

## SECTION 900

### WATER DISTRIBUTION

#### SECTION 901 – WATER MAINS

##### 901-1 DESCRIPTION

This item shall consist of water main pipe and related items of the types, classes, sizes, and dimensions required on the plans, furnished and installed at the places designated on the plans and profiles, or by the ENGINEER in accordance with these specifications and with the lines and grades given.

The bid price per linear foot of pipe in place shall include the cost of excavation and backfill, the cost of furnishing and installing all trench bracing, concrete bases, and concrete thrust blocking, and the material for and the making of all joints, including all connections to existing water mains.

“Unstable,” “Suitable,” “Unsuitable,” and “Unsatisfactory” soil or aggregate items shall be defined as stated in Section 202-1.

##### 901-2 MATERIALS

**901-2.1 GENERAL.** All materials that may come into contact with water intended for use in a public water system shall meet the American National Standards Institute (ANSI)/National Sanitary Foundation International (NSF) Standard 61. A product will be considered as meeting this standard if so certified by NSF, the Underwriters Laboratories, or other organization accredited by ANSI to test and certify such products. The materials shall be of the type selected by the CONTRACTOR and in accordance with the following appropriate requirements unless otherwise specified.

**901-2.2 POLYVINYL CHLORIDE PIPE.** Polyvinyl Chloride Pipe or Molecularly Oriented PVC (PVCO) shall meet the requirements of AWWA C900 or C905 or C909 or the latest revision thereof and shall be furnished in Cast Iron Pipe equivalent outside diameters with elastomeric joints. The pressure class of PVC pipe shall be PC150 with a DR 18 for pipe smaller than 16 inches and PC235 with a DR of 18 for pipe 16 inches or larger and for 12 inches or smaller PVCO pipe the pressure class shall be PC150 (AWWA C900 DR18 equivalent). 8-inch PVC or smaller pipe in accordance with ASTM, D2241, Class 200, DR21 may be bid as an equal if specified.

**901-2.3 DUCTILE IRON PIPE.** Ductile Iron Pipe shall be manufactured in accordance with the requirements of AWWA/ANSI C151/A21.51. Push-on joints and mechanical joints shall be manufactured in accordance with AWWA/ANSI C111/A21.11. Pipe thickness shall be designated in accordance with AWWA/ANSI C150/A21.50. All pipe under 16 inches shall use pressure class 350. All 16-inch to 20-inch pipe shall use pressure class 250 or higher. All 24-inch pipe shall be pressure class 200 or higher. All

30-inch pipe or larger shall be pressure class 150 or higher. All pipe shall be supplied with a cement mortar lining in accordance with AWWA/ANSI C104/A21.4. All pipe shall have a bituminous exterior coating in accordance with AWWA/ANSI C110/A21.10.

All pipe material suppliers shall be ISO 9001 or 9002 registered or provide the services of an independent inspection agency. Prior to the start of manufacturing, any manufacturer not meeting the ISO registration requirements shall submit to Owner or Owner's Engineer the name of an independent inspection agency for approval. The independent inspection agency shall be responsible for sample monitoring of chemical and mechanical tests, sample visual inspection of quality assurance tests performed on in-process pipe and fittings, and a sample visual and dimensional inspection report from the independent inspection agency of all witnessed tests shall be supplied to Owner or Owner's Engineer within ten (10) days of completion of pipe manufacturing.

Chemical samples shall be taken from each ladle of iron, and the manufacturers' chemical control limits shall be maintained for at least the following elements: carbon, sulfur, phosphorus, silicon, magnesium, chromium, manganese, tin, aluminum, cerium, copper, and lead. When chemical values fall outside the manufacturers' control limits, additional mechanical property tests shall be performed to assure minimum mechanical properties are met.

Where called out on the plans, restrained joint pipe and fittings shall be used. All restrained jointing systems require approval of the ENGINEER. Preapproved restraining systems include Griffin Pipe Product Co. Snap-Lok, US Pipe TR Flex, or American Cast Iron Pipe Co. Flex-Ring. The CONTRACTOR shall note that the standard mechanical joint is not a restrained joint and offers no practical resistance against joint separations.

**901-2.4 CAST IRON AND DUCTILE IRON FITTINGS.** Cast Iron fittings shall be manufactured in accordance with AWWA/ANSI C110/A21.10 and shall be furnished with either Standardized Mechanical Joints or Push-On Joints in accordance with AWWA/ANSI C111/A21.11. Cast Iron Fittings for sizes up to and including 12 inches shall have a working pressure of 250 pounds per square inch and fittings larger than 12 inches shall have a working pressure of 150 pounds per square inch conforming with AWWA/ANSI C110/A21.10. Ductile Iron fittings shall be manufactured in accordance with AWWA/ANSI C153/A21.53 or AWWA/ANSI C110/A21.10. Ductile Iron fittings shall have a working pressure of 350 pounds per square inch conforming with AWWA/ANSI C153/A21.53 or AWWA/ANSI C110/A21.10. All Cast Iron and Ductile Iron fittings shall be cement mortar lined and contain an exterior bituminous seal conforming with AWWA/ANSI C104/A21.4. All Cast Iron and Ductile Iron fittings shall be considered incidental to the price bid for water main.

**901-2.5 GATE VALVE.** The gate valve furnished shall be of a quality equal to that manufactured by American Flow Control under the minimum requirements in design, material, and workmanship conforming to the latest AWWA Standard C515. The metals used shall be in accordance with AWWA and ASTM Standards. Unless otherwise designated, all gate valves shall have a non-rising stem, O-ring stem seals,

2-inch operating nuts, and open counterclockwise. If a stem extension is specified, it shall be fastened to the operating nut with a SS set screw. The operating nut shall be drilled or otherwise indented to accept the set screw and provide a secure connection that will prevent an extension from coming loose during operation. The gate valve shall have a resilient synthetic rubber coating seat attached to the wedge, manufactured and designed in accordance with the latest AWWA Standard C515. Resilient-Seated Gate Valve body and bonnet shall be coated, inside and out, with a fusion bonded epoxy in accordance with AWWA C550. The waterway shall have a full unobstructed flow without recesses in the bottom. All bonnet bolts shall be stainless steel.

**901-2.6 BUTTERFLY VALVE.** When specified, a Butterfly Valve shall be furnished of a quality equal to that manufactured by the Mueller Company under the minimum requirements in design, material, and workmanship conforming to the latest standards of AWWA C504. The valve shall be constructed for a 150 psi differential pressure and capable of a drop tight pipeline test in either direction of flow. All bolts on the valve body and actuator shall be stainless steel. The actuator nut of the Butterfly Valves shall be placed on the east or north side of the main unless specified differently by the ENGINEER.

**901-2.7 VALVE BOXES.** The valve boxes furnished shall be of a quality equal to that manufactured by Tyler Pipe Model 6860 or Star Pipe Products Cast Iron Heavy Duty Model "G" with bases and dimensions of each section to be as follows:

- No. 6 round base for 24-inch and smaller gate valves.
- No. 160 oval base for 30-inch or larger.
- No. 6 round base for all butterfly valves.
- Covers marked "Water."
- Top Section 25 1/2 inches long.
- Extension pieces as required.

All valve boxes shall be capable of a minimum 6-inch top adjustment in either direction, up or down, to or from, the finished curb grades shown in the plans. All valve boxes shall have extension rods in place (not fastened) and be within 18" of the finished, adjusted grade of the box. A mud plug is required also. Rods and plugs shall be considered incidental to the valve box,

If any valve box extension pieces are required to make the above-mentioned adjustment, they shall be considered incidental to the price bid for either Butterfly Valve and Box and/or Gate Valve and Box.

**901-2.8 HYDRANTS.** Hydrants shall be manufactured in accordance with the requirements of AWWA C502. The hydrants shall be equipped with break-a-way type traffic flanges and two (2) 2½-inch hose connections with National Standard Threads and one (1) 4 1/2-inch pumper connection with National Standard Threads. All 6-inch and 8-inch hydrants shall be 5¼-inch Waterous Pacer Model WB-67-250 as manufactured by American Flow Control or 5¼-inch American Darling Model B-62-B as manufactured by American Flow Control or an approved equal. All hydrants shall be furnished with an 8'-6" bury depth from the bottom of the inlet pipe to the top of the ground. All bolts and nuts connecting the barrel to the foot elbow shall be stainless steel. The hydrants shall be surrounded by 1/2 cubic yards of subcut gravel so placed

that it will readily take up all water from the drip valves. The hydrants shall be set on a concrete pad 6 inches thick and 18 inches square. All hydrants shall have brass or stainless ports in the shoe. All hydrants shall be buried to the manufacturer's design depth. A hydrant marker shall be placed on all new hydrants installed during any project. The marker shall be approved for use by the Engineer and its cost will be incidental to the cost of the hydrant.

**901-2.9 RESET HYDRANT.** Hydrants to be reset shall be either furnished from the CITY OF MANDAN stores or an existing hydrant salvaged during construction. Hydrants shall be set at the location shown on the plans. Care shall be taken by the CONTRACTOR not to damage existing water mains, connections, or valves while removing existing hydrants. Care shall also be taken not to damage the hydrant to be reset during transportation or storage by the CONTRACTOR.

The depth of earth cover over the connecting pipe shall be no less than 8 feet. The hydrants shall be surrounded by 1/2 cubic yards of 3/4 crushed rock so placed that it will readily take up all water from the drip valves. The hydrants shall be set on a concrete pad 6 inches thick and 18 inches square.

**901-2.10 TAPPING SLEEVE WITH TAPPING VALVE.** For pipe sizes of 6 inches to 24 inches, the tapping sleeve shall be stainless steel with a stainless steel flange and bolts and shall conform to the "Smith Blair" Type 663 or "Romac" Type SST or an approved equal. For pipe sizes of 24 inches or larger, the tapping sleeve shall be epoxy lined and coated with stainless steel bolts and shall conform to the "Smith Blair" Type 622 Split Sleeve with O-Ring Seal. All taps must be 18" from any pipe joint or other tap location.

Tapping saddles with valves shall be hydrostatically pressure tested on the main prior to requesting a tap. The test shall be 125 pounds per square inch for a duration of 30 minutes.

The City of Mandan Utility Department will tap the water main at a charge to the CONTRACTOR. The CONTRACTOR shall be responsible for all other work connected with installation of the tapping sleeve and valve including the necessary space around the water main required for the tapping machine and assisting the Utility Department in positioning the tapping machine.

**901-2.11 CONCRETE.** Concrete for pipe cradles, anchors, and thrust blocking shall conform to the requirements of Section 501.

**901-2.12 BEDDING MATERIAL.** The bedding material shall be defined as stated in Section 801-2.9.

**901-2.13 SUBCUT GRAVEL.** The subcut gravel shall be as defined in Section 801-2.10.

**901-2.14 SALVAGE MATERIAL.** All existing pipe, gate valves, fittings, etc. removed during construction, when requested by the ENGINEER, shall be salvaged and delivered to the Utility Department as directed. No extra compensation will be allowed for this work.

**901-2.15 MARKING TAPE.** The CONTRACTOR will be required to furnish and install marking tape located 2 feet above the top of all water mains installed under this contract. The tape shall be of the non-detectable type and shall have a minimum width of 5 inches. The tape shall be blue in color with the words "CAUTION WATER LINE BELOW" imprinted on the tape in black capital letters. The marking tape shall be equal to that manufactured by Griffolyn Company, Inc.

Cost of marking tape and installation shall be considered incidental to other items.

**901-2.16 POLYETHYLENE ENCASEMENTS.** All ductile iron and cast iron pipe, valves, fittings, and hydrants shall be encased with 8-mil linear low-density (LLD) polyethylene film in accordance with ANSI/AWWA C105/A21.5. All encasements shall be considered incidental.

**901-2.17 MECHANICAL JOINT BOLT REQUIREMENTS.** Bolts for mechanical joint fittings, valves, and hydrants shall be alternated with one-half stainless steel and one-half low alloy steel. Low alloy steel bolts shall contain a maximum content of carbon at 0.2 percent, manganese at 1.25 percent, sulphur at 0.5 percent, minimum content of nickel at 0.25 percent, and a combined content of nickel, copper, and chromium at 1.25 percent. Stainless steel bolts shall be Grade 304.

**901-2.18 INSULATION BOARDS.** The insulation shall have a thermal conductivity of not more than 0.28 BTU per hour per square foot per degree Fahrenheit per inch of thickness as tested in accordance with ASTM C177. The insulation shall not absorb moisture to an extent greater than 2.5 percent by volume as tested in accordance with ASTM D2127. The compression strength of the insulation shall be greater than 20 psi as tested in accordance with ASTM D-1621. The density of the insulation shall be between 0.9 and 1.3 pounds per cubic feet as tested in accordance with ASTM D-1622. The insulation shall be specifically designed for protection of underground utilities

**901-2.19 POLYETHYLENE PLASTIC PIPE.** If specified by the ENGINEER, Polyethylene Plastic Pipe shall be AWWA C906 high-density polyethylene pipe and shall meet the requirements of ASTM 714 Polyethylene (PE) Plastic Pipe (SDR-PR), based on the outside diameter, ASTM D1248 and ASTM D3550. All pipes shall be made of virgin material. No rework except that obtained from the manufacturer of the same formulation shall be used. The pipe shall be homogeneous throughout and be free of faults such as visible cracks, holes, foreign material, and blisters. The minimum wall thickness of the high-density polyethylene pipe shall meet the minimum requirements, SDR 11 pipe with Ductile Iron Pipe outside diameters.

### **901-3 CONSTRUCTION REQUIREMENTS**

**901-3.1 EQUIPMENT.** All equipment necessary and required for the proper construction of water mains shall be on the project, in first-class working condition and approved by the ENGINEER before construction is permitted to start.

The CONTRACTOR shall provide appropriate hoisting equipment to handle the pipe while unloading and placing it in its final position without damage to the pipe.

The CONTRACTOR shall provide methods and means to obtain the required compaction of the pipe bed and the backfill, as specified.

**901-3.2 EXCAVATION AND PREPARATION OF TRENCH.** The trench shall be dug to the alignment and depth required and only so far in advance of pipe laying as the ENGINEER will permit. It is essential that the discharge from pumps be led to natural drainage channels, drains, or storm sewer.

The trench width may vary depending upon the depth of the trench and the nature of the excavated material, but in any case shall be of ample width to permit the pipe to be laid and joined properly and the backfill to be placed and compacted to the required density. The maximum width of trench for calculating bedding material quantities shall not be more than 48 inches and for pipe 15 inches or larger not more than 36 inches greater than the outside diameter of the pipe barrel.

The trench shall be excavated below the required grade so that the pipe may be laid on 4 inches of bedding material.

Where the bottom of the trench uncovered at subgrade is unsuitable and in the opinion of the ENGINEER cannot support the pipe, further depth and/or width shall be excavated and refilled to the pipe foundation grade with subcut gravel thoroughly compacted. In this instance, subcut gravel shall be considered a pay item.

If other approved means are adopted to assume a firm foundation for the pipe, the CONTRACTOR will be allowed extra compensation. Extra compensation shall not be allowed for extra excavation and gravel used for seepage and ground water control.

Whenever necessary, to prevent caving, excavations in sand, gravel, sandy soil, or other unstable material shall be adequately sheathed and braced. Where sheathing and bracing are used, the trench width shall be increased accordingly. Trench sheathing will be required on all ditches where necessary to prevent damage to utilities above or below ground. Trench sheathing shall remain in place until the pipe has been laid and the joint properly constructed and the backfill material thoroughly compacted to a depth over the pipe sufficient to protect any utility structures or adjacent paving, curb and gutter, sidewalks, or trees which might be damaged by caving of the trench walls. If ordered in writing by the ENGINEER, the CONTRACTOR will be paid for any sheathing that the ENGINEER orders left in the trench in order to protect the existing utilities. The price to be paid for such sheathing material will be the current invoice price of said materials or such lesser price as the CONTRACTOR and the ENGINEER may agree that the material is worth at the time it is left in the trench.

All broken pavement or sidewalks shall be removed from the site of the work and deposited at a place selected by the ENGINEER.

It shall be the responsibility of the CONTRACTOR to remove and replace at its own expense, unless otherwise specified, all sidewalk, driveway, curb, and gutter necessary for the installation of the pipe and manholes as shown on the plans and as directed by the ENGINEER. The removal shall be complete to the nearest joint in order that the replacement might be made in a workmanlike manner. No additional compensation will be allowed for this work and shall be included in the price bid for pipe installation.

Bell holes of ample dimension shall be dug in earth trenches at each joint to permit the joints to be made properly.

All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing sidewalks and driveways. Gutters shall be kept clean or otherwise satisfactory provisions made for street drainage.

The use of trench digging machinery will be permitted except in places where operation of same will cause damage to trees, buildings, or existing structures above or below ground, in which case hand methods shall be employed.

The CONTRACTOR is assumed to be familiar with all federal, state and local laws, codes, ordinances, and regulations which, in any manner affect those engaged or employed in the work the material or equipment used in or upon the site, of in any way affect the conduct of the work. No pleas of misunderstanding or ignorance on the part of the CONTRACTOR will, in any way, serve to modify the provisions of the contract. The CONTRACTOR shall provide and maintain on a 24-hour basis all necessary safeguards such as watchmen, and traffic control devices at CONTRACTOR's own expense in accordance with subsection 124.

Excavation for pipe laying operations shall be conducted in a manner to cause the least interruption to traffic. Where traffic must cross open trenches, the CONTRACTOR shall provide suitable bridges at street intersections and driveways. Hydrants under pressure, valve boxes, curb stop boxes, and other utility controls shall be left unobstructed and accessible during the construction period.

Adequate provisions shall be made for the flow of sewers, drains, and water courses encountered during construction, and the structures which may have been disturbed shall be satisfactorily restored upon completion of the work.

Trees, fences, poles, and all other property shall be protected unless their removal is authorized by the ENGINEER, and any property damages shall be satisfactorily restored by the CONTRACTOR. The cost of removal shall be included in the price bid per linear foot of water main in place unless listed separately in the proposal. Tree removal and root cutting shall be in conformance with Section 201.

**901-3.3 ROCK EXCAVATION.** The rock excavation shall be as defined in Section 801-3.3.

**901-3.4 PIPE LAYING.** All water main and sanitary sewer crossings shall conform to the following policy:

1. Where both water and sewer are of new construction:
  - a. No additional protections needed if water main crosses at least 5 feet above the sewer.
  - b. If the water main crosses within 3 to 5 feet above the sewer, a full length of water main shall be centered over the sewer.
  - c. If the water main crosses within 3 feet above the sewer, a full length of water main shall be centered over the sewer and the sewer joints located within 10 feet of the crossing shall be able to withstand 25 psi internal pressure.
2. Where water main crosses over an existing sewer:
  - a. No additional protection needed if water main is at least 3 feet above the sewer. The intervening dirt must be left undisturbed.
  - b. If crossing is within 3 feet above sewer, a full length of water main must be centered over the sewer main.
3. Where water main crosses under the sewer:
  - a. In all cases, additional protection shall be provided by centering a full length of water main under the sewer main. All sewer joints located within 10 feet of the crossing shall be able to withstand 25 psi internal pressure.

Before lowering and while suspended, cast iron pipe shall be inspected for defects. Any defective, damaged, or unsound pipe shall be rejected. All foreign matter or dirt shall be removed from the inside of the pipe before it is lowered into its position in the trench, and it shall be kept clean by approved means during and after laying. Care shall be taken to prevent dirt from entering the joint space. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by approved means and no trench water shall be permitted to enter the pipe.

Cutting pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise directed, pipe shall be laid with the bell ends facing the direction of laying. For lines on an appreciable slope, bells shall face upgrade, if directed by the ENGINEER. Whenever necessary to deflect the pipe from straight line, whether in the vertical or horizontal plane to avoid obstructions, to plumb stems, or other reasons, the degree of deflection shall be approved by the ENGINEER. When any railroad is crossed all precautionary construction measures required by the railroad officials shall be followed. No pipe shall be laid in water or when the trench condition or the weather is unsuitable for such work except by permission of the ENGINEER.

The CONTRACTOR shall place a 16"x16" or a larger concrete block, as directed by the ENGINEER, under all valves. A larger block will be required for larger valves. The block shall be considered incidental to the price bid for the valve.

The CONTRACTOR shall furnish and install temporary watertight plugs in any opening left in the main line or lead off the main line, during construction, that would allow water or other debris to enter the newly constructed pipe or any existing pipe.

**901-3.5 TESTS.** Inspection and tests must be made by the manufacturer on all pipe and component parts before shipment. Such tests shall be made by a testing laboratory satisfactory to the ENGINEER, and such tests shall be made in accordance with the requirements of the American Society for Testing Materials. Documentary evidence that the materials have been passed such inspection and tests must be furnished to the ENGINEER before the delivery of the materials on the job. Any materials which do not prove satisfactory after being placed, must be removed from the premises and replaced with satisfactory material. The cost of foundry inspection shall be paid for by the CONTRACTOR. After the pipe has been laid, all new pipe or any valve section thereof shall be subject to hydrostatic pressure test under the supervision of the ENGINEER. The test section shall be filled with water and the pressure shall be gradually increased. If defects are found, the CONTRACTOR shall immediately make the necessary repairs at its own expense. The final pressure test shall be 150 pounds per square inch and shall be held at least one hour. The CONTRACTOR shall furnish all tools, equipment, and material necessary to make the pressure test. The CITY OF MANDAN will provide the water for filling the pipe.

**901-3.6 DISINFECTION AND BACTERIOLOGICAL TESTING.** After the new mains, replacement mains, and valved extensions have been tested, they shall be flushed until all foreign material has been removed. Chlorination applications shall be made under supervision of the ENGINEER in accordance with AWWA C651. Water shall be fed into the new line with chlorine applied in amounts to maintain a chlorine residual of 50 milligrams per liter for 24 hours or chlorine residual of 200 milligrams per liter for three (3) hours. All valves and hydrants in the section treated shall be operated during this time in order to disinfect the appurtenance. Heavily chlorinated water should not remain in prolonged contact (maximum of 48 hours) with the water main pipe. The chlorine shall be flushed from the main through hydrants and taps until all excess chlorine has been removed. The CONTRACTOR shall be responsible for repairing all grass, new or existing, damaged by the chlorination and flushing process. No chlorination water will be permitted in the water main trench. The CONTRACTOR shall furnish all tools, equipment, materials, and chlorine to complete the chlorination process, incidental to other bid items. Prior to discharging chlorinated water into any drainage way, the CONTRACTOR shall obtain the permission of the ENGINEER. Taps are to be provided so at least one set of samples may be collected from every 1,200 feet of the new water main, with one set from the end of the line and at least one set from each branch exceeding 50 feet in length.

After final flushing each 1,200-foot segment and branches greater than 50 L.F., and before the new water main is connected to the distribution system, two consecutive sets of acceptable samples, per 1,200-foot main or 50-foot branch, taken at least 24 hours apart, shall be collected from the new main. The CONTRACTOR or testing laboratory, in the presence of the ENGINEER, shall perform the sampling. The CONTRACTOR shall record the locations the samples were taken. Sampling shall be performed with due care to prevent contamination using sterile bottles provided by the testing laboratory. It is not recommended that samples be collected from hoses or fire hydrants. The testing of the samples shall be performed by a State of North Dakota certified testing laboratory selected by the CONTRACTOR. All samples shall be tested for bacteriological quality and shall show the absence of coliform organisms.

If trench water has entered the new main during construction or, if in the opinion of the ENGINEER, excessive quantities of dirt or debris have entered the new main, bacteriological samples shall be taken at intervals of approximately 200 feet and shall be identified by location. Samples shall be taken of water that has stood in the new main for at least 16 hours after final flushing has been completed.

The testing laboratory shall test for coliforms and e-coli using the "Colilert" or other ENGINEER approved equivalent test. The "Colilert" test is a pass/fail test that does not quantify the amount of bacteria. Any presence of coliforms or e-coli shall qualify as a failed test.

If the initial disinfection fails to produce satisfactory bacteriological results, the new main may be reflushed and shall be resampled. If check samples also fail to produce acceptable results, the main shall be rechlorinated by the continuous-feed or slug method of chlorination until satisfactory results are obtained.

Bacteriological samples shall be taken after repairs or short connection pieces are completed to provide a record for determining the procedure's effectiveness. If the direction of flow is unknown, the samples shall be taken on each side of the repair or connection. If positive bacteriological samples are recorded, then the situation shall be evaluated to determine corrective action, and daily sampling shall be continued until two (2) consecutive negative samples are recorded.

All disinfection and bacteriological testing shall be incidental to other items.

**901-3.7 HANDLING PIPE AND ACCESSORIES.** Pipe, fittings, valves, hydrants, and other accessories shall, unless otherwise directed, be unloaded at the point of delivery, hauled to and distributed at the site of the project by the CONTRACTOR. They shall at all times be handled with care to avoid damage. In loading and unloading, they shall be lifted by hoists or slid or rolled on skidways in such a manner as to avoid shock. Under no circumstances shall they be dropped. Pipe handled on skidways must not be skidded or rolled against pipe already on the ground. In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. Pipe shall be handled in such a manner that a minimum of damage to the coating will result. Damaged coating shall be repaired in a manner

satisfactory to the ENGINEER. Pipe shall be placed on the site of work parallel with the trench alignment and with bell ends facing the direction in which the work will proceed unless otherwise directed. The interior of all pipe fittings and other accessories shall be kept free from dirt and foreign matter at all times. Valves and hydrants before installation, shall be drained and stored in a manner that will protect them from damage by freezing.

**901-3.8 BACKFILLING OF PIPE TRENCH.** After the pipe has been laid to line and grade, the trench shall be backfilled under and along the sides of the pipe up to 2 inches over the top of the pipe by thoroughly compacting bedding material into place so as to form a uniform bed for the pipe. This compaction may be obtained by any approved method or equipment which will produce a uniform density meeting the requirements to obtain less than 85% maximum dry density at optimum moisture made in accordance with ASTM D1557. Care shall be exercised to not displace the pipe or injure the pipe during the compaction operations. If the material in the trench is sand or gravel and acceptable to the ENGINEER, it will not be necessary to furnish any other material than that found within the trench to provide the proper bedding. If sand or gravel is not found within the trench, the CONTRACTOR will be required to furnish bedding material.

The trench shall be backfilled to a point 2 feet above the top of the pipe (except when Class D Backfill is specified) by any approved method or equipment which will produce a uniform density meeting the requirements to obtain not less than 80% of the maximum dry density at optimum moisture as determined by ASTM Compaction Control Test Designation D1557. The use of drop pile hammers, loaded or unloaded clam shells or backhoe buckets, or other similar equipment will not be permitted to obtain the required density below a point 2 feet above the top of the pipe. The CONTRACTOR shall use specialized equipment or hand tamping around all appurtenances such as manholes, valve boxes, hydrants, and curb stops to insure proper density. The remaining trench shall be backfilled in accordance with the specification for the class of backfill as set forth in these specifications. The area for each class of backfill specified shall be designated on the plans.

The CONTRACTOR shall engage an independent soils testing laboratory, approved by the ENGINEER, to determine the soil moisture density relationships and perform the required compaction testing to be determined by the ENGINEER.

The compaction control tests for this section are based on one individual compaction test per 300 feet of trench per 30 inches of backfill and a minimum of one (1) test per service line, between 2 feet above pipe to 1 foot below finish grades or where directed. The CONTRACTOR shall be responsible for all retesting of failing tests and a proctor determination to represent each soil condition to be encountered on the project. The time, locations, depths, and frequency of compaction testing shall be at the discretion of the ENGINEER during construction. Should it become necessary to require an additional number of initial compaction tests, over and above the number specified for bidding purposes, the CITY OF MANDAN will assume the responsibility to perform said additional testing. The CONTRACTOR, however, will be required to assume the

cost of all retesting of failing tests regardless of the total number required during construction.

Compaction testing to determine densities may be accomplished with a nuclear density testing apparatus and/or the sand cone method. Should disputes arise concerning test results, they will be resolved by using the sand cone method of testing.

Written reports of all test results shall be supplied to the ENGINEER and the CONTRACTOR by the testing laboratory as soon as possible. To expedite construction progress, it is necessary that the CONTRACTOR and ENGINEER be furnished with the results of all tests as soon as testing is completed.

Compaction control tests as stated above shall be incidental to the price bid for water mains.

The availability of the independent testing laboratory when needed and speed of testing and reporting are to be considered the responsibility of the CONTRACTOR.

The Contractor shall restore all shrubbery, fences, sod, or other surfaces disturbed to a condition equal to that before the work began, furnishing all labor and material incidental thereto. These requirements will not be waived. If the area cannot be restored to the original line and cross section without the aid of grade stakes, they will be furnished by the ENGINEER at the CONTRACTOR'S expense.

Following the certification of completion by the ENGINEER, the CONTRACTOR shall maintain the surfaces of unpaved trenches, adjacent curbs and gutters, sidewalks, driveways, shrubbery, fences, sod, or other surfaces disturbed for a period of 3 months thereafter. All material and labor required for maintenance of the trenches and adjacent structures shall be supplied by the CONTRACTOR and the work done in a manner satisfactory to the ENGINEER. The cost of backfilling and cleanup shall be included in the price per linear foot of water main in place.

**901-3.9 BACKFILL CLASSIFICATIONS.** The backfill classifications shall be as defined in Section 801-3.6.

**901-3.10 PROTECTING UNDERGROUND AND SURFACE STRUCTURES.**

Temporary support, adequate protection, and maintenance of all underground and surface structures, drains, sewers, water mains, service connections for both sewer and water, and other obstructions encountered in the progress of the work shall be furnished by the CONTRACTOR all at their own expense as approved by the ENGINEER.

**(a) Deviations Occasioned by Other Utility Structures.** Wherever existing utility structures or branch connections leading to main sewer or water mains or other conduits, ducts, pipes, or structures form obstructions to the grade and alignment of the water main to be laid, they shall be permanently supported, removed, relocated, or reconstructed by the CONTRACTOR through cooperation with the owner of the utility, structure, or obstruction involved. In those instances, a deviation from the line and

grade will be ordered by the ENGINEER, and the change shall be made in the manner directed by the ENGINEER.

Wherever possible, all existing utility structures or branch connections leading therefrom will be located in advance of the excavation of the trench and properly marked. The CONTRACTOR shall not cut any existing utility lines unless it is determined by the ENGINEER that it is necessary in order to install the new water mains. All utility lines that are cut by the CONTRACTOR with the approval of the ENGINEER shall be repaired or replaced by the CONTRACTOR as Extra Work. All utility lines that are damaged by the CONTRACTOR shall be repaired or replaced by the CONTRACTOR at the CONTRACTOR's expense.

Wherever the ENGINEER shall determine it is necessary to remove or relocate any existing utility in order to properly install the new water main, the change shall be made in a manner directed by the ENGINEER and for which extra compensation will be allowed the CONTRACTOR.

**(b) Deviation Without ENGINEER'S Consent.** No deviation shall be made from the required line and grade established by the ENGINEER without the consent of the ENGINEER.

**(c) Subsurface Explorations.** Whenever necessary to determine the location of existing pipes, valves, or other underground structures, the CONTRACTOR, after an examination of available records and upon written order from the ENGINEER, shall make all exploration and excavations for such purpose for which the ENGINEER may allow extra compensation.

**901-3.11 BLOCKING HYDRANTS AND FITTINGS.** All hydrants, tees, and bends 22½ degrees and more shall be provided with suitable reaction blocking of concrete blocks of adequate size to prevent movement of fittings and hydrants when the pipe is under pressure. The blocks shall be placed in a manner acceptable to the ENGINEER and shall allow pipe and fitting joints to be accessible for repair. The concrete blocks may be poured in place if sufficient time is allowed for curing.

**901-3.12 MARKING VALVE BOX LOCATIONS.** The CONTRACTOR will be required to furnish and install a steel fence post by each valve box unless directed not to by the ENGINEER. Steel fence posts to be used for valve locations shall be a "Tee" or "U" post having a minimum length of 5½ feet. The post shall be located 2 feet from the valve box in a direction toward the street.

The cost of the steel fence post and the installation shall be considered incidental to other bid items.

**901-3.13 INSULATE WATER MAIN.** The CONTRACTOR shall furnish and install the insulation required to insulate the water main as shown on the plans. The insulation shall be at least 4 inches thick by 8 feet wide centered on the water main. The material

between the top of the water main bedding and the insulation shall consist of a concrete sand.

#### **901-4 MEASUREMENT AND PAYMENT**

**901-4.10 thru 4.25 (SIZE) INCH WATER MAIN.** Water main pipe shall conform to section 901-2.2 and 901-2.3. The water main pipe shall be measured by the linear foot (LF) through fittings and from centerline of pipe to centerline of pipe as shown in Standard Detail Number 1325 and shall be paid for at the unit price bid for "(Size) Inch Water main" complete in place and accepted by the ENGINEER.

**901-4.40 thru 4.49 "(SIZE) INCH BUTTERFLY VALVE AND BOX".** Butterfly Valve and Box shall be measured on an individual unit basis (Ea.) and shall be paid for at the unit price bid for "(Size) Inch Butterfly Valve and Box" complete in place and accepted by the ENGINEER.

**901-4.50 thru 4.69 "(SIZE) INCH GATE VALVE AND BOX".** Gate Valves and Boxes shall be measured on an individual unit basis (Ea.) and shall be paid for at the unit price bid for "(Size) Inch Gate Valve and Box" complete in place and accepted by the ENGINEER.

**901-4.70 6-Inch HYDRANT.** 6-inch Hydrants shall be measured on an individual basis (Ea.) and paid for at the unit price bid for "6-inch Hydrant" complete in place and accepted by the ENGINEER.

**901-4.71 8-Inch HYDRANT.** 8-inch Hydrants shall be measured on an individual unit basis (Ea.) and paid for at the unit price bid for "8-inch Hydrant" complete in place and accepted by the ENGINEER.

**901-4.72 CAST IRON AND DUCTILE IRON FITTINGS.** Cast Iron and Ductile Iron Fittings shall be considered incidental to the price bid for (size) inch water main.

**901-4.73 AIR RELEASE VALVE AND MANHOLES.** Air Release Valve Manholes shall be measured and paid for under subsection 1205-4.4.

**901-4.74 BEDDING MATERIAL.** Bedding Material shall be measured and paid for under subsection 801-4.60.

**901-4.75 SUBCUT GRAVEL.** Subcut Gravel shall be measured and paid for under subsection 801-4.61.

**901-4.76 ROCK EXCAVATION.** Rock Excavation shall be measured and paid for under subsection 801-4.62.

**901-4.77 RESET HYDRANT.** Reset hydrants shall be measured on an individual basis (Ea.) and paid for at the unit price bid for "Reset Hydrant" complete in place and accepted by the ENGINEER.

**901-4.78 INSULATE WATER MAIN.** Insulate water main shall be measured by the linear foot of water main to be insulated (LF) and paid for at the unit price bid for "Insulate Water Main" complete in place and accepted by the ENGINEER.

**901-4.80 thru 4.99 (SIZE) TAPPING SLEEVE WITH (SIZE) TAPPING VALVE AND BOX.** Tapping sleeve and tapping valve and box shall be measured on an individual basis (Ea.) and paid for at the unit bid price for (Size) tapping sleeve with (Size) tapping valve and box complete in place and accepted by the ENGINEER.