

**SECTION 01 00 00  
GENERAL REQUIREMENTS**

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**SECTION 01 00 00  
GENERAL REQUIREMENTS**

**1.1 GENERAL INTENTION**

- A. Contractor shall completely prepare site for construction and furnish labor and materials and perform work for installation of post hydrants, with associated valves, boxes, and appurtenances as required by drawings and specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Cemetery Director.
- C. Prior to commencing work, general contractor shall provide proof that a OSHA certified “competent person” (CP) (29 CFR 1926.20(b)(2) will maintain a presence at the work site whenever the general or subcontractors are present.

**1.2 STATEMENT OF BID ITEM(S)**

- A. CLIN 001, BASE ITEM: Work includes excavation, demolition of PVC water main as needed, installation of required “tee” or saddle taps. Installation and backfill of nine (9) post hydrants provided with Type D Camlock connector.
- B. CLIN 002, DEDUCT OPTION: Work includes excavation, demolition of PVC water main, installation of “tee” and gate valve on new branch line. Installation of steel pipe sleeve under road and installation of PVC main branch line. Installation of reduction fitting. Installation and backfill of one (1) post hydrant provided with Type D Camlock connector.

**1.3 FIRE SAFETY**

- A. Applicable Publications: Publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.
  - 1. American Society for Testing and Materials (ASTM):
    - E84-2008 .....Surface Burning Characteristics of Building Materials
  - 2. National Fire Protection Association (NFPA):
    - 10-2006.....Standard for Portable Fire Extinguishers
    - 30-2007.....Flammable and Combustible Liquids Code
    - 51B-2003 .....Standard for Fire Prevention During Welding, Cutting and Other Hot Work
    - 70-2007.....National Electrical Code
    - 241-2004.....Standard for Safeguarding Construction, Alteration, and Demolition Operations
  - 3. Occupational Safety and Health Administration (OSHA):
    - 29 CFR 1926 .....Safety and Health Regulations for Construction

- B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the general contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, VA safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VA equipment, etc. Documentation shall be provided to the COR that individuals have undergone contractor's safety briefing.
- C. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- E. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with COR.
- F. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily.
- G. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- H. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- I. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to COR.
- J. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.
- K. Dispose of waste and debris in accordance with NFPA 241. Remove daily.
- L. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.

#### **1.4 OPERATIONS AND STORAGE AREAS**

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer or Contracting Officer's Representative (COR). The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

- B. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

**(FAR 52.236-10)**

- C. Working space and space available for storing materials shall be as determined by the Contracting Officer's Representative (COR).
- D. Workmen are subject to rules of Cemetery applicable to their conduct.
- E. Execute work so as to interfere as little as possible with normal functioning of Cemetery as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others.
1. Do not store materials and equipment in other than assigned areas.
  2. Schedule delivery of materials and equipment to immediate construction working areas in quantities sufficient for not more than two work days. Provide unobstructed access to Cemetery areas required to remain in operation.
- F. Utilities Services: Maintain existing utility services for Cemetery at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, it shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by the COR.
1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of COR.
  2. Contractor shall submit a request to interrupt any such services to COR, in writing, 48 hours in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
  3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Cemetery. Interruption time approved by Cemetery may occur at other than Contractor's normal working hours.
  4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the COR.

5. In case of a contract construction emergency, service will be interrupted on approval of COR. Such approval will be confirmed in writing as soon as practical.

G. Abandoned Lines: Not Applicable

H. To minimize interference of construction activities with flow of Cemetery traffic, comply with the following:

1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles.
2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the COR.

I. Coordinate the work for this contract with other construction operations as directed by COR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

J. Coordination of Construction with Cemetery Director: The burial activities at a National Cemetery shall take precedence over construction activities. The Contractor must cooperate and coordinate with the Cemetery Director, through the COR, in arranging construction schedule to cause the least possible interference with cemetery activities in actual burial areas. Construction noise during the interment services shall not disturb the service. Trucks and workmen shall not pass through the service area during this period:

1. The Contractor is required to discontinue his work sufficiently in advance of Easter Sunday, Mother's Day, Father's Day, Memorial Day, Veteran's Day and/or Federal holidays, to permit him to clean up all areas of operation adjacent to existing burial plots before these dates.
2. Cleaning up shall include the removal of all equipment, tools, materials and debris and leaving the areas in a clean, neat condition.

## **1.5 ALTERATIONS**

A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR of areas in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by both, to the Contracting Officer. This report shall accomplish the following:

1. Note any discrepancies between drawings and existing conditions at site.
2. Designate areas for working space, materials storage and routes of access to areas where alterations occur and which have been agreed upon by Contractor and COR.

B. Re-Survey: Five calendar-days before expected partial or final inspection date, the Contractor and COR together shall make a thorough re-survey of the areas involved. They shall furnish a

report on conditions then existing, as compared with conditions of same as noted in first condition survey report:

1. Re-survey report shall also list any damage caused by Contractor despite protection measures; and, will form basis for determining extent of repair work required of Contractor to restore damage caused by Contractor's workmen in executing work of this contract.

C. Protection: Provide the following protective measures:

1. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.

#### **1.6 DISPOSAL AND RETENTION**

A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:

1. Items not reserved shall become property of the Contractor and be removed by Contractor from Cemetery.

#### **1.7 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS**

A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, that are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

**(FAR 52.236-9)**

## **1.8 RESTORATION**

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COR before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.
- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.
- C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are indicated on drawings and which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

## **1.9 LAYOUT OF WORK**

- A. The Contractor shall lay out the work from Government established base lines and bench marks, indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

**(FAR 52.236-17)**

- B. Establish and plainly mark such lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations established for each such structure and/or addition, roads, parking lots, etc. are in accordance with lines and elevations shown on contract drawings.
- C. Following completion of general mass excavation and before any other permanent work is performed, establish and plainly mark (through use of appropriate batter boards or other means) sufficient additional survey control points or system of points as may be necessary to assure proper alignment, orientation, and grade of all major features of work. Survey shall include, but not be limited to, location of lines and grades of footings, exterior walls, center lines of columns in both directions, major utilities and elevations of floor slabs.
- D. Upon completion of the work, the Contractor shall furnish the COR, reproducible drawings at the scale of the contract drawings, showing the finished grade on the grid developed for constructing the work.
- E. The Contractor shall perform the surveying and layout work of this and other articles and specifications.

**1.10 AS-BUILT DRAWINGS**

- A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.
- B. All variations shall be shown in the same general detail as used in the contract drawings. To insure compliance, as-built drawings shall be made available for the COR's review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings to the COR within 15 calendar days after the acceptance of the project by the COR.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.

**1.11 USE OF ROADWAYS**

- A. For hauling, use only established public roads and roads on Cemetery property and, when authorized by the COR, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed by the Contractor at Contractor's expense. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.
- B. New permanent roads: Not Applicable.

### **1.12 TEMPORARY TOILETS**

- A. The contractor shall provide portable chemical toilets for use by workmen as necessary to comply with applicable OSHA requirements. These portable toilet facilities shall be kept clean and free of excessive odors, insects, etc. Locate portable toilet facilities in the COR approved area only. It will not be permissible to locate portable toilet facilities in any other locations throughout the cemetery. Use of the permanent cemetery toilet facilities by workmen is strictly prohibited throughout the duration of this contract. All connections and appliances connected therewith shall be removed prior to completion of contract, and premises left perfectly clean.

### **1.13 AVAILABILITY AND USE OF UTILITY SERVICES**

- A. WATER: Water will only be made available via Contractor connection to existing Cemetery water system in existing locations where connection is available, and for purposes of this contract only. The Contractor at Contractor's expense and in a workmanlike manner satisfactory to the COR shall be responsible for installing and maintaining temporary connections to the cemetery water supply in accordance with regulations. Contractor shall not obstruct normal traffic flow on adjacent roads while water is being obtained. In locations where Cemetery water system is not readily available, the Contractor shall provide and utilize portable water tanks and/or water trucks as necessary to transport water to areas where needed in order to complete the work required by this contract.
- B. ELECTRICITY: In case the Contractor requires electricity while in performance of this contract, the Contractor shall provide and utilize portable generators as necessary to complete the work.

### **1.14 HISTORIC PRESERVATION**

Where the Contractor or any of the Contractor's employees, prior to, or during the construction work, are advised of or discover any possible archeological, historical and/or cultural resources, the Contractor shall immediately notify the COR verbally, and then with a written follow up.

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**SECTION 01 33 23**  
**SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES**

- 1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- 1-2. For the purposes of this contract, samples, test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1-3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
  - A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
  - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
  - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- 1-4. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.
- 1-5. Submittals will be reviewed for compliance with contract requirements by MSN III Engineer, and action thereon will be taken by COR on behalf of the Contracting Officer.
- 1-6. Upon receipt of submittals, MSN III Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.
- 1-7. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant to request therefor by Contracting Officer, adjustment in contract price and time will be made in accordance with Articles titled CHANGES (FAR 52.243-4) and CHANGES - SUPPLEMENT (VAAR 852.236-88) of the GENERAL CONDITIONS.

- 1-8. Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer and MSN III Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
- 1-9. Submittals must be submitted by Contractor only and shipped prepaid. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.
- A. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in quadruplicate, except where a greater number is specified.
- B. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via first class mail and shall contain the list of items, name of Cemetery, name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.
1. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
  2. Each certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Cemetery, name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.
  3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
- C. In addition to complying with the applicable requirements specified in preceding Article 1.9, samples which are required to have Laboratory Tests (those preceded by symbol "LT" under the separate sections of the specification shall be tested, at the expense of Contractor, in a commercial laboratory approved by Contracting Officer.
1. Laboratory shall furnish Contracting Officer with a certificate stating that it is fully equipped and qualified to perform intended work, is fully acquainted with specification requirements and intended use of materials and is an independent establishment in no way connected with organization of Contractor or with manufacturer or supplier of materials to be tested.
  2. Certificates shall also set forth a list of comparable projects upon which laboratory has performed similar functions during past five years.

3. Samples and laboratory tests shall be sent directly to approved commercial testing laboratory.
  4. Contractor shall send a copy of transmittal letter to both COR and to MSN III Engineer simultaneously with submission of material to a commercial testing laboratory.
  5. Laboratory test reports shall be sent directly to COR for appropriate action.
  6. Laboratory reports shall list contract specification test requirements and a comparative list of the laboratory test results. When tests show that the material meets specification requirements, the laboratory shall so certify on test report.
  7. Laboratory test reports shall also include a recommendation for approval or disapproval of tested item.
- D. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings and schedules shall be stamped and signed by Contractor certifying to such check.
1. For each drawing required, submit one legible photographic paper or vellum reproducible.
  2. Reproducible shall be full size.
  3. Each drawing shall have marked thereon, proper descriptive title, including Cemetery location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
  4. A space 120 mm by 125 mm (4-3/4 by 5 inches) shall be reserved on each drawing to accommodate approval or disapproval stamp.
  5. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
  6. One reproducible print of approved or disapproved shop drawings will be forwarded to Contractor.
  7. When work is directly related and involves more than one trade, shop drawings shall be submitted to MSN III Engineer under one cover.
- 1-10. Shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to

National Cemetery Administration

MSN III Engineer

155 Van Gordon Street, Box 25126

Denver, Colorado 80225-0126

- 1-11. At the time of transmittal to the MSN III Engineer, the Contractor shall also send a copy of the complete submittal directly to the COR.

--- E N D ---

**SECTION 03 30 53**  
**(SHORT-FORM) CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies cast-in-place structural concrete and material and mixes for other concrete.

**1.2 RELATED WORK:**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Concrete roads, walks, and similar exterior site work: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

**1.3 TOLERANCES:**

- A. ACI 117.
- B. Slab Finishes: ACI 117, F-number method in accordance with ASTM E1155.

**1.4 REGULATORY REQUIREMENTS:**

- A. ACI SP-66 ACI Detailing Manual
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.

**1.5 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Concrete Mix Design.
- C. Shop Drawings: Reinforcing steel: Complete shop drawings.
- D. Manufacturer's Certificates: Air-entraining admixture, chemical admixtures, curing compounds.

**1.6 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):
  - 117R-06 .....Tolerances for Concrete Construction and Materials
  - 211.1-91(R2002).....Proportions for Normal, Heavyweight, and Mass Concrete
  - 301-05 .....Specification for Structural Concrete
  - 305R-06 .....Hot Weather Concreting
  - 306R-2002 .....Cold Weather Concreting
  - SP-66-04 .....ACI Detailing Manual
  - 318/318R-05 .....Building Code Requirements for Reinforced Concrete

- 347R-04 .....Guide to Formwork for Concrete
- C. American Society for Testing And Materials (ASTM):
- A185-07 .....Steel Welded Wire, Fabric, Plain for Concrete Reinforcement
- A615/A615M-08.....Deformed and Plain Billet-Steel Bars for Concrete  
Reinforcement
- A996/A996M-06.....Standard Specification for Rail-Steel and Axle-Steel Deformed  
Bars for Concrete Reinforcement
- C31/C31M-08 .....Making and Curing Concrete Test Specimens in the Field
- C33-07 .....Concrete Aggregates
- C39/C39M-05 .....Compressive Strength of Cylindrical Concrete Specimens
- C94/C94M-07 .....Ready-Mixed Concrete
- C143/C143M-05 .....Standard Test Method for Slump of Hydraulic Cement Concrete
- C150-07 .....Portland Cement
- C171-07 .....Sheet Material for Curing Concrete
- C172-07 .....Sampling Freshly Mixed Concrete
- C173-07.Air Content of Freshly Mixed Concrete by the Volumetric Method
- C192/C192M-07 .....Making and Curing Concrete Test Specimens in the Laboratory
- C231-08 .....Air Content of Freshly Mixed Concrete by the Pressure Method
- C260-06 .....Air-Entraining Admixtures for Concrete
- C330-05 .....Lightweight Aggregates for Structural Concrete
- C494/C494M-08 .....Chemical Admixtures for Concrete
- C618-08 .....Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in  
Concrete
- D1751-04.Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction  
(Non-extruding and Resilient Bituminous Types)
- D4397-02 .....Polyethylene Sheeting for Construction, Industrial and  
Agricultural Applications
- E1155-96(2008) .....Determining  $F_F$  Floor Flatness and  $F_L$  Floor Levelness Numbers

## **PART 2 - PRODUCTS**

### **2.1 FORMS:**

Wood, plywood, metal, or other materials, approved by COR, of grade or type suitable to obtain type of finish specified.

**2.2 MATERIALS:**

- A. Portland Cement: ASTM C150, Type I or II.
- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent.
- C. Coarse Aggregate: ASTM C33, Size 67. Size 467 may be used for footings and walls over 300 mm (12 inches) thick. Coarse aggregate for applied topping and metal pan stair fill shall be Size 7.
- D. Fine Aggregate: ASTM C33.
- E. Lightweight Aggregate for Structural Concrete: ASTM C330, Table 1
- F. Mixing Water: Fresh, clean, and potable.
- G. Air-Entraining Admixture: ASTM C260.
- H. Chemical Admixtures: ASTM C494.
- I. Reinforcing Steel: ASTM A615 or ASTM A996, deformed. See structural drawings for grade.
- J. Expansion Joint Filler: ASTM D1751.
- K. Sheet Materials for Curing Concrete: ASTM C171.

**2.3 CONCRETE MIXES:**

- A. Design of concrete mixes using materials specified shall be the responsibility of the Contractor as set forth under Option C of ASTM C94.
- B. Compressive strength at 28 days shall be not less than 30 Mpa (4000 psi).
- C. Establish strength of concrete by testing prior to beginning concreting operation. Test consists of average of three cylinders made and cured in accordance with ASTM C192 and tested in accordance with ASTM C39.
- D. Maximum slump for vibrated concrete is 100 mm (4 inches) tested in accordance with ASTM C143.
- E. Cement and water factor (See Table I):

**TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE**

Concrete: Strength Min. 28 Day Comp. Str. MPa (psi)	Non-Air-Entrained		Air-Entrained	
	Min. Cement kg/m <sup>3</sup> (lbs/c. yd)	Max. Water Cement Ratio	Min. Cement kg/m <sup>3</sup> (lbs/c. yd)	Max. Water Cement Ratio
35 (5000) <sup>1,3</sup>	375 (630)	0.45	385 (650)	0.40
30 (4000) <sup>1,3</sup>	325 (550)	0.55	340 (570)	0.50

25 (3000) <sup>1,3</sup>	280 (470)	0.65	290 (490)	0.55
25 (3000) <sup>1,2</sup>	300 (500)	*	310 (520)	*

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'c. For concrete strengths above 35 Mpa (5000 psi), the proposed mix design shall achieve a compressive strength 9.7 MPa (1400 psi) in excess of f'c.

\* Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.

- F. Air-entrainment is required for all exterior concrete and as required for Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS. Air content shall conform with the following table:

**TABLE I - TOTAL AIR CONTENT  
FOR VARIOUS SIZES OF COARSE AGGREGATES (NORMAL CONCRETE)**

Nominal Maximum Size of Coarse Aggregate	Total Air Content Percentage by Volume
10 mm (3/8 in)	6 to 10
13 mm (1/2 in)	5 to 9
19 mm (3/4 in)	4 to 8
25 mm (1 in)	3 1/2 to 6 1/2
40 mm (1 1/2 in)	3 to 6

#### **2.4 BATCHING & MIXING:**

- A. Store, batch, and mix materials as specified in ASTM C94.
  1. Job-Mixed: Concrete mixed at job site shall be mixed in a batch mixer in manner specified for stationary mixers in ASTM C94.
  2. Ready-Mixed: Ready-mixed concrete comply with ASTM C94, except use of non-agitating equipment for transporting concrete to the site will not be permitted. With each load of concrete delivered to project, ready-mixed concrete producer shall furnish, in duplicate, certification as required by ASTM C94.
  3. Mixing structural lightweight concrete: Charge mixer with 2/3 of total mixing water and all of the aggregate. Mix ingredients for not less than 30 seconds in a stationary mixer or not

less than 10 revolutions at mixing speed in a truck mixer. Add remaining mixing water and other ingredients and continue mixing. Above procedure may be modified as recommended by aggregate producer.

## **PART 3 - EXECUTION**

### **3.1 FORMWORK:**

- A. Installation shall conform to ACI 347. Sufficiently tight to hold concrete without leakage, sufficiently braced to withstand vibration of concrete, and to carry, without appreciable deflection, all dead and live loads to which they may be subjected.
- B. Treating and Wetting: Treat or wet contact forms as follows:
  - 1. Coat plywood and board forms with non-staining form sealer. In hot weather cool forms by wetting with cool water just before concrete is placed.
  - 2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather cool metal forms by thoroughly wetting with water just before placing concrete.
  - 3. Use sealer on reused plywood forms as specified for new material.
- C. Inserts, sleeves, and similar items: Flashing reglets, masonry ties, anchors, inserts, wires, hangers, sleeves, boxes for floor hinges and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned and built into construction, and maintained securely in place.
- D. Construction Tolerances:
  - 1. Contractor is responsible for setting and maintaining concrete formwork to assure erection of completed work within tolerances specified to accommodate installation or other rough and finish materials. Remedial work necessary for correcting excessive tolerances is the responsibility of the Contractor. Erected work that exceeds specified tolerance limits shall be remedied or removed and replaced, at no additional cost to the Government.
  - 2. Permissible surface irregularities for various classes of materials are defined as "finishes" in specification sections covering individual materials. They are to be distinguished from tolerances specified which are applicable to surface irregularities of structural elements.

### **3.2 REINFORCEMENT:**

Details of concrete reinforcement, unless otherwise shown, in accordance with ACI 318 and ACI SP-66. Support and securely tie reinforcing steel to prevent displacement during placing of concrete.

### **3.3 PLACING CONCRETE:**

- A. Remove water from excavations before concrete is placed. Remove hardened concrete, debris and other foreign materials from interior of forms, and from inside of mixing and conveying equipment. Obtain approval of COR before placing concrete. Provide screeds at required elevations for concrete slabs.
- B. Before placing new concrete on or against concrete which has set, existing surfaces shall be roughened and cleaned free from all laitance, foreign matter, and loose particles.
- C. Convey concrete from mixer to final place of deposit by method which will prevent segregation or loss of ingredients. Do not deposit in work concrete that has attained its initial set or has contained its water or cement more than 1 1/2 hours. Do not allow concrete to drop freely more than 1500 mm (5 feet) in unexposed work nor more than 900 mm (3 feet) in exposed work. Place and consolidate concrete in horizontal layers not exceeding 300 mm (12 inches) in thickness. Consolidate concrete by spading, rodding, and mechanical vibrator. Do not secure vibrator to forms or reinforcement. Vibration shall be carried on continuously with placing of concrete.
- D. Hot weather placing of concrete: Follow recommendations of ACI 305R to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete.
- E. Cold weather placing of concrete: Follow recommendations of ACI 306R, to prevent freezing of thin sections less than 300 mm (12 inches) and to permit concrete to gain strength properly, except that use of calcium chloride shall not be permitted without written approval from COR.

### **3.4 PROTECTION AND CURING:**

Protect exposed surfaces of concrete from premature drying, wash by rain or running water, wind, mechanical injury, and excessively hot or cold temperature. Curing method shall be subject to approval by COR.

### **3.5 FORM REMOVAL:**

Forms remain in place until concrete has a sufficient strength to carry its own weight and loads supported. Removal of forms at any time is the Contractor's sole responsibility.

### **3.6 SURFACE PREPARATION:**

Immediately after forms have been removed and work has been examined and approved by COR, remove loose materials, and patch all stone pockets, surface honeycomb, or similar deficiencies with cement mortar made with 1 part portland cement and 2 to 3 parts sand.

### **3.7 FINISHES:**

- A. Vertical and Overhead Surface Finishes:

1. Exterior Exposed Areas (finished): Finished areas, unless otherwise shown, shall be given a grout finish of uniform color and shall have a smooth finish treated as follows:
  - a. After concrete has hardened and laitance, fins and burrs have been removed, scrub concrete with wire brushes. Clean stained concrete surfaces by use of a hone or stone.
  - b. Apply grout composed of 1 part portland cement and 1 part clean, fine sand (smaller than 600 micro-m (No. 30) sieve). Work grout into surface of concrete with cork floats or fiber brushes until all pits and honeycomb are filled.
  - c. After grout has hardened, but still plastic, remove surplus grout with a sponge rubber float and by rubbing with clean burlap.
  - d. In hot, dry weather use a fog spray to keep grout wet during setting period. Complete finish for any area in same day. Confine limits of finished areas to natural breaks in wall surface. Do not leave grout on concrete surface overnight.

B. Slab Finishes:

1. Floating: Allow water brought to surface by float used for rough finishing to evaporate before surface is again floated or troweled. Do not sprinkle dry cement on surface to absorb water.
2. Float Finish: Ramps, stair treads, and platforms, both interior and exterior, equipment pads, and slabs to receive non-cementitious materials, except as specified, shall be screened and floated to a smooth dense finish. After first floating, while surface is still soft, surfaces shall be checked for alignment using a straightedge or template. Correct high spots by cutting down with a trowel or similar tool and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections on floated finish by rubbing or dry grinding. Refloat the slab to a uniform sandy texture.
3. Broom Finish: Finish all exterior slabs, ramps, and stair treads with a bristle brush moistened with clear water after the surfaces have been floated.
4. Finished slab flatness (FF) and levelness (FL) values comply with the following minimum requirements:

Slab on grade & Shored suspended slabs	Unshored suspended slabs
Specified overall value $F_F$ 25/ $F_L$ 20	Specified overall value $F_F$ 25
Minimum local value $F_F$ 17/ $F_L$ 15	Minimum local value $F_F$ 17

--- E N D ---

**SECTION 31 20 11  
EARTH MOVING (SHORT FORM)**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the requirements for furnishing all equipment, materials, labor and techniques for earthwork including excavation, fill, backfill and site restoration utilizing fertilizer, seed and/or sod.

**1.2 DEFINITIONS**

- A. Unsuitable Materials:
1. Fills: Topsoil, frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 75 mm (3 inches); organic materials, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable.
  2. Existing Subgrade (except footings): Same materials as above paragraph, that are not capable of direct support of slabs, pavement, and similar items, with the possible exception of improvement by compaction, proof rolling, or similar methods of improvement.
  3. Existing Subgrade (footings only): Same as Paragraph 1, but no fill or backfill. If materials differ from // reference borings and // design requirements, excavate to acceptable strata subject to Resident Engineer's approval.
- B. Earthwork: Earthwork operations required within the new construction area. It also includes earthwork required for auxiliary structures and buildings and sewer and other trench work throughout the job site.
- C. Degree of Compaction: Degree of compaction is expressed as a percentage of maximum density obtained by the test procedure presented in ASTM D1557.
- D. The term fill means fill or backfill as appropriate.

**1.3 RELATED WORK**

- A. Safety Requirements: Section 01 00 00, GENERAL REQUIREMENTS, Article, ACCIDENT PREVENTION.
- B. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.
- C. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.



## **PART 3 - EXECUTION**

### **3.1 SITE PREPARATION**

- A. Stripping Topsoil: Unless otherwise indicated on the drawings, the limits of earthwork operations shall extend anywhere the existing grade is filled or cut or where construction operations have compacted or otherwise disturbed the existing grade or turf. Strip topsoil as defined herein, or as indicated in the geotechnical report, from within the limits of earthwork operations as specified above unless specifically indicated or specified elsewhere in the specifications or shown on the drawings. Topsoil shall be fertile, friable, natural topsoil of loamy character and characteristic of the locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by the Resident Engineer. Eliminate foreign material, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials, larger than 0.014 m<sup>3</sup> (1/2 cubic foot) in volume, from soil as it is stockpiled. Retain topsoil on the station. Remove foreign materials larger than 50 mm (2 inches) in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work, shall not, under any circumstances, be carried out when the soil is wet so that the tilth of the soil will be destroyed.
- B. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

### **3.2 EXCAVATION**

- A. Shoring, Sheet piling and Bracing: Shore, brace, or slope to its angle of repose banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities, in compliance with OSHA requirements.
1. Extend shoring and bracing to the bottom of the excavation. Shore excavations that are carried below the elevations of adjacent existing foundations.
- B. Trench Earthwork:
1. Utility trenches (except sanitary and storm sewer):
    - a. Excavate to a width as necessary for sheet piling and bracing and proper performance of the work.
    - b. Grade bottom of trenches with bell-holes, scooped-out to provide a uniform bearing.
    - c. Support piping on undisturbed earth unless a mechanical support is shown.
    - d. The length of open trench in advance of pipe laying shall not be greater than is authorized by the Resident Engineer.

- C. Site Earthwork: Excavation shall be accomplished as required by drawings and specifications. Remove subgrade materials that are determined by the COR as unsuitable, and replace with acceptable material. /
- D. Finished elevation of subgrade shall be as follows:
  - 1. Pavement Areas - bottom of the pavement or base course as applicable.
  - 2. Planting and Lawn Areas - 100 mm (4 inches) below the finished grade, unless otherwise specified or indicated on the drawings.

### **3.3 FILLING AND BACKFILLING**

- A. General: Do not fill or backfill until all debris, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from the excavation. Proof-roll exposed subgrades with a fully loaded dump truck. Use excavated materials or borrow for fill and backfill, as applicable. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or dampproofing applied, and pipes coming in contact with backfill have been installed, and inspected and approved by Resident Engineer.
- B. Proof-rolling Existing Subgrade: Proof-roll with a fully loaded dump truck. Make a minimum of one pass in each direction. Remove unstable uncompactable material and replace with granular fill material completed to mix requirements specified.
- C. Placing: Place material in horizontal layers not exceeding 200 mm (8 inches) in loose depth and then compacted. Do not place material on surfaces that are muddy, frozen, or contain frost.
- D. Compaction: Use approved equipment (hand or mechanical) well suited to the type of material 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 layer to not less than 95 percent of the maximum density determined in accordance with the following test method ASTM D1557 Method A.

### **3.4 GRADING**

- A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.
- B. Place crushed stone or gravel fill under concrete slabs on grade tamped and leveled. The thickness of the fill shall be 150 mm (6 inches), unless otherwise indicated.

### **3.5 LAWN AREAS**

- A. General: Harrow and till to a depth of 100 mm (4 inches), new or existing lawn areas to remain, which are disturbed during construction. Establish existing or design grades by dragging or similar operations. Do not carry out lawn areas earthwork out when the soil is wet so that the tilth of the soil will be destroyed. Plant bed must be approved by Resident Engineer before seeding or sodding operation begins.
- B. Sodding: Topsoil shall be firmed by rolling and during periods of high temperature the topsoil shall be watered lightly immediately prior to laying sod. Sod strips shall be tightly butted at the ends and staggered in a running bond fashion. Placement on slopes shall be from the bottom to top of slope with sod strips running across slope. Secure sodded slopes by pegging or other approved methods. Roll sodded area with a roller not to exceed 225 kg/m (150 pounds per foot) of the roller width to improve contact of sod with the soil.
- F. Watering: Contact the COR immediately after sod installation is complete. The Cemetery staff will be responsible for watering.

### **3.6 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL**

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Cemetery property.
- //A. Disposal: Transport surplus satisfactory soil to designated storage areas on Cemetery property. Stockpile or spread soil as directed by Resident Engineer.
  - 1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Cemetery property.
- B. Place excess excavated materials suitable for fill and/or backfill on site where directed.
- C. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.
- D. Segregate all excavated contaminated soil designated by the Resident Engineer from all other excavated soils, and stockpile on site on two 0.15 mm (6 mil) polyethylene sheets with a polyethylene cover. A designated area shall be selected for this purpose. Dispose of excavated contaminated material in accordance with State and Local requirements.

### **3.6 CLEAN-UP**

Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove debris, rubbish, and excess material from the Cemetery Property.

--- E N D ---

**SECTION 33 10 00  
WATER UTILITIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Water distribution system complete, ready for operation, including all appurtenant structures, and connections to existing potable water supply.

**1.2 RELATED WORK**

- A. Maintenance of Existing Utilities: Section 01 00 00, GENERAL REQUIREMENTS.
- B. Excavation, trench widths, pipe bedding, backfill, shoring, sheeting, bracing: Section 31 20 00, EARTH MOVING.
- C. Concrete: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- E. Post Hydrant Assemblies: Section 32 30 01, SITE FURNISHINGS.

**1.3 DEFINITIONS**

- A. Water Distribution: Pipelines and appurtenances which are part of the distribution system. The distribution system comprises the network of piping located throughout the site, as applicable, that provides water from the potable water supply source for the project, including hydrants, valves, and other appurtenances used to supply water for domestic purposes.
- B. Water Service Line: Pipe line connecting building piping to water distribution lines.

**1.4 QUALITY ASSURANCE**

- A. Products Criteria:
  - 1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units shall be product of one manufacturer.
  - 2. Nameplate: Nameplate bearing manufacturer's name or identifiable trademark securely affixed in a conspicuous place on equipment or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- B. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to Public Water lines and the extension, and/or modifications to Public Utility systems.
- C. All material surfaces in contact with potable water shall comply with NSF 61.

**1.5 SUBMITTALS**

2. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturers' Literature and Data (Submit all items as one package):

(Ductile Iron Pipe (D.I.P.) and Polyvinyl Chloride (PVC) shall be in accordance with AWWA C600 and C605 respectively.)

- 1. Piping.
- 2. Fittings
- 3. Gaskets.
- 4. Valves.
- 5. Post hydrants.
- 6. Valve boxes.
- 7. Corporation and curb stops.
- 8. Joint restraint.
- 9. Disinfection products.
- 10. Warning Tape
- 11. Link/sleeve seals.

C. Testing Certifications:

- 1. Hydrostatic Testing.
- 2. Certification of Disinfection, including free chlorine residuals, and bacteriological examinations.

**1.6 APPLICABLE PUBLICATIONS**

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

B. American National Standards Institute (ANSI/ASME):

B16.1-2005 ..... Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800

B16.18-2001 ..... Cast Copper Alloy Solder Joint Pressure Fittings

B16.26-2006 ..... Cast Copper Alloy Fittings for Flared Copper Tubes

B40.100-2005 ..... Pressure Gauges and Gauge Attachments

C. American Society of Mechanical Engineers (ASME):

B18.5.2.1M - 2006 Metric Round Head Short Square Neck Bolts

B18.5.2.2M - 1982 Metric Round Head Square Neck Bolts

B18.2.2 - 1987 Square and Hex Nuts

D. American Society for Testing and Materials (ASTM):

A47/A47M - 99(2004)Standard Specification for Ferritic Malleable Iron Castings

A48/A48M - 03(2008)Standard Specification for Gray Iron Castings

A123/A123M-08.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A148M/A148M-08 .....Standard Specifications for Steel Castings

A242/A242M-04e1 .....Standard Specifications for High Strength Low Alloy Structural  
Steel AASHTO No. M161

A307/A307-07b .....Standard Specifications for Carbon Steel Bolts and Studs, 415  
MPa (60,000 psi) Tensile Strength

A536-84(2004)e1 .....Standard Specifications for Ductile Iron Castings

A563M – 07 .....Standard Specification for Carbon and Alloy Steel Nuts [Metric]

B42-02e1 .....Standard Specification for Seamless Copper Pipe, Standard  
Sizes

B61-08 .....Standard Specifications for Steam or Valve Bronze Castings

B62-02 .....Standard Specifications for Composition Bronze or Ounce Metal  
Castings

B88-03 .....Standard Specifications for Seamless Copper Water Tube

B117-07a.....Standard Practice for Operating Salt Spray (Fog) Apparatus

B-633-07 .....Standard Specification for Electrodeposited Coatings of Zinc on  
Iron and Steel

C94/C94M-09 .....Standard Specification for Ready-Mixed Concrete

D1784-08 .....Standard Specifications for Rigid PVC Compounds and CPVC  
Compounds

D1785-06 .....Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic  
Pipe, Schedules 40, 80, and 120

D2241-05 .....Standard Specification for Poly(Vinyl Chloride) (PVC)  
Pressure-Rated Pipe (SDR Series)

D2464-06 .....Standard Specifications for Threaded PVC Pipe Fittings,  
Schedule 80

D2466-06 .....Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic  
Pipe Fittings, Schedule 40

- D2467-06 ..... Standard Specifications for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
- D2564-04e1 ..... Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
- D2855-96(2002)..... Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
- D3139-98(2005)..... Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
- D4101-08 ..... Standard Specification for Polypropylene Injection and Extrusion Materials
- F441/F441M-02(2008) ..... Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
- F477-08 ..... Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- F593-02(2008) ..... Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
- F1674-05 ..... Standard Test Method for Joint Restraint Products for Use With PVC Pipe
- E. American Water Works Association (AWWA):
  - B300-04 ..... Hypochlorites
  - B301-04 ..... Liquid Chlorine
  - C104/A21.4-08 ..... Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
  - C105/A21.5-05 ..... Polyethylene Encasement for Gray and Ductile C.I. Piping for Water and Other Liquids
  - C110/A21.10-08 ..... Ductile-Iron and Gray-Iron Fittings, 80 mm Through 1200 mm (3 Inches Through 48 Inches) for Water and Other Liquids
  - C111/A21.11-07 ..... Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
  - C115/A21.15-05 ..... Flanged Ductile-Iron and Gray-Iron Pipe with Threaded Flanges
  - C150/A21.50-08 ..... American National Standard for Thickness Design of Ductile Iron Pipe

- C151/A21.51-02 .....Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
- C153/A21.53-06 .....Ductile-Iron Compact Fittings, 80 mm Through 300 mm (3 inches Through 12 inches) for Water and Other Liquids
- C200-05 .....Steel Water Pipe - 150 mm (6 in.) and Larger
- C206-03 .....Field Welding of Steel Water Pipe
- C207-07 .....Standard for Steel Pipe Flanges for Waterworks Service-Sizes 100 mm Through 3600 mm (4 in. through 144 in.)
- C208-07 .....Standard for Dimensions for Fabricated Steel Water Pipe Fittings
- C209-06 .....Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections and Fitting for Steel Water Pipe
- C210-07 .....Standard for Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
- C500-02 .....Metal-Seated Gate Valves for Water Supply Service
- C503-05 .....Wet-Barrel Fire Hydrants
- C509-01 .....Resilient Seated Gate Valve for Water Supply Service
- C550-05 .....Standard for Protective Interior Coatings for Valves and Hydrants
- C600-05 .....Installation of Ductile-Iron Water Mains and Their Appurtenances
- C605-05 .....Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
- C651-05 .....Standard for Disinfecting Water Mains
- C800-05 .....Underground Service Line Valves and Fittings
- C900-07 .....Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 100 mm Through 300mm (4 inches Through 12 inches), for Water Distribution
- C901-02 .....Polyethylene (PE) Pressure Pipe and Tubing, 13mm Through 76mm (1/2 inch Through 3 inch.), for Water Service
- C906-07 .....Polyethylene (PE) Pressure Pipe and Fittings, 100 mm (4 inches)through 1,600 mm (63 inches) for Water Distribution and Transmission

WATER UTILITIES

- D2000-08 .....Standard Classification System for Rubber Products in Automotive Applications
- F593-02(2008) .....Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
- M11-04.....Manual: Steel Pipe: A Guide for Design and Installation
- M23-02.....Manual: PVC Pipe - Design and Installation
- F. NSF International:
  - 14-03 .....Plastics Piping Components and Related Materials
  - 61-02 .....Drinking Water System Components-Health Effects (Sections 1-9)
- G. American Welding Society (AWS):
  - A5.8-04 .....Brazing Filler Metal
- H. UNI-BELL PVC PIPE ASSOCIATION (UBPPA)
  - UNI-B-8(2000).....Recommended Practice for the Direct Tapping of Polyvinyl Chloride (PVC) Pressure Water Pipe (Nominal Diameters 150 mm – 300 mm (6-12 Inch)
- I. Foundation for Cross-Connection Control and Hydraulic Research-2009

**PART 2 - PRODUCTS**

**2.1 DUCTILE IRON PIPE AND FITTINGS**

- A. Ductile iron pipe, direct buried:
  1. Provide ductile iron pipe and fittings conforming to the requirements of AWWA C151, Pressure Class 350 for Pipe 100 mm through 300 mm (4 inches through 12 inches) in diameter with double thickness cement mortar lining interior, and interior asphaltic seal coat and exterior asphaltic coating, in accordance with AWWA and ANSI Standards.
  2. Below Grade: Supply pipe in lengths not in excess of a nominal 6 m (20 feet) with rubber ring type push-on joints, mechanical joint or approved restrained joint. Provide mechanical and restrained joint pipe with sufficient quantities of accessories as required for each joint.
  3. When a polyethylene encasement over pipe, fittings, and valves is a requirement as indicated on the drawings, the material, installation and workmanship shall conform to applicable sections of AWWA C105. Make provisions to keep the polyethylene from direct exposure to sunlight prior to installation. Backfill following installation without delay to avoid exposure to sunlight.

## **2.2 POLYVINYL CHLORIDE PIPE AND FITTINGS**

- A. Class-Rated Polyvinyl Chloride (PVC) Pipe: Pipe and accessories shall bear the NSF mark indicating pipe size, manufacturer's name, AWWA and/or ASTM Specification number, working pressure and production code.
  - 1. PVC pipe and accessories 100 mm to 350 mm (4 inches–14 inches) in diameter, AWWA C900 “Polyvinyl Chloride (PVC) Pressure Pipe”, Class 200, DR 14, cast iron outside diameters, unless otherwise shown or specified.
  - 2. PVC Pipe and Accessories Smaller than 100 mm (4 inches): Schedule 80, meeting the requirements of ASTM D-1785, Type 1, Grade 1.
- B. Joints:
  - 1. Pipe 75 mm (3 inches) and Greater in Diameter: Push-on type with factory installed solid cross section elastomeric ring meeting the requirements of ASTM F-477.
  - 2. Pipe Less Than 75 mm (3 inches) in Diameter: Threaded (ASTM D-2464) or solvent welded (ASTM 2467). Use Teflon tape or liquid Teflon thread lubricant approved for use on plastic on all threaded joints.
- C. Fittings: All joints at changes in direction and/or reduction in pipe size for:
  - 1. Class-Rated Pipe 75 mm (3 inches) in Diameter and Greater: Ductile iron with mechanical joints conforming to the requirements of AWWA C153. Mechanical joint fittings shall include retainer glands, unless otherwise noted. Fittings shall be Harco push-on joint deep bell ductile iron fittings (or approved equal) with Harco knuckle joint restraints (or approved equal).
  - 2. For Schedule 80 Pipe less than 75 mm (3 inches) in Diameter: Threaded or solvent weld. Threaded PVC fittings shall conform to ASTM D2464. CPVC fittings shall conform to ASTM F437 for threaded fittings and ASTM F439 for solvent weld fittings.

## **2.3 MECHANICAL JOINT RETAINER GLANDS**

- A. Restraint devices for mechanical joint fittings and appurtenances conforming to either ANSI/AWWA C111/A21.11 or ANSI/AWWA C153/A21.53, shall conform to the following:
  - 1. Restraint devices for nominal pipe sizes 75 mm (3 inch) through 900 mm (36 inch) shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10.

2. The devices shall have a working pressure rating equal to that of the pipe on which it is used. Ratings are for water pressure and must include a minimum safety factor of 2:1 in all sizes.
3. Gland body, wedges and wedge actuating components shall be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536. Ductile iron gripping wedges shall be heat treated within a range of 370 to 470 BHN.
4. An identification number consisting of year, day, plant and shift (YYDDD) (plant designation) (Shift number), shall be cast into each gland body. All physical and chemical test results shall be recorded such that they can be accessed via the identification number on the casting. All components shall be manufactured in the United States.
5. Mechanical Joint restraint shall require conventional tools and installation procedures per AWWA C600, while retaining full mechanical joint deflection during assembly. Proper actuation of the gripping wedges shall be ensured with torque limiting twist off nuts.
6. MJ restraints shall be listed by Underwriters Laboratories, and approved by Factory Mutual in the 75 mm (3 inch) through 300 mm (12 inch) sizes.
7. All casting bodies shall be surface pretreated with a phosphate wash, rinse and sealer before drying. The coating shall be electrostatically applied and heat cured. The coating shall be a polyester based powder to provide corrosion, impact and UV resistance.

## 2.4 VALVES

### A. Gate:

1. Unless otherwise specified, valves shall conform to AWWA C509 with mechanical-joint ends. Valves 75 mm (3 inches) and larger shall be resilient seated, ductile iron body, bronze mounted inclined seats, non-rising stem type, turning counter-clockwise to open, with a minimum 1375 kPa (200 pound) WOG. The resilient seat shall be fastened to the gate with stainless steel fasteners or vulcanizing methods. The interior and exterior shall be coated with thermo-setting or fusion epoxy coating in accordance with AWWA C550. Stuffing boxes shall have O-ring stem seals. Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair. Asbestos packing is not allowed.
2. Operator:
  - a. Underground: Except for use with post indicators, furnish valves with 50 mm (2 inch) nut for socket wrench operation.
  - b. Above Ground and in Pits: Hand wheels.
3. Joints: Ends of valves shall accommodate, or be adapted to, pipe installed.

- B. Corporation stops and saddles - Ground key type; bronze, 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, AWWA C800; coupling nut for connection to flared copper tubing, ASME B16.26.

## **2.5 TRACER WIRE FOR NONMETALLIC PIPING**

Provide bare copper or aluminum wire not less than 0.10 inch in diameter in sufficient length to be continuous over each separate run of nonmetallic pipe.

## **2.6 WARNING TAPE**

Standard, 4-Mil polyethylene 75 mm (3 inch) wide tape, // detectable // non-detectable // type, blue with black letters, and imprinted with "CAUTION BURIED WATER LINE BELOW".

## **2.7 VALVE BOX**

- A. Cast iron extension box with screw or slide-type adjustment and flared base. Minimum thickness of metal shall be 5 mm (3/16 inch). Box shall be adapted, without full extension, to depth of cover required over pipe at valve location. Cast the word "WATER" in cover. Provide one (1) "T" handle socket wrenches of 16 mm (5/8 inch) round stock long enough to extend 600 mm (2 feet) above top of deepest valve box. The least diameter of the shaft of the box shall be 133 mm (5 1/4 inches). Cast-iron box shall have a heavy coat of bituminous paint. Valve box and cover shall be installed where indicated on the drawings to be utilized as access points for the tracer wire or detectable warning tape.

## **2.8 POST HYDRANTS**

- A. Hydrant shall be approximately 48-inch depth bury, with 2-inch Horizontal FIP inlet and 2-inch Type D Camlock (female) nozzle outlet. Hydrant shall be designed to accept field-installed grade-change modifications.
  - 1. Hydrant shall be non-freezing and self-draining. Hydrant shall be operated by turning a top-mounted operating nut. Hydrant must seal the drain outlet in all positions from 1/4-open to fully-open.
  - 2. The inlet and the outlet shall be low-lead brass; the operating rod shall be stainless steel. All working parts shall be serviceable from above ground with no digging required. All wear

- parts (o-rings and valve seat) shall be commonly-available dimensions and materials, and none may be of vendor unique design.
3. An anti-vandal locking mechanism shall be provided.
  4. Hydrant shall be designed to break away at grade level in even of significant traffic-type impact with safety flange on barrel.
  5. Outlet nozzle shall be able to point in any of 8-radial directions.
  6. Barrel and fittings exposed to view in the finished work are to be painted in accordance with Section 09 91 00, PAINTING. Exposed hydrant shall not receive the standard tar or asphalt coat on the outside surfaces but shall be shop primed on the outside with one coat of the hydrant manufacturer standard color of rust inhibitive primer or equal. Finished paint color shall be a Dark Green color. Provide COR with color selection for approval in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

## **2.9 SERVICE SADDLE**

- A. The service saddle shall have a ductile iron body per ASTM A536. Construction shall be suitable for a maximum working pressure of 200 psi. The saddle shall have either a wide (greater than 2 inches) single stainless steel strap or have double straps. The saddle shall have an outlet for the service connection that will allow an NPT or AWWA F.I.P. thread to be tapped into it.

## **2.10 PIPE SLEEVES**

- A. Ductile iron or zinc coated steel.

## **2.11 POTABLE WATER**

- A. Water used for filling, flushing, and disinfection of water mains and appurtenances shall conform to Safe Drinking Water Act.

## **2.12 DISINFECTION CHLORINE**

- A. Liquid chlorine shall conform to AWWA B301 and AWWA C651.
- B. Sodium hypochlorite shall conform to AWWA B300 with 5 percent to 15 percent available chlorine.
- C. Calcium hypochlorite shall conform to AWWA B300 supplied in granular form or 5.g tablets, and shall contain 65 percent chlorine by weight.

## **PART 3 - EXECUTION**

### **3.1 PIPE LAYING, GENERAL**

- A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as recommended by the manufacturer to maintain the product performance as if it were undamaged.
- B. All pipe and fittings shall be subjected to a careful inspection just prior to being laid or installed. If any defective piping is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Government. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed or laid, shall conform to the lines and grades required.
- C. All buried piping shall be installed to the lines and grades as shown on the drawings. All underground piping shall slope uniformly between joints where elevations are shown.
- D. Contractor shall exercise extreme care when installing piping to shore up and protect from damage all existing underground water line and power lines, and all existing structures.
- E. Do not lay pipe on unstable material, in wet trench, or when trench or weather conditions are unsuitable.
- F. Do not lay pipe in same trench with other pipes or utilities unless shown otherwise on drawings.
- G. Hold pipe securely in place while joint is being made.
- H. Do not walk on pipes in trenches until covered by layers of earth well tamped in place to a depth of 300 mm (12 inches) over pipe.
- I. Full length of each section of pipe shall rest solidly upon pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipes on wood blocking.
- J. Tees, plugs, caps, bends and hydrants installed on underground pipe shall be anchored. See Section 3.8 "PIPE SUPPORTS".
- K. Close pipe openings with caps or plugs during installation. Tightly cover and protect equipment against dirt, water and chemical, or mechanical injury. At completion of all work, thoroughly clean exposed materials and equipment.
- L. Good alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by the manufacturer.
- M. Warning tape shall be continuously placed 300 mm (12 inches) below finish grade above buried water pipes, or at bottom of subbase where roadways exist, whichever is deeper with overall depth

not exceeding 24 inches. Detectable warning tape shall be locatable by the NCA staff from the finish grade above the pipe, utilizing existing locating equipment, as specified in Paragraph 2.6.

### **3.2 DUCTILE IRON PIPE**

- A. Installing Pipe: Lay pipe in accordance with AWWA C600 //with polyethylene encasement, if required, in accordance with AWWA C105//. Provide a firm even bearing throughout the length of the pipe by tamping selected material at the sides of the pipe up to the spring line.
- B. All pipe shall be sound and clean before laying. When laying is not in progress, the open ends of the pipe shall be closed by watertight plug or other approved means.
- C. When cutting pipe is required, the cutting shall be done by an appropriate industry standard method leaving a smooth cut at right angles to the axis of the pipe. Bevel cut ends of pipe to be used with push-on bell to conform to the manufactured spigot end. Cement lining shall be undamaged /.
- D. Jointing Ductile-Iron Pipe:
  - 1. Push-on joints shall be made in strict accordance with the manufacturer's instruction. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe is to be aligned with the bell of the pipe to which it is joined, and pushed home following industry standard procedures or manufacturer's approved means.
  - 2. Mechanical Joints at Valves, Fittings: Install in strict accordance with AWWA C111. To assemble the joints in the field, thoroughly clean the joint surfaces and rubber gaskets with soapy water before tightening the bolts. Bolts shall be tightened to the specified torque. For new construction, all mechanical joints at valves and fittings shall be secured with an approved mechanical joint retainer glands suitable for the pipe.
  - 3. Ball Joints: Install in strict accordance with the manufacturer's instructions. Where ball joint assemblies occur at the face of structures, the socket end shall be at the structure and ball end assembled to the socket.
  - 4. Flanged joints shall be in accordance with AWWA C115. Flanged joints shall be fitted so that the contact faces bear uniformly on the gasket and then are made up with relatively uniform bolt stress.

### 3.5 PVC PIPE

- A. PVC piping shall be installed in strict accordance with the manufacturer's instructions and AWWA 605. Place selected material and thoroughly compacted to one foot above the top of the pipe and thereafter back filled as specified in Section 31 20 00, EARTH MOVING.
- B. Copper Tracer Wire: Copper tracer wire consisting of No. 14 AWG solid, single conductor, insulated copper wire shall be installed in the trench with all piping to permit location of the pipe with electronic detectors. The wire shall not be spiraled around the pipe nor taped to the pipe. Wire connections are to be made by stripping the insulation from the wire and soldering with rosin core solder. Solder joints shall be wrapped with rubber tape and electrical tape. At least every 300 m (1000 feet), provide a 2.3 kg (5 pound) magnesium anode attached to the main tracer wire by solder. The solder joint shall be wrapped with rubber tape and with electrical tape. An anode shall be attached at the end of each line.

### 3.6 TRACER SYSTEM INSTALLATION

- A. Install with all buried water main piping.
- B. Begin and terminate system at all connections to existing mains.
- C. Install wire continuously along the lower quadrant of the pipe. Do not install wire along the bottom of the pipe. Attach wire to the pipe at the midpoint of each pipe length; use 2-inch wide, 10 mil thickness polyethylene pressure sensitive tape.
- D. Install splices only as authorized by the MSN Engineer. Allow the COR to inspect all below-grade splices of tracer wire prior to backfill.
- E. Install ground rods adjacent to connections to existing piping and at locations ~~shown on plans~~ specified in the contract documents or as directed by the ~~Jurisdictional~~ Engineer.
- F. Bring two wires to the surface at each hydrant designated location within a valve box and cover and terminate with an accessible tracer wire termination.
- G. Final inspection of the tracer system will be conducted at the completion of the project and prior to acceptance by the owner. Verify the electrical continuity of the system. Repair any discontinuities.

### 3.7 RESTRAINED JOINTS

- A. Sections of piping requiring restrained joints shall be constructed using pipe and fittings with restrained "locked-type" joints and the joints shall be capable of holding against withdrawal for

line pressures 50 percent above the normal working pressure but not less than 1375 kPa (200 psi). The pipe and fittings shall be restrained push-on joints or restrained mechanical joints.

- B. The minimum number of restrained joints required for resisting force at fittings and changes in direction of pipe shall be determined from the length of retained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil. Restrained pipe length shall be as shown on the drawings.
- C. Restrained joint assemblies with ductile iron mechanical joint pipe shall be as specified herein in Paragraph 2.3 or approved equal.
- D. Thrust blocks shall be required, unless otherwise noted..
- E. Where ductile iron pipe manufactured with restrained joints is utilized, all restrained joints shall be fully extended and engaged prior to back filling the trench and pressurizing the pipe.
- F. Ductile iron mechanical joint fittings used with PVC pipe shall be restrained with the specified Mechanical Joint Restrainer Gland, or approved equal.

### **3.8 PIPE SEPARATION**

- A. Horizontal Separation-Water Mains and Sewers:
  - 1. Water mains shall be located at least 3 m (10 feet) horizontally from any proposed drain, storm sewer, sanitary or sewer service connection.
  - 2. Water mains may be located closer than 3 m (10 feet) to a sewer line when:
    - a. Local conditions prevent a lateral separation of 3 m (10 feet); and
    - b. The water main invert is at least 450 mm (18 inches) above the crown of the sewer; and
    - c. The water main is either in a separate trench or in the same trench on an undisturbed earth shelf located one side of the sewer.
  - 3. When it is impossible to meet (1) or (2) above, both the water main and drain or sewer shall be constructed of mechanical joint ductile iron pipe. Ductile iron pipe shall comply with the requirements listed in this specification section. The drain or sewer shall be pressure tested to the maximum expected surcharge head before back filling.
- B. Vertical Separation-Water Mains and Sewers:
  - 1. A water main shall be separated from a sewer so that its invert is a minimum of 450 mm (18 inches) above the crown of the drain or sewer whenever water mains cross storm sewers, sanitary sewers or sewer service connections. The vertical separation shall be maintained for that portion of the water main located within 10 feet horizontally of any sewer or drain

- crossed. A length of water main pipe shall be centered over the sewer to be crossed with joints equidistant from the sewer or drain.
2. Both the water main and sewer shall be constructed of slip-on or mechanical joint ductile iron pipe or PVC pipe equivalent to water main standards of construction when:
    - a. It is impossible to obtain the proper vertical separations described in (1) above; or
    - b. The water main passes under a sewer or drain.
  3. A vertical separation of 450 mm (18 inches) between the invert of the sewer or drain and the crown of the water main shall be maintained where a water main crosses under a sewer. Support the sewer or drain lines to prevent settling and breaking the water main.
  4. Construction shall extend on each side of the crossing until the perpendicular distance from the water main to the sewer or drain line is at least 3 m (10 feet).

### **3.9 SETTING OF VALVES AND BOXES**

- A. Provide a surface concrete pad 450 by 450 by 150 mm (18 by 18 by 6 inches) to protect valve box when valve is not located below pavement.
- B. Clean valve and curb stops interior before installation.
- C. Set valve and curb stop box cover flush with finished grade.
- D. Set curb stop box and cover for access to identification wire and/or detectable warning tape with a 300 by 300 by 75 mm (12 by 12 by 3 inches) at approximately the depth of the warning tape and bring the tape and/or identification wire into the box and coil extra length sufficient to allow the tape or wire to be uncoiled and extended 1500 mm (5 feet) above finish grade at the location.
- E. Valves shall be installed plumb and level and in accordance with manufacturer's recommendations.

### **3.10 SETTING OF POST HYDRANTS**

- A. Set center of each hydrant not less than 6 feet nor more than 7 feet back of edge of road or face of curb. Apparatus connection shall face away from the road. Set traffic flange not less than 2 inches nor more than 4 inches above finished grade.
- B. Set each hydrant within layer of mulch not less than 2 inches thick and 24 inches in diameter.
- C. Set bases in not less than 1/2 cubic yard of crushed rock or gravel placed entirely below hydrant drainage device.
- D. Clean interiors of hydrants of all foreign matter before installation.

### 3.11 PIPE SLEEVES

Install where water lines pass under roads. Seal with modular mechanical type link seal. Install piping so that no joint occurs within a sleeve.

### 3.12 FLUSHING AND DISINFECTING

- A. Flush and disinfect new water lines in accordance with AWWA C651.
- B. Initial flushing shall obtain a minimum velocity in the main of 0.75 m/sec (2.5 feet per second) at 275kPa (40 psi) residual pressure in water main. The duration of the flushing shall be adequate to remove all particles from the line.

Pipe Diameter		Flow Required to Produce 76 cm/sec (2.5 ft/sec)(approx.) Velocity in Main		Number of Hydrant Outlets			
				Size of Tap. mm (in.)			
mm	(In)			L/sec	(gpm)	25(1)	38 (1 ½)
				Number of taps on pipe			
100	(4)	6.3	(100)	1	--	--	1
150	(6)	12.6	(200)	--	1	--	1
200	(8)	25.2	(400)	--	2	1	1
250	(10)	37.9	(600)	--	3	2	1
300	(12)	56.8	(900)	--	--	3	2
400	(16)	100.9	(1600)	--	--	4	2

The backflow preventers shall not be in place during the flushing.

- C. The Contractor shall be responsible to provide the water source for filling, flushing, and disinfecting the lines. Only potable water shall be used, and the Contractor shall provide all required temporary pumps, storage facilities required to complete the specified flushing, and disinfection operations.
- D. The Contractor shall be responsible for the disposal of all water used to flush and disinfect the system in accordance with all governing rules and regulations. The discharge water shall not be allowed to create a nuisance for activities occurring on or adjacent to the site.
- E. The bacteriological test specified in AWWA C651 shall be performed by a laboratory approved by the // Health Department // Department of Environmental Quality // of the State. The cost of sampling, transportation, and testing shall be the responsibility of the Contractor.
- F. Re-disinfection and bacteriological testing of failed sections of the system shall be the sole responsibility of the Contractor.
- G. Before backflow preventers are installed, all upstream piping shall be thoroughly flushed.

### **3.13 HYDROSTATIC TESTING**

- A. Hydrostatic testing of the system shall occur prior to disinfecting the system.
- B. After new system is installed, except for connections to existing system and building, backfill at least 300 mm (12 inches) above pipe barrel, leaving joints exposed. The depth of the backfill shall be adequate to prevent the horizontal and vertical movement of the pipe during testing.
- C. Prior to pressurizing the line, all joint restraints shall be completely installed and inspected.
- D. If the system is tested in sections, and at the temporary caps at connections to the existing system and buildings, the Contractor shall provide and install all required temporary thrust restraints required to safely conduct the test.
- E. The Contractor shall install corporation stops in the line as required to purge the air out of the system. At the completion of the test, all corporation stops shall be capped.
- F. The Contractor shall perform pressure and leakage tests for the new system for 2 hours to 200 psi). Leakage shall not exceed the following requirements.
  - 1. Copper Tubing: No leaks.
  - 2. Ductile Iron Pipe: AWWA C600. Provide to MSN Engineer office.
  - 3. Polyvinyl Chloride (PVC) AWWA C605. Provide to MSN Engineer office.

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