



STATE OF TENNESSEE  
**DEPARTMENT OF ENVIRONMENT AND CONSERVATION**  
**DIVISION OF WATER RESOURCES**

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312 Rosa L. Parks Avenue, 11<sup>th</sup> Floor  
Nashville, Tennessee 37243  
PHONE: 615-532-0191 FAX: 615-532-0686

November 20, 2013

Mr. Justin Bowling, PE  
Metro Water Services  
1600 Second Avenue North  
Nashville TN 37208-2206

RE: Metro Water Services (PWSID# 0000494)  
Davidson County  
Project Number WS 13-1165  
Standard Specifications for Water Line Construction

Dear Mr. Bowling:

This letter acknowledges receipt of six copies of standard construction specifications for the Metro Water System. We have reviewed the specifications and found them satisfactory. The specifications have been stamped to indicate our approval. This approval is valid for three years and will expire on November 20, 2016. You must then either resubmit the standard specifications or request in writing for extension of approval.

The approved standard specifications may be referenced on any plans submitted for approval before the expiration date. We are retaining one copy of the standard specifications for our records, and are returning the remaining copies to you. All addenda, revisions or correspondence concerning these specifications should contain the WS Project Number as referenced. If you have any questions contact us at (615) 532-0191.

Very truly yours,

R. William Hench, P.E.  
Drinking Water Engineering  
Division of Water Resources

RWH/ DWS-35

cc: Nashville Field Office – Water Resources

# SPECIFICATIONS

FOR  
STATE APPROVAL  
STANDARD WATER SPECIFICATIONS  
ISSUED BY

THE METROPOLITAN GOVERNMENT OF NASHVILLE AND DAVIDSON COUNTY  
222 THIRD AVENUE NORTH, 6TH FLOOR  
NASHVILLE, TENNESSEE 37201

WS 13 1165



November 8, 2013

METRO WATER SERVICES  
1600 SECOND AVENUE NORTH  
NASHVILLE, TN 37208

TN DEPT OF ENVIRONMENT  
AND CONSERVATION

NOV 13 2013

DIV OF WATER RE-  
RECEIVED



## SECTION 02660 - WATER DISTRIBUTION SYSTEM

### PART 1 - GENERAL

1.1 SUMMARY - Work under this section consists of providing labor, material, equipment, tools, and services required for the furnishing, installation, construction and testing of water mains and appurtenances required. In cases of conflict with these specifications and the drawings, the more stringent conditions shall govern as directed by the Engineer.

### 1.2 RELATED SECTIONS

- A. Section 02222: Excavating
- B. Section 02223: Backfilling
- C. Section 03300: Concrete

### 1.3 UNIT PRICES

#### A. Water Mains Outside and Inside Roadway

1. Measurement for payment of water mains shall be made at the unit price per linear foot named in the Contract. The quantity to be paid shall be the actual number of linear feet furnished and laid, by sizes and classes, as required. Measurement shall be made horizontally along the centerline of the pipe in place, including valves, bends, reducers, offsets and branches. Where water mains intersect and/or connect, measurement shall be made from the point of intersection of the centers of the two lines.
2. The unit price bid shall cover the cost of excavating, furnishing, installing, cutting, laying, jointing, incidental materials, making of end connections, testing, disinfection, and labor required to complete the work.
3. Unit price bid shall include the cost of all excavation, blocking, crushed stone bedding and envelope and backfill necessary for the complete installation of the water main and appurtenances; and no separate payment shall be allowed.
4. In traversing dips, rises, and/or avoidance of underground obstructions and it becomes necessary for the Contractor to dig the trench deeper than the required minimum depth; the Contractor shall attain the necessary additional depth at no additional cost and the cost of the work shall be merged in the unit price bid.

#### B. Fittings

1. Unless specifically included as a bid item on the bid form, the cost for all fittings, whether shown on the plans or not, shall be included in the unit price bid for water mains. No separate measurement or payment will be made.
2. No separate payment shall be made for blocking or rodding of either new or existing water mains to complete the work.

C. Cutting and Capping Existing Water Mains - Payment for cutting and capping existing water mains will be made at the unit price bid per each as named in the Contract. The quantity to be paid for will be the actual number of mains cut and capped complete, including fittings,

excavation, and backfill. No separate payment will be made for excavation, backfill, rodding or blocking.

D. Water Service Lines

1. Measurement for payment of water service lines shall be made at the unit price bid per linear foot for each size named in the Contract as specified. The quantity to be paid shall be the actual number of linear feet for each size of water service line installed. Measurement shall be made from the corporation stop of the new water main to the curb stop in the proposed location of the meter box.
2. The price per linear foot shall include all excavation, backfill, copper pipe, fittings, labor and materials necessary for installation of the water service line from the corporation stop on the new main to the curb stop at the proposed location of the meter box or to a point of connection with a satisfactory existing service line.
3. Separate payment shall be allowed for the connection of service lines to the new water main as detailed in item Tap and Connection to Water Main and/or Service Line.

E. New Tap and Connection to Water Main and/or Service Line

1. The unit price bid shall include any or all of the four types of connections listed in Paragraph 3.1C, and all labor and materials that are necessary for a complete water main and/or water service line connection. The unit price shall include disconnecting and plugging the existing main and/or service from the water main to be abandoned. Only one connection shall be paid for each individual service line set.
2. Separate payment shall be allowed for new service line installation in excess of 2 feet.

F. Water Meter Boxes

1. Measurement for payment of water meter boxes shall be made at the unit price per each named in the Contract. The quantity to be paid shall be the actual number of each size of new/or rebuilt water meter boxes installed. The unit price bid shall include excavation, brick sidewalls, frame and cover, backfill, and labor and materials for a complete installation. Where an existing meter box is to be rebuilt, it shall also include the cost of removing the existing meter box.

G. Valves, Valve Boxes, and Valve Vaults

1. Valves, tapping sleeves, blow-off valve assemblies, and air-relief valve assemblies will be paid for at the unit price per each as named in the Contract. The quantity to be paid shall be the actual number of valves of each kind installed complete with valve box, frame and cover, and appurtenances.

H. Fire Hydrants

1. Payment for furnishing and installing fire hydrant assemblies shall be made at the Contract unit price for each unit installed. The unit price shall cover all costs for materials, equipment and labor, fire hydrant, excavation, backfill, concrete or stone blocking, rodding, testing and appurtenances necessary for the complete installation of the fire hydrant assembly.

2. The unit price shall not include ductile iron pipe, ductile iron fittings, tapping valves and sleeves, valves and valve boxes, pavement replacement, and/or other units of work specifically set out in the Contract, but they shall be paid separately under other items listed.

I. Miscellaneous Concrete - Miscellaneous concrete shall be paid at the unit price bid named in the Contract based on the calculated quantities. This shall not include standard concrete blocking.

J. Undercutting and Crushed Stone Refill for Water Lines

1. Measurement of undercutting and crushed stone refill made for the construction of water lines shall be computed from the formula: trench depth x trench width x trench length = allowable volume for payment expressed in cubic yards. Each dimension shall be as defined below:
2. Trench depth for refill shall equal the vertical centerline depth from a point 6 inches below the pipe installed to the bottom of the trench ordered by the Engineer.
3. Trench length shall equal the actual horizontal measurement along the centerline of the trench less the allowable horizontal dimensions of valve boxes and other appurtenances as specified below:
4. Where use of crushed stone refill is directed by the Engineer, it shall be paid per cubic yard of refill placed. No payment shall be allowed for gravel refill placed at the discretion of the Contractor and not at the direction of the Engineer.
5. Crushed stone bedding 6 inches below the pipe and gravel backfilling to 8 inches above the pipe shall not be measured for payment under this unit of work, but it shall be merged in the unit prices for other units of work of this Contract and no separate payment shall be allowed.

K. Trench Width Dependant Items - Payment for all items dependant on the trench width such as flowable fill, binder, pavement, undercutting and refill, etc., shall be measured using the following table and no separate payment will be allowed for exceeding the allowable trench widths:

<u>Pipe Size</u>	<u>Trench Width</u>
12-inch pipe and smaller	2.5 feet
16-inch pipe	3 feet
18-inch pipe	3 feet
24-inch pipe	4 feet
36-inch pipe	5 feet

## 1.4 REFERENCE STANDARDS

### A. American Water Works Association (AWWA):

- C500 Gate Valves 3" through 48" for Water and Sewerage System
- C502 Dry-Barrel Fire Hydrants
- C600 Installation of Ductile Iron Water Mains
- C651 Disinfecting Water Mains
- C800 Underground Service Line Valves and Fittings

### B. American National Standards Institute (ANSI):

- A-21.4 Cement Mortar Lining for Ductile Iron and Gray Iron Pipe and Fittings for Water.
- A-21.10 Ductile Iron and Gray Iron Fittings, 3"-48" for Water and Other Liquids
- A-21.11 Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe Fittings
- A-21.51 Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids

### C. American Society of Testing Materials (ASTM):

- A-47 Malleable Iron Castings
- A-48 Gray Iron Castings
- B-88 Seamless Copper Water Tube
- D-1784 Rigid Poly (Vinyl Chloride) Compounds and Chlorinated Poly (Vinyl Chloride) Compounds
- D-2241 Poly Vinyl Chloride (PVC) Plastic Pipe (SDR-PR)
- D-2666 Polybutylene (PB) Plastic Pipe
- D-3139 Joints for Plastic Pressure Pipe Using Flexible Elastomeric Seals
- E8-69 Tension Testing of Metallic Materials

### D. Southern Standard Building Code

1. When materials and methods are indicated in these specifications as being in conformance with a standard specification, it shall refer to the latest edition of the specifications and include all interim revisions.
2. Listing of a standard specification without further reference indicates that the particular materials or method shall conform to such listed specification.

## 1.5 SUBMITTALS

A. Shop Drawings - The Contractor shall submit, for approval from the Engineer, descriptive details and shop drawings covering full details of pipe, fittings, specials valves, tapping sleeves and valves, fire hydrants, joints and assemblies, joint materials, and cuts of all castings to be incorporated within the work under this Contract.

## B. Test Requirements

1. Section 01410 requiring the inspection and testing of materials shall be a part by reference of these specifications. The required tests shall be performed by an independent testing laboratory, selected by the Contractor and approved by the Engineer. The required test shall be at the expense of the Contractor and no separate payment will be allowed.
2. Materials to be incorporated in the construction of water mains and appurtenances required under this Contract shall be subject to inspections and tests as follows:
  - a. Ductile Iron Water Pipe and Fittings - The pipe manufacturer shall furnish the Engineer with certificates of inspection.
  - b. Concrete
    - 1) For each separate class of concrete of 25 cubic yards placed, 2 standard 6-inch concrete cylinders shall be made and tested.
    - 2) The cylinders of each set shall be molded from the same sample of concrete and tested at 7 and 28 days.
    - 3) Sampling of concrete for test purposes shall be per ASTM C-172. Testing of specimens shall be per ASTM C-39.
  - c. Miscellaneous Materials
    - 1) All material used on this project shall be visually inspected by the Engineer at the site for conformance to the required specifications.
    - 2) Where reasonable doubt exists that material fails to meet the specifications, the Engineer may require certified mill tests, samples, and/or tests by independent laboratory or other suitable forms of verification that the material meets the required specifications.

## 1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Materials delivered to the site shall be inspected for damage, unloaded, and stored with the minimum handling. The Contractor shall store materials on site in enclosures or under protective coverings and above ground. The Contractor shall keep the interiors of pipes and fittings free of dirt and debris.

B. The Contractor shall handle pipes, fittings, valves, hydrants and other accessories to insure delivery to the point of installation in sound undamaged condition. If coatings or linings of pipes or fittings are damaged, the pipes or fittings shall be removed from the site and new materials furnished at no extra cost.

## PART 2 - PRODUCTS

### 2.1 General

A. Material and equipment shall be furnished by an established and reputable manufacturer or supplier as listed on MWS Approved Material List. Material and equipment shall be new and made with first-class ingredients and construction. Material and equipment shall be designed and guaranteed to perform the service required and conform to the specifications. Material and equipment shall be the product of the listed manufacturer or an Engineer approved equal.

B. All Pipe, pipe fittings, plumbing fittings, and fixtures including, but not limited to, coated or uncoated brass or bronze materials that could come in contact with drinking water shall be in accordance with the 2011 Reduction of Lead in Drinking Water Act that amends the Safe Drinking Water Act Section 1417 effective January 4, 2014. The following internet link provides further clarification and direction on the requirement: <http://nepis.epa.gov/Adobe/PDF/P100GRDZ.pdf>

## 2.2 Materials

### A. Pipe and Fittings

#### 1. Ductile Iron Pipe Sizes 4-inch through 48-inch

- a. Ductile iron pipe shall conform to all requirements of ANSI A21.51 Standards and AWWA C-151.
- b. The pipe shall have joints as specified on the Drawings.
- c. Pipes shall be made of high quality ductile iron and shall meet the requirements and standard specifications for Modular Iron Castings, ASTM Designation, E8-69 - Tension Testing of Metallic Materials (or latest revision).
- d. The length of each piece of pipe shall be normal 18 feet and 20 feet laying lengths.
- e. Ductile iron pipes shall have a pressure class of 350 psi, unless otherwise specified. The pipe class shall be visibly cast or stamped on the outside of pipe.
- f. Certificate of Inspection, List of Pipe Weights, etc: The pipe manufacturer shall furnish the Engineer a certificate of inspection, sworn to by the factory inspector in the presence of a Notary Public, stating that the pieces of pipe making up the shipment were made and tested in accordance with ANSI Specifications A21.51 and that they were subjected to and withstood a hydrostatic pressure of 500 pounds per square inch. Each statement shall include the number of pieces of pipe in the shipment and the length of each piece of pipe making up the shipment.
- g. Cement Mortar Lining: All ductile iron pipe and fittings are to be cement lined at no extra cost, in accordance with ANSI A21.4 (AWWA C-104), or latest revision. Fittings may be epoxy coated. Cement mortar or epoxy coated fittings should have NSF61 approval.
- h. A bituminous seal coat or asphalt emulsion spray coating shall be applied to the cement lining in accordance with the pipe manufacture's standard practice.

#### 2. Ductile Iron Fittings

- a. Fittings shall be mechanical joint ends and mechanical furnished joint and plain end fittings, ductile iron, except as specified and/or indicated on the Contract Drawings.
- b. All ductile iron fittings for sizes 4-inch through 24-inch shall be Class 350 and for sizes 30-inch through 48-inch shall be Class 250 in accordance with ANSI/AWWA C-153-94 or ANSI A21.10 (AWWA Specifications C-110). Fittings shall be furnished complete with glands, gaskets, and bolts.

- c. Fittings shall be cement mortar lined the same as specified for ductile cast iron pipe. Fittings may be epoxy coated. Epoxy coated fittings shall meet or exceed ANSI/AWWA C-550 and C-116/A21.16. Cement mortar or epoxy coated fittings should have NSF61 approval.
- d. Each fitting shall have a notarized statement from the factory inspector furnished to the Engineer stating that the fittings were made in full compliance with the specifications.
3. Ductile Iron Push-on Joint (3" through 48") - Pipe shall be manufactured in accordance with American National Standard Institute (ANSI) A21.511976 and American Water Works Association (AWWA) C151 - 76. Wall Thickness shall be that of Class 52. Pipe Class must be cast or stamped on the outside of pipe permanently and visible. Push-on joint shall be single rubber-gasket joint as described in ANSI A21.11 (AWWA C111). Cement-mortar linings shall be in accordance with ANSI A21.4 (AWWA C104) of latest revision. Coating for use under normal conditions shall be bituminous coating approximately 1 mil thick. The manufacturer shall mark the year in which the pipe was produced and the letters "DI" or "Ductile" shall be cast or stamped on the pipe. Each pipe shall be subjected to a hydrostatic test of not less than 500 psi.
4. Ductile Iron Mechanical Joint (3" through 48") - Pipe shall be manufactured in accordance with American National Standard Institute (ANSI) A21.51 - 1976 and American Water Works Association (AWWA) C151 - 76. Wall Thickness shall be that of Class 52. Mechanical joint shall be gasketed and bolted joint as detailed in ANSI A21.11 (AWWA C111) of latest revision. The mechanical-joint glands shall be cast iron in accordance with ANSI A21.11 of latest revision, and bolts shall conform to the requirements of the same standard. Cement-mortar linings shall be in accordance with ANSI A21.4 (AWWA C104) of latest revision. Coating for use under normal conditions shall be a bituminous coating approximately 1 mil thick. The manufacturer shall mark, the year in which the pipe was produced and the letters "DI" of "Ductile" shall be cast or stamped on the pipe. Each pipe shall be subjected to a hydrostatic test of not less than 500 psi. Water Service Lines - The contractor shall furnish service line pipe, valves, and fittings conforming to MWS Approved Materials List.
5. Mechanical Joint (3" through 48") - Ductile iron mechanical joint fittings shall be manufactured in accordance with ANSI/AWWA C110-77. Rated Working Pressure: Size 3" through 24" = 350 psi and Size 30" through 48" = 250 psi. Mechanical joint shall be gasketed and bolted joint as detailed in ANSI A21.11 (AWWA C111) of latest revision. The mechanical joint glands shall be cast iron or ductile iron in accordance with ANSI A21.11 of latest revision, and bolts shall conform to the requirements of the same standard. Cement Mortar Linings shall be in accordance with ANSI A21.4 (AWWA C104) of latest revision. Coating for use under normal conditions shall be a bituminous coating approximately 1 mil thick. Fittings shall have distinctly cast upon them the manufacturer's identification, pressure rating, nominal diameters of openings and the number of degrees or fraction of the circle on all bends along with the letters "DI" of "Ductile". Mechanical joint ductile iron anchor tees, elbows, couplings and anchor pipe similar to those manufactured by Clow Corporation are approved for use with fire hydrant installations.
- Wall Thickness shall be as follows:  
3-inch diameter = 0.48-inch thickness

4-inch diameter = 0.52-inch thickness  
6-inch diameter = 0.55-inch thickness  
8-inch diameter = 0.60-inch thickness  
10-inch diameter = 0.68-inch thickness  
12-inch diameter = 0.75-inch thickness  
14-inch diameter = 0.66-inch thickness  
16-inch diameter = 0.70-inch thickness  
18-inch diameter = 0.75-inch thickness  
20-inch diameter = 0.80-inch thickness  
24-inch diameter = 0.89-inch thickness  
30-inch diameter = 1.03-inch thickness  
36-inch diameter = 1.15-inch thickness  
42-inch diameter = 1.28-inch thickness  
48-inch diameter = 1.42-inch thickness

#### B. Water Meter Boxes

1. Meter boxes shall be constructed of precast concrete or brick in accordance with the details shown on the Contract Drawings.
2. Brick used in constructing meter boxes shall be grade SW clay brick conforming to the requirements of ASTM C-62 and/or concrete brick Grade N-I, as per ASTM C-55.
3. Cement used in mortar shall be Portland cement conforming to the requirements of ASTM C-150 Type 1.
4. Sand used in mortar shall conform to the requirements of ASTM C-33.
5. Water meter frames and covers shall be made of cast iron and conforming to the details shown on the Contract Drawings and meet the requirements of ASTM A-48, Class 30.
6. Castings shall be made accurately to the required dimensions and shall be sound, smooth, clean and free from blemishes or other defects. Defective castings that have been plugged or otherwise treated to remedy defects shall be rejected. Contact surfaces of frames and covers shall be hand ground so that the covers rest securely in the frames with no rocking. The cover shall be in contact with the frame for the entire perimeter of the contact surface.

#### C. Valves, Valve Boxes, and Valve Vaults

1. All valves shall conform to MWS Approved Materials List.
2. Valves shall meet all applicable requirements of AWWA C509/C515. Valves shall provide bubble tight closure up to 200 psi when closed and an unobstructed waterway when open. Valves shall be non-rising stems with clockwise operation to open. The end configuration shall be mechanical joint. Stem seals shall be O-ring capable of replacement under pressure when valve is fully open. Resilient seats shall be bonded or mechanically attached to either the gate or valve body. If the resilient seat is rubber material, the method used for bonding or vulcanizing shall be proved by ASTM D429. The valves shall be hydrostatically tested with twice the specified rated pressure applied to one side of the gate and zero pressure on the other side. The test shall be made in each direction across the gate. Valves shall be epoxy-coated on the inside including the interior of the gate in accordance

with AWWA C550. Outside of valve including bolt holes shall be coated with epoxy. The gate shall be provided with a drain in the bottom to flush the internal cavity of foreign material each time the valve is opened. All valves 24-inch and greater shall be horizontal in orientation.

a. The Contractor shall submit specifications and blueprints of manufacture showing detail dimensions with material used, tensile strength, elastic limit of metal, and weight of valves and diameter of stem at bottom of thread.

b. The Contractor shall furnish the Engineer with certificates of inspection, sworn to by the factory inspector in the presence of a Notary Public, stating that the valves were made and tested in full compliance with the specifications.

### 3. Valves- Horizontal Bevel Geared Gate Valves (24-inch through 60-inch)

a. The Contractor shall use these valves only when tapping large water mains as approved by the Engineer.

b. The Contractor shall submit complete and detailed specifications for proposed valves including tensile strength; composition of stem and stem nut; and a detailed dimensioned print. The valves shall be mechanical joint end, horizontal, double gate, bevel geared valves, with grease case and drain plug. Grease cases shall be simple and rugged in construction and designed to provide reasonable access to the valve stem-packing gland. By-pass for the valves (required on valves 20-inch in size and larger) shall satisfactorily meet the same pressure test as the main valves. Bypass valves shall open to the right (clockwise) and shall have a 2-inch square nut on top of stem.

c. Horizontal Bevel Geared Gate Valves (24-inch through 60-inch) shall be of the parallel seat, double disc, and bottom-wedging type. The valves must be of high quality and operate properly. The wedging mechanism shall have multiple wedges of solid bronze; act on both gates equally; independent of the operating nut and spindle; or the wedging mechanism shall consist of a cast iron bronze mounted bottom wedge cooperating with a bronze mounted top wedge. The top wedge shall contain a bronze stem nut. A wedge shall act to spread the gates evenly.

d. Horizontal Bevel Geared Gate Valves (24-inch through 60-inch) shall be designed to withstand a hydrostatic test pressure of 300 pounds per square inch applied internally with the gates closed and be guaranteed for not less than 250 pounds per square inch of water working pressure. Valves shall open by turning the wrench nut clockwise. Operating nuts shall be 2 inches square with a cast arrow indicating the direction of turning for opening the valve. Wearing and bearing faces of the valve shall be suitably proportioned and working parts shall be made of bronze or be bronze mounted.

e. The body, bonnet, gates, and other as specified shall be cast iron equal to or exceeding the requirements of ASTM A126, Class B. Castings shall be clean and sound, without defects of any kind. No plugging, welding, or repairing of defects shall be allowed.

f. Bronze metal used in working parts of valves except stem and stem nut shall have a tensile strength of not less than 30,000 pounds per square inch.

g. Stem and stem nut shall be made of manganese bronze or other non-corrodible metal. The stem shall have a tensile strength of not less than 60,000 pounds per square inch. The

stem nut shall have a tensile strength of not less than 38,000 pounds per square inch and elongation of not less than 15 percent in 2 inches. Test bars shall be made and tested in accordance with the American Society for Testing Materials Specifications covering the materials used. Gate rings shall be cast bronze, rolled, peened, or pressed into grooves machined in the gates. They shall be further secured with bronze or suitable non-corrodible rivets, or rolled into dovetailed slots. Finish cuts shall be taken over the gate rings after they are finally secured in place. Body rings shall be cast bronze, carefully machined, the threads accurately cut, and the rings screwed into machined seats in the body.

h. Stuffing boxes shall have a depth not less than the diameter of valve stem to be passed. Glands shall be solid bronze ball-joint type with circular cast iron follower, or cast iron bronze brushed. The stuffing box and follower shall be secured properly with two or more bolts.

i. Gland bolts and nuts shall be bronze. All bolts and nuts except as otherwise specified shall be hot-galvanized.

j. Except as otherwise explicitly required by supplementary specifications, geared valves shall be equipped with gears made of cast iron equal to or exceeding the requirements of ASTM A126, Class B, accurately formed and smooth running with steel pinion shaft operating in bronze or permanently sealed antifriction bearings. Gearing shall be designed for maximum facility and speed of operation with a minimum number of men.

k. Valves shall be designed to lie horizontal in a horizontal pipeline and shall be equipped with solid bronze tracks securely fastened in body and bonnets, carrying the weight of the gates throughout their entire length of travel on rollers. The disc shall be carried on solid bronze rollers, securely attached to the gates; also, bronze scrappers shall be provided to traverse the tracks ahead of the rollers in both directions, removing any foreign matter, which may have accumulated on the track. All ironwork, after being thoroughly cleaned, shall be painted throughout with asphaltum varnish or dipped in suitable coating material. As minimum requirements, these valves must conform, in every respect, to the American Water Works Association Specifications C500, for valves. All internal and external ferrous surfaces shall be fusion bonded (or approved equal) epoxy coated in accordance with AWWA C550.

l. An O-Ring stem seal will not be allowed for gear operated valves. The Contractor shall submit specifications and blueprints showing detail dimensions and giving the kind of metal used, also tensile strength and elastic limit of metal, and must give weight of valves and diameter of stem at bottom of thread. The Contractor shall furnish the Engineer with certificates of inspection, sworn to by the factory inspector, in the presence of a Notary Public, stating that the valves were made and satisfactorily tested in full compliance with the specifications.

#### 4. Tapping Sleeve and Valves (12-inch and smaller)

a. All tapping sleeves and valves shall conform to MWS Approved Materials List. The sleeve shall be held together by bolts, and the valves shall be bolted to sleeves. All sleeves must have a test tap. Rubber gaskets shall be furnished for use with the bolted sleeves. The

valves on the connecting or outlet sides shall have mechanical joints suitable for cast iron or ductile iron pipe.

b. The valves shall be of standard make, double gate, cast iron body bronze mounted, to be vertical valves, open to the right (clockwise) have a 2-inch square nut on top of stems, and have oversize seat rings to permit entry of the tapping machine cutters. The valves shall be suitable for safely opening and closing when subjected to full working water pressure on one side of gates and zero pressure on the other side. Rubber gaskets shall be furnished for use between the flanges of the tapping sleeves and the tapping valve.

c. All tapping sleeves and valves shall be tested at not less than 400 pounds per square inch hydrostatic pressure and be suitable and guaranteed to safely stand a working pressure of 200 pounds per square inch. As minimum requirements, these valves must conform to the AWWA specifications C500 for valves. The O-Ring stem will be accepted.

d. The Contractor shall submit specifications and blueprints of manufacture showing detail dimensions and giving the kind of metal used, also tensile strength and elastic limit of metal, and also shall give weight of valves and also the weight of sleeves and the diameter of stems at bottom of threads.

e. The Contractor shall furnish the Engineer with certificates of inspection, sworn to by the factory inspector, in the presence of a Notary Public, stating that the tapping sleeves and valves were made and satisfactorily tested in full compliance with the specifications.

#### 5. Tapping Sleeves and Valves (16-inch and larger)

a. Tapping sleeves and valves shall conform to MWS Approved Materials List.

b. The sleeves must be held together by bolts and valves are to be bolted to sleeves. All sleeves must have a test tap. Rubber gaskets must be furnished for use with the bolted sleeves and between the flanges of the tapping sleeve and the tapping valve. The valves on the connection or outlet sides are to have mechanical joints suitable for cast iron or ductile iron pipe.

c. Valves shall be of standard make, double gate, cast iron body, bronze mounted with oversized seats to permit entry of the tapping machine cutters, have bevel gearing, set horizontal lie to the right or left when standing on sleeve and looking down on valve, as specified on order, open to the right (clockwise), have a 2-inch square nut on top of stem.

d. Bypass for the valve (required on valves 20-inch in size and larger) shall satisfactorily meet the same pressure test as the main valves. Bypass valves shall open to the right (clockwise) and shall have a 2-inch square nut on top of stem. Valves shall be designed to lie horizontal.

e. The disc shall be carried on solid bronze rollers securely attached to the gates. Bronze scrapers shall be provided to traverse the tracks ahead of the rollers in both directions removing any foreign matter that has accumulated on the tracks.

f. The valves must be suitable for safely opening or closing when subjected to full working water pressure on one side of gates and zero pressure on the other side.

g. All tapping sleeves and valves must be tested at not less than 300 pounds per square inch hydrostatic pressure and be suitable and guaranteed to safely stand a working water

pressure of 150 pounds per square inch. As minimum requirements, these valves must conform in every respect to AWWA Standard C-500 for valves.

h. The Contractor shall submit specifications and blueprints of manufacturer showing detail dimensions providing the kind of metal used, tensile strength, elastic limit of the metal, weight of valves, the weight of sleeves, and the diameter of stems at bottom of threads. The Contractor shall furnish the Engineer with certificates of inspection, sworn to by the factory inspector, in the presence of a Notary Public, stating that the tapping sleeves and valves were made and satisfactorily tested in full compliance with the specifications.

#### 6. Valve Boxes

a. All valve boxes with footing blocks shall be constructed in accordance with the details as shown on the Contract Drawings.

b. Valve boxes for valves up to and including 12 inches are to be made of pre-cast concrete sections measuring 11-inch by 13 $\frac{1}{4}$ -inch inside dimensions and 17-inch by 19 $\frac{1}{4}$ -inch outside dimensions with a height of 12 inches to 15 inches for 8-inch through 12-inch valves and 15 inches to 18 inches for 6-inch valves and smaller. Reinforcement shall be placed as shown on the Contract Drawings and shall be deformed billet or rail steel bars conforming to the requirements of ASTM A615, Grade 60 or ASTM A616, Grade 60.

c. Footing blocks for standard concrete valve boxes are to be precast in blocks measuring 12-inch by 12-inch by 4-inch. No reinforcing steel is required.

d. The concrete mixture for valve boxes and footing block shall be one part cement, two parts sand, and four parts gravel or 1-inch crushed stone.

#### 7. Valve Box and Valve Vault Frames and Covers

a. Valve box and valve vault frames and covers shall be made of cast iron and conforming to the details shown on the Contract Drawings and meeting the requirements of ASTM A-48, Class 30.

b. Casting shall be made accurately to the required dimensions and shall be sound, smooth, and free of blemishes or other defects. Defective castings that have been plugged or otherwise treated to remedy defects shall be rejected. Contact surfaces of frames and covers are to be hand ground so that the covers rest securely in the frames with no rocking. The cover shall be in contact with the frame for the entire perimeter of the contact surface.

c. The manufacturer shall furnish the Engineer with certificates of inspection, sworn to by the factory inspector in the presence of a Notary Public, stating that frames and covers were made in full compliance with the specifications.

#### 8. Water Valve Vaults

a. All water valve vault boxes 16 inches and larger shall be constructed of pre-cast sections or brick in accordance with the details as shown on the Contract Drawings.

b. Bricks shall be the same as those specified for water meter boxes.

c. Cement used in mortar shall be Portland cement conforming to the requirements of ASTM C-150, Type 1.

- d. Sand used in mortar shall conform to the requirements of ASTM C-33.
- e. Water vault frames and covers shall be made of cast iron and conforming to the details shown on the Contract Drawings and meeting the requirements of ASTM A-48, Class 30.
- f. Castings shall be made accurately to the required dimensions and shall be sound, smooth, clean and free from blemishes or other defects. Defective castings, which have been plugged or otherwise treated to remedy defects, shall be rejected. Contact surfaces of frames and covers shall be hand ground so that the covers rest securely in the frames with no rocking. The cover shall be in contact with the frame for the entire perimeter of the contact surface.
- g. Concrete for plain concrete base shall be Class "A" as specified in Section 03300.

9. One-Inch Air Relief and 2-Inch Blow-Off Valve Assemblies

- a. One-inch air relief and 2-inch blow-off valve assemblies shall be constructed in accordance with the details as shown on the Contract Drawings.

D. Fire Hydrants

1. AWWA C502 American Water Works Association Standard for Dry Barrel Fire Hydrants shall apply except where the following supplementary specifications supersede.
2. Bury length shall be 3  $\frac{1}{2}$  feet unless otherwise indicated. The size of main valve for the hydrant shall be 4  $\frac{1}{2}$  inches. The hydrant outlets shall consist of one 4  $\frac{1}{2}$ -inch outlet and two 2  $\frac{1}{2}$ -inch outlets with nozzles and caps meeting NFPA No. 194-1974 National Fire Protection Standard for Screw Threads and Gaskets for Hose Connections.
3. Fire hydrants shall be compression post type opening against the pressure.
4. The Contractor shall protect the casting containing hydrant outlets and the stem from damage with a method approved by the Engineer.
5. The manufacturer shall furnish the drawings and data outlined in AWWA C502 and furnish 5 sets of certified drawings.
6. The Engineer shall be furnished with certificates of inspection, sworn to by the factory inspector in the presence of a Notary Public, stating that the hydrant and material used in fabrication conform to the applicable requirements of AWWA C502 and these supplementary specifications and the tests specified have been performed and all tests requirements have been met.
7. The hydrant barrel is to be made in two sections with revolving upper section to provide for adjusting position of hydrant outlets. The upper flange connection shall be above the ground line to easily remove bolts and revolve the head part of hydrant.
8. Hydrants shall be fitted with a mechanical joint inlet. Lubrication application shall be accessible without removing stem nut.
9. Hydrants shall have a 1-inch square operating nut on top of stem and on nozzle caps. The nozzle caps shall be chained or cabled to the barrel of the hydrant with a chain or cable constructed of material not less than 1/8-inch in diameter. The opening between the stem nut and the top of the bonnet shall be protected by a weather shield cap.

10. There shall be cast on top of the hydrant in characters raised 1/8" an arrow at 1 1/4 inches long and the word "open" in letters 1/2-inch high and 1/8-inch relief, indicating direction to turn to open the hydrant. Hydrants must open to the left (counterclockwise). No stuffing boxes or glands shall be used.
11. O-rings or other approved seals of equal ease of operation shall be used. Corners shall have sufficient radius in accordance with standard foundry practice. Asphalt varnish and not primer shall be used for coatings.
12. Fire hydrants shall conform to MWS Approved materials List.
13. The Contractor shall obtain test data from Metro Water Services including static and residual pressure; provide material and labor to properly paint fire hydrants per Metro Water Fire Hydrant Painting Colors Policy; and provide labor to attach tags provided by the Inspector for each fire hydrant installed within the scope of the project. The following table contains a summary of the current fire hydrant color policy:

Table 1 - MWS FIRE HYDRANT PAINTING COLORS					
	HYDRANT RESIDUAL PRESSURE (2-1/2" NOZZLE - psi)	FLOW (gpm)	BARREL	CAPS	DOME
ALL HYDRANTS	0	0	SHROUD WITH BLACK BAG AND TURN IN FOR REPAIR - OUT OF SERVICE EXCEPTION: EMERGENCY CALL IN IF HYDRANT IS ADJACENT TO ESSENTIAL SERVICES (HOSPITAL, NURSING HOMES, ETC)		
PUBLIC HYDRANT	0.1 - 8.9	1-500	RED	BLACK	RED
PUBLIC HYDRANT	9 - 35.9	501-1000	RED	GREEN	GREEN
PUBLIC HYDRANT	>= 36	>1000	RED	ORANGE	ORANGE
END OF LINE PUBLIC HYDRANT	0.1 - 8.9	1-500	WHITE	BLACK	RED
END OF LINE PUBLIC HYDRANT	9 - 35.9	501-1000	WHITE	GREEN	GREEN
END OF LINE PUBLIC HYDRANT	>= 36	>1000	WHITE	ORANGE	ORANGE
<b>Notes:</b>					
<p>1. White "cap color" is the de facto indicator of the fire hydrant flow capacity; "barrel" color can sometimes also provide useful information. For example, fire hydrants with white barrels signify those which are last on a dead end main.</p> <p>2. Typically, silver fire hydrants (caps and barrels) signify private hydrants while red hydrants (caps and barrels) signify hydrant not yet in service.</p> <p>3. Cap color is determined by field tests performed by Metro Water Services or their designee and is representative of the latest residual pressure testing performed. Records of testing are available at the office of MWS.</p> <p>4. Regulations of the Tennessee Department of Environment and Conservation (Rules of TDEC Public Water System Chapter 1200-5-1-.17, paragraph 18) require that fire hydrant be capable of providing at least 500 gallons per minute with a minimum residual pressure of 20 pounds per square inch (psi). There are some hydrants in MWS' system that are not capable of this requirement and are color coded accordingly (black caps). Therefore, the MFD agrees not to connect a pumper truck to any black cap hydrants.</p> <p>5. In order to assure consistency, it is imperative that all water companies having jurisdiction within Davidson County identify their hydrant using this same cap color code.</p>					

## PART 3 - EXECUTION

### 3.1 INSTALLATION

#### A. Pipe and Fittings

##### 1. General

a. Proper and suitable tools and appliances for the safe and convenient handling and laying of the pipes and fittings shall be used. The Contractor shall prevent the pipe coating from being damaged particularly on the inside of the pipes and fittings. All pieces shall be carefully examined for defects and no pieces shall be laid that are known to be defective.

Defective pieces discovered after installation shall be removed and replaced by the Contractor at his own expense.

b. Pipes and fittings shall be kept clean and conform accurately to the depth of cover below established grade designated.

c. Before lowering, each joint of pipe and/or fitting shall be brushed out and cleaned so that no loose or foreign material remains in the pipe. After the pipe is laid, the end shall be covered or plugged when not actually laying pipe so that the pipe will be kept clean inside. The pipe shall be laid to a straight and/or uniform line and grade without kinks or sags in the line.

## 2. Depth of Cover

a. Pipes and/or fittings shall be laid so that the top of the hubs shall have the minimum depth of cover below the finished grade of the road surface, shoulder, existing ground surface and/or drainage ditch. For each particular size of pipe the minimum cover is as follows:

<u>Pipe Size in Inches</u>	<u>Required Minimum Depth of Cover in Inches</u>
10 and Smaller	30
12 and Larger	36

b. The Engineer may, at his discretion where circumstances and conditions warrant, allow less than the required minimum depth of cover, but under no condition will there be permitted less than 24 inches of cover to the top of the hub from the finished grade of either the road surface, road shoulder, existing ground surface, and/or drainage ditch.

## 3. Water and Sewer Separation

a. The following factors should be considered in providing adequate separation: materials and type for water and sewer pipes; soil conditions; service and branch connections into water main and sewer line; space repair and alterations of water and sewer pipes; off-setting of pipes around manholes; compensating variations in horizontal and vertical separations; water mains and sanitary or storm sewers shall not be laid in the same trench.

### b. Parallel Installation

1) Normal conditions - Water mains shall be laid at least 10 feet measured horizontally edge to edge from any sanitary sewer, storm sewer, or sewer manhole.

2) Unusual conditions - When local conditions prevent a horizontal separation of 10 feet, a water main may be laid closer to a storm or sanitary sewer provided that:

a) The bottom of the water main is at least 18 inches above the top of the sewer;

b) Where vertical separation cannot be obtained, the sewer shall be constructed of materials and with joints equivalent to water main standards of construction and shall be pressure tested to assure water-tightness prior to backfilling.

### c. Crossings

1) Normal conditions - water mains crossing house sewers, storm sewers, or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer.

2) Unusual conditions - when conditions prevent a vertical separation and as described in the following construction shall be used:

a) Water mains passing under sewers shall be protected by providing:

- 1) A vertical separations of at least 18 inches between the bottom of the sewer and the top of the water main;
- 2) Adequate structural support for sewers to prevent excessive deflection of joints and settling and breaking the water mains;
- 3) That the length of water pipe be centered at the point of crossing so that the joints will be equidistant and far as possible from the sewer.
- 4) Both the sewer and the water main shall be constructed of water pipe and tested in accordance with water specifications herein.

#### 4. Foundation and Bedding

a. Pipes and fittings shall be laid on stable foundations, trimmed to shape, and where required secured against settlement in a manner approved by the Engineer.

b. Pipes and fittings shall have a solid even bearing throughout the entire length. The Contractor shall ensure the pipe is not supported on its bells. Bell holes shall be excavated in the foundation under the pipe at each bell.

c. Section 02223 of these specification provides more information for the foundation; bedding; and backfill for pipes and fittings.

#### 5. Joint Installation

a. Cleaning Joints: Prior to joint field assembly, the inside of the bell and the outside of the plain end of the pipe shall be brushed with a wire brush and wiped with a clean cloth with soapy water to remove loose scale and rust and provide clean surfaces for the joints.

b. Prior to installation, the gasket shall be cleaned with a cloth with soapy water.

c. During pipe installation and joint assembly, the Contractor shall ensure that joint surfaces remain clean and free of any dirt or other foreign material.

d. Field Cuts: When the pipe is cut in the field, the rough cut edge shall be made smooth with a file or portable grinder so that the plain cut end is beveled and will not damage the gasket in assembly of the joint.

e. Slip-Type Gasket Joint: In joining slip-type gasket pipe, the inside of the bell and the outside of the spigot end shall be thoroughly cleaned as specified. The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the bell socket. A thin film of gasket lubricant shall be applied in accordance with the manufacturer's recommendations. Gasket lubricant shall be as supplied by the pipe manufacturer and approved by the Engineer. The spigot end of the pipe shall enter into the socket to keep the joint from contacting the ground. The joint shall be completed by forcing the plain end

to the bottom of the socket with a forked tool or jack-type tool or other device approved by the Engineer. Pipe that is not furnished with a depth mark shall be marked before assembly to assure that the spigot end is inserted to the full depth of the joint. Complete assembly shall be in strict conformance with the manufacturer's recommendations.

f. Mechanical Joints: Mechanical joint pipe shall be joined in accordance with the manufacturer's recommendations and bolts shall be tightened with an approved torque wrench or other approved means to secure uniform and allowable tension of the bolts. The pipe shall be installed to true alignment with the spigots carefully centered in the bells. Complete assembly shall be in strict conformance with the manufacturer's recommendations.

g. When tightening bolts, the gland shall be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. This may be done by partially tightening the bottom bolt first, then the top bolt, next the bolts at either side and last, the remaining bolts. Repeat this cycle until all bolts are within the above range of torques. If effective sealing is not attained at the maximum torque indicated above, the joint should be disassembled and reassembled after thorough cleaning. Overstressing of bolts to compensate for poor installation practice shall be avoided.

6. Blocking when not using Restraint Joints - All bends 11 1/4 degree or greater, tees, crosses, plugs, pressure connections, etc., shall be backed up and anchored with concrete so that there will be no movement of the pipe in joints due to internal or external pressures.

7. Pressure Connection - Where connections are made to the existing distribution system, they shall be pressure connections unless otherwise indicated on the drawings. The Metropolitan Department of Water and Sewerage Services will furnish the tapping machine and the crew to make the tap. The Contractor shall furnish and install the tapping sleeve and valve, and shall perform all excavation, blocking, backfill, and disinfection of the tapping sleeve and valve including cleaning the material and spraying with bleach solution. The Contractor shall have the ditch open and be ready to actually make the connection prior to scheduled appointment of the tapping crew. The Contractor shall notify and give the Metropolitan Department of Water and Sewerage Services 48 hours advance notice to schedule the tapping crew.

#### 8. Shutting Down Water Mains

a. Where it is necessary to shut off water mains and/or pipes to make connections or for capping mains, the work shall be done as quickly as possible so as to cause the least inconvenience possible to the water consumers, but not exceeding 4 hours.

b. All shutdowns shall be scheduled in writing by the Contractor and must be approved in advance by the Metropolitan Department of Water and Sewerage Services. If it is deemed necessary; critical shutdowns shall be scheduled for night and/or weekends.

c. The Contractor shall not operate any valves on existing water mains and/or water mains placed in service under this Contract without prior approval and only under the supervision of MWS.

- d. The Contractor shall provide all water customers at least 24 hours notice of an intended shutdown or interruption of water service.
9. Maintain Water Service - The water service to consumers, whose connections are to existing mains in the street where the proposed mains under the Contract are to be constructed, must be maintained by the Contractor so that they will not be deprived of water service while proposed mains are being constructed.
10. Abandon Existing Water Mains
- a. It shall be the responsibility of the Contractor to remove from the grounds all existing valve boxes over valves on abandoned mains.
- b. All valves on the abandoned main shall be closed only when directed by the Engineer.
- c. On valves to be abandoned, the frame and cover shall be removed and safely stored to prevent loss or damage until picked up by the Metropolitan Department of Water and Sewerage Services forces. The hole shall be filled with gravel and surface restored.
- d. The cost of work necessary to close valves as directed; remove frames and covers; and fill the holes of the valves necessary to abandon existing water mains shall be merged in the unit prices bid and no separate payment shall be allowed. Where it is necessary to remove a valve frame and cover from a paved street, separate payment shall be allowed for temporary and/or permanent pavement restoration.
11. Construction Procedures - The installation of all mains under this Contract should generally proceed as follows:
- a. The Contractor may, at his option, begin the installation of the water main at the connection to the existing system by two means in conformance with the following:
- 1) The Contractor may begin construction without making any connection to the existing system. In this event, the new water line shall be temporarily capped near the proposed connection to the existing system. When the new water line is ready to be filled with water for testing and sampling, it shall be filled through a sufficiently sized copper jumper pipe tapped from the existing to the new water main using a backflow prevention device. Upon completion of all required pressure and sterilization tests, the Contractor shall make the required connection to the existing water main and sleeve the new main into the new connection.
- 2) The Contractor may begin construction by making the required connection to the existing system. In this event, the existing system shall be separated from the new construction by 2 consecutive valves. These 2 valves must remain closed at all times and only be operated under the close supervision of the Engineer to fill and/or flush the new pipeline.
- a) This connection to the existing system may be made at one connection point only. Any proposed connection points should remain free to allow the new pipe line to be flushed through a fire hydrant or other means. After the new pipeline is filled and flushed, water for the pressure test and samples should be obtained by placing a sufficiently sized copper jumper line around the new valves at the connection point. The new pipeline may be filled through the new valves and

eliminate the copper jumper only with the prior approval of MWS due to hazardous connection point locations, etc.

b) The disinfection test must be conducted by the Contractor first. No pressure test will be allowed to be conducted on the new pipeline until the required samples have been taken and satisfactory results obtained.

c) The required pressure test should then be conducted by the Contractor. The Contractor shall be responsible that the valves shall pass the required pressure tests. If the valve should leak, it shall be the Contractor's responsibility to cut and cap the line for testing purposes.

3) The Contractor shall install all new mains, fittings, valves, and hydrants. Existing mains are to be in service at all times.

4) The Contractor shall test, disinfect, and flush the new mains, then place them in service, continuing to maintain service in the existing mains.

5) The Contractor shall reconnect and/or tie-over existing service lines from existing mains to new mains and install new service lines.

6) After all services are removed from the existing water main, the existing main shall be abandoned by cutting and capping as required. All tie-ins of the new water main shall then be completed.

7) The Contractor shall remove from the ground all existing valve boxes over valves on abandoned mains and restore the surface as specified.

b. Pursuit of Work:

1) The Contractor shall plan and pursue the work in such a manner as to maintain a work area confined to the immediate area of installation and be completed to the extent possible as the job progresses. This means that all valves, fire hydrants, air release valves, blow offs, valve boxes, and other appurtenances shall be installed at the time the water main is installed. As soon as the installation is complete and prior to testing, the excavations shall be backfilled, as specified, and the excess material is to be removed. Any damage claims to private property shall be investigated promptly and followed by such corrective action as may be necessary. The work area shall also be cleaned immediately following the installation.

2) The purpose of the above requirements is to keep the inconvenience to the public at a minimum. If service lines must be installed at a later date, and the same procedure as outlined above shall be followed upon installation of the service line.

## 12. Cutting and Capping Exist Water Mains

1) At all locations shown on the plans or where directed by the Engineer, the Contractor shall cut and cap the existing water mains. This item shall include excavation, cutting existing water main, and furnishing and installing an approved cap and necessary concrete blocking, backfill and all labor and materials required for a complete installation. The line shall be excavated to the supply main. Existing tapping sleeves and valves, complete with frames and covers, shall be removed and a new section of pipe of proper size will be sleeved in to restore supply. Where tees exist, they will be capped at the tee.

2) Any shutdown of existing mains shall be conducted as required under paragraph 3.1A.8 of this Section.

#### B. Water Service Lines

1. This item shall include the replacement of existing substandard water services and the installation of new services where directed by the Engineer or shown on the Contract drawings. It shall include excavation, backfill, furnishing all material, providing temporary service lines (where necessary), and performing all labor and work necessary for the construction of the sizes and types of water service lines as listed in the Contract Documents.
2. Work reconnecting or replacing customer service lines shall be performed by a Licensed and Bonded Plumber. The Contractor shall employ the services of a Licensed and Bonded Plumber (if the Contractor is not a Licensed and Bonded Plumber) to perform all service line work, be employed as a sub-contractor, and must be approved by the Owner. This requirement shall not relieve the prime Contractor of responsibility for the entire installation and replacement of services to their original condition or as required as specified. The licensed and Bonded Plumber must obtain the necessary permits for each service line reconnection from the Engineering and Permits Section of the Department of Water and Sewerage Services and no charge to the Contractor.
3. Existing service lines are to be replaced where they are smaller than  $\frac{3}{4}$ -inch in size.
4. Lead or galvanized water service lines shall be replaced with copper service lines within the limits of work.
5. The water service line shall have a gooseneck, minimum length of 12 inches, installed in each line. The gooseneck shall be adjacent to the water main and supported with brick or concrete block supports. The service shall be laid in the trench, sufficiently weaving, to allow not less than 1-foot extra length in its entire length. It shall be laid to a depth of at least 2 feet below the grade of the street from the water main to the meter box.
6. Excavating, bedding, and backfilling for service lines shall be the same as required for water mains.
7. The Contractor shall furnish all service line pipes and fittings per paragraph 2.2A.3 of this Section.

#### C. New Tap and Connection to Water Main and/or Service Line

1. This item shall include the following type of connections:
  - a. Connection of an existing service line in good condition to a new water main.
  - b. Connection of a new service line to a new water main.
  - c. Connection of a new service line to an existing service line in good condition.
  - d. Connection of a new service line to the curb stop in a new meter box and/or connection to an existing meter in an existing meter box.
2. The item New Tap and Connection to Water Main and/or Service Line shall include excavating, backfilling, furnishing all materials, including corporation stop, curb stop and up to 2 linear feet of the required diameter service line, and providing temporary service lines

(where needed) and performing all labor and work necessary to make complete water main service line connections.

3. Excavating, bedding, and backfilling for service lines shall be the same as required for water mains.
4. Each new water service or replacement of existing substandard service shall include a curb stop. The curb stop shall be at the end of the service and within the meter box.
5. Each new water service or replacement of existing substandard shall include a new tap and connection to the water main. Each water service pipe shall be connected to the water main through a brass corporation stop. The water main shall be tapped and the corporation stop inserted in the top of the water main under pressure. The Metropolitan Department of Water and Sewerage Services will make all taps. The Contractor shall furnish the brass corporation stop and shall perform all excavation, blocking, and backfilling. The Contractor shall have the ditch open and be ready to actually make the connection prior to the scheduled appointment for the tapping crew.

#### D. Water Meter Boxes

1. The Contractor shall construct the stack out walls plumb and square. Joints shall be broken in successive courses and all joints shall be trowel struck flush joints to provide a clean smooth face on the inside and outside of the meter box.
2. Mortar for brick installation shall be proportioned by volume of 1 part cement and 2 parts sand.
3. Mortar shall be mixed in a suitable mixer or in a watertight mixing box. The materials shall be thoroughly mixed dry and then only sufficient water added to bring the mixture to a workable consistency. No mortar that has begun to set shall be used and tempering will not be permitted.
4. The water meter frame shall be set on the meter box sidewall in a full cement mortar bed at the required elevation. The frame and cover shall be set to conform to the exact slope, crown, and/or grade of the surrounding area.
5. When existing substandard water service lines are being replaced, the existing meter shall be reinstalled as directed by the Metropolitan Department of Water and Sewerage Services.
6. On renewal of existing water meter boxes and/or where new services are installed, the end of the water service line shall be such that the top of the water meter is at least 22 inches and no more than 26 inches below finished grade.

#### E. Valves, Valve Boxes, Valve Vaults

1. This item shall include furnishing and installing valves, tapping sleeves and valves, valve boxes, and valve vaults of the sizes and classes specified at the locations shown on the Contract Drawings or as directed by the Engineer. All shall be in compliance with these specifications. This item shall also include all excavation and backfill except as specified elsewhere in these specifications, furnishing and installing joint materials, and all other work necessary for a complete and usable installation.

2. The Contractor shall construct the stack out walls plumb and square. Joints shall be broken in successive courses and trowel struck flush joints to provide a clean smooth wall face on the inside and outside of the vault box.
3. Mortar for brick laying shall be proportioned by volume of 1 part cement and 2 parts sand.
4. Mortar shall be mixed in a suitable mixer or in a watertight mixing box. The materials shall be thoroughly mixed dry and then only sufficient water added to bring the mixture to a workable consistency. No mortar that has begun to set shall be used and tempering will not be permitted.

#### F. Fire Hydrants

1. This item shall include furnishing and installing fire hydrants of the type specified at the locations as shown on the plans and/or in compliance with these specifications. It shall include all excavation and backfill, concrete for blocking, and rodding required for complete installation of the fire hydrant.
2. This item does not include furnishing and installing valves, valve boxes, the tee on the water main, or other items of work set out in the Bidding Schedule of the Proposal and Agreement of this Contract.
3. AWWA C600 "American Water Works Association Standard for Installation of Cast-Iron Water Mains" section entitled, "Hydrant Installation," and "Thrust Restraint," shall apply except where the following specifications supersede.
4. The material required for drainage around a fire hydrant shall be a minimum of 2 cubic feet of 2-inch broken stone. Crushed rock or sand shall not be used. The drain port shall not be plugged under any circumstances.
5. The fire hydrant shall be located not less than 12 inches or more than 18 inches from the outside edge of curb to the front of the hydrant case.
6. Concrete block, a minimum of 12-inch x 12-inch x 4-inch thick, shall be required to wedge between hydrant base and back of trench and around the hydrant. Concrete blocks, 12-inch x 12-inch x 4-inch minimum, shall be used underneath hydrant. These slabs shall be wedged firmly behind and extending around the hydrant to undisturbed earth. The equivalent of poured concrete may be used, but the drain hole must not be clogged. If the Engineer deems that concrete restraints lack sufficient backing in the Engineer's opinion, the shoe or bowl of the hydrant shall be rodded to the valve.
7. The valve shall be rodded to the tee.
8. Fire hydrant assemblies shall be visually inspected for leaks by the Engineer, under the existing main line pressure, for a 10-minute period. All visible leaks shall be repaired by the Contractor regardless of the amount of leakage.

#### G. Miscellaneous Concrete and Concrete Blocking

1. Concrete shall be adequately protected from injurious action of the sun by wetting, covering with water-saturated cover, or other methods approved by the Engineer.
2. In cold weather, concrete shall be mixed and placed only when the temperature is at 40 degrees Fahrenheit or above, and rising, unless specifically authorized by the Engineer, in

which event all materials shall be heated in a manner approved by the Engineer. In freezing weather, suitable means shall be provided for maintaining the concrete at a temperature of at least 50 degrees Fahrenheit for a period not less than 72 hours after placing. Salt, chemicals, or other foreign materials shall not be mixed with the concrete for the purpose of preventing freezing, unless approved by the Engineer.

3. Freshly placed concrete shall be protected from wash by rain, flowing water, mud deposits, and other damaging conditions.
4. The Contractor shall ensure that the water pipe is not moved from its proper grade and alignment when placing concrete.

### 3.4 TESTING

#### A. General

1. Water mains and sections of pipe constructed under this Contract shall meet or exceed the requirements of the Pressure and Leakage Test.
2. Pipe shall be tested in lengths between line valves or plugs not more than 1,000 feet. The Contractor shall provide and install temporary test plugs and blocking adequate for tests.
3. The Contractor shall not make connections to existing valves until the new pipeline has been tested. Where special cases require that a connection be made to an existing valve, the connection shall be made only with the approval of the Engineer and the Contractor shall be responsible that the section of pipe meets the required tests.
4. In order to maintain satisfactory ingress and egress to public streets and private property or avoid hazards, the Contractor shall backfill trenches and be responsible that the water main meet all the required tests.
5. The Engineer may direct when tests of completed sections or relatively short sections of water main shall be tested so that hazardous areas may be backfilled promptly.
6. A meter and/or pressure gauge for measuring the required water and/or pressure as specified will be furnished by the Metropolitan Department of Water and Sewerage Services. All other necessary equipment, other than the meter for recording leakage, such as pumps, barrels, (copper pipe, fittings and temporary plugs, etc.) for testing, shall be furnished by the Contractor and maintained in a satisfactory work condition. These items shall be considered an integral part of the Contract, and no additional payment will be allowed.
7. The Contractor shall give notification 48 hours previous to the day scheduled for testing a section of line so the Metropolitan Department of Water and Sewerage Services can furnish a meter and/or recording pressure gauge on the section of line to be tested.
8. No allowance will be made for faulty seating of valves. The Contractor shall be held responsible to ensure valves are cleaned to seat properly. The Contractor shall be required to remedy any condition that may cause a greater leakage and/or loss of pressure of the section and test the section until it meets the specified requirements.

#### B. Pressure Test

1. The Contractor shall conduct a pressure test for all newly installed water pipeline. The pressure test shall be 1.5 times the stated working pressure of the pipeline at the lowest elevation along the test section (1.25 times the stated working pressure of the pipeline at the highest elevation) and shall be maintained for a minimum of 4 hours. The test pressure shall not vary by more than  $\pm 5$  pounds per square inch (PSI) for the duration of the test.
2. In general, each section of main to be tested shall be filled with water from the distribution system through a  $\frac{3}{4}$  inch or greater corporation cock/service tap utilizing a backflow prevention device. Water should be introduced slowly to vent all air for the section of main being tested. If permanent air vents, such as hydrants, blow offs, or air release valves, are not located at all high points on the section, the Contractor shall install corporation cocks at points to expel air as the line is filled with water. As directed by the Engineer, the Contractor shall remove these additional corporation cocks and plug the line after pressure testing.
3. If the Contractor cannot maintain the testing pressure (1.5 times stated working pressure) within  $\pm 5$  psi, makeup water may be added into the pipeline to maintain the pressure, as directed by the Engineer. No more than the amount shown in the table below shall be allowed as make up water. The quantity shown is the maximum amount allowed per hour per 1,000 feet for the 4 hour test. The Contractor shall demonstrate his ability to measure the amount of makeup water to be added prior to adding to the water main. The addition of makeup water shall be done in the present of the Engineer or his representative allowing visual measurement of the amount added.

Pressure Testing Make Up (Allowance) Water to Maintain Testing Pressure*										
Gallons allowed per hour per 1,000 feet of main tested										
Pipe Diameter	Average Test Pressure (psi)									
	100	125	150	175	200	225	250	275	300	350
4"	0.27	0.30	0.33	0.36	0.38	0.41	0.43	0.45	0.47	0.51
6"	0.41	0.45	0.50	0.54	0.57	0.61	0.64	0.67	0.70	0.76
8"	0.54	0.60	0.66	0.72	0.76	0.81	0.85	0.90	0.94	1.01
10"	0.68	0.76	0.83	0.89	0.96	1.01	1.07	1.12	1.17	1.26
12"	0.81	0.91	0.99	1.07	1.15	1.22	1.28	1.37	1.40	1.52
16"	1.08	1.21	1.32	1.43	1.53	1.62	1.71	1.79	1.87	2.02
18"	1.22	1.36	1.49	1.61	1.72	1.82	1.92	2.02	2.11	2.28
20"	1.35	1.51	1.66	1.79	1.91	2.03	2.14	2.24	2.34	2.53
24"	1.62	1.81	1.99	2.15	2.29	2.43	2.56	2.69	2.81	3.03
30"	2.03	2.27	2.48	2.68	2.87	3.04	3.21	3.36	3.51	3.79
36"	2.43	2.72	2.98	3.22	3.44	3.65	3.85	4.03	4.21	4.55
42"	2.84	3.17	3.48	3.75	4.01	4.26	4.49	4.71	4.92	5.31
48"	3.24	3.63	3.97	4.29	4.59	4.86	5.13	5.38	5.62	6.07
54"	3.65	4.08	4.47	4.83	5.16	5.47	5.77	6.05	6.32	6.83
60"	4.05	4.53	4.97	5.36	5.73	6.08	6.41	6.72	7.02	7.58

\* Source: ANSI/AWWA C600-11 Table 5A

4. During testing, all exposed pipes, fittings, valves, hydrants and joints shall be carefully examined for defects, excessive leakage or weaknesses. The Contractor shall remove and

replace any damaged or deflection pipe, fittings, valves, hydrants and/or joints (at the Contractor's cost) and the test shall be repeated until satisfactory to the Engineer.

5. Water for the pressure test will be furnished by the Metropolitan Government without charge to the Contractor.

### C. Disinfection

1. In general, the Contractor shall disinfect pipes, fittings, and appurtenances of a potable water supply according to ANSI/AWWA C651-05 (Standard for Disinfection Water Mains) and methods acceptable to the Tennessee Department of Environmental and Conservation and the Engineer.
2. The Contractor shall submit a disinfection plan in accordance with procedures specified in AWWA C651 and as specified. The disinfection plan shall be reviewed and approved by the Engineer a minimum of two weeks prior to conducting disinfection of new water mains and appurtenances. The disinfection plan shall include, but not be limited to: an overall explanation of the disinfection process; the method of disinfection; the number and location of sampling points depicted on a sketch, map, or drawing; and a description and location of all tie-ins.
3. Unless otherwise directed by the Engineer, the Contractor shall use the Tablet Method of disinfection with the following exceptions:
  - a. The Contractor shall introduce chlorine in the water main in accordance with MWS policy rather than the AWWA standard.
  - b. After the Engineer acknowledges acceptable bacteriological test results, the Contractor shall make final connections between the Project and the MWS Distribution System as described in Section 4.6.1 of ANSI/AWWA C651-05.
4. The Contractor shall minimize dirt and debris in the water main during installation.
5. The Contractor shall place Calcium hypochlorite granules (HTH, 65 percent strength or greater) in the water main during construction to insure a minimum of 25 mg/l of free chlorine residual continuous through the line when filled with potable water. Water used to fill the line should be supplied from a temporary backflow protected connection.
6. The Contractor shall add sufficient material to the potable water to provide a free chlorine residual concentration not less than 10 mg/l after the 24 hour holding period.
7. The Contractor shall assist the Engineer during testing of free chlorine residual concentrations at any or all locations along the water main being disinfected to confirm specified beginning and/or ending free chlorine residual concentrations. The Contractor shall correct free chlorine residual concentration deficiencies.
8. After the 24 hour holding period, the Contractor shall flush the water main until free chlorine residual concentrations are similar to potable water in the vicinity. The Contractor shall flush the water main at a target velocity of 2.5 ft/s. This may require several or larger flushing ports for water mains greater than 12 inches in diameter. The Contractor shall not discharge chlorine water directly on the ground without pretreatment to eliminate high concentration chlorine residual.

9. The Contractor shall assist MWS personnel to obtain bacteriological samples taken a minimum of 24 hours apart at intervals of 1,000 feet maximum along the water main and at branches and outlets. Typically, the bacteriological analysis requires a minimum of 48 hours after the last sample is taken. If the bacteriological analysis indicates the possibility of contamination, the Contractor shall re-disinfect the water main without additional compensation. If re-disinfection is not successful, the Engineer may consider an alternate means of disinfection.

3.5 MAINTENANCE - Excavation, backfilling, cleanup, and temporary pavement restoration on any individual road or street that water mains are installed shall be prosecuted concurrently with the water main installation to the point that satisfactory ingress and egress to public streets and private property is maintained. The Contractor shall be responsible that the water main meets all tests for pressure and leakage.

END OF SECTION