

GENERAL – WATER MAIN SPECIFICATIONS

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GENERAL – WATER MAIN SPECIFICATIONS

1. GENERAL

- a. These specifications are supplemental to and form a part of the Contract herewith attached and are intended to technically describe the nature of the materials, equipment and workmanship required to complete in a workmanlike manner, the water mains and appurtenances shown on the accompanying plans.
- b. All labor, tools, and materials necessary to excavate for, lay, join, backfill, and finish the water mains and appurtenances shall be considered as part of the water distribution system construction.
- c. Water mains shall be considered to mean ductile iron and/or pre-stressed concrete cylinder pipe complete with specials, fittings, valves, valve wells, valve boxes, hydrants and appurtenances, and connections to existing mains.
- d. This work shall be performed in accordance with the general conditions and general specifications unless otherwise noted in an addendum.

2. METHOD OF CONSTRUCTION

Construction procedure will generally be left to the discretion of the Contractor so long as satisfactory progress is made, good workmanship is produced, and required precautions are taken for safety.

3. BASIS OF PAYMENT

Water main of the diameter specified will be paid for at the contract unit price per lineal foot, measured in place along the center line of pipe, which price shall be payment in full for furnishing the materials, including specials and fittings, all necessary excavation, sheeting or bracing, draining, laying, jointing, bedding, testing, disinfecting, water used in testing and disinfecting, backfilling, disposal of surplus excavated materials, restoration and final cleanup, and all other work incidental to the construction of the water main. Measurement will be taken from end to end with no reductions for fittings and valves. Special structures or sections for which either lump sum or unit price bids have been taken will be deducted from the total length of water main, and will be paid for at the prices bid therefore. Hydrant connections will not be paid for as water main.

Hydrants will be paid for at the contract unit price, which shall include all work between main and hydrant and shall include pipe and specials and the hydrant valve and box.

4. MATERIAL TESTING

The Contractor shall provide the Owner a list of all suppliers of the pipe, fittings specials and valves. Each of the suppliers shall provide the Owner with a Certificate of Intent of Compliance prior to material delivery. The Certificate shall certify that all materials supplied for the work will be manufactured, tested and inspected in accordance with the contract documents. Following the delivery of the materials the supplier shall provide the Owner with a Certificate of Compliance. The Certificate shall certify that all materials supplied have been manufactured, tested and inspected in accordance with the contract documents. Each of the above Certificates shall include the following: Suppliers name and mailing address; project title, a description of each material supplied, a statement that all materials will be (or have been) manufactured, tested and inspected in accordance with the contract documents for the project and shall be signed and notarized. All of the above shall be provided at the Contractor's expense.

5. EXCAVATION

- a. Excavation shall include clearing of the site of the work and the removal and disposal of all materials necessary to be removed in the construction of all work under this Contract.
- b. Excavation shall be to depths to provide cover of five and one half (5½) feet over the top of pipe to plan grade, unless otherwise noted on the plans.
- c. Excavation shall precede the pipe laying by a safe distance but shall not exceed 200 feet unless authorized by the Engineer. Excavation shall be of sufficient widths and depths to provide adequate room for construction bedding and installation of the work to lines, grades, and dimensions called for on the plans.
- d. The widths of the trench from the top of the pipe to a height twelve (12") inches above the top of the pipe barrel shall be as follows:

Pipe Internal Diameter	Maximum Trench Width
Less than 18"	30"
18" to 24"	Pipe O.D. plus 18"
Greater than 24"	Pipe O.D. plus 24"

- e. If the maximum trench width as specified above is exceeded, unless otherwise shown on the drawings, the Contractor shall install at his own expense such concrete cradling or other bedding as is approved by the Engineer to support the added load of the backfill.
- f. Where, through the Contractor's construction procedure or because of poor existing ground conditions, it is impossible to maintain alignment and grade properly, the Contractor shall at his own expense shall undercut the first three (3) feet of trench bottom below grade and refill the trench to the proper grade with a compacted 1½" maximum size aggregate in order to insure that the pipe, when laid, will maintain correct alignment and grade.
- g. Excavated materials may be temporarily stored along the trench in a manner that will not cause damage to trees, shrubs, fences, or other property, nor that will endanger the bank of the trench by imposing too great a load thereon.

5. EXCAVATION (continued)

- h. Open cut excavations for shafts or other structures shall be adequately braced and/or sheeted to prevent caving or squeezing of the soil. Tunnels shall be sheeted and/or braced as necessary to enable the work to be performed with safety to the men, the work, and neighboring structures. All excavations shall be completely dewatered prior to construction of the water main or other structures; and adequate provisions shall be made to prevent water from flowing through or over newly placed concrete or brickwork. Drainage shall be carried to sumps from which the water may be pumped.

6. BEDDING AND BACKFILLING

- a. Bedding for water main is shown on the standard detail sheet for water main. Standard pipe bedding is defined as the envelope surrounding the pipe and extending from a sub-grade of three (3) inches minimum to four (4) inches maximum below the bottom of the pipe upwards, bearing laterally against the sides of the trench, to an elevation providing twelve (12) inches of cover over the pipe. Blocking under pipe is strictly prohibited. If the contractor wishes to use a bedding material different than indicated on the standard detail sheet, prior approval regarding material and method of installation must be obtained from the engineer. If the trench is wet or unstable or an undercut is required, sand bedding will not be allowed. All costs for pipe bedding, including material, labor and equipment will be incidental to the contract unless otherwise indicated in the proposal.
- b. After the pipe is laid, sand bedding shall be thoroughly compacted in place to a level twelve (12) inches above the top of the pipe. Particular care shall be taken to assure filling all spaces under, around and above the top of the pipe. The bedding shall then be completed to at least twelve (12) inches above the top of the pipe, and thoroughly compacted in place
- c. Backfill is defined as that material placed into the trench from the top of the standard pipe bedding (as previously defined) to the ground surface.
- d. Selected excavated material for use in backfill is defined as soil that is capable of meeting identified compaction requirements and is free of large or frozen lumps, asphalt, concrete, rubble, boulders, blue clay, topsoil, peat, marl, wood, debris, vegetation, or other extraneous materials as determined by the Engineer.
- e. Zone of influence is defined as a one to one (1 horizontal to 1 vertical) slope from the edge of pavement to the trench bottom.
- f. Wherever compaction is required, it shall be by suitable mechanical compaction equipment approved by the Engineer. Initial compaction tests will be made by a representative of the Owner and paid for by the Owner. However, if it is necessary to repeat compaction tests because initial compaction methods or construction procedures failed to produce required density, in place, the Contractor shall be billed for the cost of all repeat testing until material meets specifications.
- g. The backfill from 12" above the pipe shall be placed into the trench according to one of the following specified manners as determined by location of the edge of trench nearest the existing pavement:

6. **BEDDING AND BACKFILLING (continued)**

- (1.) Concrete and Asphalt Pavements, Sidewalks, Driveways & Parking Areas.

Trench Location

Backfill Requirements

- (a) Under concrete and asphalt surfaces and within the zone of influence.

Backfill shall be in accordance with the detail sheet with mechanically tamped class II sand or stone in 6" layers, loose measure, with each layer compacted to not less than 95% of maximum dry density as determined by the ASTM D 1557 Compaction Standard.

- (b) Outside the zone of influence and within road right-of-way.

Backfill material shall be placed into trench in 6" layers, loose measure, with each layer compacted to not less than 90% of maximum dry density as determined by the ASTM D 1557 Compaction Standard. Selected excavated material may be used provided compaction requirement can be met.

6. BEDDING AND BACKFILLING (continued)

- (2). Gravel Roads, Driveways, and Parking Areas.

Trench Location

Backfill Requirements

- (a) Within the zone of influence and within road right-of-way.

Backfill materials shall be placed into trench in 6" layers, loose measure, with each layer compacted to not less than 90% of maximum dry density as determined by the ASTM D 1557 Compaction Standard. Selected excavated material may be used provided compaction requirement can be met. The Contractor shall immediately restore all roads, driveways, and parking areas with (MDOT 21AA natural gravel) or slag aggregate, or approved equal, to match original aggregate, at least 8 inches thick and shall maintain them in good, dust-free condition during the life of the Contract. Additional aggregate shall be added if settlement occurs. Before final acceptance of the road, driveway, or parking area, it shall be top-dressed with approved material to match the original surface treatment. Gravel shall be suitably stabilized with calcium chloride.

- (b) Outside the zone of influence and within the road right-of-way.

Same as 2. (a) above.

- (3.) Open Fields & Lawn Areas

Backfill material shall be placed into trench in 12" layers, loose measure, with each layer compacted to not less than 90% of maximum dry density as determined by the ASTM D 1557 Compaction Standard. Selected excavated material may be used provided compaction requirement can be met. Compaction will be tested at the inspector's discretion.

Contractor shall re-grade as necessary during the life of the Contract. For restoring lawn and landscaped areas see Section GS-8, "Final Cleanup and Restoration". No frozen materials permitted.

- (4.) Special Backfill

Where called for on the plans or where required by Road Permits, the Contractor shall backfill trenches in accordance with the requirements of said plans or Road Permits.

Where "Special Backfill Requirements" are called for along highways under the jurisdiction of the State of Michigan, the Road Commission for Oakland County, or the local unit of government, the Owner will employ an independent testing laboratory to make compaction tests and the costs of the tests will be paid for by the Contractor.

6. BEDDING AND BACKFILLING (continued)

- (4) Backfilling around all structures shall be placed in compacted one foot layers, in a manner that will not cause unequal pressure or damage to any exterior coatings or plastering.

7. THRUST BLOCKS

- a. The Contractor shall furnish and place horizontal and/or vertical thrust blocks at all plugs, caps, tees and fittings whether or not indicated on the drawings unless otherwise specified. The cost of thrust blocks shall be included in the unit price bid per foot of water main. The inspector or Engineer shall approve all thrust blocks of any nature prior to backfilling.
- b. In unstable soil conditions, the thrust blocks are to be supported by piling driven to solid foundations or by removal of the unstable soils and replacement with ballast of sufficient stability to resist the thrusts. The thrust blocks are to be approved by the Engineer before backfilling. The cost of piling or ballast at thrust blocks shall be included in the unit price bid per foot of water main.

8. ANCHORAGE AND ENCASEMENT

The Contractor shall furnish and place all concrete anchorage and encasements, as called for on the drawings. The cost of anchorage and encasements shall be included in the unit price bid per foot of water main.

9. UNLOADING PIPE

All pipe and special castings shall be unloaded and distributed along the line of work in such a manner and with such care as will effectually avoid the cracking of any pipe or special castings. Dropping directly from the truck will not be permitted.

10. HYDROSTATIC TESTS

- a. Within a reasonable length of time following pipe laying and backfilling, the Contractor shall complete all work necessary to perform hydrostatic testing. If, in the opinion of the Engineer, work has not progressed in a reasonable manner, he shall have the right to direct the Contractor to proceed with the work or any portion thereof immediately. The Contractor shall perform all necessary preliminary hydrostatic tests and shall make all necessary repairs, including the repair of all visible leaks and cracks, and retest with his own forces to ready the water mains for final hydrostatic inspection and testing by the Owner. Immediately after the water mains have passed such preliminary tests, the Contractor shall submit a written request to the Owner for final hydrostatic inspection and test.
- b. Prior to and during the hydrostatic test the new main is not to be connected to the existing water system, except as specified herein. Temporary blow-offs, caps or plugs shall be provided at the ends of the new main.
- c. At the option of the Contractor he may test against closed valves providing that the new main to be tested and the testing apparatus shall have first been flushed and chlorinated in accordance with accepted procedure. After chlorinating and subsequent flushing, a sample of water must show by test by a recognized laboratory, safe bacteriological results. In the event of an unsatisfactory hydrostatic test he will cut the new main, install caps or plugs, pressure test and re-chlorinate without additional cost or charge.

10. HYDROSTATIC TESTS (continued)

- d. The Contractor shall furnish all necessary personnel, temporary timber bracing, plugs, test pumps and all other necessary apparatus for conducting the test.
- e. Before applying test pressure, all air shall be expelled from the pipe. If necessary to accomplish this, taps shall be made at points of highest elevation in the pipe and such openings subsequently closed, prior to test, with tight threaded brass plugs.
- f. Pressure tests shall be in conformity with the current standards for pressure and leakage test, AWWA C-600. Test pressure shall be maintained at 150 pounds per square inch (p.s.i.) at the point of highest elevation in the test section by pumping potable water into the pipe for a period of at least two (2) hours and in all cases long enough to permit assurance of a satisfactory test. Leakage as measured by the quantity of water pumped into the pipe to maintain 150 p.s.i. pressure during the test, shall not exceed a rate of eleven (11.65) gallons per inch diameter of main, per mile of pipe, in 24 hours.
- g. Minimum size pressure gauge is to be 3 1/2" diameter graduated in one (1) p.s.i. increments. All gauges shall be calibrated every six (6) months with the last certification date provided to the OCDC prior to testing. Calibration will be to an accuracy of ±1 degree or better.
- h. The Contractor shall furnish all water used on this project including water used for hydrostatic testing, chlorination and flushing. If he elects to purchase water from the Owner he shall pay for the full-metered amount at the current water rate for the system used.
- i. If a meter is not available to measure the volume of water, the Contractor shall pay for a minimum of three times the volume of the pipe installed or as otherwise determined by the Engineer.
- j. If more than one Contractor is involved in the installation of the water system the Engineer shall prorate the amount of water used between the various Contractors based upon the volume of the pipe in each section.

11. CHLORINATION

- a. Chlorination shall be in conformity with current AWWA standards for disinfection, AWWA C-651. After satisfactory hydrostatic tests are obtained, the new main shall be chlorinated. A chlorine gas-water mixture shall be applied by means of a solution-feed chlorinating device. The chlorine solution shall be applied through a corporation stop at the beginning of the main. A slow flow of water shall be let into the main approximately at the point of injection of the chlorine solution, at a rate such that the chlorine dosage of the entering water shall be at least 50 parts per million. An open discharge shall be maintained at the far end of the main, and the introduction of chlorine solution and water shall continue until the water discharging at the far end shall carry the required dosage of chlorine. As the main is filled with chlorinated water each outlet from the main shall be opened and sufficient water drawn off to assure that the full dosage of chlorine reaches each outlet.
- b. The chlorine treated water shall remain in the main at least 24 hours, and at the end of that time the chlorine residual at pipe extremities and other representative points shall be at least 10 p.p.m. If the chlorine residual shall be less than 10 p.p.m. at the end of 24 hours, further application of chlorine shall be made and the retention period repeated until the

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required 10 p.p.m. residual is obtained.

11. CHLORINATION (continued)

- c. Following chlorination, all treated water shall be thoroughly flushed from the main. The treated water will be considered flushed when the residual chlorine content is less than 0.7 p.p.m. Prior to the water main being placed in service, two consecutive sets of water samples for bacteriological analysis shall be collected 24 hours apart and each analysis shall not indicate the presence of coliform. The engineer shall determine the number and location of the sampling points. Analysis of other contaminants may be required if the engineer has reason to believe that these contaminants are present.
- d. Should the initial treatment of all or any section of the main, in the opinion of the Engineer, prove ineffective, the chlorination procedure shall be repeated until confirmed tests show that water sampled from the new main conforms to the foregoing requirements. If the system is not activated within 30 days after initial testing, bacteriological tests shall be repeated to assure a safe water supply system.

12. TUNNELING

- a. The Contractor may at his option (and with the approval of the Engineer), construct the water main in tunnel, where it crosses existing roadways, public and private utilities, walks, or other structures. The water main shall be constructed in tunnel where noted on the Drawings or, as may be required under road permits.
- b. All tunneled water mains shall be installed within a casing pipe consisting of new and unused steel spiral welded pipe conforming to ASTM A-139, Grade B.
- c. Casing pipe ends shall be prepared for field welding. Welders performing field welding shall have satisfactorily passed "structural welding code" qualification tests within the previous 12 months. Joints in casing pipe shall be fully welded along the circumference of the pipe.
- d. The diameter of the casing pipe shall be sufficient to house the pipe, wooden skids, and provide a minimum of 3" of clearance as measured from the crown of the bell of the pipe to the casing. Unless otherwise indicated on the Plans, the minimum wall thickness of the casing pipe shall conform to the following table:

ALLOWABLE HEIGHT OF COVER (H) IN FEET, FOR STEEL CASING											
WALL THICKNESS (INCHES)		STEEL CASING OUTSIDE DIAMETER (INCHES)									
FRACTION	DECIMAL	12	14	16	18	20	24	28	30	36	42
3/16	.1675	39	30	24	21	19	17	16			
1/4	.250	50	50	39	31	27	21	19	18	16	
5/16	.3125			50	48	39	28	23	21	18	17
3/8	.375				50	50	39	29	27	22	19
7/16	.4375						50	39	34	26	21
1/2	.500							50	44	31	25
9/16	.5625								50	39	30
5/8	.625									48	35

THIS TABLE NOT APPLICABLE AT RAILROAD CROSSINGS

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12. TUNNELING (continued)

- e. The casing pipe shall be installed by a continuous boring-jacking operation. The boring auger shall not proceed ahead of the casing pipe. Water shall not be used in the boring operation.
- f. The face of the jacking pits generally shall be located a minimum of ten (10) feet from the edge of the pavement and/or back of curb, and shall be sheeted and shored sufficiently to protect the pavement and/or track installations, existing underground utilities and the safety of the workman. Access pits shall be protected from vehicular traffic and shall be provided with suitable fencing and barricades to prohibit public access to the work site. Equipment shall not be used in lieu of fencing to protect the access pits.
- g. The water main shall be supported within the casing pipe by means of construction grade (No. 2) 4" x 4" pressure preservative treated timber skids. Skids shall be continuous from bell to bell. A minimum of four (4) skids, positioned 45° each side of the top and bottom centerlines of the water main is required. Skids are to be strapped to the water main by 1 1/8" wide, 12 gauge galvanized steel or stainless steel bands. A minimum of four (4) straps per pipe length is to be installed.
- h. After the water main is pushed through the casing, masonry bulkheads shall be installed tight around the water main at both casing ends. Standpipes suitable to receive pressure grouting shall also be installed.
- i. The void between the water main and the casing pipe shall be pressure grouted using a concrete grout mix as approved by the Engineer.
- j. If the Contractor proposes to employ a different method of tunnel crossing than the method described in these specifications, he shall obtain written approval from the Engineer.