms may be removed earlier than specified if ASTM C 39 test results of field-cured samples from a representative portion of the structure indicate that the concrete has reached a minimum of 85 percent of the design strength.

3.1.3 Reshoring

Reshore concrete elements where forms are removed prior to the specified time period. Do not permit elements to deflect or accept loads during form stripping or reshoring. Forms on columns, walls, or other load-bearing members may be stripped after 2 days if loads are not applied to the members. After forms are removed, slabs and beams over 10 feet in span and cantilevers over 4 feet shall be reshored for the reminder of the specified time period in accordance with paragraph entitled “removal of Forms.” Perform reshoring operations to prevent subjecting concrete elements shall have the same load-carrying capabilities as original shoring and shall be spaced similar to original shoring. Firmly secure and brace reshoring elements to provide solid bearing and support.

3.2 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

ACI 301. Provide bars, wire fabric, wire ties, supports, and other devices necessary to install and secure reinforcement. Reinforcement shall not contain rust, scale, oil, grease, clay, or foreign substances that would reduce the bond. Rusting of reinforcement is a basis of rejection if the effective cross-sectional area or the nominal weight per foot of the reinforcement has been reduced to less than specified in paragraph entitled “Reinforcement Bars.” Remove loose rust prior to placing steel. Tack welding is prohibited.

3.2.1 Vapor Barrier

Provide beneath the on-grade concrete floor slab. Use the greater widths and lengths practicable to eliminate joints wherever possible. Lap joints a minimum of 12 inches. Remove torn, punctured, or damaged vapor barrier material and provide with new vapor barrier prior to placing concrete. Concrete placement shall not damage vapor barrier material.

3.2.2 Tolerance

Place reinforcement and secure with galvanized or noncorrodible chairs, placers, or metal hangers. Use concrete or other noncorrodible material for supporting reinforcement on the ground.

3.2.3 Splicing

As indicated. For splices not indicated ACI 301. Do not splice at points of maximum stress. Overlap welded wire fabric the spacing of the cross wires, plus 2 inches. AWS d1.4. Welded splices shall be approved prior to use.

3.2.4 Future Bonding

Plug exposed, threaded, mechanical reinforcement bar connectors with a greased bolt. Bolt threads shall match the connector. Countersink the connector in the concrete. Caulk the depression after the bolt is installed.

3.2.5 Cover

ACI 301 for minimum coverage, unless otherwise indicated.

3.2.6 Setting Miscellaneous Material

Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement. Plumb anchor bolts and check location and elevation. Temporary fill voids in sleeves with readily removable material to prevent the entry of concrete.

3.2.7 Construction Joints

Locate joints to least impair strength. Continue reinforcement across joints unless otherwise indicated.

3.2.8 Expansion Joints and Contraction Joints

Provide expansion joint at edge of interior floor slabs on grade abutting vertical surfaces, and as indicated. Make expansion joints ½ inch wide unless indicated otherwise. Fill expansion joints not to expose to weather with performed joint filler material. Completely fill joints exposed to weather with joints filler material and joint sealant. Do not extend reinforcement or other embedded metal items bonded to the concrete through any expansion joint unless an expansion sleeve is used. Provide contraction joints, either formed or saw cut or cut with a jointing tool, to the indicated depth after the surface has been finished. Sawed joints shall be completed within 4 to 12 hours after concrete placement. Protect joints from intrusion of foreign matter.

3.3 BATCHING, MEASURING, MIXING, AND TRANSPORTING CONCRETE.

ASTM C 94, ACI 301, ACI 302. 1R, and ACI 304R, except as modified herein. Batching equipment shall be such that the concrete ingredients are consistently measured within the following tolerance: 1 percent for cement and water, 2 percent for aggregate, and 3 percent for admixtures. Furnish mandatory batch ticket information for each load of ready-mix concrete, where used.

3.3.1 Measuring

Make measurement at intervals as specified in paragraph entitled “Sampling” and Testing.”

3.3.2 Mixing

ASTM C94 and ACI 301. Machine mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of cement to aggregate if the air temperature is less than 85 degrees F. Reduce mixing time and place concrete within 60 minutes if the air temperature is greater than 85 degrees F except as follows: if set retarding admixture is used and slump requirements can be met, limit for placing concrete may remain at 90 minutes. Additional water may be added, provided that both the specified maximum slump and additional 30 revolutions of the mixer at mixing speed is required. If the entrained air content falls below the specified limit, add a sufficient quantity of admixture to bring the entrained air content within the specified limits. Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch.

3.3.3 Transporting

Transport concrete from the mixer to the forms as rapidly as practicable. Prevent segregation or loss ingredients. Clean transporting equipment thoroughly before each batch. Do not use aluminum pipe or chutes. Remove concrete which has segregated in transporting and dispose of as directed.

3.4 PLACING CONCRETE

Place concrete as soon as practicable after the forms and the reinforcement have been inspected and approved. Do not place concrete when weather conditions prevent proper placement and consolidation; in uncovered areas during periods of precipitation; or in standing water. Prior to placing concrete, remove dirt, construction debris, and water, within the forms. Deposit concrete as close as practicable to the final position in the forms. Do not exceed a free vertical drop of 3 feet from the point of discharge. Place concrete in one continuous operation from one end of the structure toward the other. Position grade stakes on 10-foot centers maximum in each direction when pouring interior slabs and on 20-foot centers maximum for exterior slabs.

3.4.1 Vibration

ACI 301. Furnish a spare vibrator on the job site whenever concrete is placed. Consolidate concrete slabs greater than 4 inches in depth with high frequency, internal, mechanical vibrating equipment supplemented by hand spading and tamping. Consolidate concrete slabs 4 inches or less in depth by wood tampers, spading, and settling with a heavy leveling straightedge. Operate vibrators with vibratory element submerged in the concrete, with a minimum frequency of not less than 6000 impulses per minute when submerged. Do not use vibrators to transport the concrete in the forms. Insert and withdraw vibrators approximately 18 inches apart. Penetrate the previously placed lift with the vibrator when more than one lift is required. Place concrete in 18-inch maximum vertical lifts. External vibrators do not provide adequate consolidation of the concrete.

3.4.2 Application of Epoxy Bonding Compound

Apply a thin coat of compound to dry, clean surfaces. Scrub compound into the surface with a stiff-bristle brush. Place concrete while compound is stringy. Do not permit compound to harden prior to concrete placement. Follow manufacturer’s instructions regarding safety and health precautions when working with epoxy resins.

3.4.3 Pumping

ACI 304R and ACI 304. 2R. Pumping shall not result in separation or loss of materials nor cause interruptions sufficient to permit loss of plasticity between successive increments. Loss of slump in pumping equipment shall not exceed 2 inches. Concrete shall not be conveyed through pipe made of aluminum or aluminum alloy. Minimum size of pipe diameter shall be 5 inches. Rapid changes in pipe sizes shall be avoided. Maximum size of course aggregate shall be limited to 33 percent of the diameter of the pipe. Maximum size of well-rounded aggregate shall be limited to 40 percent of the pipe diameter. Samples for testing shall be taken at both the point of delivery to the pump and the discharge end.

3.4.4 Hot Weather

ACI 305R. Maintain required concrete temperature using Figure 2.1.5 in ACI 305R to prevent the evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. Shade the fresh concrete as soon as possible after placing. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Provide water hoses, pipes, spraying equipment, and water hauling equipment, where job site is remote to water source, to maintain a moist concrete surface throughout the curing period. Provide burlap cover or other suitable, permeable material with fog spray or continuous wetting of the concrete when weather conditions prevent the use of either liquid membrane curing compound or impervious sheets. For vertical surfaces, protect forms from direct sunlight and add water to top of structures once concrete is set.

3.5 SURFACE FINISHES EXCEPT FLOOR, SLAB, ANDPAVEMENT FINISHES

3.5.1 Defects

Repair formed surfaces by removing minor honeycombs, pits greater than 1-square inch surface area or 0.25-inch maximum depth, or otherwise defective areas. Provide edges perpendicular to the surface and patch with nonshrink grout. Patch tie holes and defects when the forms are removed. Concrete with extensive honeycomb including exposed steel reinforcement, cold joints, entrapped debris, separated aggregate, or other defects which affect the serviceability or structural strength will be rejected, unless correction of defects is approved. Obtain approval of corrective action prior to repair. The surface of the concrete shall not vary more than the allowable tolerances of ACI 347R. Exposed surfaces shall be uniform in appearance and finished to a smooth form finish unless otherwise specified.

3.5.2 Not Against Forms (Top of Walls)

Surfaces not otherwise specified shall be finished with wood floats to even surfaces. Finish shall match adjacent finishes.

3.5.3 Formed Surfaces

3.5.3.1 As-Cast Rough Form for Surfaces Not Exposed to Public View

Remove fins and other projections exceeding 0.25 inch in height; level abrupt irregularities.

3.5.3.2 As-Cast Smooth Form for Surface Exposed to Public View

Form facing material shall produce a smooth, hard, uniform texture or the concrete. Remove fins and other projections.

3.6 FLOOR, SLAB, AND PAVEMENT FINISHES AND MISCELLANEOUS CONSTURCTION

ACI 302. 1R, unless otherwise specified. Slope floors uniformly to drains where drains are provided. Depress the concrete base slab where are specified, Contractor shall provide straightedge.

3.6.1 Finish

Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleedwater.

3.6.1.1 Scratched

Use for surfaces intended to receive bonded applied cementitious applications. After the concrete has been placed, consolidated, struck off, and leveled to a Class C tolerance as defined below, the surfaces shall be roughened with stiff brushes of rakes before final set.

3.6.1.2 Floated

Use for surfaces to receive roofing, waterproofing membranes, and exterior slabs where not otherwise specified. After the concrete has been placed, consolidated, struck off, and leveled, do not work the concrete further, until ready for floating. Whether floating with a wood, magnesium, or composite hand float, with a bladed power trowel equipped with float shoes, or with a powered disc, float shall begin when the surface has stiffened sufficiently to permit the operation. During or after the first floating, surface shall be checked with a 10 foot straightedge applied at no less than two different angles, one of which is perpendicular to the direction of strike off. High spots shall be cut down and low spots filled during this procedure to produce a surface level within ¼ inch in 10 feet.

3.6.1.3 Steel Troweled

Use for floors intended as walking surfaces, and for reception of floor coverings. First, provide a floated finish. The finish shall next be power troweled two times, and finally hand troweled. The first troweling after floating shall produce a smooth surface which is relatively free of defects but which may still show some trowel marks. Additional trowelings shall be done by hand after the surface has hardened sufficiently. The final troweling shall be done when a ringing sound is produced as the trowel is moved over the surface. The surface shall be thoroughly consolidated by the hand troweling operations. The finished surface shall be essentially free of trowel marks and uniform in texture and appearance. The finished surface shall produce a surface level to within ¼ inch in 10 feet.

3.6.1.4 Nonslip Finish

Use on surfaces of exterior platforms, steps, and landings; and on exterior and interior pedestrian ramps. Apply dry shake aggregate of ceramically bonded aluminum oxide to the surface at a minimum rate of 25 pounds per 100 square feet. Blend approximately two-thirds of the aggregate with Portland cement as recommended by the manufacturer and apply to the surface evenly and without segregation. After blended material has been embedded by floating, apply the remainder of the blended material to the surface at right angles to the previous application. Apply blended material heavier in any areas not sufficiently covered by the first application. Perform a second floating immediately following the first. After the selected material has been embedded by the two floating, complete the operation with a broomed finish.

3.6.1.5 Broomed

Use on surfaces of exterior walks, platforms, patios, and ramps, unless otherwise indicated. Perform floated finish, then draw a broom or burlap belt across the surface to produce a coarse scored texture. Permit surface to harden sufficiently to retain the scoring or ridges. Broom transverse to traffic or right angles to the slope of the slab.

3.6.1.6 Pavement

Screed the concrete with a template advanced with a combined longitudinal and crosswise motion. Maintain a slight surplus of concrete ahead of the template. After screeding, float the concrete longitudinally. Use a straight edge to check slope and flatness; correct and refloat as necessary. Obtain final finish by a burlap drag. Drag a strip of clean, wet burlap from 3 to 10 feet wide and 2 feet longer than the pavement width across the slab. Produce a fine, granular, sandy textured surface without disfiguring marks. Round edges and joints with an edger having a radius of 1/8 inch.

3.6.2 Concrete Walks

Provide 4 inches thick minimum. Provide contraction joints spaced every 5 linear feet unless otherwise indicated. Cut contraction joints one inch deep with a jointing tool after the surface has been finished. Provide 0.5 inch thick transverse expansion joints at changes in direction where sidewalk abuts curb, steps, rigid pavement, or other similar structures; space expansion joints every 50 feet maximum. Give walks a broomed finish. Unless indicated otherwise, provide a transverse slope of ¼ inch per foot. Limit variation in cross section to ¼ inch in 5 feet.

3.6.3 Pits and Trenches

Place bottoms and walls monolithically or provide waterstops and keys.

3.6.4 Curbs and Gutters

Provide contraction joints spaced every 10 feet maximum unless otherwise indicated. Cut contraction joints ¾ inch deep with a jointing tool after the surface has been finished. Provide expansion joints ½ inch thick and spaced every 100 feet maximum unless otherwise indicated. Perform pavement finish.

3.6.5 Splash Blocks

Provide at outlets of downspouts emptying at grade. Splash blocks may be pre-cast concrete, and shall be 24 inches long, 12 inches wide, and 4 inches thick, unless otherwise indicated, with smooth-finished countersunk dishes sloped to drain away from the building.

3.7 CURING AND PROTECTION

ACI 301 unless otherwise specified. Begin curing immediately following form removal. Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the specified curing period. Do not use membrane-forming compound on surfaces where appearance would be objectionable, on any surface to be painted, where coverings are to be bonded to concrete, or on concrete to which other concrete is to be bonded. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period. Provide moist curing for those areas receiving liquid chemical sealer-hardener or epoxy coating.

3.7.1 Moist Curing

Remove water without erosion or damage to the structure

3.7.1.1 Ponding or Immersion

Continually immerse the concrete throughout the curing period. Water shall not be more than 20 degrees F less than the temperature of the concrete. For temperatures between 40 and 50 degrees F, increase the curing period by 50 percent.

3.7.1.2 Fog Spraying or Sprinkling

Apply water uniformly and continuously throughout the curing period. For temperatures between 40 and 50 degrees F, increase the curing period by 50 percent.

3.7.1.3 Pervious Sheeting

Completely cover surfaces and edges of the concrete with two thicknesses of wet sheeting. Overlap sheeting 6 inches over adjacent sheeting. Sheeting shall be at least as long as the width of the surface to be cured. During application, do not drag the sheeting over the finished concrete nor over sheeting already placed. Wet sheeting thoroughly and keep continuously wet throughout the curing period.

3.7.1.4 Impervious Sheeting

Wet the entire exposed surface of the concrete thoroughly with fine spray of water and cover with impervious sheeting throughout the curing period. Lay sheeting directly on the concrete surface and overlap edges 12 inches minimum. Provide sheeting not less than 18 inches wider than the concrete surface to be cured. Secure edges and transverse laps to form closed joints. Repair torn or damaged sheeting or provide new sheeting. Cover or wrap columns, walls, and other vertical structural elements from top down with impervious sheeting; overlap and continuously tape sheeting joints; and introduce sufficient water to soak the entire surface prior to completely enclosing.

3.7.2 Liquid Membrane – Forming Curing Compound

Seal or cover joint openings prior to application of curing compound. Prevent curing compound from entering the joint. Apply in accordance with the recommendations of the manufacturer immediately after any water sheen which may develop after finishing has disappeared from the concrete surface. Provide and maintain compound on the concrete surface throughout the curing period. Do not use this method of curing where the use of Figure 2.1.5 in ACI 305R indicates that hot weather conditions will cause an evaporation rate exceeding 0.2 pound of water per square foot per hour.

3.7.2.1 Application

Unless the manufacturer recommends otherwise, apply compound immediately after the surface loses its water sheen and has a dull appearance, and before joints are sawed. Mechanically agitate curing compound thoroughly during use. Use approved power – spraying equipment to uniformly apply two coats of compound in a continuous operation. The total coverage for the two coats shall be 200 square feet maximum per gallon of undiluted compound unless otherwise recommended by the manufacturer’s written instructions. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel. Immediately apply an additional coat of compound to areas where the film is defective. Re – spray concrete surfaces subjected to rainfall within 3 hours after curing compound application.

3.7.2.2 Protection of Treated Surfaces

Prohibit pedestrian and vehicular traffic and other sources of abrasion at least 72 hours after compound application. Maintain continuity of the coating for the entire curing period and immediately repair any damage.

3.7.3 Liquid Chemical Sealer – Hardener

Apply sealer – hardener to interior floors not receiving floor covering and floors located under access flooring. Apply the sealer – hardener in accordance with manufacturer’s recommendations. Seal or cover joints and openings in which joint sealant is to be applied as required by the joint sealant manufacturer. The sealer – hardener shall not be applied until the concrete has been moist cured and has aged for minimum of 30 days. Apply a minimum of two coats of sealer – hardener.

3.7.4 Curing Periods

ACI 301 except 15 days for retaining walls, pavement or chimneys, 30 days for concrete that will be in full – time or intermittent contact with seawater, salt spray, alkali soil or waters. Begin curing immediately after placement. Protect concrete form premature drying, excessively hot temperatures, and mechanical injury; and maintain minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing shall be subject to approval by the Government.

3.8 FIELD QUALITY CONTROL

3.8.1 Sampling

ASTM C 172. Collect samples of fresh concrete to perform tests specified. ASTM C 31 for making test specimens.

3.8.2 Testing

3.8.2.1 Slump Tests

ASTM C 143. Take concrete samples during concrete placement. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water – cement ratio is not exceeded. Perform test at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every ten cubic yards (maximum) of concrete.

3.8.2.2 Temperature Tests

Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions (below 50 degrees F and above 80 degrees F) for each batch (minimum) or every 10 cubic yards (maximum) of concrete, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.

3.8.2.3 Compressive Strength Tests

ASTM C 39. Make five test cylinders for each set of tests in accordance with ASTM C 31. Precautions shall be taken to prevent evaporation and loss of water from the specimen. Test two cylinders at 7 days, two cylinders at 28 days, and hold one cylinder in reserve. Samples for strength tests for each mix design of concrete placed each day shall be taken not less than once a day, nor less than once for each 100 cubic yards of concrete, nor less than once for each 5000 square feet of surface area for slabs or walls. For the entire project, take no less than five sets of samples and perform strength tests for each mix design of concrete placed. Each strength test result shall be the average of two cylinders from the same concrete sample tested at 28 days. If the average of any three consecutive strength test result is less than f’c or if any strength test result falls below f’c by more than 500 psi, take a minimum of three ASTM C 42 core samples from the in – place work represented by the low test cylinder results and test. Concrete represented by core test shall be considered structurally adequate if the average of three cores is equal to at least 85 percent of f’c by more and if no single core is less than 75 percent of f’c. Locations represented by erratic core strengths shall be retested. Remove concrete not meeting strength criteria and provide new acceptable concrete. Repair core holes with non – shrink grout. Match color and finish of adjacent concrete.

## PAINTING

PART 1 GENERAL

* 1. SUMMARY
	2. REFERENCES

The publications listed below from a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

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| CODE OF FEDERAL REGULATIONS (CFR) |
| 29 CFR 1910. 1000 | Air Contaminants  |
| COMMERCIAL ITEM DECRIPTIONS (CID) |
| CID A-A-1500 | (Rev. A) Sealer, Surface (Latex Block Filler) |
| FEDERAL SPECIFICATIONS (FS**)** |
| FS TT-P-29 | (Rev. J) (Int Am. 2) Paint, Latex Base, Interior, Flat, White and Tints |
| FS TT-T-291 | (Rev. F) (Am. 1) Thinner, Paint, Mineral Spirits, Regular and Odorless |
| FS TT-E-509 | (Rev. C) Enamel, Odorless, Alkyd, Interior, Semigloss, White and Tints |
| FS TT-E-545 | (rev. C) Primer, (Enamel-Undercoat, Alkyd, Odorless, Interior, Flat, Tints & White) |
| FS TT-P-654 | (Rev. B) Primer, Paint, Zinc-Molybdate, Alkyd Type |
| FS TT-P-1728 | (Rev. A) (Am. 1) Paint, Latex Base, Interior, Flat, Deep-Tone |
| FEDERAL STANDARDS (FED-STD) |
| FED-STD-313 | (Rev. C) Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities. |

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| --- |
| MILITARY SPECIFICATIONS (MIL) |
| DOD-P-15328 | (Rev. D) (Am. 1) Primer (Wash), Pretreatment (Formula No. 117 for metals) (Metric)  |
| MIL-P-24441 | (Rev. A) (Supp. 1) Paint, Epoxy-Polyamide |
| MIL-P-28577 | (Rev. B) Primer, Water-Borne, Acrylic or Modified Acrylic, for Metal Surfaces |
| STEEL STRUCTURES PAINTING COUNCIL (SSPC) |
| SSPC PA 1 | 1982 Shop, Field, and Maintenance Painting |
| SSPC PA 3 | 1982 A Guide to Safety in Paint Application |
| SSPC SP 1 | 1982 Solvent Cleaning |
| SSPC SP 6 | 1989 Commercial Blast Cleaning |
| SSPC SP 7 | 1989 Brush-Off Blast Cleaning |

* 1. SUBMITTALS

Submit the following in accordance with Section 01300, “Submittals.”

1.3.1 SD-06, Instructions

1. Application Instructions
2. Manufacturer’s material safety data sheets

Submit Manufacturer’s materials safety data sheets for coatings, solvents, and other potentially hazardous materials, as defined in FED-STD-313.

1.3.2 SD-08, Statements

1. Applicator’s qualifications
2. Evidence of acceptable variation
	* + 1. Applicator’s Qualifications

Submit evidence that the Contractor or his subcontractor has satisfactorily applied paint by airless spray at a minimum of two sites. Indicate the names and locations of the sites, and type and design of the equipment used, including safety devices.

* + - 1. Evidence of Acceptable Variation

If a product proposed for use does not conform to requirements of the referenced specification, submit for approval to the Government, evidence that the proposed product is either equal to or better than the product specified. The submittal shall include the following:

a. Identification of the proposed substitute;

b. Reason why the substitution is necessary;

1. A comparative analysis of the specified product and the proposed substitute,

including tabulations of the composition of pigment and vehicle;

d. The differences between the specified product and the proposed substitute; and

e. Other information necessary for an accurate comparison of the proposed substitute

 and the specification product.

1.3.3 SD-13 Certificates

1. Coating
2. Sealant
	* + 1. Requirements

For each type of coating, sealant, or other product furnished:

1. Submit a certificate from the manufacturer stating that the product conforms to requirements of the referenced specification.
2. If the referenced specification has a Qualified Product List (QPL), certify that the product has been tested and approves for inclusion in the QPL.
	1. QUALITY ASSURANCE
		1. Qualifications of Airless Spray Applicators

Satisfactory application of paint by airless spray at a minimum of two sites.

* + 1. Field Samples and Tests

The Government will take one-pint samples of paint at random from the products delivered to the job site and test them to verify that the products either conform to the referenced specifications or the approved substitution. Products which do not conform shall be removed from the job site and replaced with new products that conform to the referenced specification or the approved substitution.

* 1. REGULATORY REQUIREMENTS
		1. Lead Content

Do not use coatings containing lead.

* + 1. Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate.

* + 1. Asbestos Content

Materials shall not contain asbestos.

* + 1. Mercury Content

Materials shall not contain mercury or mercury compounds.

* 1. DELIVERY AND STORAGE

Deliver materials in sealed, labeled containers bearing the manufacturer’s name, brand designation, specification number, batch number, color, and date of manufacture. Restrict storage and mixing of materials to locations designated by the Government.

* 1. SAFETY METHODS

Apply coating materials using safety methods and equipment in accordance with the following:

* + 1. Safety Methods Used During Coating Application

Comply with the requirements of SSPC PA 3.

* + 1. Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

1. The chemical manufacturer when using mineral spirits, or other chemicals. Use impermeable gloves, chemical goggles or face-shield, and other recommended protective clothing and equipment to avoid exposure of skin, eyes, and respiratory system. Conduct work in a manner to minimize exposure of building occupants and the general public.
2. 29 CFR 1910.1000.
3. Threshold Limit Values ® of the American Conference of Governmental Industrial

Hygienists.

1. Manufacturer’s Material Safety Data Sheets (MSDS).
	1. ENVIRONMENTAL CONDITIONS

1.8.1 Exterior Coatings

Do not apply coating to surfaces during foggy or rainy weather, or under the following surface temperature conditions;

1. Less than 5 degrees F above the dew point;
2. Below 40 degrees F (for oil-based paints), 50 degrees F (for latex paints or over 95

degrees F, unless approved by the Government.

1.8.2 Interior Coatings

Apply coatings when surfaces to be painted are dry and the following surface temperatures can be maintained:

1. Between 65 and 95 degrees F during the application of enamels and varnishes;
2. Between 50 and 95 degrees F during the application of other coatings.
	1. COLOR SELECTION

Colors of finish coats shall be as indicated or specified. Where not indicated or specified, colors shall be selected by the Government. Manufacturer’s names and color identification are used for the purpose of color identification only. Named products are acceptable for use only if they conforms to specified requirements. Products of other manufacturers are acceptable if the colors approximate colors indicated and the product conforms to specified requirements.

* 1. LOCATION AND SURFACE TYPE TO BE PAINTED
		1. Painting Included

Where a space or surface is indicated to be painted, include the following unless indicated otherwise.

1. Surfaces behind portable object and surface mounted articles readily detachable by removal of fasteners, such as screws and bolts.
2. New factory finished surfaces that require identification or color coding and factory finished surface that are damaged during performance of the work.
3. Existing coated surfaces that are damaged during performance of the work.
	* 1. Painting Excluded

Do not paint the following unless indicated otherwise.

1. Surfaces concealed and made inaccessibly by panelboards, fixed ductwork, machinery, and equipment fixed in place.
2. Surfaces in concealed spaces. Concealed spaces are defined as enclosed spaces above suspended ceilings, furred spaces, attic spaces, crawl spaces, and chases.
3. Steel to be embedded in concrete.
4. Copper, stainless steel, aluminum, brass, and lead, except existing coated surfaces.
	* 1. Mechanical and Electrical Painting

Includes field coating of interior new surfaces.

1. Where a space or surface is indicated to be painted, include the following items unless indicated otherwise.
2. Exposed piping, conduit, and ductwork;
3. Supports, hangers, air grilles, and registers;
4. Miscellaneous metalwork and insulation coverings.
5. Do not paint the following, unless indicated otherwise:
6. New zinc-coated, aluminum, and copper surfaces under insulation;
7. New aluminum jacket on piping; and
8. New interior ferrous piping under insulation.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to the specifications and standards referenced in PART 3. For materials specified by reference to a specification which has a Qualified Products List (QPL), the material provided shall have been tested and approved for inclusion in the QPL.

2.1.1 Latex Blocker Filler

CID A-A-1500

2.1.2 Deep Tone Colors

Where deep tone colors are indicated or specified and a latex coating is specified, use FS TT-P-1728, in lieu of FS TT-P-29.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS AND SPACES

Prior to surface preparation and coating applications, remove, mask, or otherwise protect, hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact to surfaces to be coated. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

3.2 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, disintegrated coatings, and other substances deleterious to coating performance as specified for each substrate.

* 1. PREPARATION OF METAL SURFACES
		1. Galvanized Surfaces
1. New Galvanized: Solvent clean in accordance with SSPC SP 1. If the galvanized metal has been “passivated” or “stabilized,” the coating shall be completely removed by brush-off abrasive blast or other treatment, or the surface shall be primed with a primer which is specifically recommended by the paint manufacturer for use on passivated or stabilized galvanized steel.
2. Galvanized with Slight Coating Deterioration or with Little or No Rusting: Water blast between 2000 to 3000 psi, to remove loose coating from surfaces with less than 20 percent coating deterioration and no blistering, peeling, or cracking. Use inhibitor as recommended by the coating manufacturer to prevent rusting.
3. Galvanized with Severe Deteriorated Coating or Severe Rusting: Spot abrasive blast rusted areas (SSPC SP 6) and abrasive blast (SSPC SP 7) remaining areas to remove existing coating. The depth shall be no greater than 1.5 mils.

1. Pretreatment: Apply DOD-P-15328 as a pretreatment on galvanized surfaces (.3 to .5 mil DFT).
	* 1. Aluminum, Other Non-Galvanized, and Non-Ferrous Surfaces
2. Surface Cleaning: Solvent clean in accordance with SSPC SP 1 and wash with a mild detergent to remove dirt and water soluble contaminates.
3. Pretreatment: Apply DOD-P-15328 as a pretreatment (.3-.5 mil DFT).
	* 1. Terne-Coated Metal Surfaces

Solvent clean surfaces with mineral spirits, FS TT-T-291. Wipe dry with clean, dry cloths.

* 1. APPLICATION
		1. Coating Application

Apply coating materials in accordance with SSPC PA 1. SSPC PA 1 methods are applicable to all substrates, except as modified herein. Thoroughly work coating materials into joints, crevices, and open spaces. Touch up damaged coatings before applying subsequent coats. Interior areas shall be broom clean and dust free before and during the application of coating material.

1. Drying Time: Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying. Provide each coat in specified condition to receive the next coat.
2. Primers, and Intermediate Coats: Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by the manufacturer, before applying subsequent coats. Follow manufacturer’s recommendations for surface preparation if primers of intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Each coat shall cover the surface of the preceding coat or surface completely, and there shall be a visually perceptible difference in shades of successive coats.
3. Finished Surfaces: Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colors.
	* 1. Equipment

Apply coatings with approved brushes, approved rollers, or approved spray equipment, unless specified otherwise. Spray areas made inaccessible to brushing by items such as ducts and other equipment.

* + 1. Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory for the type of paint being used. Obtain written permission shall include quantities and types of thinners to use.

* + 1. Coating Systems
1. Systems by Substrates: Apply coatings that conform to the respective specifications listed in the following Tables:

Table

II Interior Metal Surfaces

1. Minimum Dry Fill Thickness (DFT): Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness of 1.5 mil each coat unless specified otherwise in the Tables. Coating thickness where specified, refers to the minimum dry film thickness.
2. Coatings for Surfaces Not Specified Otherwise: Coat surfaces which have not been specified, the same as surfaces having similar conditions of exposure.
3. Existing Surfaces Damaged During Performance of the Work, Including New Patches In Existing Surfaces: Coat surfaces with the following:
4. One coat of primer.
5. One coat of undercoat or intermediate coat.
6. One top coat to match adjacent surfaces.
7. Existing Coated Surfaces To Be Painted: Apply coatings conforming to the respective specifications listed in the Tables herein, except that pretreatments, sealers and fillers need not be provided on surfaces where existing coatings are soundly adhered and in good condition. Do not omit undercoats or primers.
	1. COATING SYSTEM FOR METAL
8. Primer: Apply specified ferrous metal primer on the same day that surface is cleaned. If flash rusting occurs, re-clean the surface prior to application of primer.
9. Inaccessible Surfaces: Prior to erection, use two coats of the specified primer on metal surfaces that will be inaccessible after erection.
10. Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.
11. Surface Previously Coated with Epoxy or Urethane: Apply MIL-P-24441/1, Formula 150, 1.5 mils DFT immediately prior to application of epoxy or urethane coatings.
12. Pipes and Tubing; The semitransparent film applied to pipes and tubing at the mill is not to be considered a shop coat. Apply specified ferrous metal primer prior to application of subsequent coats.
13. Exposed Nails, Screw, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer, MIL-P-28577.

b. Apply Coatings of Tables II. “DFT” means dry film thickness in mils.

* 1. INSPECTION ANS ACCEPTANCE

In addition to meeting the previously specified requirements, demonstrate the mobility of moving components, including but not limited to swinging and sliding doors, cabinets, and windows with operable sash, for inspection by the Government. Perform this demonstration after appropriate curing and drying times of the coatings have elapsed and prior to invoicing for final payment.

|  |
| --- |
| TABLE-II |
| INTERIOR METAL SURFACES |
| Surface/Area | Primer | DFT | Intermediate Coat | DFT | Topcoat | DFT |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| A. | Metal | FS | TT-P-645 | 2.0 | FS TT-E-545 | 1.5 | FS TT-E-509 | 1.5 |
|  | Except Floors, Not Specified Otherwise |  | on non-shop-primed surfaces |  |  |  |  |  |

## FILTRATION EQUIPMENT

PART 1 GENERAL

1.1 SCOPE OF WORK

Work required under this section consists of furnishing and installing automatic valve-less gravity filtration equipment complete with all necessary piping, valves, filter media, under – drains, appurtenances and accessories for the AVGF filter system (s) listed in the “Special Provisions” and shown on the Drawings, as specified herein.

1.2 WORK IN OTHER SECTIONS

Earthwork – Division 02

Concrete Work – Division 03

Metal Work – Division 05

General Mechanical Requirements – Division 15

Piping – Division 15

Valves, Gates and Appurtenances – Division 15

Painting and Coatings – Division 09

1.3 SUPPLIER RESPONSIBLILITY

The Contractor’s attention is directed to the fact that each filtration unit is to be a complete integrated system, and as such, shall be furnished by one supplier who shall provide all of the equipment and appurtenances, regardless of manufacture, and be responsible to the Contractor for satisfactory operation of the entire system.

Unless otherwise specified, all materials and equipment shall be standard commercial products in regular production by the filtration equipment manufacturer and suitable for the required service. Substitutes for functions specified will not be acceptable.

The filtration equipment supplier shall prefabricate and preassemble all equipment and piping to the greatest degree practicable. The limits of the equipment and piping to be furnished and installed under this section shall be shown on the Drawings and as specified herein.

The filtration equipment supplier shall be responsible for furnishing all erection, welding and piping diagrams, markings, instructions, location and dimensional data to the Contractor as required for the proper installation and subsequent operation of the Contractor and/or supplier shall schedule the required service trips only after obtaining approval of the Contracting Officer.

1.4 DESCRIPTION

Equipment to be furnished as part of the filtration system package shall include but no be limited to the following components. Refer to the Drawings for a schematic diagram of the system.

Automatic valve – less gravity filter, including:

1. Filter tank
2. Wash storage tank and cover
3. Filter piping
4. Wash collector
5. Filter media
6. Under – drain system
7. Inlet head tank and supports
8. Tankage painting and lining
9. Inlet isolating valve
10. Inlet pipe & fittings
11. Backwash sump weir

Automatic valve – less gravity filters shall be designed to backwash, rinse and return the unit to service without the use of valves, electrical control, or attention from the operator. The filter shall be the configuration known to the trade as “Municipal”.

1.5 OPERATION

Filtering: Water from a constant – level source enters the filter bed compartment just above the bed. It flows downward through the sand and plastic strainers into the collector chamber and upward through the effluent duct and out to service. As the filter bed collects dirt during the filter run, the head loss increases and the water level will slowly rise in the inlet pipe and in the backwash pipe. Just before the water passes over into the downward section of the backwash pipe, a self-actuated primer system evacuates air from the backwash pipe. This pulls water rapidly over into the pipe so that a large volume of water flows down the backwash pipe and starts the siphon action that backwashes the filter.

The upper tank section shall provide for storage of the backwash water obtained from the previous rinse operation of the filter. This wash storage tank section shall be provided with a cover and 18” diameter vented man – way. The backwash storage space shall be designed to hold the optimum amount of backwash water for the area of the filter bed. It shall always fill to the same height, and thus provide uniformity of backwash rate and volume. The maximum head loss prior to backwash shall be five feet.

The lower tank shall be divided into two compartments by a steel strainer plate. The upper compartment shall from the filter inlet section and the bottom compartment shall from the filtered water collection compartments. Elliptical access manholes 12” X 16” shall be provided for both compartments. Anchor pads shall be provided to secure the filter tank to the foundation. Filter tanks shall be shipped preassembled complete and ready for installation.

2.1 FILTER PIPING

Each filter unit shall be furnished with all necessary filter, backwash and control piping required to perform the function of filtering, backwashing and retuning the unit to service automatically. The piping is to be arranged so that each unit shall backwash when the total head loss has reached approximately 4’ – 6”. Suitable interlock piping shall be provided for multiple filter installations so that only one piping to be furnished by the filtration equipment manufacturer shall include the flange on the influent line at the constant head tank; the constant head tank; inlet pipe and fittings between the constant head tank and the filter; the filter; the backwash piping and accessories; and the effluent flange at the filter outlet. The entire assembly within these limits shall be interconnecting piping complete, ready for assembly by the Contractor. The Contractor shall be responsible for furnishing and installing inlet piping and wafer type butterfly valve before the constant head box inlet flange, all interconnecting and header piping for the filter effluent beyond the outlet flange and drain piping from the backwash sump outlet.

2.2 WASH COLLECTOR

Each unit shall have a suitable system for collecting backwash water uniformly over the surface area at a rate of approximately 18 gpm per square foot at the start of the wash and 12 gpm per square foot at the end of the wash. Maximum horizontal travel to collector shall be less than 3’0”.

2.3 FILTER MEDIA

Each filter unit shall be provided with a 24” bed of fine sand.

PART 3 – PERFORMANCE

3.1 INSTALLATION OF EQUIPMENT AND PIPING

Installation shall conform to the applicable provisions of Section 15011, “General Mechanical Requirements” and other applicable sections of these specifications and to the supplier’s written instructions.

3.2 ERECTION OF EQUIPMENT

Special care shall be taken to ensure proper alignment of all equipment. The anchor bolts shall be set in place and the nuts tightened against the shims. After the foundation alignments have been approved, assembly shall be securely bolted in place. The filter shall be aligned with associated piping and under no circumstance will “pipe springing” be allowed. The weir (s) shall be set in accordance with the directions of the manufacturer, based on anticipated flows.

3.3 SPECIAL TREATMENT OF SURFACE COURSE UNDER THE FLOOR OF THE VALVELESS GRAVITY FILTER

Directly above the concrete foundation pad, a mixture of sand and oil conforming to grades 4, 5 or 6 of Specification VV – F – 815, and passing the corrosion test specified in Note 2 of Table 1 of the above specification shall be installed within the ring wall. Coral sand shall be obtained by the Contractor at his cost from sand pits well above the salt water line, in order to provide sand that has a minimum of salt content. The amount of oil to be added to the sand shall be the maximum amount that the sand will absorb. Sand and oil shall be mixed and spread evenly over the concrete slab and tamped to a firm surface, level with the top of the concrete ring wall. Hand mechanical tampers shall be used. No free oil will be permitted on the top surface of this surface course.

3.4 FILED TESTS AND INSPECTIONS

After installation of all equipment, a complete operating test which shall include filtering and backwash cycles shall be made. The test shall be in accordance with Section 15011, “General Mechanical Requirements” and as directed by the Contracting Officer. The Contracting Officer shall witness all field tests and conduct all field inspections. The Contactor shall give the Contracting Officer 7 day’s prior notice for dates and times for acceptance tests and inspections.

## MECHANICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below from a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|  |  |
| --- | --- |
| ASTM B 117 | 1990 Salt Spray (Fog) Testing |

CODE OF FEDERAL REGULATIONS (CFR)

|  |  |
| --- | --- |
| 29 CFR 1910.147 | Control of Hazardous Energy (Lock Out/Tag Out) |

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

|  |  |
| --- | --- |
| NEMA MG 1 | 1993 Motors and Generators |
| NEMA MG 10 | 1983 (R 1988) Energy Management Guide for Selection and Use of Polyphase Motors |
| NEMA MG 11 | 1977 (R 1992) Energy Management Guide of Selection and Use of Single-Phase Motors |

1.2 RELATED REQUIREMENTS

This section applies to certain sections of Division 2, “Site Work”; Division 11, “Equipment”; Division 13, “Special Construction”; and all sections of Division 15, “Mechanical” of this project specification, unless specified otherwise in the individual section.

1.3 QULAITY ASSURANCE

1.3.1 Material and Equipment Qualifications

Provide materials and equipment that are standard products of manufacturers regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. Standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstance and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers’ catalog, or brochures during the 2 year period.

1.3.2 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer’s factory or laboratory tests, can be shown.

1.3.3 Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.3.4 Manufacturer’s Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer’s name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.3.5 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, “shall” had been substituted for “should” wherever it appears. Interpret references in these publications to the “authority having jurisdiction,” or words of similar meaning, to mean the Contracting Officer.

1.4 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer’s recommendations, and as approved by the Contracting Officer. Replace damages or defective items.

1.5 SAFETY REQUIREMENTS

1.5.1 Equipment Safety

Provide positive means of locking out equipment so that equipment cannot be accidentally started during maintenance procedures. High-temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be properly guarded or covered with insulation of the type specified. Ensure that access openings leading to equipment are large enough to carry through routine maintenance items such as filters and tools.

1.5.2 Warning Sign

Provide a permanent placard or sign at the entrance to confined spaces contained in the equipment. The sign shall warn personnel not to enter the space until the atmosphere inside has been tested and systems have been de-energized.

1.5.3 Lockout of Energy Sources

Provide appropriate lockout devices for energy isolating valves and for machines or other equipment to prevent unexpected start-up or release of stored electrical, mechanical, hydraulic, pneumatic, thermal, chemical, or other energy in accordance with 29 CFR 1910.147. Lockout devices for valves shall provide a means of attachment to which, or through which, a lock can be affixed or shall have a lockout position until the lock is removed. Electrical isolation of machines or other equipment shall be in accordance with requirements of DIVISION 16 “Electrical.”

1.6 ELECTRICAL REQUIREMENTS

Furnish motors, controllers, disconnects and contactors with their respective pieces of equipment. Motors, controllers, disconnects and contactors shall conform to and have electrical connections provided under Division 16, “Electrical”. Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Extended voltage range motors will not be permitted. Controllers and contactors shall have a maximum of 120 volt controls circuits, and shall have auxiliary contacts for use with the controls furnished. When motors and equipment furnished are larger than the sizes indicated, the cost of additional electrical service and related work shall be included under the section that specified that motor or equipment.

Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of Division 16, “Electrical”.

1.6.1 New Work

Provide electrical components of mechanical equipment, such as motors, motor starters, control or push-button stations, float or pressure switches, solenoid valves, integral disconnects, and other devices functioning to control mechanical equipment, as well as control wiring and conduit for circuits rated 100 volts or less, to conform with the requirements of the project specifications and drawings. Extended voltage range motors shall not be permitted. The interconnecting power wiring and conduit, control wiring rated 120volts (nominal) and conduit, the electrical power circuits shall be provided under Division 16, except internal wiring for components of package equipment shall be provided as an integral part of the equipment. When motors and equipment furnished are larger than sizes indicated, provide any required changes to the electrical service as may be necessary and related work as a part of the work for the section specifying that motor or equipment.

1.6.2 Modifications to Existing Systems

Where existing mechanical systems and motor-operated equipment require modifications, provide electrical components under Division 16.

1.6.3 High Efficiency Motors

1.6.3.1 High Efficiency Single-Phase Motors

Unless otherwise specified, single-phase fractional-horsepower alternating-current motors shall be high efficiency types corresponding to the applications listed in NEMA MG 1.

1.6.3.2 High Efficiency Poly-Phase Motors

Unless otherwise specified, poly-phase motors shall be selected based on high efficiency characteristics relative to the applications as listed in NEMA MG 10. Additionally, poly-phase squirrel-cage medium induction motors with continuous ratings shall meet or exceed energy efficient ratings in accordance with Table 12-6C of NEMA MG 1.

1.7 INSTRUCTION TO GOVERNMENT PERDONNEL

When specified in other sections, furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with the equipment or system. When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PAINTING OF NEW EQUIPMENT

Equipment painting, factory applied or shop applied, shall be as specifies herein, and provided under each individual section.

3.1.1 Factory Painting Systems

Manufacturer’s standard factory painting system may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test. Salt-spray fog test shall be in accordance with ASTM B 117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creep age beyond 0.125 inch on either side of the scratch mark. The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen. If manufacturer’s standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees F, submit certifications that the manufacturer’s standard factory painting system conforms to the heat resistance requirement in addition to other certifications.

3.1.2 Shop Painting Systems for Metal Surfaces

Clean, preheat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 120 degrees Fahrenheit (F) shall be cleaned to bare metal. Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat shall be aluminum or light gray.

1. Temperatures Less Than 120 Degrees F: Immediately after cleaning, the metal surfaces subject to temperatures less than 120 degrees F shall receive one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to a minimum dry film thickness of one mil; and two coats of enamel applied to a minimum dry film thickness of one mile per coat.
2. Temperature between 120 and 400 Degrees F: Metal surfaces subject to temperatures between 120 and 400 degrees F shall receive two coats of 400 degrees F heat-resisting enamel applied to a total minimum thickness of 2 mils.
3. Temperature Greater Than 400 Degrees F: Metal surfaces subject to temperatures greater than 400 degrees F shall receive two coats of 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 2 mils.

## ELECTRICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

|  |  |
| --- | --- |
| 29 CRF 1910.147 | Control of Hazardous Energy (Lock Out/Tag Out) |

FEDERAL SPECIFICATIONS (FS)

|  |  |
| --- | --- |
| FS L-P-387 | (Rev. A) (Int Am. 2) Plastic Sheet, Laminated, Thermosetting (for Design Plates) |

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC. (IEEE)

|  |  |
| --- | --- |
| IEEE 100 | 1992 Dictionary of Electrical and Electronics Terms |

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

|  |  |
| --- | --- |
| NEMA ICS 6 | 1988 (Rev. 1) Enclosure for Industrial Control and Systems |

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

|  |  |
| --- | --- |
| NFPA 70 | 1993 National Electrical Code |

1.2 RELATED REQUIREMENTS

This section applies to all sections of Division 16, “Electrical”, of this project specification unless specified otherwise in the individual sections.

1.3 DEFINITIONS

1. Unless otherwise specifies or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.
2. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal type.
3. The technical paragraphs referred to herein are those paragraphs in PART 2 – PRODUCTS and PART 3 – EXECUTION of the technical sections that describe products, system, installation procedures, equipment, and test methods.

1.4 ELECTRICAL CHARACTERISTICS

Electrical characteristics for this project shall be 120/208 volt, three phase, four wire, 60 Hz. Final connections to the power distribution system at the existing transfer switch shall be made by the Contractor as directed by the Government.

1.5 SUBMITTALS

Submittals required in the sections which refer to this section shall conform to the requirements of Section 01300, “Submittals” and to the following additional requirements. Submittals shall include the manufacturer’s name, trade name, place of manufacture, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and technical paragraph reference. Submittals shall also include applicable federal, military, industry, and technical society publication references, and years of satisfactory service, and other information necessary to establish contract compliance of each item to be provided. Photographs of existing installations are unacceptable and will be returned without approval.

1.5.1 Manufacturer’s Catalog Data

Submittal for each manufactured item shall be current manufacturer’s descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts.

Handwritten and typed modifications and other notations not part of the manufacturer’s preprinted data will result in the rejection of the submittal. Should manufacturer’s data require supplemental information for clarification, the supplemental information shall be submitted as specified for certificates of compliance.

1.5.2 Drawings

Submit drawings a minimum of 24 inches by 36 inches in size using a minimum scale of 1/8 inch per foot, except as specified otherwise. Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other item that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminal and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

1.5.3 Instructions

Where installation procedures or part of the installation procedures are required to be in accordance with manufacturer’s instructions, submit printed copies of those instructions prior to installations. Installation of the item shall not proceed until the manufacturer’s instructions are received. Failure to submit manufacturer’s instructions shall be cause for rejection of the equipment or material.

1.5.4 Certificates

Submit manufacturer’s certifications as required for products, materials, finishes, and equipment as specified in the technical sections. Certificates from materials suppliers are not acceptable. Preprinted certifications and copies of previously submitted documents will not be acceptable. The manufacturer’s certifications shall name the appropriate products, equipment, or materials and publication specified as controlling the quality of that item. Certification shall not contain statements to imply that the item does not meet requirements specified, such as “as good as”; “achieve the same end use and results as materials formulated in accordance with the referenced publications”; or “equal or exceed the service and performance of the specified material”. Certifications shall simply state that the item conforms to the requirements specified. Certificates shall be printed on the manufacturer’s letterhead and shall be sign certificates of compliance.

1.5.4.1 Reference Standard Compliance

Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), Underwriters Laboratories Inc. (UL), and Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance.

1.5.4.2 Independent Testing Organization Certificate

In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Government. The certificate shall state that the item has been tested in accordance with the specified organization’s test methods and that the item complies with the specified organization’s reference standard.

1.5.5 Operation and Maintenance Manuals

Comply with the requirements of Section 01730 and the technical sections.

1.5.5.1 Operating Instructions

Submit text of posted operating instructions for each system and principal item of equipment as specified in the technical sections.

1.6 QUALITY ASSURANCE

1.6.1 Material and Equipment Qualifications

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers’ catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in the technical section.

1.6.2 Regulatory Requirements

Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70.

1.6.3 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers’ factory or laboratory tests, is furnished.

1.6.4 Service Support

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.6.5 Manufacturer’s Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer’s name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.6.6 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, “shall” had been substituted for “should” wherever it appears. Interpret references in these publications to the “authority having jurisdiction”, or words of similar meaning, to mean the Government.

1.7 POSTED OPERATING INSTRUCTIONS

Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

* 1. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
	2. Start up, proper adjustment, operating, lubrication, and shutdown procedures.
	3. Safety precautions.
	4. The procedure in the event of equipment failure.
	5. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

1.8 NAMEPLATES

FS L-P-387. Provide laminated plastic nameplates for each panel-board, equipment enclosure, relay, switch, and device. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align letting and engrave into the core. Minimum size of nameplates shall be 1 by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

1.9 INSTRUCTION TO GOVERNMENT PERSONNEL

Where specified in the technical sections, furnish the services of competent instructions to give full instruction to designated Government personnel in the adjustment, operation, and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructions shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with equipment or system. When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instructions to acquaint the operating personnel with the changes or modifications.

1.10 LOCKOUT REQUIREMENTS

Provide disconnecting means capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with 29 CFR 1910.147. Mechanical isolation of machines and other equipment shall be in accordance with requirements of Division 15, “Mechanical”

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PAINTING OF EQUIPMENT

3.1.1 Factory Applied

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test and the additional requirements specified in the technical sections.

3.1.2 Field Applied

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09900, “Painting”, or the section specifying the associated electrical equipment.

3.2 NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.