City of Germantown
Engineering Division

WS 08 0403

STANDARD SPECIFICATIONS FOR WATER CONSTRUCTION

2008

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
6th Floor L & C Tower, 401 Church Street
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For Local Field Office
Call 1-888-891-TDEC

March 27, 2008

Mr. Jonathan Smith
Germantown Water Dept
1920 South Germantown Road
Germantown, Tennessee 38138-2815

RE: Standard Construction Specifications for Water Lines
Germantown Water Department (PWSID # 0000262)
Shelby County
Project Number WS 08-0403

Dear Mr. Smith:

This letter acknowledges receipt of two copies of standard construction specifications for Germantown Water Department. 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 March 27, 2011. You must then either resubmits the standard specifications or request in writing for extension of approval.

Please note:

1. **Rocks found in the trench must be removed for a depth at least 6-inches below the bottom of the pipe.**
2. **Pressure and leakage tests shall be performed in accordance with current AWWA standard C600 and/or manufacture's installation procedure.**
3. **The test pressure of the installed pipe shall be 150 psi or 1.5 times the working pressure whichever is greater.**
4. **Allowable Leakage shall be no greater than as calculated in L=SD $(P)^{1/2}$/133,200. Where L is allowable leakage in gallons/hour, S is the length of the pipe tested in feet, D is pipe diameter inches, and P is the test pressure in psi.**
5. **Adequate flushing, Disinfection, and bacteriological testing of all new water mains shall be performed in accordance with current AWWA standard C651.**

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 Sami Arnouk at (615) 532-0184.

Very truly yours,

R. William Hench

R. William Hench, P.E.
Manager, Engineering Program
Division of Water Supply

RWH/SA DWS-35

SECTION 4
CITY OF GERMANTOWN WATER DISTRIBUTION

1. GENERAL:

A. This section includes the furnishing of and paying for all materials, labor, tools, equipment and other items required for the complete water main extensions consisting generally of: pipe; valves; fire hydrants; fittings; connections to existing water system; and other items as herein specified and indicated.

B. Read carefully GENERAL PROVISIONS and SPECIAL CONDITIONS, all of which shall apply to all work included in this section.

2. PIPE MATERIALS:

A. All water pipe for various locations and usages shall be:

1. Water service lines 3" and smaller - Type K copper
2. All pipe 4" and larger - Ductile iron

B. All 4" and larger ductile iron pipe shall be of pressure class and nominal wall thickness conforming to AWWA specifications C151 and shall have a minimum working pressure of at least 150 psi. All pipe shall have AWWA Specification C104 standard thickness bituminous sealed cement mortar lining, bituminous outside coating and ends as required for the types of joints specified below for the various pipe locations and services.

Pipe Size	Wall Thickness	Pressure Class	Pipe Size	Wall Thickness	Pressure Class
4"	0.25"	350	16"	0.34"	350
6"	0.25"	350	18"	0.34"	350
8"	0.25"	350	20"	0.33"	350
10"	0.26"	350	24"	0.37"	350
12"	0.28"	350	30"	0.42"	350
14"	0.31"	350	36"	0.42"	350

C. Except as otherwise specified or indicated, joints in ductile iron pipe shall be AWWA Specification C111 mechanical or push-on type with plain rubber gaskets.

D. Fittings for ductile iron pipe shall be AWWA Specification C110 cast iron or ductile iron short body pattern, class 250, bituminous coated inside and outside, with ends as required for the types of joints specified above for the various pipe locations and services.

(1) Tees for connecting fire hydrants to mains shall be mechanical joint anchoring type, each with a 6" spigot outlet and a locked-on rotating mechanical joint gland ring.

(2) Furnish to the City of Germantown in duplicate certificates from the manufacturer certifying that all ductile iron pipe and iron fittings furnished for this project comply with the above specifications.

3. CUT-OFF VALVES AND VALVE BOXES:

A. General: For each location where a certain type of cut-off valve is specified, indicated or required for the application involved, provide the appropriate type accordingly. OTHERWISE, cut-off valves 6" through 12" shall be gate type. Valves 14" and up shall be butterfly type.

B. Gate Valves: These shall be iron body, resilient-seated gate, non-rising stem type, for at least 200 psi working pressure, conforming to AWWA Specification C509, of Mueller, M & H Clow, or as approved make. Each valve shall have "O" ring type stem seal, standard two inch AWWA operating nut, and shall be opened by COUNTER-CLOCKWISE stem rotation. Except where otherwise specified, indicated or required for the application involved, all gate valve ends shall be AWWA Specification C111 mechanical joint type, with plain rubber gaskets. The valve body shall be coated inside and out with an epoxy coating conforming to AWWA Specification C550.

C. Butterfly Valves: These shall be Pratt "Groundhog," Dresser 450, American Darling, or as approved resilient seated type, for at least 150 psi water working pressure, conforming to AWWA Specification C504. Each valve shall have AWWA Specification C111 mechanical joint ends with plain rubber gaskets, watertight operator with standard 2" AWWA operating nut, and shall be opened with COUNTER-CLOCKWISE stem rotation.

D. Valve Boxes: These shall be standard cast iron two-piece 5-1/3" inside shaft diameter screw adjustable type, each consisting of a cover marked WATER, an upper telescoping section and a lower section. Where necessary to provide extra depth, provide cast iron extension pieces as required.

4. FIRE HYDRANTS:

A. Fire hydrants shall be Mueller "Improved," M & H "Traffic" - Style 129, Dresser "500" Traffic Model (no substitutions) compression type conforming to AWWA Specification C502.

B. Fire hydrants shall be of the lubricated dry top break-away traffic type, each complete with: 5" valve opening; 6" AWWA Specification C111 mechanical joint inlet connection; 3 foot bury, unless otherwise indicated; two 2-2" National standard fire hose thread nozzles; one 4" CITY OF MEMPHIS, TENNESSEE STANDARD pumper connection nozzle 15/16" square cross section 1-1/8" high operating nut and cap nuts; and CLOCKWISE direction of opening.

C. All interior working parts of the hydrant shall be solid bronze or bronze mounted. The hydrant shall be so designed that all interior parts can be removed without removing the standpipe from its set position. Each hydrant shall be equipped with a drip valve that will positively drain the standpipe when the main valve is closed. Submit cutaway view drawings prior to purchasing hydrants.

D. All nozzles shall be equipped with caps anchored to the standpipe with chains.

E. Each hydrant shall be factory painted on the outside below grade line with black asphalt paint, and above grade line with red paint. After setting, paint all parts of the hydrant above grade line silver.

5. EXISTING METER RELOCATIONS AND SERVICE CONNECTORS OR RECONNECTIONS:

A. If an existing water main is to be removed from service, it shall remain in service until the new water main has been sterilized, tested and placed in service. All service reconnections shall be made after the water main is placed in service.

B. Relocate all existing water meters affected by construction as required or as directed.

C. Reconnect all existing services along the new water main to the new main.

D. Where meters are relocated, each 3/4" service unit shall consist of one Mueller H-15000, or as approved, 3/4" corporation stop with straight coupling nut; one 3/4" Type K soft copper tubing service pipe from street main to meter location, length as required; one Mueller No. H-15175 or as approved 3/4" inverted Key curb stop; and two Mueller H-10890 or as approved 3/4" meter couplings and gaskets. Connect each service to the relocated meter.

E. For new service line extensions, furnish all items noted above except meter couplings and gaskets. Line to run from main to future meter location with curb stop.

F. Each service unit larger than 3/4" shall consist of all items specified above for 3/4" service units, except that each item shall be the same size as that of the service pipe.

G. All joints between copper tubing and fittings shall be flared type. Couplings for copper tubing shall be Mueller H-15400 or as approved; use these ONLY in open trenches where permitted by the Engineer.

H. Set the corporation stop in the main at an angle of 45 degrees (45°) with the vertical.

I. All service pipe shall have 24" minimum cover.

J. Where meters are not relocated, reconnect existing services to the new main using a corporation stop and service pipe, length as required, as specified in Paragraph C hereinbefore using material the same size as the existing service connection.

K. Connect services to the main by tapping directly into the wall of the main in accordance with the MAXIMUM permissible direct tapping sizes for various sizes of mains listed below; where service size exceeds the maximum allowable size direct tapping for the main involved, use approved service clamp or tee fitting.

4" Main: 3/4" maximum size direct tapping
8" Main: 1-1/4" maximum size direct tapping
10" Main: 1-1/2" maximum size direct tapping
12" & Larger: 2" maximum

6. TRENCHING, EXCAVATING, SHORING, BRACING AND DE-WATERING:

A. Except as otherwise indicated on the drawings specified herein, or authorized, make all excavations open cut.

B. Excavate trenches to the indicated lines and locations to provide uniform and continuous bearing and support of each pipe barrel on firm undisturbed earth at every point between bell holes, with an ample bell hole at each joint to facilitate proper jointing and to prevent bells from bearing on the trench bottom. Trench depths shall be as required to provide the specified MINIMUM cover over the tops of pipes; as required to permit pipes to pass under culverts, existing pipelines and other obstructions; and as required to accommodate valves and boxes. Trench widths shall be as required for the proper laying and jointing of pipes, and the proper placing and compacting of backfill, but in no case shall a trench be more than 24" wider than the inside diameter of the pipe to be laid therein. Machine or hand-cut trenches, except that in all cases, prepare the final subgrade accurately with hand tooks, and in special cases where required, cut the trenches entirely by hand. Where excavation is carried below proper subgrade, before laying pipe bring the trench bottom up to the proper subgrade by backfilling with approved material placed in 3" maximum thickness loose layers, and

thoroughly compact each layer as required to provide uniform and continuous bearing and support for the pipe barrel at every point between bell holes.

C. Where trench conditions are unsuitable for pipe support, lay pipe on washed gravel bedding as authorized. Gradation of gravel bedding material shall be: 100% passing □" screen; and 95% retained on a No. 4 sieve.

D. Minimum cover over tops of pipes shall be as follows:

(1) All pipes, except as otherwise specified below: 36" MINIMUM cover.
(2) Hydrant leads, where they cross side ditches ONLY: 18" MINIMUM cover.
(3) Hydrant leads, all other locations: 36" MINIMUM cover.
(4) Special Conditions: MINIMUM cover as indicated on the drawings.

E. IN ALL CASES, THE SPECIFIED MINIMUM COVER OVER PIPES SHALL BE BASED UPON FINAL FINISHED SURFACES, INCLUDING PAVING, IF ANY. Where grading is involved, do not cut trenches under roads, streets or other areas until the final finish grading has been done, unless otherwise authorized.

F. Shore and brace trenches and excavations as required, to protect personnel, adjacent structures and adjacent property. Where required by the conditions encountered, brace trenches and excavations with suitable close sheeting or sheet piling. Do all necessary cribbing up required for the proper operation of trenching machines.

G. Provide and maintain in proper working order all necessary dewatering equipment required to remove water from the excavations. Where quicksand or other water bearing strata are encountered, install and connect the necessary number of well points with pumping equipment of sufficient capacity to prevent rise of water in the excavation until the work has been installed properly and will be unaffected by submersion.

H. Do not install any work until excavations are free of water, mud and loose earth. Do not install any work on frozen ground.

I. Install pipe crossing concrete driveways, sidewalks, asphalt driveways and other special conditions by tunneling or boring, or as authorized. Install pipes crossing dirt or gravel drives by open cut, unless otherwise authorized.

J. Where the trench bottom at required subgrade is found to be unstable or include ashes, cinders, any type of refuse, vegetable or other organic material, or large pieces or fragments of inorganic material which in the City of Germantown's opinion should be removed, excavate and remove such unsuitable material.

Before laying pipe, bring the trench bottom up to proper subgrade by backfilling with approved material placed in 3" maximum thickness loose layers, and thoroughly compact each layer as required to provide uniform and continuous breating and support for the pipe barrel at every point between bell holes.

7. HANDLING AND LAYING DUCTILE IRON PIPE AND FITTINGS:

A. Provide and use suitable equipment for the safe and convenient handling of pipe, fittings, valves and other water piping materials. Unload all other piping materials carefully, and lower them carefully into the trenches, piece by piece, with suitable equipment, in a manner that will prevent damage to the materials and their protective coatings and linings. Do not under any circumstances drop or dump water piping materials, either from transportation vehicles or into trenches.

B. Inspect each length of pipe and fittings for defects.

C. Before laying pipe and fittings: remove all lumps, blisters and excess coal tar coating from each spigot and the inside of each bell; wire brush and wipe all dirt and other foreign matter from the outside of each spigot and the inside of each bell; swab out the inside of each length of pipe and each fitting; and remove all dirt and other foreign matter from all gaskets, glands, bolts and nuts. Use every precaution to prevent dirt and other foreign matter from entering pipe and fittings while they are being laid. Spigot ends, insides of bells, gasket grooves, gaskets, glands, bolts and nuts shall be kept free from dirt and other foreign matter after they have been cleaned and before the joints have been made up.

D. Mechanical Joints: After placing pipe and fittings into the trench, slide gland over spigot, apply proper lubricant to gasket and spigot, slip gasket over spigot, center spigot end in bell, force pipe home and bring it into correct line and grade. Press gasket evenly in place into bell, slide gland into position for bolting, insert all bolts, screw on and hand tighten all nuts, then tighten all nuts with an approved wrench. Tighten diagonally opposite nuts alternately to obtain uniform pressure on all parts of the glad, with torques of 40 to 60 foot pounds for 5/8" bolts, and 60 to 90 foot pounds for 3/4" bolts. Realign pipe as required and secure it in place with approved backfill material tamped around pipe, except at bells.

(1) On wedge type retainer type glands, after pipe has been aligned properly, tighten all set screws as specified hereinafter under ANCHORAGE.

E. Push-On Joints. Make up push-on joints in accordance with the manufacturer's recommendations, generally as follows: after placing pipe and fittings into the trench, insert gasket in gasket groove, apply proper lubricant to gasket and spigot, center spigot end in bell, and force pipe home with proper jacks, bars, chains, cables or other suitable equipment. Realign around pipe, except at bells. Taper each field cut spigot and end back about 1/8" at a 30 degree (30□) angle, using a coarse file or portable grinder to prevent gasket damage.

F. Do not "buckle-in" any pipe without the City of Germantown's specific approval.

G. At all times when pipe laying is not in progress, keep all open ends closed tightly with approved caps or plugs to prevent foreign material from entering any part of the pipework.

8. ALIGNMENT OF PIPE:

A. Ductile Iron Pipe: In straight trenches, lay pipe to follow the trench center line as closely as possible, using appropriate fittings at all sharp breaks in grade, and using appropriate fittings or deflecting joints and using shorter than standard lengths of pipe as necessary to make the required curves. Do not deflect any joint in excess of pipe manufacturer's recommendations.

9. ANCHORAGE:

A. Provide anchorage for each bend, tee, plug, deadened and other fitting subject to blowing off of the line under pressure.

B. Unless otherwise indicated, anchorage shall consist of a 1:2:4 concrete blocking poured between firm undisturbed earth and the unbalanced sides of the items to be acnchored, with sufficient earth bearing area to prevent displacement of joints under pressure. Pour concrete blocking before applying pressure test on piping and arrange it so that the pipe and fitting joints will be accessible for repair.

C. Wedge Type Retainer Glands: These shall be "Megalug," as manufactured by EBAA Iron, Inc., Eastland, Texas or as approved, consisting of a specifically designed ductile iron mechanical joint follower gland with multiple wedging action restraining mechanisms with a minimum working pressure of 250 psi. Gland shall be suitable for use with a standard mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21.11. Twist off nuts shall be used to indicate proper torque of the restraining wedges. Glands shall be installed in accordance with manufacturers written instructions and directions. This type of anchorage MAY be used at any location instead of concrete anchorage subject to approval, and SHALL be used at the following locations:

(1) Where indicated.
(2) Where concrete anchorage is not practicable.

D. Anchoring Type Tees for Fire Hydrant Connections: These shall be as specified hereinbefore under DUCTILE IRON PIPE, FITTINGS AND JOINTS. Anchor fire hydrant cut-off valves directly to the locked-on gland rings of the tee outlets.

10. BORED PIPE INSTALLATION:

A. Before commencing work thereon, obtain permission from the appropriate agency for each crossing of a facility not owned by the City of Germantown.

B. Provide a pipe casing around each water main and each service pipe where a bored pipe installation is required. Depths of casings and lengths of casings shall be as indicated or as required. Install casings for mains by dry boring, and jack them in place behind the cutter bit as the boring progresses. Install casings for service pipes by dry boring or jacking. Open cut will be permitted only beyond pavement and shoulders. Install pipes in casings by methods that will positively prevent separation of pipe joints and damage to pipes.

C. Casings for Mains: These shall be 1/4" minimum wall thickness ASTM A53, Class B steel pipe, with an inside diameter as required for the satisfactory installation of the carrier pipes through the casings. Weld all casing joints.

D. Casings for Service Pipes: These shall be Schedule 40 galvanized steel pipe with threaded and coupled joints, with an inside diameter approximately 1" larger than the outside diameter of the service pipe.

11. INSTALLATION OF VALVES AND BOXES:

A. Install valves with their operating stems plumb, at approximate locations indicated, but at exact locations as approved and as specified below. Leave all valves in normal operating positions, free from leakage.

(1) Fire Hydrant Cut-Off Valves: Install these directly on the spigot outlets of the anchoring type tees in the mains.

(2) All Other Valves: Insofar as practicable, install these 3'-0" from centers of tees and crosses at intersections, and at locations in runs where easy to find in the future.

B. Set and support each valve box so that no stress or shock can be transmitted to the valve, with the box centered and plumb over the valve wrench nuts, and the box top exposed and flush with the finished grade. Readjust boxes as required so that all boxes conform to these requirements at the time of acceptance of the system. Leave all valves in normal operating position, free of leakage.

C. Provide a 24" square 8" thick concrete pad around each valve box, one inch below paving surface in all presently paved areas, and one inch below future paving in all areas which will receive future paving. Provide forms for all pad edges.

D. Plug the outlet of each valve installed for future use, with a standard cast iron plug, anchored as specified hereinbefore.

12. EXISTING FIRE HYDRANT RELOCATIONS:

A. Existing fire hydrants located along the new main shall be relocated and connected to the new water main. All hydrant leads shall be 6" pipe.

B. Set each hydrant on a 4" thick 15" square minimum size precast concrete slab, in true plumb position, with lowest nozzle not less than 12" above finished grade. Securely block or anchor hydrant to prevent it from blowing off of lead, and place at least 1/4 cubic yard of broken stone or coarse gravel around the base to at least 12" above and 12" below the drain hole for proper drainage. See TYPICAL FIRE HYDRANT INSTALLATION detail in the specifications.

C. Hydrant Extensions: Provide hydrant extension units at the unit price bid, only where authorized for satisfactory hydrant settings under abnormal or adverse job conditions beyond the Contractor's control. No payment will be made for any hydrant extension units which may be required as a result of Contractor's errors or negligence, and all such hydrant extensions necessary for satisfactory hydrant settings in all such cases shall be provided by the Contractor at his own expense, as required. Otherwise, install standard 3 foot bury hydrants. All hydrant settings regardless of length, shall conform to all of the above specified setting requirements.

D. All joints between the anchor tee and the hydrant shall be restrained.

13. BACKFILLING:

A. Do not backfill pipe trenches until the City of Germantown has inspected and approved the pipe. Immediately after approval, backfill the trenches as specified below. Testing for leaks on the surface of the pipe prior to backfilling will not be required, but other test procedures, as specified under TESTING AND STERILIZING, shall be followed after backfilling trenches.

B. All Locations, Except for Sand Backfill: After the pipework has been approved, thoroughly hand tamp all backfill into bell holes, around and over the pipework until a 6" cover has been tamped over the tops of the pipes.

C. Pipe Under Existing Paved Areas, Including Paved Driveways, Except for Sand Backfill: Place all backfill from 6" above pipe tops up to paving subgrade in 8" maximum thickness loose layers. Compact each layer to 95% standard proctor density using pneumatic or other approved mechanical tampers.

At the end of each day's work, do not leave more than 200 feet of trench without compacted backfill, unless otherwise approved by the City of Germantown. PUDDLING OR WATER SETTLING WILL NOT BE PERMITTED.

D. Pipe Under Areas Proposed to be Paved, Except for Sand Backfill: Fill the trenches from 6" above pipe tops in 8" maximum thickness loose layers up to paving subgrade. Compact the backfill, using pneumatic or other approved mechanical tampers until the backfill is compacted to at least the density set forth in Section 2101 - Excavation Embankment and Subgrade Preparation. At the end of each day's work, do not leave more than 200 feet of trench without compacted backfill, unless otherwise approved by the City of Germantown. PUDDLING OR WATER SETTLING WILL NOT BE PERMITTED.

E. Pipes Under Non-Paved Areas: Fill the trenches from 6" above pipe tops up to trench tops, and windrow the excess excavated materials over the trenches. After sufficient settlement satisfactory to the City of Germantown has occurred, complete the surface dressing, surplus material removal and surface cleanup.

F. Vehicular Traffic: For all pipes crossing streets, roads, gravel driveways and dirt driveways which are in regular use, backfill the trenches and make the crossing usable by vehicular traffic immediately after laying pipe and obtaining the City of Germantown's approval thereof, and maintain these crossings usable by vehicular traffic until acceptance of the water piping work by the City of Germantown. Do not under any circumstances leave a street or road crossing or a private driveway unusable overnight.

G. Backfill Materials, Except Sand: Except where sand backfill is indicated on the drawings, specified herein, or approved by the City of Germantown, backfill materials shall be:

(1) Up to 6" above pipe tops: Selected earth, free of rocks, stones, bricks, cinders, broken concrete, rubbish, vegetable materials and other unapproved materials.

(2) From 6" above pipe tops up to finished grade or paving subgrade, as the case may be: Any materials removed from the excavation and suitable for backfill, except do not use as backfill material any pieces of the following materials which are larger than 6: in their greatest dimensions: Rock; stone; concrete; asphalt paving; or masonry.

(3) All backfill materials shall be subject to the City of Germantown's approval. Dispose of all excavated materials not used as backfill, as approved.

H. Sand Backfill: Use sand ONLY as backfill materials at the following locations:

(1) For all pipes in tunneled holes, and for all mains in bored holes without casings; thoroughly tamp or otherwise place the backfill in an approved manner to prevent caving and settling.

(2) At all locations where indicated on the drawings or authorized by the City of Germantown, from pipe laying subgrade up to paving subgrade: Same backfill shall be compacted with a vibratory plate compactor.

I. Refill and smooth off as required all backfill which settles, so that all backfill finally conforms to the original ground surfaces, not only at the time of project acceptance, but also for the duration of the guarantee period. This includes removing and repairing all pavement which may be damaged by settlement.

14. CONNECTIONS TO EXISTING WATER SYSTEMS:

A. Unless otherwise indicated or authorized, make connections to existing water mains by removing plug from existing plugged fitting, or inserting a tee and proper sleeve in existing main, as applicable, at each point of connection between new and existing mains. This type of connection is classified as a "Non-Pressure Connection."

B. BEFORE SHUTTING OFF EXISTING WATER MAINS TO MAKE CONNECTIONS, OBTAIN APPROVAL OF THE CITY OF GERMANTOWN WATER AND FIRE DEPARTMENTS, AND ADVISE ALL AFFECTED WATER CUSTOMERS ACCORDINGLY. AFTER SHUTTING OFF, DO ALL NECESSARY WORK AND RESTORE WATER SERVICE AS QUICKLY AS POSSIBLE.

C. Where indicated or authorized, make connections to existing water mains by installing a mechanical joint split tapping valve, and cutting proper hole in existing main with special tapping machine, without shutting off the water in the existing main. Tapping valves and their boxes shall conform in all respects to the requirements of VALVES AND BOXES, except that one end of the valve shall be flanged to match tapping sleeve flange, and the other end of the valve shall be a mechanical joint end. This type of connection is classified as a "Pressure Connection."

15. PROCEDURES FOR ABANDONING THE EXISTING MAIN:

A. When called for on the plans, water main will be abandoned and left in place. Depth and locations of this main and other utilities along the proposed route of the new main shall be verified, and the new main installed at locations and depths to facilitate connections of existing service lines and fire hydrants and to expedite the interconnections with other water mains as detailed or as required.

B. If at all possible, the existing main is to be left in place full of water. All existing valves on the services, hydrants, and interconnected mains shall be left in place in the CLOSED position and the operating nut shall be removed. For all such valves with valve boxes, lower the tops of these valve boxes at least 1'0" below finished grade and cover with pavement or ground as applicable.

C. In the event that sections of the existing main have to be removed for proper connection of the new main to existing facilities, then the existing main shall be emptied. Extreme care

shall be taken in discharging water from the existing main to prevent damage and/or to create adverse conditions on adjacent property, to interfere with traffic movements, or to create conditions detrimental to the construction of this project. Before draining the main, the Contractor shall present his procedure for accomplishing this operation to the City of Germantown for approval. UNDER NO CIRCUMSTANCES SHALL THE EXISTING WATER MAIN BE DRAINED WITHOUT THE APPROVAL OF THE CITY OF GERMANTOWN.

D. If the existing line is drained, plug all open ends and other openings on the line.

16. IN-LINE VALVE INSTALLATION:

A. When called for on the plans, in-line valves may be required to isolate parts of the existing system to facilitate the work in progress without disruption of customers being served by the existing system.

B. In-line valve installation shall be accomplished using the water line stopping system of Hydra-Stop, Inc., 12601 South Homan Avenue, Blue Island, Illinois, 60406, or other approved method. Equipment and materials shall be suitable for making connections to cast iron and/or ductile iron pipe.

C. Each in-line valve installation will require two pressure taps spaced to allow for the removal of sufficient lengths of pipe for the installation of a valve, fittings, pipe plug and blocking as detailed for each specific connection: all work of which will be performed between the pressure taps. The Contractor shall investigate each connection site and plan the work for the incline valve installation to minimize the area needed to make the respective connection.

D. If the contractor elects to make the pressure tapping/waterstopping installations with his own forces, a technical representative from the company providing the equipment and materials for the tapping/waterstopping installation shall be present when connections are made to existing water lines. the representative shall be thoroughly knowledgeable and familiar with all phases of the tapping/waterstopping procedures and installation.

E. If the tapping/waterstopping installations are subcontracted, the Contractor shall comply with Paragraph 23 of the GENERAL PROVISIONS. If the Contractor intends to use equipment on hand, and/or rent, lease or purchase equipment for making the tapping/waterstopping installations, a complete list of all equipment and the method for making tapping/waterstopping installation shall be submitted to the City of Germantown for approval.

F. All work involved for in-line valve installation shall conform to other applicable parts of this SECTION of these specifications.

17. TESTING AND STERILIZING:

A. After backfilling and before testing the pipe lines, sterilize all new pipework with chlorine for a period of not less than 24 hours. Introduce sufficient chlorine into pipe line to provide a chlorine strength of not less than 50 ppm throughout the entire piping system, using either liquid chlorine or chlorine bearing compounds similar to "HTH," and determining the required quantity of chlorinating agent in accordance with the manufacturer's directions for the calculated volume of water to be treated. Inject chlorine solution into the pipe line, or by other approved means. After a retention period of not less than 24 hours, thoroughly flush the chlorinated water out of the pipe lines from its extremities, take samples of water from approved locations in the pipe line, and have the samples analyzed for bacterial purity by an approved laboratory. Continue this process until the samples indicate that the water is free of contamination and safe for domestic use, all to the satisfaction of the City of Germantown and the Memphis & Shelby County Health Department. Furnish all necessary approved sterilizing equipment. The costs of all laboratory services shall be borne by the Contractor. Samples shall be taken of water that has stood in the main for at least 24 hours.

B. After sterilization, subject all pipework to pressure and leakage tests. Piping may be tested in sections between valves as the work progresses. Admit water slowly into the section to be tested, and expel all air through corporation stops installed in the high points of the pipe lines, and through other openings, as required. After all air has been expelled, apply a pressure of 200 psi and maintain it for not less than two hours, during which time the leakage shall not exceed that permitted by AWWA Specification C600-77 for mechanical joint and push-on joint pipe. Repair all apparent leaks. Should the measured leakage exceed the maximum specified allowable leakage, locate and repair the leaks and repeat the tests on sections of pipe involved until all tests have been approved. Furnish approved testing equipment, consisting of suitable pump to apply and maintain test pressure, accurate pressure gauges, suitable equipment to measure volume of water pumped and other necessary equipment, and conduct all tests in the City of Germantown's presence in an approved manner. Determine leakage by measuring the volume of water pumped to maintain the required test pressure for the duration of the leakage test. Obtain a copy of AWWA Specification C600-77, and keep it on the job in good condition for the Contractor's and City of Germantown's use in computing the permissible leakage in each section to be tested.

C. Water for testing, sterilization and flushing will be furnished at no cost to the contractor by the City. Except that should the Contractor operate any existing valve in any unauthorized manner or use an excessive quantity of water, then the City may, at its discretion, charge the Contractor for the estimated quantity of water used. The Contractor shall furnish all piping and equipment to convey the water to the new pipe lines.

D. Corporation stops shall be Mueller No. H-15000 or as approved; provide these as required, and leave them in place after testing and sterilizing with the outlets plugged.

E. DO NOT UNDER ANY CIRCUMSTANCES OPEN THE SECTIONALIZING VALVES BETWEEN THE EXISTING MAINS AND THE NEW MAINS UNTIL THE BACTERIAL ANALYSIS OF THE MAINS INVOLVED HAS BEEN APPROVED BY THE CITY OF GERMANTOWN, EXCEPT THAT UPON THEIR APPROVAL, VALVES MAY BE OPENED ONLY AS REQUIRED TO ADMIT WATER INTO THE NEW MAIN S FOR TESTING, STERILIZING AND FLUSHING.

18. CLEANING UP OF DISTRIBUTION SYSTEM:

A. Clean up the distribution system as the work progresses. Negligence in proper cleaning up which causes undue inconvenience to the public or private citizens or presents an unsightly or dangerous condition or causes embarrassment to civic officials, will be sufficient reason for rejection of construction estimates until the unsatisfactory conditions have been remedied.

B. After all work is complete, make a final cleanup of all areas where work has been done and leave them in broom clean condition.

C. See Paragraph 33 in GENERAL CONDITIONS.

19. FINAL VALVE CHECK:

A. After completion of all water line work and before the work will be accepted, make a final check of each valve installed and hydrant set or reset under this project, and of each existing valve that has been operated in connection with the work under this project.

B. Make this final valve check in the presence of a City representative and demonstrate that each valve is in fully open position and that each fire hydrant operates properly.

20. PAVEMENT REPAIRS - GERMANTOWN STREETS:

A. As approved by the Engineer, as soon as practicable after installing water lines, restore the streets to a condition that permits passing traffic.

B. Where existing paved areas are cut for the installation of water mains, repair the pavement in accordance with the details on the drawing entitled "TYPICAL REPAIR OF UTILITY CUTS IN PAVEMENTS" included in the back of these specifications. Repairs shall conform to the detail "PATCH FOR ASPHALTIC CONCRETE OR SURFACE TREATED STREETS ON ALL TYPES OF BASE" FOR THE MAJOR CLASS STREET.

C. Materials:

(1) Asphalt shall be as specified hereinafter; thickness shall be as indicated on the drawings.

(2) Pug-mill mix shall be a locally available mix containing 7% minimum cement.

21. SEPARATION OF WATER MAINS AND EXISTING SEWERS:

A. Parallel Installation:

1. Normal conditions: Water mains shall be laid at least 10 feet horizontally from existing sanitary sewers, storm sewers and sewer manholes, wherever possible; the distance shall be measured edge-to-edge.

2. Unusual conditions: Where local conditions prevent a 10 foot horizontal separation, a water main may be laid closer to existing storm or sanitary sewers, provided that the bottom of the water main is at least 18 inches above the top of the existing sewer.

B. Crossings:

1. Normal conditions: Water mains crossing existing 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 existing sewer, wherever possible.

2. Unusual conditions: Where local conditions prevent a vertical separation as described above, water mains passing under existing sewers shall be protected by providing:

a. A vertical separation of at least 18 inches between the bottom of the existing sewer and the top of the water main.

b. Adequate structural support for the existing sewers, to prevent excessive deflection of joints and settling on and breaking the water mains.

c. A full laying length of water pipe centered at the point of crossing, so that the joints will be equidistant and as far as possible from the existing sewer.

C. Manholes: No water pipe shall pass through or come into contact with any part of any existing manhole.

22. BASIS OF PAYMENT:

A. Pipe, Ductile Iron, Open Cut: Paid for at the unit price per linear foot of pipe in place in open cut trenches or open cut excavations, measured along the top centerline of the pipe between intersecting centerlines or ends of pipes, through fittings and valves.

B. Iron Fittings: Paid for at the unit price per pound of fittings in place, as established by the invoice weight of the fittings on the basis of AWWA C110 published body weights of mechanical joint fittings, but not including the weight of bolts, nuts, glads, gaskets or cement linings; does not include tapping sleeves.

C. Valves and Boxes: Paid for at the unit price for each valve and its box in place; does not include tapping valves and their boxes, which will be paid for as specified hereinafter under "Pressure Conditions."

D. Fire Hydrants: Paid for at the unit price for each new fire hydrant in place with base supports, draining gravel and based upon hydrants of the specified bury.

E. Relocated Hydrants: Paid for at the unit price for each relocated hydrant in place with base supports, drainage, gravel and based upon hydrants of the specified bury, without hydrant extensions.

F. Hydrant Extensions: Paid for at the unit price per linear foot of hydrant extension in place. No payment will be made for unauthorized hydrant extensions (See HYDRANT INSTALLATION, hereinbefore).

G. Hydrant Leads: Paid for as PIPE, IN OPEN CUT.

H. Connections to Existing Plugged Lines: No separate payment; include this in the various unit prices.

I. In-Line Valve Installation: Paid for at the unit price for each complete in-line valve installation made to existing mains while the main is in service under pressure. This includes the linestopping fitting, pressure tap, linestopping pressure plugging, temporary valve and all other appurtenances required to isolate a section of existing water main.

J. Granular Pipe Bedding Material and Granular Backfill Material: Paid for at the unit price per ton of material in place as evidenced by delivery tickets.

K. Cement Treated Base (Pug-Mill Mix): Paid for per square yard, to the thickness indicated, compacted and in place.

L. Replacement of Pavement and Special Surfaces for Utility Cuts: Paid for at the unit price per ton or per square yard, as applicable, of each type of pavement or special surface in place, as computed by actual measurement of the areas repaired, except that no payment will be made for repairs outside fo the specified payment limits.

M. Meter Relocations: Paid for at the unit price for each meter and box relocated, including couplings, gaskets, excavation and backfill.

N. New Service Connector or Existing Service Reconnection Unit: Paid for at the unit price for each complete existing service reconnection unit or new service connection unit in place, including corporation stop (if specified); tapping or fittings required to connect the corporation stop of service pipe to water main; service pipe couplings and fittings; adapters; disconnecting existing service pipe from existing water main; connecting new service pipe to new or existing water service pipe; excavation; and backfill; but does not include service pipe, which will be paid for separately.

O. Service Pipe, In Open Cut: Paid for at the unit price per linear foot of service pipe for the size specified in place in open cut trenches and open cut excavations.

P. Non-Pressure Connections: These include all connections made to existing plugged openings, except existing plugged valves, and all connections made by inserting new fittings in existing mains, while the main is out of service and substantially not under pressure, regardless of water conditions in the trench at the connection point; no separate payment; include these in the various unit prices. However, all new piping materials used in these connections will be paid for separately, as specified hereinbefore.

Q. Pressure Connections: Paid for at the unit price for each complete tapping sleeve type connection made to existing water mains, while the main is in service and under pressure. This includes the tapping sleeve, tapping valve and tapping valve box in place and in the hole cut in the existing main.

R. Pipe, Incasing, Mains and Service Pipes: Paid for at the unit price per lineal foot of pipe in place in pipe casing; includes WATER PIPE AND ITS CASING; no payment will be made for any pipe in casing in excess of the lengths indicated or authorized.

S. Gaskets, Bolts, Nuts, Mechanical Joint Glands and Other Joint Materials; Excavation and Backfill; Removal of Existing Pavement; Anchorage; Testing and Sterilizing; and Removing and Replacing Sod, Fences, Etc.: No separate payment unless specifically otherwise indicated; include these in the various unit prices.

T. Extra Depth Excavation: The MINIMUM cover for pipes is specified hereinbefore; no extra payment will be made for any extra depth excavation that may be required to permit piping to pass under obstructions, whether they are indicated on the drawings or not.

U. Other Miscellaneous Items: No separate payment unless specifically otherwise indicated; include these in the various unit prices.

V. Quantities and Payments, In General: Payments will be made to the nearest complete unit as listed in the PROPOSAL. Quantities submitted for payment shall be rounded off to the nearest linear foot, pound, cubic yard, or other applicable unit.

Payment will be made under:

Item No.	Pay Item	Unit
A	PIPE, DUCTILE IRON AND OPEN CUT	LF
B	IRON FITTINGS	LB
C	VALVES AND BOXES	EA
D	FIRE HYDRANTS	EA
E	RELOCATED HYDRANTS	EA
F	HYDRANT EXTENSIONS	EA
G	HYDRANT LEADS	EA
H	CONNECTIONS TO EXISTING PLUGGED LINES	EA
I	IN-LINE VALVE INSTALLATION	EA
J	GRANULAR PIPE BEDDING MATERIAL AND GRANULAR BACKFILL MATERIAL	TON
K	CEMENT TREATED BASE	SY
L	REPLACEMENT OF PAVEMENT AND SPECIAL SURFACES FOR UTILITY CUTS	TON OR SY
M	METER RELOCATIONS	EA
N	NEW SERVICE CONNECTOR OR EXISTING SERVICE RECONNECTION UNIT	EA
O	SERVICE PIPE, IN OPEN CUT	LF
P	NON-PRESSURE CONNECTIONS	EA
Q	PRESSURE CONNECTIONS	EA
R	PIPE, INCASING, MAINS AND SERVICE PIPES	LF
S	GASKETS, BOLTS, NUTS, MECHANICAL JOINT GLANDS, AND OTHER JOINT MATERIALS; EXCAVATION AND BACKFILL; REMOVAL OF EXISTING PAVEMENT; ANCHORAGE; TESTING AND STERILIZING; REMOVING AND RE-PLACING SOD, FENCES, ETC.	EA
T	EXTRA DEPTH EXCAVATION	EA
U	OTHER MISCELLANEOUS ITEMS	EA
V	QUANTITIES AND PAYMENTS, IN GENERAL	EA