



City of Duncan, Oklahoma

SECTION 500

STANDARD

CONSTRUCTION

SPECIFICATIONS

FOR

WATER MAINS

TABLE OF CONTENTS SECTION 500

SECTION 500 – WATER MAINS.....	5
SECTION 500 – CONSTRUCTION REQUIREMENTS.....	5
500.01 – DESCRIPTION.....	5
500.02 – EXCAVATION AND BACKFILLING.....	5-8
500.03 – MATERIALS CERTIFICATION.....	8-9
500.04 – MISCELLANEOUS REQUIREMENTS.....	9-10
500.05 – PROGRESS OF CONSTRUCTION.....	10
500.06 – DELIVERY OF MATERIALS.....	10
500.07 – SURFACE DRAINAGE STRUCTURES.....	10
500.08 – CONCRETE AND STEEL REINFORCEMENT.....	10
500.09 – DEPTH OF COVER.....	10
500.10 – STANDARD DESIGN CONDITIONS	11
500.11 – CLEAN-UP	11
SECTION 505 – PIPE AND FITTINGS INSTALLATION.....	11
505.01 – DESCRIPTION.....	11
505.02 – MATERIALS.....	11-12
505.02.01 – PIPE AND FITTINGS	12
505.02.02 – EMBEDMENT	12
505.04 – CONSTRUCTION METHODS.....	12
505.04.01 – NOT USED.....	12
505.04.02 – INSTALLATION REQUIREMENTS	12-13
505.06 – METHOD OF MEASUREMENT	13
505.07 – BASIS OF PAYMENT.....	14
SECTION 510 – WATER SERVICE LINE CONNECTIONS	14
510.01 – DESCRIPTION.....	14
510.01.01 – GENERAL.....	14
510.01.02 – DEFINITIONS	14
510.02 – MATERIALS.....	15
510.02.01 – DESIGN OF VALVES AND FITTINGS	15
510.02.02 – DETAILED DESIGN OF VALVES AND FITTINGS.....	15-16
510.02.03 – END CONNECTIONS	16
510.04 – CONSTRUCTION METHODS.....	16
510.04.01 – GENERAL.....	16
510.04.02 – AFFIDAVIT OF COMPLIANCE	16
510.05 – TESTING.....	17
510.07 – BASIS OF PAYMENT	17
SECTION 511 – WATER SERVICE LINES	17
511.01 – DESCRIPTION.....	17
511.01.01 – GENERAL.....	17
511.01.02 – TYPES.....	17
511.02 – MATERIALS.....	17
511.04 – CONSTRUCTION METHODS.....	17
511.06 – METHOD OF MEASUREMENT	17
511.07 – BASIS OF PAYMENT.....	17-18
SECTION 512 – NOT USED.....	

- SECTION 513 - WET CONNECTIONS.....18
 - 513.01 – DESCRIPTION.....18
 - 513.04 – CONSTRUCTION METHODS.....18
 - 513.06 – METHOD OF MEASUREMENT18
 - 513.07 – BASIS OF PAYMENT.....18
- SECTION 514 – TAPPING CONNECTIONS.....18
 - 514.01 – DESCRIPTION.....18
 - 514.02 – MATERIALS.....18
 - 514.04 – CONSTRUCTION METHODS.....18-19
 - 514.06 – METHOD OF MEASUREMENT19
 - 514.07 – BASIS OF PAYMENT19
- SECTION 515 – NOT USED.....
- SECTION 516 – FIRE HYDRANTS.....19
 - 516.01 – DESCRIPTION.....19
 - 516.02 – MATERIALS.....19
 - 516.02.01 – GENERAL.....19
 - 516.02.02 – SUBMITTALS.....19
 - 516.02.03 – AFFIDAVIT OF COMPLIANCE19
 - 516.02.04 – TYPE OF SHUT-OFF.....19
 - 516.02.05 – DELIVERY CLASSIFICATION.....19
 - 516.02.06 – INLET CONNECTION20
 - 516.02.07 – OUTLET CONNECTIONS20
 - 516.02.08 – HARNESSING LUGS.....20
 - 516.02.09 – NOZZLE CAP GASKET20
 - 516.02.10 – DRAIN VALVE AND OUTLET20
 - 516.02.11 – PAINT.....20
 - 516.02.12 – SHAPE AND SIZE OF OPERATING AND CAP NUTS20
 - 516.02.13 – BREAKABLE TYPE20
 - 516.02.14 – STAND PIPE, FLANGES, AND EXTENSIONS20
 - 516.02.15 – STEM20
 - 516.02.16 – COUPLINGS20
 - 516.02.17 – GROUND LINE GASKETS21
 - 516.02.18 – MAIN AND VALVE SEATS21
 - 516.02.19 – NOZZLE CAP CHAINS21
 - 516.02.20 – FLANGES21
 - 516.02.21 – OPERATING STEMS.....21
 - 516.02.26 – O-RINGS21
 - 516.02.27 – CAP NUTS21
 - 516.04 – CONSTRUCTION METHODS.....21
 - 516.04.01 – BURY LENGTH21
 - 516.04.02 – TAPPING OF DRAIN OPENING.....21
 - 516.04.03 – DIRECTION OF OPENING21
 - 516.04.04 – INSTALLATION.....21
 - 516.05 – TESTING.....22
 - 516.06 – METHOD OF MEASUREMENT22
 - 516.07 – BASIS OF PAYMENT.....22
- SECTION 517 – NOT USED.....

SECTION 518 – THRUST BLOCKS	22
518.01 – DESCRIPTION.....	22
518.02 – MATERIALS.....	22
518.04 – CONSTRUCTION METHODS.....	22
518.06 – METHOD OF MEASUREMENT	22
518.07 – BASIS OF PAYMENT.....	22
SECTION 519 – BLOW-OFF CONNECTIONS.....	22
519.01 – DESCRIPTION.....	22
519.04 – CONSTRUCTION METHODS.....	22
519.06 – METHOD OF MEASUREMENT	23
519.07 – BASIS OF PAYMENT	23
SECTION 520 – WATER VALVES.....	23
520.01 – DESCRIPTION.....	23
520.02 – MATERIALS.....	23
520.02.01 – GATE VALVES.....	23
520.02.02 – TAPPING VALVES	23-24
520.02.03 – NOT USED.....	
520.02.04 – CHECK VALVES	24
520.02.05 – NOT USED.....	
520.04 – CONSTRUCTION METHODS.....	24
520.06 – METHOD OF MEASUREMENT	24
520.07 – BASIS OF PAYMENT.....	24
SECTION 521 – VALVE BOXES.....	24
521.01 – DESCRIPTION.....	24
521.02 – MATERIALS.....	25
521.07 – BASIS OF PAYMENT.....	25
SECTION 522 – HYDROSTATIC PRESSURE TESTING.....	25
522.01 – DESCRIPTION	25
522.06 – METHOD OF MEASUREMENT	25
522.07 – NOT USED	
SECTION 523 – DISINFECTION	25
523.01 – DESCRIPTION.....	25
523.04 – CONSTRUCTION METHODS.....	26
523.04.01 – GENERAL.....	26
523.04.02 – FLUSHING.....	26
523.04.03 – DISINFECTION	26
523.06 – METHOD OF MEASUREMENT	26
523.07 – NOT USED.....	
SECTION 524 – DUCTILE IRON PIPE (DIP).....	26
524.01 – DESCRIPTION.....	26
524.02 – MATERIALS.....	26
524.02.01 – GENERAL.....	26-27
524.02.02 – SUBMITTALS.....	27
524.02.03 – DESIGN BASIS	27
524.02.04 – MINIMUM PIPE DESIGN FOR DUCTILE IRON PIPE	28
524.02.06 – PIPE JOINTS AND FITTINGS	28-29
524.02.07 – COATING AND LINING	29
524.02.08 – CORROSION PROTECTION	29

524.05 – SOURCE QUALITY CONTROL	29-30
524.06 – METHOD OF MEASUREMENT	30
524.07 – BASIS OF PAYMENT.....	30
SECTION 525 – POLYVINYL CHLORIDE (PVC) PIPE.....	30
525.01 – DESCRIPTION.....	30
525.02 – MATERIALS.....	30
525.02.01 – GENERAL.....	30-31
525.02.02 – SUBMITTALS.....	31
525.02.03 – DESIGN BASIS	31
525.02.04 – DIMENSION RATIO (DR).....	32
525.02.05 – DIMENSIONS	32
525.02.06 – PIPE JOINTS AND FITTINGS	32
525.03 - SOURCE QUALITY CONTROL TESTING.....	32
525.04 – CONSTRUCTION METHODS.....	33
525.05 – DISINFECTION AND HYDROSTATIC PRESSURE TESTING.....	33
525.07 – BASIS OF PAYMENT.....	33
SECTION 526 – TRACE WIRE INSTALLATION.....	33
526.01 – GENERAL.....	33
526.02 – APPROVED TRACE WIRE MATERIAL.....	33
526.03 – TRACE WIRE CONNECTIONS.....	33
526.04 - INSTALLATION.....	34
SECTION 527 – NOT USED.....	
SECTION 528 – STEEL CASING PIPE.....	34
528.01 - DESCRIPTION.....	34
528.02 – MATERIALS.....	34
528.02.01 – SUBMITTALS.....	34
528.02.02 – GENERAL.....	34-35
528.07 – BASIS OF PAYMENT.....	35
SECTION 529 – NOT USED	
SECTION 530 – NOT USED.....	
SECTION 532 - TAPPING SLEEVES.....	35
532.01 - DESCRIPTION	35
532.02 - MATERIALS.....	35
532.04 – CONSTRUCTION METHODS.....	35
532.06 – METHOD OF MEASUREMENTS.....	35
532.07 – BASIS OF PAYMENT.....	35
SECTION 533 – TAPPING CLAMPS.....	36
533.01 – DESCRIPTION.....	36
533.02 – MATERIALS.....	36
533.04 – CONSTRUCTION METHODS.....	36
533.06 – METHOD OF MEASUREMENTS.....	36
533.07 – BASIS OF PAYMENT.....	36

SECTION 500 – WATER MAINS

SECTION 500 – CONSTRUCTION REQUIREMENTS

500.01 – DESCRIPTION

This section covers general requirements for construction of water lines and appurtenances as described herein. The intent of these specifications is to provide for complete installation including materials, labor and equipment necessary to complete the work.

All design, materials, construction, sampling and testing shall comply with ODEQ rules and regulations and AWWA Standards. These specifications shall apply to water mains with nominal diameter of 6” through 12” only.

The work to be done under this contract consists in general of the installation of pipe, fittings, specials, valves, and other pipe line appurtenances, shall include unloading such material at the point of delivery, hauling, distribution and installation thereof; the furnishing and installation of all jointing materials, gate valves, air valves and appurtenances, structures, concrete and all other materials required by the plans and specifications; making all specified and necessary connections with existing mains; making all required tests; restoration of all roadways, streets, driveways, sidewalks, crosswalks, and street crossing surfaces, and replacement or repair of all drains, sewers, conduits, water, oil and gas lines, fences, culverts, bridges and other structures which may be damaged in the prosecution of the work; maintenance of traffic across sites of the work where required, with all necessary barricades, lights and other safety provisions; making of all repairs to coatings and linings of pipe under the supervision of a representative of the pipe manufacturer; and the performance of all other work required by the plans and as specified herein.

500-02 - EXCAVATION AND BACKFILLING

- A.) DEFINITION – The terms “excavation” and “trenching”, as used herein or in any other reference to the work under contract shall refer to and mean any and all material excavated, for whatever purpose, in accordance with the terms of the specifications, plans, proposal and contract, and shall include all subsequent handling, backfilling, compacting, disposal of excess excavation materials, and the preparation of all sub-grades, etc., necessary for a first class job.
- B.) EXCAVATION WORK – Excavation work shall include clearing and preparation of the trench or excavation size, including the removal of all surface vegetation, stumps and debris; all sheeting, shoring, bracing, protection of adjacent property, preparation of all sub-grades, storage of excavated materials off of the excavation site where necessary, backfilling, tamping and otherwise compacting of backfill and specified embankments, grading and surfacing; moving, hauling or otherwise transporting excavated materials from whatever source, where materials are to be returned to the excavation site for backfill purposes, as directed by the Engineer; and all other excavation stipulated in this specification.
- C.) CLASSIFICATION OF EXCAVATION – There shall be no classification of excavated materials (except as otherwise provided for in the proposal) and the term “excavation” shall include all materials excavated or removed on the several sites of the work regardless of the type, character, composition or condition of the materials so excavated; and shall further include all debris, junk, broken concrete and all other materials within the excavation limits.
- D.) PIPE TRENCH EXCAVATION – Pipe lines shall be installed to the alignment, grades and elevations shown on the drawings. Grade and alignment of pipe and pipe sub-grades will ordinarily be obtained from offset (hub) stakes. Trenches shall be dug by means of a backhoe, trackhoe or trenching machine wherever practicable. The use of any other type of power excavating equipment such as drag line or power shovel will not be permitted except with special authorization by the Engineer and under such requirements relative to uniformity of trench width and vertical trench banks as they may require. Hand

digging will be required where the operation of trench digging machinery will damage trees, buildings, surface or subsurface structures.

The minimum width of trench cut for each size of pipe shall be as follows:

<u>SIZE OF PIPE</u>	<u>WIDTH OF TRENCH</u>
6"	20"
8"	22"
10"	24"
12"	28"

The trenching machine shall be maintained on a sufficiently level roadbed to provide substantially vertical trench walls. The maximum horizontal offset of the trench bottom from the trench top (undercutting) shall be two inches.

- E.) Where soft foundation is encountered in the trench bottom, the Contractor shall excavate below grade and provide either a gravel cushion or a concrete cradle for the purpose of supporting the pipe, as directed by the Engineer.
- F.) All bell holes shall be of ample size
- G.) All excavated materials shall be deposited on the sides of trenches at such a distance that no additional load due to surcharge is placed on the bank, and shall also be deposited or moved after original deposit in such a manner that the pipe laying crew and the public, when the trench is in highway or city streets, will be inconvenienced as little as possible.
- H.) It will be the Contractor's responsibility to maintain the trench banks in a stable and vertical position by use of all necessary bracing or sheeting required for safety.
- I.) The Contractor will be required to keep the pipe trenches free from water and shall keep the natural ground water table or surface not less than four (4) inches below the elevation of the finished sub-grade, from the time the sub-grade preparation is started until the pipe has been backfilled. No work shall be done in trenches after rough excavation is completed if the sub-grade is submerged or within four (4) inches of ground water. All water removed in the dewatering of trenches and other excavations shall be disposed of in a satisfactory manner. The Contractor shall be liable for all damages to private property caused by such disposal of water.
- J.) Rock Excavation – In rock excavation, the Contractor shall over-excavate six (6) inches and place 6 inches of screenings in the trench upon which the pipe is laid. The Contractor shall further backfill over pipe with same or earth free from stone or rocks, to a depth of 6 inches.
- K.) BACKFILLING TRENCHES. Except where water mains lie under drives, streets, or alleys, backfill shall be brought up around the pipe in six inches (6") loose measurement layers from materials selected from the trench excavation, compacted by means of mechanical or hand tampers to twelve inches (12") above the top of the pipe, compaction shall be to ninety percent (90%) standard proctor density. Where water main crosses under drives, streets or alleys, the backfill shall be brought up from the point twelve inches (12") above the pipe as outlined above in six inch (6") layers compacted by mechanical or hand tampers to a minimum of ninety (90%) standard proctor density with the exception that the top twelve inches (12") the backfill under the drive shall be compacted to ninety-five percent (95%).

Where the main crosses or lies within the paved portion of a street or alley, special construction details as shown on the plans shall govern. In open areas the back fill from the point twelve inches above the top of the pipe shall be placed within the trench by either hand or machine methods and the top of the trench shall be left slightly mounded to allow for future settlement.

All tamping and backfill shall be to the approval of the Engineer. In compacted backfill driveways, streets, or alleys, the backfill shall extend three feet (3') on each side of the driveway, street or alley.

- L.) DISPOSAL OF EXCESS EXCAVATION MATERIALS. In general, excess excavated materials from trenches located in open fields and unimproved property will be distributed directly back over the pipe line and within the pipe line right-of-way, to a maximum depth above the original ground elevation at any point of six (6) inches, at and across the trench, and sloping uniformly each way therefrom. Materials so wasted shall be carefully finished with a drag or blade machine to have a neat and uniform appearance without obstructing drainage at any point.

Except as stated in the above paragraph, all excess excavated material remaining after final settlement of the trenches has occurred shall be removed and disposed of by and at the expense of the Contractor, and to the satisfaction of the Engineer.

- M.) REPLACEMENT OF SOD. Where shown on the plans, the Contractor shall replace sod removed or destroyed in the excavation of pipe trenches with new sod of a quality and condition and from a source approved by the Engineer. All such sod furnished shall be equal to or better than the original sod removed. Sod replaced shall be kept watered for a period of one month after installation.

- N.) TREES AND SHRUBBERY. The Contractor shall use every possible precaution to prevent injury to trees and shrubbery on and adjacent to the site of work. He shall replace, at his own expense, any such trees or shrubbery damaged or destroyed by him, unless the removal thereof is required by the plans or is authorized by the Engineer. When tree roots one and one-half inches (1 ½") or larger are encountered in making the excavation the roots are not to be cut. Hand excavation shall be used, and any damaged root or roots 1 ½" or larger shall be treated with a creosote paint as directed by the Engineer.

- O.) LENGTH OF DITCH TO BE OPENED. In no case shall more than three hundred (300) feet of ditch be opened at one time in advance of the pipe laid, without consent of the Engineer.

- P.) DRIVEWAYS. When the water main passes underneath any private driveway, tunneling shall not be used, unless special permission is given by the Engineer. Driveway pavement shall be saw cut to the pipe trench width to allow the main to be laid and for the proper backfilling of the ditch. After the main is laid and ditch is properly backfilled, the driveway shall be restored to as good a condition as found. See standard detail drawings.

Where driveways are cut to private residences, they shall be cut, the pipe installed, and trench properly backfilled all in the same day.

Where the water main passes underneath any private or public driveway, where the driveway is used for parking cars such as at shopping centers, large business buildings, stores, etc., the Contractor shall confer with the Engineer for an approved method of procedure in doing work in order to minimize the interference of traffic to and from the parking area.

- Q.) PUBLIC STREETS AND ROADS. All public streets and roads which are closed to traffic, under authority of proper permit, shall be protected in accordance with the requirements of the authority having jurisdiction over the street or road by means of effective barricades on which shall be placed acceptable warning signs.

Materials stored upon or alongside public streets and highways shall be so placed and the work at all times shall be conducted so as to cause the minimum obstruction and inconvenience to the traveling public.

All barricades, signs, warning lights and other protective devices shall be installed and maintained in conformity with applicable statutory requirements.

500.03 – MATERIALS CERTIFICATIONS

The Contractor, in all cases, shall furnish required samples without charge. A laboratory approved by the City shall perform all tests. When the Standard Specifications require testing of prefabricated products or any other materials, the City Engineer may waive local testing requirements in lieu of a certification from the manufacturer that the material or product furnished conforms to the appropriate Specifications as called for in the Standard Specifications.

GENERAL REQUIREMENTS

The Contractor shall be responsible for obtaining all certifications and arranging for their delivery to the proper destinations as required by this specification. A responsible representative of the company that issues the certification shall sign materials certifications. The official company title of the signer must be clearly shown immediately beneath the Contractor's signature.

All certifications shall be furnished in duplicate and each copy shall show the following information:

- A) City's Project Name or Number
- B) Name of Contractor
- C) Identification Markings on Shipment
- D) Quantity of Material Represented by the Certification

When certified mill tests are submitted as a Type A certification the quantity information need not be furnished provided that the identifying heat number is permanently rolled, stamped or otherwise permanently affixed to each individual piece of material in the shipment covered by the certification.

TYPES OF CERTIFICATIONS

Unless otherwise specified, a certification shall be one of the following types:

- A) Type A certification shall be prepared by the manufacturer and shall consist of a certified copy of a report covering tests conducted by an approved laboratory. Such tests shall have been conducted on samples obtained from the lot or lots of material in the shipment.
- B) Type B certification shall consist of a certification prepared by the manufacturer and shall show the limits of test values as determined by an approved manufacturer's laboratory, a qualified commercial laboratory or other approved laboratory.
- C) Type C certification shall be prepared by the manufacturer and shall certify that the material in the shipment conforms to the same formula and/or is essentially the same as the material previously approved by the City Engineer.
- D) Type D certification shall be prepared by the manufacturer and shall state that the materials meet the applicable Specifications. These Specifications shall be listed by number, section reference or other appropriate identification acceptable to the City Engineer.

E) Type E certification shall be prepared by the fabricator to cover a composite item incorporating two (2) or more materials which have been previously approved on an individual basis for City Projects, but which lose their identity when they are incorporated into the composite item. All materials used in the fabrication shall be listed and identified. The certification shall state that all materials used in the fabrication of the item in question were previously approved for City use. The fabricator shall keep test reports and/or other pertinent identifying records of the individual items incorporated into the composite item until the item has been approved and accepted by the City Engineer.

DISTRIBUTION OF CERTIFICATIONS

Certifications shall be mailed in duplicate to:

City Engineer, City of Duncan

P.O. Box 969

Duncan, OK 73534-0969

These certifications will be checked for conformance with the applicable Specifications.

BASIS OF ACCEPTANCE

Whenever a certification as defined above is required or requested by the City Engineer, such material may be accepted on the basis of certification provided that all applicable requirements are met. Visual inspection at delivery and installation will also be used to verify the Workmanship and condition of the material to be satisfactory.

All material furnished under certification shall be tagged, stenciled, stamped or otherwise marked with a lot number, heat number, order number, or other appropriate identification which can be readily recognized and checked against the certification. Material accepted on certification shall not be incorporated in the Work until the City Engineer has approved the certificates.

STORED MATERIALS

Stored materials shall be located and protected to preserve their quality and fitness for the Work. Materials shall be placed on wooden platforms or other hard, clean surfaces and not on the ground and shall be placed under cover as required. Stored materials shall be located to facilitate prompt inspection. The City assumes no responsibility for materials located on the site or off-site. The Contractor assumes full responsibility for any damage or loss to any stored materials. No stored material shall be located off-site unless approved by the City Engineer. Material shall be insured prior to payment for stored materials.

All aggregates shall be handled in such a manner as to preserve their quality, gradation and fitness for the work. The provisions for transporting aggregates shall be such to assure a continuous and adequate supply of material to the work. Aggregate stockpiles shall be built up in such a manner that acceptable materials will be delivered to the plant or the Project. Aggregates from different sources and different gradations shall not be stockpiled together. The gradation requirements, for the individual stockpiles and proportioning from the stockpiles, shall be the responsibility of the Contractor. Aggregates that have become segregated, or mixed with earth or other foreign material, shall be considered unacceptable, and will not be utilized in the work until Contractor causes aggregate piles to be integrated, and all foreign materials to be removed.

500.04 – MISCELLANEOUS REQUIREMENTS

- A) All salvageable water pipe and fittings removed from the existing water mains and not re-used during construction of the new water mains shall remain the property of the City of Duncan.
- B) Contractor shall remove and reset existing mailboxes as necessary during construction to avoid damaging them during the work. Contractor shall relocate the mailboxes to maintain access by the mail carrier and residents at all times. Contractor shall relocate mailboxes to original location after water main construction is complete. Cost to be included in the price bid for other items of work.

Any excavation within street right-of-way shall be backfilled with soil, temporary construction entrance materials and/or permanent pavement within 72 hours of starting such excavation. The applicant shall ensure that any water that accumulates within any excavation within street right-of-way that has not been backfilled shall be removed by pumping or other approved means within 24 hours of the beginning of such accumulation.

- C) All concrete used in making pavement repairs shall be Class A (HES), meeting the requirements of 1999 ODOT Standard Specifications. All concrete used in making sidewalk repairs shall be Class C, meeting the requirements of 1999 ODOT Standard Specifications. All asphalt used in making pavement repairs shall be Type B Asphalt meeting the requirements of ODOT Standard Specifications. TBSC Type E meeting 1999 ODOT Standard Specifications shall be used to repair gravel driveways. All repairs shall be made in accordance with City of Duncan standard detail drawings.
- D) When water main shut down is required, CONTRACTOR shall coordinate the shut down with OWNER'S water department staff, and shall give a minimum 72-hour notice to said staff and the Public Works Director. OWNER'S water department staff will be responsible for operation of all valves which require closing.

500.05 – PROGRESS OF CONSTRUCTION

The Contractor shall work at enough different locations to complete the entire contract within the time limit specified. Water Line appurtenances shall be constructed as soon as the Water Line that they serve is constructed. Postponing the construction of appurtenances until the Water Line has been completed, or the building of appurtenances in advance of the construction of the Water Line, will not be permitted.

- A) The construction of Water Lines for more than six hundred feet (600') in advance of appurtenances which are incomplete or the construction of which has not been started, will not be permitted.
- B) All water lines that are to be abandoned in place shall be cut to the nearest connections and either capped or plugged as required to provide a tight connection. The Contractor shall be responsible for providing the appropriate plug or cap for the job. The cost of this work is considered incidental.

500.06 – DELIVERY OF MATERIALS

Construction materials shall not be delivered to the site of the work more than three (3) days in advance of their anticipated use nor shall the quantity of pipe or other materials on hand at the site of the work at any time be in excess of the amount required to complete six hundred feet (600') of Water Line unless with special permission of the Engineer.

500.07 – SURFACE DRAINAGE STRUCTURES

Unless otherwise specified or called for on the plans, all surface drainage structures and appurtenances shall not be disturbed.

500.08 – CONCRETE

Unless otherwise approved by the Engineer, all concrete used in construction of waterlines and their appurtenances shall be High Early Strength Concrete and shall have a minimum three (3) day compressive strength of three thousand five hundred pounds per square inch (3,500 psi). It is recognized that some situations may occur in which different requirements may be more suitable for completion of the work. The contractor shall receive approval from the Engineer prior to proceeding with the work in such situations.

500.09 – DEPTH OF COVER

Where not otherwise indicated on plans, the pipe shall be laid at an elevation that will provide after completion, a minimum depth of cover over the top of pipe of four feet (4') below the surface.

500.10 – STANDARD DESIGN CONDITIONS

A) **Standard Design Pressures** - Unless otherwise specified, all pipes and fittings shall be designed for the following minimum pressure conditions:

Minimum Internal Pressure (psi)		
Working	Surge	Design
150	100	250

B) **Live Loading** -Unless otherwise specified or called for on the plans, minimum pipe design corresponding to the specified design pressure shall be for highway live loading condition and where waterline is crossing or running parallel to the railroad, corresponding minimum pipe design for railroad live loading condition shall govern (with or without casing).

C) Water main pipe materials shall be ductile iron pipe (DIP) or polyvinyl chloride (PVC) pipe. All water main pipe shall be new.

500.11 – CLEAN-UP

Clean-up operations shall follow excavation and construction a distance not to exceed six hundred feet.

SECTION 505 – PIPE AND FITTINGS INSTALLATION

505.01 – DESCRIPTION

This section covers installation of pipes in open-cuts, in conformity with the lines, grades, and dimensions and as provided in applicable sections of these specifications.

505.02 – MATERIALS

505.02.01 – PIPE AND FITTINGS

Acceptable pipe materials and fittings shall meet the requirements of the appropriate sections listed below:

Pipe Material	Section
Ductile Iron Pipe (DIP)	524
Polyvinyl Chloride (PVC) Pipe	525

All pipe and fittings shall be new.

505.02.02 – EMBEDMENT

A) **General** -Embedment material shall be 3/8” screenings. Prior to delivery, the Contractor shall submit laboratory sieve analysis test reports for materials to be used for embedment. Materials shall be approved by the Engineer prior to placement.

B) **Delivery Tickets** - The Contractor shall submit delivery tickets for the purpose of verifying use of minimum quantities necessary to complete installation pursuant to the appropriate standard details and the minimum dimensions specified.

505.04 – CONSTRUCTION METHODS

- A) **Polyvinyl Chloride (PVC Pipe)** – All PVC pipe shall be embedded in accordance with ASTM D-2274, “Standard Recommended Practice for Underground installation of Thermoplastic Pressure Piping”, and ASTM D-2321, “Standard Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe”, and as shown on the Standard Detail “Typical Bedding and Trench Detail for PVC Pipe” and meeting the requirements of Section 525.
- E) **Ductile Iron Pipe (DIP)** – All ductile iron pipe shall be embedded as shown on the Standard Detail “Typical Bedding and Trench Detail for Ductile Iron Pipe.

505.04.02 – INSTALLATION REQUIREMENTS

- A) **Shipping, Handling and Storage** -Pipe shall be transported from the plant, where it is manufactured, to the job site employing special methods of packaging to prevent damage to the pipe. After the pipe is received at the job site, it shall be carefully inspected for any damage that may have occurred in transit. The pipe shall be handled at all times with care using padded slings or hooks. The pipe shall not be dropped, skidded or rolled against pipe already on the ground. If any damage occurs to pipe, the pipe shall be rejected. All pipe and accessories shall be stored on flat, level ground with no rocks or other objects under the pipe. Gaskets for push-on joints and pipe shall be stored in cool location out of direct sunlight in accordance with the manufacturer's recommendations.
1. Pipe, fittings, specials, and other accessories shall be unloaded at the point of delivery, hauled to and distributed at the site of the project by the Contractor, and shall at all times be handled with extreme care to avoid damage thereto. Equipment, tools and methods used in unloading, reloading, hauling, and laying pipe and accessories shall be such that no damage is done to the pipe or any lining therein.
 2. Cement lining in pipes or fittings which is broken or loosened in unloading or subsequent handling shall be repaired by and at the expense of the Contractor, under the direct supervision of the representative of the pipe manufacturer. All outside pipe coating which is damaged by the contractor shall be repaired, prior to laying the pipe or placing the backfill, by removing all damaged coating, wire brushing the exposed metal, and applying two coats of a permanently elastic coal tar paint of a type and quality equal to that used in originally coating the outside of the pipe and preferably of the same brand and formula. This paint shall be sufficiently hard before backfilling so that it will not be damaged thereby.
 3. Pipe lines shall be accurately installed to the alignment and profile indicated on the approved pipe installation drawings furnished for the purpose. Grades and elevations shall be determined by the pipe sub-grade prepared as specified.
 4. The maximum deflection of any pipe joint, made necessary by vertical and horizontal curves or offsets, shall not exceed the amount as recommended by the manufacturer of the pipe.
 5. PLACING PIPE IN TRENCH. Proper equipment, implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe, fittings, hydrants and valves shall be carefully lowered into the trench, piece by piece, by means of cranes, derricks, tongs, slings, ropes or other suitable tools and equipment, in such a manner that no damage occurs to the pipe, pipe coating, pipe lining or to the trench sub-grade. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

6. PIPE TO BE KEPT CLEAN. All earth, rubbish, dirt and other foreign matter shall be removed from the inside of all pipe and other appurtenances (and from the outside of the spigots), before lowering into the trench, and shall be kept clean by approved means during and after laying. At times when pipe laying is not in progress, all open ends of pipe and fittings shall be closed by approved means, and no trench water shall be permitted to enter the pipe.
 7. INSPECTION OF PIPE. Before lowering, and while still suspended, the pipe shall be inspected for defects. Any defective, damaged or unsound pipe shall be rejected.
 8. CUTTING PIPE. Cutting of pipe for closure pieces or for other reasons shall be done in a neat and workmanlike manner by a method which will not damage either the pipe or the pipe lining.
- B) **Pipe Foundation** - No waterline shall be laid unless the foundation is in a condition satisfactory to the Engineer. Where trenches are excavated in soft, unsuitable, or rock material, trench bottom shall be stabilized as directed by the Engineer.
- C) **Laying Requirements** -All pipes, specials, fittings and other appurtenances shall be examined carefully for damage and other defects before installation. The City retains the right to reject damaged and defective materials.

The pipe ends shall be free of all lumps, blisters and they shall be wiped clean of foreign materials such as dirt and sand before installation.

Pipe shall be laid with the bell ends facing in the direction of laying unless directed otherwise by the Engineer. Where pipe is laid on a slope of ten (10%) percent or greater laying shall start at the bottom and proceed up the slope.

When laying pipe is not in progress during the noon hour or overnight, the open ends of the pipe shall be closed by watertight plugs. If water is in the trench the plugs shall be left in place until the trench is pumped dry.

Bell holes for bell-and-spigot pipe shall be excavated at proper intervals so that the barrel of the pipe will rest for its entire length upon the bottom of the trench. Bell holes shall be large enough to permit proper installation of pipe. Bell holes shall not be excavated more than ten (10) joints ahead of pipe laying. Filling and ramming earth or other material beneath the pipe to raise it to grade shall not be permitted.

The Contractor shall use every precaution at all times during construction of the pipeline. All pipe, specials, fittings, and other appurtenances shall be lowered carefully into the trench with suitable equipment, to prevent damage to the waterline materials. In rock trenches, plywood shields or other approved means shall be used to prevent the cradled pipe from swinging against the sides of the trench.

All joint preparation and joining operations shall comply with the instructions and recommendations of the pipe manufacturer and meet the joint requirements in the appropriate material section. Rubber gaskets shall be positioned on the joint in accordance with the manufacturer's recommendations. Immediately before joints are pushed together, all joint surfaces shall be coated with the lubricant furnished with the pipe.

Any damage to the pipe, from any cause during installation of the pipeline shall be cause for replacement, as directed by the Engineer, and at the expense of the Contractor.

After a section of pipe is properly installed and approved for backfill, the trench shall be backfilled and compacted.

505.06 – METHOD OF MEASUREMENT

Payment for "Water Line" shall be made at the unit price bid per lineal foot of pipe installed for each size. The price established shall be full compensation for all materials including pipe, short pieces and specials, trench excavation, embedment material, backfilling, labor, tools, equipment and incidentals necessary to complete this item of work. "Water Line" shall be measured along the pipe.

Payment for fitting shall be paid for by the pound. The price established shall be full compensation for all materials including fittings, trench excavation, backfilling, embedment material, concrete thrust blocks, labor, tools, equipment and incidentals necessary to complete this item of work.

505.07 – BASIS OF PAYMENT

(SIZE) (TYPE) WATERLINE	L.F.
FITTINGS	LB.

Such payment shall be compensation in full for furnishing all materials, labor, equipment, tools and incidentals, and for performing the work in accordance with these specifications.

SECTION 510 – WATER SERVICE LINE CONNECTIONS

510.01 – DESCRIPTION

510.01.01 – GENERAL

This section covers water service line connections in sizes five-eighths inch (5/8") through two inches (2") for use in buried service lines from the main to the meter valve or meter setting appurtenance in accordance with ANSI/AWWA C-800 Standard for Underground Service Line Valves and Fittings or as modified herein. All water service lines and connections shall be installed as per city ordinances and standards.

510.01.02 – DEFINITIONS

The following definitions shall apply:

- A) **Adapter** -A fitting used to connect pipe, tubing, or other fittings with differing characteristics such as sizes, diameters, or material type.
- B) **Chamfer** - A bevel made on the end of a thread to facilitate thread engagement.
- C) **Corporation valve (stop)** - A valve attached to the water main to start a service connection, which is used to interrupt flow during installation or maintenance of the service line.
- D) **Coupling** - A fitting for connecting two pipes or tubing sections together.
- E) **Curb valve** -A valve installed in the water service line and accessible for operation from the surface of surface of the ground for routinely interrupting flow through the service line.
- F) **Driving thread** - A thread installed on the outlet end of corporation valves and used to hold the valve during installation.
- G) **Dry seal** -A type of pipe thread covered by ANSI/ASME B1.20.3. Dryseal pipe threads are based on the USA (American) pipe thread. They differ from the USA (American) pipe thread in that they are designed to seal pressure-tight joints without the need for sealing compounds.
- H) **Fitting** - A part used to connect piping or tubing.
- I) **Inlet** - The opening in a valve or fitting through which flow from the water main enters the valve or fitting.
- J) **N.P.T.** - National Pipe Thread as specified in ANSI/ASME B1.20.1.
- K) **Outlet** -The opening in a valve or fitting through which flow from the water main leaves the valve or fitting
- L) **Tapping Clamp** - A fitting that attaches circumferentially to a pipe to provide for attachment of a corporation valve.

510.02 – MATERIALS

Materials in contact with potable water shall be copper or brass. The alloy shall contain no more than 0.25% lead.

All services shall use Type K copper tubing. All corporation stops, curb stops and inlets and adapters shall be Mueller brand or approved equivalent Brass Fittings. All service line installations, taps and connections shall comply with the City of Duncan standards.

Component Parts - Component parts such as fasteners, seals, and packing may be of other materials selected for adequate endurance, corrosion resistance, and strength.

510.02.01 – DESIGN OF VALVES AND FITTINGS

General - Valves, fittings, and parts thereof shall be machined to the sizes and tolerances defined in AWWA C-800. End connections may be soldered, threaded, flared.

Pressure Rating - Service line valves and fittings shall be suitable for use with water at one hundred (100) degree F and one hundred fifty pounds per square inch pressure. (150 psi)

510.02.02 – DETAILED DESIGN OF VALVES AND FITTINGS

Dimensions of Corporation Valves:

A) **General** -Corporation valves shall be installed with drilling or tapping machines. Unless otherwise specified, the minimum inside diameter of the waterway through a corporation valve shall be large enough to accommodate the maximum drill sizes herein. Maximum drill sizes for installation of corporation valves and service clamps or saddles with a driving machine shall be as shown below.

Corporation Valve Size (inches)	Maximum Drill Size	
	Corporation Valve with AWWA Thread inlet	Corporation Valve with N.P.T Thread Inlet
¾	1 1/16	1 1/16
1	1 5/16	1 5/16
1 ½	1 7/16	1 7/16
2	1 15/16	1 3/4

B) **Overall Body Dimensions** -For corporation valves to be installed by a tapping machine, overall body dimensions shall conform with the dimensions listed below.

Corporation Valve Size (inches)	Maximum Radius (inches)	Maximum Length (less nut) (inches)
¾	1.50	4
1	1.50	4
1 ½	2.50	9 1/16
2	2.50	9 1/16

B) **Tapping Clamps** -Tapping Clamps shall conform to the requirements of Section 533.

D)Service Line Fittings

a. **General** -The fittings used in service lines shall be designed for connection to the service line by soldering, threading or flaring. Small waterways and abrupt corners causing water turbulence and pressure drop shall be minimized.

b. **Solder for service line fittings** - When solder is used with fittings, it shall be "lead free" with a maximum lead content of no more than two-tenths (0.2%) percent as defined in the 1986 amendments to the SDWA.

510.02.03 – END CONNECTIONS

End connections shall be in conformance with AWWA C-800.

510.04 – CONSTRUCTION METHODS

510.04.01 – GENERAL

The following are general connection requirements only. Additional plumbing code and other requirements may be applicable, which are not included herein.

- A) Single taps shall be made at forty-five degree angles (45°) from crown of distribution main. When two (2) or more taps are to be made, they shall be a minimum of thirty-six (36") inches apart and alternate from forty-five degrees (45°) to thirty degrees (30°) from crown of distribution main.
- B) Back/reverse tap may be allowed only under adverse conditions and only when approved by the Engineer.
- C) No tap shall be allowed on fire hydrant leads except under adverse conditions and only when approved by the Engineer.
- D) Direct taps shall be allowed into cast iron or ductile iron mains only.
- E) Tapping clamps shall be Mueller Single Section Servi-Seal All Stainless Steel Pipe Repair Clamps with integral CC Threaded service outlet, minimum 15" length or approved equal for three quarter inch ($\frac{3}{4}$ ") to two inch (2") service line connections. Tapping clamp shall also conform with the requirement of Section 533. All other taps shall be accomplished using tapping sleeves in accordance with Section 532.
- F) When tapping clamps are installed a pressure test shall be performed. Tapping clamps shall hold a minimum of one hundred pounds per square inch (100 psi) of pressure for thirty (30) minutes.
- G) Service connections two (2") inches and smaller shall be by corporation valve (stop) of the same size as the service line and meter to be installed. Corporation valves shall be as specified in Section 510.02. Service connections to the main for service lines larger than two (2") inches shall be a branch connection.
- H) When tapping mains where it is necessary to remove part of the polyethylene wrapping, the polyethylene wrap shall be repaired or replaced in such a manner as to protect both the pipe and corporation valve. Any bedding material removed during excavation shall be replaced in kind and compacted.
- I) No tees shall be connected to existing water service lines three inches (3") and smaller in diameter providing water to a single meter of the same size.

510.04.02 – MATERIAL CERTIFICATION

Contractor shall provide a Type D certification for all materials used in service lines and service line connections.

510.05 – TESTING

Any valves or fittings found to be defective shall be replaced with new valves or fittings at the Contractor's expense.

510.07 – BASIS OF PAYMENT

All cost of service line connections shall be included in the price bid for water services.

SECTION 511 – WATER SERVICE LINES

511.01 – DESCRIPTION

511.01.01 – GENERAL

This section covers water service lines intended to be used from the connection to the meter valve for meter setting appurtenance in accordance with AWWA C-800 Standard for Underground Service Line Valve and Fitting or as modified herein. All water service lines shall be connected as per city ordinances.

511.01.02 – TYPES

Long Service (EA) is for one service line from the new water meter to a meter or meters on the opposite side of the street, irrespective of the number of meters served by one line. Short Service (EA) is for one service line from the new water main to a meter or meters on the same side of the street, irrespective of the number of meters served by one line.

511.02 – MATERIALS

All service lines shall be seamless copper tubing of the designation "Type K". Substitutions such as plastic or PVC pipe shall not be accepted. All corporation stops, curb stops and inlets and adapters shall be Mueller brand or approved equivalent Brass Fittings. All service line installations, taps and connections shall comply with the City of Duncan Standards.

511.04 – CONSTRUCTION METHODS

The following are general construction requirements only. Additional plumbing code and other requirements may be applicable, which are not included herein.

- A.) Joints in water lines less than one and one-half (1½") inch in diameter shall not be soldered.
- B) Boring –
 1. Lines for all long services will be bored or punched under the existing road.
 2. Copper lines under street pavement shall not be spliced.
 3. Street bores shall be a minimum of thirty (30") inches below the bottom of the street.
 4. Service line bores shall be level.

511.06 – METHOD OF MEASUREMENT

The price established shall be full compensation for all materials including copper service lines, boring, fittings, connections to meter, labor, tools, equipment, and incidentals necessary to complete this item of work.

511.07 – BASIS OF PAYMENT

The items measured as provided above will be paid for at the contract unit price bid:

SHORT SERVICE (SIZE)	EA.
LONG SERVICE (SIZE)	EA.

Such payment shall be compensation in full for furnishing all materials, labor, equipment, tools and incidentals, and for performing the work in accordance with these specifications.

SECTION 513 - WET CONNECTIONS

513.01 – DESCRIPTION

This section covers wet connections for tie-in to existing mains. The connections shall be either a cross or tee as called for on the plans where tapping is not allowed.

513.04 – CONSTRUCTION METHODS

The wet connection shall begin with isolating the point of tie-in by closing of valves. The existing main shall then be cut where wet connection is to be made and the line drained. Contractor shall prevent all non-potable water and foreign materials from entering the water main by use of adequate pumps and other necessary means.

513.06 – METHOD OF MEASUREMENT

"Wet Connection" will not be measured separately.

513.07 – BASIS OF PAYMENT

All cost of making wet connections shall be included in the price bid for fittings.

SECTION 514 – TAPPING CONNECTIONS

514.01 – DESCRIPTION

This section covers water main tapping for connections to existing water mains.

514.02 – MATERIALS

The following materials shall be used and meet the requirements of the appropriate Sections listed below.

Tapping Mechanism	Section
Tapping Sleeve	532
Tapping Valves	520.02.02

514.04 – CONSTRUCTION METHODS

A) Description - A tap is the cutting of a coupon, utilizing a tapping sleeve or saddle with tapping valve for a connection.

B) Methods

a. Direct taps -Direct taps shall be made when the main to be tapped is on the same horizontal plane as the branch. The cutting operation is to be done with a sharp shell-cutter tool, which shall be lubricated with the manufacturer's recommended cutting tool lubricant.

b. Swing Ties - Swing ties shall be made when the main to be tapped is either above or below the branch when called for on the plans or specified. A swing tie may consist of

- i. Waterline pipe
- ii. Tapping sleeve as necessary;
- iii. Tapping valve and Box;
- iv. Tap;
- v. Solid sleeve;
- vi. Forty-five degree (45°) bends.

514.06 – METHOD OF MEASUREMENT

Tapping Connection will not be measured separately.

514.07 – BASIS OF PAYMENT

All cost of making tap connections shall be included in the price bid for tapping valve with sleeve.

SECTION 516 – FIRE HYDRANTS

516.01 – DESCRIPTION

This section covers fire hydrants intended to be used for fire protection when specified or called for on the plans. The hydrant shall be located and positioned in such a way as to be accessible and protected from traffic.

516.02 – MATERIALS

516.02.01 – GENERAL

All fire hydrants furnished shall conform to AWWA C-502, as amended, or as modified herein. Fire hydrants shall be A-423 Mueller 3-way fire hydrant, Centurion Model, 5 ¼" valve opening, 2-2 ½" hose nozzles, 1-5" pumper nozzle, 6" M.J. Shoe, silver color, City of Duncan specifications or approved equal.

516.02.02 – SUBMITTALS

The Contractor shall provide three (3) copies of all submittals for fire hydrants. The submittal shall clearly identify the make, model, design, and metal characteristics for approval by the Engineer prior to installation.

Drawings shall show principal dimensions, metal thickness, construction details, materials used in all parts of the fire hydrant with ASTM designation and structural properties. Net assembled weight of hydrants shall be shown.

Specifications shall include comprehensive parts list with sufficient drawings or details to clearly identify parts.

516.02.03 – AFFIDAVIT OF COMPLIANCE

The Contractor shall provide an Affidavit of Compliance that fire hydrants furnished comply with all provisions of these specifications.

516.02.04 – TYPE OF SHUT-OFF

Type of shut-off shall be of the compression type with the flow.

516.02.05 – DELIVERY CLASSIFICATION

All hydrants shall be equipped with two (2) hose nozzles and one (1) steamer nozzle. Leaded in nozzles shall not be acceptable.

516.02.06 – INLET CONNECTION

Unless otherwise specified, the inlet connection shall be a mechanical joint hub complete with all joint accessories. All mechanical joint gland bolts shall be high strength, low alloy, corrosion resistant material, such as Cor-Ten or equal, as specified in ASTM A-252. The inlet valve opening shall be five and one-quarter (5¼") inches net.

516.02.07 – OUTLET CONNECTIONS

The outlet connections shall be two (2) hose nozzles, two and one-half inches (2½") in nominal I.D. and one (1) pumper nozzle five inches (5") in nominal I.D. Nozzle threads shall be Duncan Standard.

516.02.08 – RESTRAINED JOINTS

Restrained Joints shall be furnished when specified or called for on the plans.

516.02.09 – NOZZLE CAP GASKET

Gaskets shall be furnished on all nozzle caps. Gaskets shall be neoprene.

516.02.10 – DRAIN VALVE AND OUTLET

A positive operating drain valve or valves shall be provided.

516.02.11 – PAINT

Fire hydrants shall be painted with two (2) coats of silver enamel paint manufactured by Pittsburgh Paint or approved equal. Each coat of paint shall have a minimum dry thickness of two (2) mils.

516.02.12 – SHAPE AND SIZE OF OPERATING AND CAP NUTS

The operating and cap nuts shall be National Standard Pentagon nuts.

516.02.13 – BREAKABLE TYPE

Breakable type (traffic models) shall be furnished. A breakable type hydrant is one that requires no excavation and shall break at the design point.

516.02.14 – STAND PIPE, FLANGES, AND EXTENSIONS

Breakable parts of standpipe shall be located approximately three inches (3") but not more than five inches (5") above the ground line. These parts shall be of the breakable flange type, breakable coupling or integral flange with sawed bolts. Breakable flanges screwed to the standpipe shall not be accepted. The flange on each end shall have at least eight (8) bolts, or other acceptable method to permit proper orientation of nozzles in forty-five degree (45°) increments and shall be designed so that a wrench can be used on nuts and bolts. Extension of hydrant shall be made by adding at the ground line flange a new coupling and stem section equal to the length of the extension. Stem extensions made by adding new section of stem to the threaded section of the stem at the top of the hydrant shall not be acceptable.

516.02.15 – STEM

Provisions shall be made in the design of the stem to disconnect the stem from the hydrant parts above the standpipe break point in the event of traffic accidents.

516.02.16 – COUPLINGS

If breakable or sleeve type couplings are used, they shall have sufficient torsional strength such that a torsional failure of the stem shall occur at some point other than coupling. Design of the coupling shall be such that when the coupling is broken, no parts shall come loose and fall into hydrant, and the break shall not occur through the pins or bolts holding the coupling to the stem.

516.02.17 – GROUND LINE GASKETS

Gaskets furnished for ground line flanges shall be full face, or flange shall be recessed.

516.02.18 – MAIN AND VALVE SEATS

Main valve seats on the hydrant shall be of such design that incorrect positioning is impossible and that the threads shall be adequately guided into position. Arrangements shall also be made to hold the main valve gasket in place during assembly. The main valve seat shall be made of bronze and threaded into a bronze retainer ring or it may be threaded into a heavy bronze bushing in the hydrant base. All bronze parts in constant contact with the water shall be of type "A", "D", or "E" bronze in accordance with Table 1, AWWA C-212.

516.02.19 – NOZZLE CAP CHAINS

All fire hydrants shall be equipped with nozzle cap chains.

516.02.20 – FLANGES

All flanges shall have a minimum thickness of seven-eighths inch (7/8"). Bolt hole edge distance shall be sufficient to provide full support for the bolt heads and nuts.

516.02.21 – OPERATING STEMS

Operating stems shall be high grade bronze, wrought iron or steel. Stem nuts shall be bronze. Where passing through O-rings, iron or steel stems shall have a bronze, stainless steel, or other non-corrodible metal sleeve. Operating threads shall be sealed against contact with water regardless of open or closed position of the main valve. An internal lubricant chamber shall be provided as a part of the dry top construction. An external access for adding lubricant shall be provided

516.02.26 – O-RINGS

Fire hydrants shall be equipped with O-rings in lieu of stem packing.

516.02.27 – CAP NUTS

The hydrants shall have a cap nut to seal the bottom end of the stem threads against contact with water.

516.04 – CONSTRUCTION METHODS

516.04.01 – BURY LENGTH

Unless otherwise specified, hydrants shall be furnished with a depth of bury to match the water main depth.

516.04.02 – TAPPING OF DRAIN OPENING

Tapping of drain opening shall not be required.

516.04.03 – DIRECTION OF OPENING

The direction of opening shall be to the left or Counter-Clockwise. An arrow and the word "OPEN" shall be cast in relief to be clearly visible on the top of the hydrant, to designate the direction of opening. A minimum number of turns to open shall be ten (10).

516.04.04 – INSTALLATION

The hydrant shall be inspected and cleaned prior to installation. It shall be placed on a concrete mat not less than four inches (4") thick and sixteen inches (16") square. The rear side of the hydrant, opposite the pipe, shall be blocked with concrete between the hydrant and a vertical face of undisturbed earth. A minimum of seven (7) cubic feet of crushed rock shall be placed around and below the hydrant to allow the hydrant to properly drain. The hydrant shall be firmly supported prior to backfill.

516.05 – TESTING

Hydrostatic tests outlined in AWWA C-502 shall be complied with.

516.06 – METHOD OF MEASUREMENT

Payment for "Fire Hydrant Assembly" shall be made at the unit price bid per each. Price bid for "Fire Hydrant Assembly" shall be full compensation for equipment, labor and materials for complete and acceptable installation of a fire hydrant per City of Duncan standards, including fire hydrant, TEE, Gate valve, extension pipe, riser pipe and up to five (5) linear feet of 6" diameter ductile iron pipe connection between fire hydrant and water main.

516.07 – BASIS OF PAYMENT

The items measured as provided above will be paid for at the contract unit price bid:

FIRE HYDRANT ASSEMBLY EA.

Such payment shall be compensation in full for furnishing all materials, labor, equipment, tools and incidentals, and for performing the work in accordance with these specifications.

SECTION 518 – THRUST BLOCKS

518.01 – DESCRIPTION

This section covers thrust blocks intended to be used to transmit unbalanced thrust forces into undisturbed soil.

518.02 – MATERIALS

High Early Strength Concrete shall be used for thrust blocks. Compressive strength of concrete shall be minimum 3500 psi at three (3) days.

518.04 – CONSTRUCTION METHODS

All construction shall be in accordance with the Standard Details for Thrust Blocks.

518.06 – METHOD OF MEASUREMENT

"Thrust Blocks" will not be measured separately.

518.07 – BASIS OF PAYMENT

All cost of installing thrust blocks shall be included in the price bid for water line.

SECTION 519 – BLOW-OFF CONNECTIONS

519.01 – DESCRIPTION

This section covers blow-off connections intended to be used to provide outlets for draining waterlines at dead ends.

519.04 – CONSTRUCTION METHODS

Blow-off connections shall be constructed of the size, detail and location shown on the plans. Blow-offs shall be provided with a shut-off valve. Blow off connections shall be constructed in accordance with standard details in contract.

519.06 – METHOD OF MEASUREMENT

Blow-off Connections will not be measured separately.

519.07 – BASIS OF PAYMENT

All costs of providing and installing blow-off connections shall be included in the price bid for waterline.

SECTION 520 – WATER VALVES

520.01 – DESCRIPTION

This section covers water valves of size and type specified or called for on the plans. Unless otherwise specified, all valves shall be gate valves. Valves specified shall be of the types shown in the following table:

Valve Type	Reference Standard
Gate (Resilient Seated)	AWWA C-509, C-550 and C111
Tapping	AWWA C-509, C-550 and C111
Check	AWWA C-508

520.02 – MATERIALS

The Contractor shall submit the following for approval prior to installation:

- A) Valve make and model
- B) Valve detail drawings
- C) Type "A" and "D" Certifications.

520.02.01 – GATE VALVES

- A) General - Gate valves shall conform to the requirements of AWWA C-509, C-550 and C-111 and shall be, bronze mounted, outside screw and yolk, non-rising stem, open counter-clockwise, close clockwise, mechanical joint both ends, resilient seated, "O-ring" for non-rising stem, and shall have 2" square operating nut.
- B) Pressure Rating - Valves produced conforming to AWWA C-509, C-550, and C-111 shall have a design working pressure of two hundred pounds per square inch (200 psi).
- C) Acceptable Manufacturers – Gate valves shall be Mueller or approved equal.

520.02.02 – TAPPING VALVES

- A) General - Valves to be used with tapping sleeves shall have connecting flanges (Standard Class 125) with centering lip on the valve flange to fit recess or counterbore on the outlet tapping sleeve flange. The outlet end of the valve shall have a combination mechanical joint end and tapping machine flange.
- B) Tapping valves shall conform to AWWA C-509 and C-550, except as modified for passage and clearance of tapping machine cutters. The opening through the valve shall be at least one-quarter inch (¼") larger than nominal valve diameter. The outlet end of the valve shall have the desired joint connection for the intended pipe. Tapping Valves shall be Mueller Tapping Valve, or approved equivalent.

Tapping valves shall allow full size cutters to be used. Seating of the disc gate shall not require any sliding or wedging to achieve a zero leakage. A maximum of three (3) internal moving parts shall be required for operation of the valve. The stem collar shall be protected from outside grit, sand, etc., by dual O-rings above stem collar. There shall be an O-ring below stem collar sealing off lubrication chamber from line fluid. Pressure energized O-rings may be used in place of flat gaskets on flanged joints in valve body/bonnet.

All interior and exterior ferrous surfaces shall be protected against corrosion by factory-coated fusion-bonded epoxy coating. Coating shall be applied prior to assembly to insure coverage of all exposed areas, including boltholes.

E) Acceptable Manufacturers - Tapping valves shall be Mueller or an approved equal:

520.02.04 – CHECK VALVES

A) General - Check valves shall conform to the requirements of AWWA C-508 Standard for Swing-Check Valves for Waterworks Service, two (2") inches through twenty-four (24") inches NPS. Check Valves shall be Mueller A2600-06BB Gravity operated Swing Check Valve or approved equal.

B) Pressure Ratings – Check valves conforming to AWWA C-550 shall have a working pressure rating of one hundred seventy-five pounds per square inch (175 psi).

C) Acceptable Manufacturers - Check valves shall be Mueller or an approved equal:

D) Pressure Rating- Tapping valves manufactured conforming to AWWA C-509 and C-550 shall have 200 psi working pressure rating

520.04 – CONSTRUCTION METHODS

Gate valves shall be set with the stems plumb.

Check valves shall be set horizontally.

Tapping valves shall be installed in accordance with the recommendations of the pipe manufacturer being tapped.

Other types of valves shall be set in position shown on the plans or as directed by the Engineer.

At the site of the work and just prior to placing the valve in the trench, the valve shall be fully opened and closed and a record of the number of turns required for full operation shall be furnished to the Engineer. The inside of the valve shall be thoroughly cleaned before installation.

The valve shall be set on a firm base. Valves in PVC pipelines shall be supported by concrete independently of the pipe. The valve and the valve box shall be firmly supported and centered prior to backfill. Installation of valves shall also comply with the appropriate standard detail.

520.06 – METHOD OF MEASUREMENT

Payment for valves, valve boxes and valve vaults shall be made at the unit price bid per each for each type and size of valve. The price established shall be full compensation for all material including valve, valve boxes, valve vaults, installation, labor, tools, equipment and incidentals necessary to complete this item of work.

520.07 – BASIS OF PAYMENT

Unless otherwise called out on plans, the item measured as provided above will be paid for at the contract unit price bid:

(SIZE) (GATE) VALVE WITH BOX EA.

(SIZE) TAPPING VALVE AND SLEEVE EA.

(SIZE) CHECK VALVE AND VAULT EA.

Such payment shall be compensation in full for furnishing all materials, labor, equipment, tools and incidentals, and for performing the work in accordance with these specifications.

SECTION 521 – VALVE BOXES

521.01 – DESCRIPTION

This section covers valve boxes intended to provide means to operate the valve.

521.02 – MATERIALS

- A) Valve Boxes - All valve boxes shall be Duncan Standard three (3) piece cast iron of the extension type suitable for a depth of cover over the pipeline as required by the backfill requirements at each valve. Each valve box shall be provided with a suitable cast iron base and cover. All parts of valve boxes, bases, and covers shall be coated by dipping in hot bituminous base material. Covers shall have cast thereon an appropriate name designating the service for which the valve is to be used.

521.07 – BASIS OF PAYMENT

Payment for valve boxes shall be paid for as per Section 520.07.

SECTION 522 – HYDROSTATIC PRESSURE TESTING

522.01 – DESCRIPTION

This section covers hydrostatic pressure testing of installed water mains in accordance with the requirements specified herein.

All pipelines shall be tested by means of hydrostatic pressure of not less than 150 pounds per square inch. If test plugs are used, they shall be furnished and installed by the Contractor at his own expense, together with all necessary anchors, braces and other devices necessary to withstand the hydrostatic pressure on such plug or plugs without placing any hydraulic thrust on the pipe line or any part thereof. The Contractor shall be solely responsible for any and all damage to the pipeline and public and private property, which might be caused by the failure of such test plugs or supports therefore. The allowable leakage shall not exceed 10 gallons per inch diameter per mile of pipe per 24 hours at 150 psi testing pressure.

After the section of line to be tested has been filled with water, the specified test pressure shall be applied by means of a force pump of such design and capacity that such pressure can be applied and maintained for the duration of the test period, which shall be not less than two (2) hours.

All water supplied to the line, after the initial filling thereof shall be metered by means of a tested water meter approved by the Engineer.

If any section of pipeline including specials, fitting and appurtenances are discovered to be damaged after the hydrostatic test, they shall be repaired or replaced with sound material and the test shall be repeated to the satisfaction of the Engineer. If any test of pipe installed indicates leakage greater than the allowable leakage, the contractor shall, at his own expense, locate and repair the source of leak in the pipeline until the leakage is within the specified allowance. All visible leaks are to be repaired regardless of the amount of leakage.

522.06 – METHOD OF MEASUREMENT

All costs for Hydrostatic Pressure Testing shall be included in the price bid for water line.

SECTION 523 – DISINFECTION

523.01 – DESCRIPTION

This section covers disinfection of water mains.

523.04 – CONSTRUCTION METHODS

523.04.01 – GENERAL

- A) Water Mains -All new water mains shall be disinfected before they are placed in service. All water mains taken out of service for inspecting, repairing, or other activity that might lead to contamination of water shall be disinfected before they are returned to service. All work shall comply with AWWA C-651 Standard for Disinfecting Water Mains.
- B) Continuous-feed method disinfection per AWWA 651, Sec. 4.4.3 shall be used only. Contractor shall be responsible for collecting all water drained from the existing water main and from the new water main and disposing of it in accordance with all appropriate State and Federal regulations.

523.04.02 – FLUSHING

The Contractor shall perform preliminary flushing with potable water at a velocity of not less than two and one-half feet per second (2½-fps).

523.04.03 – DISINFECTION

The disinfection of the pipeline and the bacteriologic and chemical tests shall be provided by the Contractor. The Contractor shall furnish the necessary equipment and materials for disinfection and testing. The Contractor shall furnish labor to make the necessary connections and shall provide any temporary drainage measures for disposal of the flushed water. Contractor shall obtain safe bacteriological samples on two consecutive days before placing the waterline into service.

523.06 – METHOD OF MEASUREMENT

All costs of Disinfection shall be included in the price bid for water line. Contractor shall provide all material including disinfectants, flushing, dechlorination, disinfection, hydrostatic pressure testing, labor, tools, equipment and incidentals necessary to complete this item of work. All necessary water for flushing shall be provided by the City.

SECTION 524 – DUCTILE IRON PIPE (DIP)

524.01 – DESCRIPTION

This section covers ductile iron pipe and fittings, for pressure applications, intended to be used for conveyance of potable water, in sizes six inches (6") through twelve inches (12").

524.02 – MATERIALS

524.02.01 – GENERAL

All ductile iron pipe and fittings and installation of same shall conform to the requirements of the following standards listed below or as modified herein.

- A) ANSI/AWWA C-150/A 21.50, Thickness design of Ductile Iron Pipe
- B) ANSI/AWWA C-151/A 21.51, Ductile Iron Pipe, Centrifugally Cast
- C) ANSI/AWWA C-111/A 21.11, Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.
- D) ANSI/AWWA C-104/A 21.4, Cement Mortar Lining for Ductile Iron Pipe for Water.
- E) ANSI/AWWA C-600, Installation of Ductile Iron Water Mains and Their Appurtenances.

F) ANSI/AWWA C-115/A 21.15, Flanged Ductile Iron Pipe with Threaded Flanges.

G) ANSI/AWWA C-116/A 21.16, Protective Fusion-Bonded Epoxy Coatings for Interior and Exterior surface of Ductile Iron and Gray Iron Fitting

H) ANSI/AWWA C-153/A 21.53, Ductile Iron Compact Fittings

I) NSF/ANSI 61, Drinking Water System Components –Health Effects

524.02.02 – SUBMITTALS

The Contractor shall submit the following and shall receive approval of same from the Engineer prior to incorporating any materials into the work.

Review and approval of the Contractor submittals, by the Engineer, shall not be construed in any way as relieving the Contractor and the manufacturers of their responsibilities for manufacturing ductile iron pipe and fittings as described herein.

A) General - Detail drawings of pipes, specials, fittings, and joints.

B) Certification - Type "A" and "D" certification for pipe, specials, fittings, gaskets, and lining material pursuant to, but not limited to, applicable standards in Section 524. The affidavits of compliance and test reports shall be certified by a registered professional engineer.

C) Copies - The Contractor shall provide three (3) copies of all submittals.

524.02.03 – DESIGN BASIS

A) General - All ductile iron pipes are designed in accordance with AWWA C-150/ANSI 21.50. The designs are based on prism load of ordinary clay backfill with a unit weight of one hundred twenty pound per cubic feet (120 pcf), maximum horizontal ring deflection of three (3%) percent, design factor safety of two (2), and for AASHTO HS-20 truck highway (HWY) or Cooper axle E-80 railroad (RR) live loading conditions.

B) Depth of Cover - The minimum design depth of cover shall be five (5') feet. Pipe to be installed inside a casing shall be designed for full cover including live load (a single H-20 or Railroad E-80) neglecting the casing.

C) Deflection – The allowable deflection for the specified mortar lining system is three (3%) percent. Deflection calculation is in accordance with AWWA C-150.

D) Bending and Hoop Stresses -The bending and hoop stress requirements are met in accordance with AWWA C-150.

E) Buckling

a. Buried Installations - The controlling load for buried pipes is determined from the greater of hydrostatic and earth loads plus vacuum or hydrostatic and earth load plus live load with a factor of safety of two (2.0) as determined in accordance with Section 6.3 of AWWA M-11. It is assumed that the groundwater level is equal to natural ground surface and the ground is fully saturated.

b. Unburied Installations - For unburied pipes, the internal collapsing vacuum pressure is used in determining the minimum wall thickness(es) in accordance with equation 4-2 of AWWA M11 for a factor of safety of 1.5 against buckling. The Poisson's ratio is 0.28 and modulus of elasticity is 52×10^6 psi.

c. Vacuum Pressure - For both buried and unburied installations, the internal collapsing vacuum pressure is taken as 14.7 psi.

524.02.04 – MINIMUM PIPE DESIGN FOR DUCTILE IRON PIPE

Unless otherwise specified, ductile iron pipe and fittings for buried installations, including boring, shall have the following minimum nominal thickness(es), shown below.

For boring, installations, the minimum pipe design shall be equal to or greater than the minimum pipe design on either side of the installation.

Minimum Pipe Design for Ductile Iron Pipe		
Pipe Size (inches)	Nominal Push on Joint Wall Thickness Class 50 (Inches)	Flange Joints Class 53 (inches)
6"	0.25"	0.34"
8"	0.27"	0.36"
10"	0.29"	0.38"
12"	0.31"	0.40"

524.02.06 – PIPE JOINTS AND FITTINGS

- A) General - All specials and fittings may be used with push-on, mechanical, or flanged joints conforming to the requirements of AWWA/ANSI C-110/A 21.16. Fittings with push-on joints shall be installed with thrust blocks. Mechanical joints shall be adequately protected against unbalanced forces. All joints shall have the same pressure rating as the pipe of which they are a part and shall meet the requirements of AWWA/ANSI C-111/A 21.11. All pipe shall be marked in accordance with Sec. 4.7 of AWWA C-151.
- B) Push-on Joints - Push-on joints are a rubber gasket compression type joint meeting the requirements of AWWA C-111. Push-on joints shall have a deflection capability of three degrees (3°).
- C) Mechanical Joints - A mechanical joint is a bolted joint of the stuffing-box type. Each joint shall consist of a bell that is cast integrally with the pipe or fitting and provided with an exterior flange having bolt holes or slots, and a socket with annular recesses for the sealing gasket and the plain end of the pipe or fitting, a pipe or fitting plain end, a sealing gasket, a follower gland with bolt holes, and T-head and hexagonal nuts.
- D) Flanged Joints - The flanged joints for ductile iron pipe shall be in accordance with AWWA C-111. Bolts, gaskets, and installation shall meet the requirements of AWWA C-115, Appendix A. The flanged joints for specials and fittings shall meet the requirements of AWWA C-110.

The flanges shall be rated for two hundred fifty (250 psi) pounds per square inch working pressure with bolt-hole drillings as for Class 125 flanges for service at temperatures ranging from twenty degrees (20°) to one hundred fifty degrees F (150°F) are pressure temperature rated for one hundred fifty (150) to two hundred pounds per square inch (200 psi) as shown in ANSI B 16.1. All flanged joints shall be made with single piece, red rubber gaskets one-eighth (1/8") inch thick. Gaskets shall be full face for exposed installations and ring type or full faced for buried service meeting AWWA C-110, Appendix A requirements. As directed by the Engineer or shown on plans, flange joints meeting the requirements of ASME/ANSI B-16.1 may be used.

E) Mechanical Joint Restraints -

Mechanical Joint Restraints may be used only at locations approved by the Engineer. Typical examples where the Engineer may permit use of Mechanical Joint Restraints are: creek crossings, locations where excavation depth exceeds five feet and bends greater than 22 1/2° are required to match new pipe to existing pipes and locations where required connections or other laying conditions do not permit sufficient time to complete thrust blocks prior to returning water mains to service.

Mechanical Joint Restraints will not be used in lieu of thrust blocks.

Mechanical Joint Restraints, if permitted, shall be as follows or approved equal. Mechanical Joint Restraints such as Ford Meter Box Company Uni-Flange Retainer Glands, EBAA Iron Sales Mega-Lug Series 1100 and other models that require set screws or bolts in direct contact with the pipe will not be permitted for use on PVC pipe.

Restrained Joints		
Company	Size	Type
American Cast Iron Pipe Co.	6" to 12"	Flex-Ring
EBAA Iron Sales Co.	6" to 12"	Mega-Lug Series 1100
Ford Meter Box Co.	6" to 12"	Uni-Flange
US Pipe and Foundry Co.	6" to 12"	TR-Flex
N/A	6" to 12"	3/4" all thread with Duc Lug

F) Sleeve Couplings - All sleeve couplings, except as noted on the plans or otherwise specified, shall be restrained with tie rods and shall be designed for the pipe design pressure and maximum allowable stress not to exceed sixty-five percent (65%) of minimum yield strength of steel used. Sleeve couplings shall be:

Dresser Style 38
Rockwell Steel Coupling 511
Smith Blair
Approved Equal

Sleeve Couplings shall be compact fittings meeting the requirements of AWWA C-153 and AWWA C-110

524.02.07 – COATING AND LINING

- A) Exterior Coating - The exterior of ductile-iron pipe, specials and fittings shall be coated with the asphalt coating in accordance with AWWA C-151, Section 516. The coating shall have a minimum thickness of one (1) mil. The finished coating shall be smooth, continuous and strongly adherent to the pipe. Any damage to the outside coating during shipping, storage, handling and installation shall be field repaired with a fresh coating in accordance with the manufacturer's recommendations.
- B) Interior Lining - Unless otherwise called for on the plans or specified, the interior of ductile-iron pipe, specials and fittings shall be cement mortar lined in the shop, with centrifugally spun lining in accordance with AWWA C-104. The Portland cement for cement mortar lining shall be in accordance with the requirements of ASTM C-150, Type I cement. Field repair of lining shall be made in accordance with AWWA C-104, Section 4-7.2.

524.02.08 – CORROSION PROTECTION

When specified or called for on the plans, all ductile-iron pipe, specials, fittings and other appurtenances shall be polyethylene encased in accordance with AWWA C-105/ANSI A 21.5. Exposure to sunlight of polyethylene wrapped pipe shall be kept to a minimum to prevent deterioration of polyethylene. Damage to polyethylene wrapping shall be prevented during backfilling operations. The minimum thickness for polyethylene is eight (8) mils.

524.05 – SOURCE QUALITY CONTROL TESTING

A) Ductile Iron Pipe shall be tested at the manufacturer's plant by the manufacturer in accordance with Sec. 5.2 of AWWA C-151.

B) Ductile Iron fittings shall be tested at the manufacturer's plant by the manufacturer in accordance with Sec. 5.2 of AWWA C-153.

C) Joint Testing – Joints shall be tested and meet the performance requirements established in AWWA C-111/ANSI A 21.11, Section 11-9 and as modified herein. The working pressure rating of the joint shall be established by subjecting the joints to three (3%) percent of the pipe produced to hydrostatic pressure of twice the rated working pressure, but in no event less than twice the minimum working pressure rating shown below. At least two (2) joints shall be hydrostatically tested at a deflected angle of the degrees (3°) at the above specified pressure rating.

The minimum working pressure ratings for joints shall be 350 psi.

D) Contractor shall provide certifications stating the pipe and fittings meet these requirements.

E) Welding - All welding shall be done by qualified welders. The ductile-iron pipe manufacturer shall be responsible for quality control and testing of all welding done in the plant during fabrication of special fittings.

Inspection - The City retains the right to inspect the pipe, specials and fittings, all work performed and materials furnished, at the manufacturer's plant and at the project site and to independently monitor the fabrication of the pipe, specials and fittings. Such inspection shall not relieve the Contractor or the manufacturer of their responsibilities to furnish material and perform work in accordance with these specifications.

524.06 – METHOD OF MEASUREMENT

Payment shall be made pursuant to Section 505 for water line.

524.07 – BASIS OF PAYMENT

Such payment shall be compensation in full for furnishing all materials, labor, equipment, tools and incidentals, and for performing the work in accordance with these specifications.

SECTION 525 – POLYVINYL CHLORIDE (PVC) PIPE

525.01 – DESCRIPTION

This section covers polyvinyl chloride (PVC) pipe for pressure applications, intended to be used for conveyance of potable water, in sizes six inch (6") through twelve inch (12") diameter.

525.02 – MATERIALS

PVC pipe shall be produced by extrusion from Class 12454-A or 12454-B PVC compound providing a hydrostatic design basis (HDB) of four thousand pounds per square inch (4,000 psi).

525.02.01 – GENERAL

All PVC pipe and installation of same shall conform to the requirements of the following standards listed below or as modified herein.

AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for water

AWWA C-900-PVC pressure pipe, 4 inch through 12 inch for water distribution.

AWWA M-23 – PVC pipe Design and Installation.

ASTM D-2774-Recommended Practice for Underground Installation of Thermoplastic Pressure Piping.

ASTM D-2827-Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.

ASTM D-3139-Specifications for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

ASTM F-477-Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

NSF 14-Plastic Piping System Components and Related Materials. PPI TR3-Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials.

NSF/ANSI 61 Drinking Water System Components – Health Effects.

525.02.02 – SUBMITTALS

The Contractor shall submit the following and shall receive approval of same from the Engineer prior to incorporating any materials into the work.

Review and approval of the Contractor submittals, by the Engineer, shall not be construed in any way as relieving the Contractor and the manufacturers of their responsibilities for manufacturing PVC pipe and fittings as described herein.

- A) General -Detail drawings of pipes
- B) Certification - Type "A" and "D" certification for pipe, specials, fittings, gaskets, and lining material. The affidavits of compliance and test reports shall be certified by a registered professional engineer.
- C) Guides - The manufacturer's pipe installation guide, standard pipe material repair guide, and written quality control manual shall be provided by all suppliers who have not previously provided same to the City of Duncan, or if same has been revised since last provided to the City of Duncan.
- D) Mill Test Reports - Mill test reports of materials used in the fabrication of pipe.
- E) Copies - The Contractor shall provide three (3) copies of all submittals.

525.02.03 – DESIGN BASIS

- A) General - The PVC pipe is designed in accordance with AWWA M23, or as modified herein, and shall conform to DR 14.
- B) Depth of Cover - The minimum design depth of cover shall be five feet (5'). The pipe to be installed inside a casing shall be designed for full cover including live load (a single H-20 or Railroad E-80) neglecting the casing.
- C) Allowable Stresses – For pipes six (6") inches through twelve 12" inches, the allowable design stress is sixteen hundred pounds per square inch (1,600 psi), as established per AWWA C-900.
- D) Dimension Ratio (DR) - Pipe DR shall be DR 14.
- E) Deflection - The allowable deflection is five (5%) percent of the nominal diameter. Deflections are determined based on the following:
 - a. Deflection lag factor = 1.0
 - b. Bedding Constant = 0.10
 - c. Modulus of soil reaction, $E' = 1000$ psi
 - d. Earth load considered is the prism load of ordinary clay backfill with a unit weight of one hundred and twenty (120 pcf) pounds per cubic foot, compacted to 90% density (ASTM D-698).
 - e. A highway live loading of AASHTO HS-20 truck, or railroad live loading of Cooper Axle E-80.

525.02.04 – DIMENSION RATIO (DR)

PVC pipe for buried installations including boring, shall have dimension ratio (DR 14).

For boring installations, the minimum dimension ratio shall be equal to or greater than the minimum dimension ratio on either side of the installation.

525.02.05 – DIMENSIONS

All PVC pipe shall have Cast-Iron-Pipe equivalent (C.I.) outside diameter (O.D.) dimensions.

525.02.06 – PIPE JOINTS AND FITTINGS

A) Fittings for use with PVC pipe shall conform to provisions of AWWA C110/A21.10 and shall be short-bodied style. Fittings shall be mechanical joint type. Pressure rating shall conform to the requirements of Section 524.02.06 for ductile iron pipes and fittings. The outside coating for fittings shall conform to the requirements of Section 524.02.07.

B) Mechanical Joint Restraints -

Mechanical Joint Restraints may be used only at locations approved by the Engineer. Typical examples where the Engineer may permit use of Mechanical Joint Restraints are: creek crossings, locations where excavation depth exceeds five feet and bends greater than 22 1/2° are required to match new pipe to existing pipes and locations where required connections or other laying conditions do not permit sufficient time to complete thrust blocks prior to returning water mains to service.

Mechanical Joint Restraints will not be used in lieu of thrust blocks.

Mechanical Joint Restraints, if permitted, shall be as follows or approved equal. Mechanical Joint Restraints such as Ford Meter Box Company Uni-Flange Retainer Glands, EBAA Iron Sales Mega-Lug Series 1100 and other models that require set screws or bolts in direct contact with the pipe will not be permitted for use on PVC pipe.

Restrained Joints		
Company	Size	Type
American Cast Iron Pipe Co.	6" to 12"	Flex-Ring
Ford Meter Box Co.	6" to 12"	Uni-Flange
US Pipe and Foundry Co.	6" to 12"	TR-Flex
N/A	6" to 12"	3/4" all thread with Duc Lug

525.03 – SOURCE QUALITY CONTROL TESTING

- A) Polyvinyl chloride Pipe shall be tested at the manufacturer's plant by the manufacturer in accordance with Sec. 5.1 of AWWA C-900.
- B) Ductile Iron Fittings shall be tested in accordance with Section 524.05 B)
- C) Contactor shall provide certifications stating the pipe meets the requirements of these specifications.

525.04 – CONSTRUCTION METHODS

The owner retains the right to inspect the pipe, specials and fittings, all work performed and materials furnished at the manufacturer's plant and at the project site and to independently monitor the fabrication of the pipe, specials and fittings. Such inspection shall not relieve the Contractor or the manufacturer of their responsibilities to furnish material and perform the work in accordance with these specifications.

During backfill of PVC pipe, the contractor shall place a locator wire along with the pipe in accordance with the standard drawings. The wire is to be placed continuously throughout the extent of the pipeline. Wire shall be copper 14 AWG single conductor type THHN or THWN. All field splices shall be in waterproof couplings for underground installations. Wire shall extend up into valve boxes and other access points as directed by the Engineer. Cost of locator wire shall be included with the price bid for water line.

525.05 – DISINFECTION AND HYDROSTATIC PRESSUE TESTING

Disinfection and Hydrostatic Pressure Testing shall be accomplished in accordance with Section 522 and Section 523.

525.07 – BASIS OF PAYMENT

Payment shall be made pursuant to Section 505.

SECTION 526 – TRACE WIRE INSTALLATION

526.01 - GENERAL

This Section governs trace wire installation on PVC water mains. A 14 gauge or larger trace wire shall be installed on all PVC water mains.

Typical hydrant branches, that are perpendicular to the water main, do not require trace wire. Trace wire shall be installed on non-typical hydrant branches (i.e. dog-legged hydrant branch).

Take care to protect the wire insulation and repair it with electrical tape if the coating is damaged.

Refer to the standard drawings for additional details.

526.02 - APPROVED TRACE WIRE MATERIAL

- a. Trace wire for direct bury installations shall be #14 AWG Copper Clad Steel wire as manufactured by Copperhead Industries, LLC #14 AWG solid Copper wire with 30 mil high molecular weight polyethylene insulation as manufactured by Agave Wire LTD, or approved equal.
- b. Valve Box Top Sections
- c. Direct Bury Wire Nuts (Dryconn Direct Bury Wire Nut (10444) manufactured by King Innovation, DBY-6 or DBR-6 as manufactured by 3M or approved equal).
- d. Direct Bury Lug (Dryconn Direct Bury Lug as manufactured by King Innovation or approved equal).

526.03 - TRACE WIRE CONNECTIONS

Joining Ends of Trace Wire: Connections into existing trace wire, connections between one spool of trace wire to another, and other similar connections shall be made using a direct bury wire nut.

When connecting trace wire ends together, strip 5/8" of insulation from the end of each wire. Insert the two ends firmly into the direct bury wire nut. Twist the wire nut clockwise while pushing the wires firmly into the nut. Do not over torque. Tie the wires in a knot.

Joining Trace Wire - Branch to Main: Connections of trace wire at tees, crosses, and at locations where the trace wire will be brought to the surface shall be conducted using a direct bury lug.

526.04 - INSTALLATION

Trace wire shall be installed in a continuous fashion. Install trace wire on top of water main and secure to main every five (5) feet with electrical tape.

Bring trace wire to surface at every valve box, and dead end and as called out in the drawings. Trace wire shall be brought to the surface at least every five hundred (500) feet. Take care not to damage the wire coating. Repair damaged coating with electrical tape.

Trace Wire in a Valve Box

Trace wire shall be brought to the surface in a separate meter box. The trace wire shall be brought to the surface according to standard drawings.

SECTION 528 – STEEL CASING PIPE

528.01 - DESCRIPTION

This section covers steel pipe intended to be used as a casing pipe for boring installations.

528.02 – MATERIALS

528.02.01 – SUBMITTALS

The Contractor shall submit the following, provided that all applicable requirements are met, and that visual inspection at destination shows the workmanship and condition of material to be satisfactory.

- A) Type "A" certification for pipe
- B) Shop drawings of pipe, joints and seams
- C) Documentation of manufacturer's on-going quality control program.

528.02.02 – GENERAL

- A) General -Steel pipe shall conform to ASTM A-139, Standard Specification for Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4 and Over). The steel material shall be new, smooth wall, carbon steel, Grade B, with minimum sixty thousand pounds per square inch (60,000 psi) tensile strength, and minimum thirty-five thousand pounds per square inch (35,000 psi) yield strength.

The Pipe shall be straight seam pipe, shall be one hundred (100%) percent welded, and the weld's height over the outside wall surface shall be equal to or less than three-sixteenths (3/16") inch. All steel pipe shall be square cut and shall have a roundness such that the difference between the major and minor outside diameters shall not exceed one percent (1%) of the specified nominal outside diameter or one-fourth inch (1/4"), whichever is less. The outside circumference must be within plus or minus (\pm) one percent (1%) of the nominal circumference or within plus or minus (\pm) one-half inch (1/2"), which is less. The pipe shall have a maximum allowable straightness deviation in any ten foot (10') length of one-eighth inch (1/8"). Steel pipe joints shall be continuously welded with an approved butt weld. The welds shall attain the full strength of the pipe and shall result in a fully watertight section. The welded joints shall conform to the requirements of AWWA C-206.

C) Boring Installation

a. Casing Pipe Size – Steel casing pipe shall have the follow minimum inside diameters:

Pipe Nominal Size (inches)	Casing Pipe Inside Diameter (inches)
6	10
8	14
10	16
12	20

b. Casing Pipe Thickness - Steel casing pipe wall thickness shall be 3/8” minimum.

528.07 – BASIS OF PAYMENT

Payment shall be made pursuant to the appropriate Section of 505.

532 – TAPPING SLEEVES

532.01 - DESCRIPTION

This section covers tapping sleeves intended to be used for tapping water mains.

532.02 - MATERIALS

Tapping sleeves shall be manufactured in accordance with AWWA C-110 and equipped with gaskets made in accordance with AWWA C-111. Tapping Sleeve shall be Ductile Iron. Tapping sleeves shall be Mueller H-615 M. J. Tapping sleeve, or approved equivalent. Stainless Steel sleeves will not be permitted.

532.04 – CONSTRUCTION METHODS

The installation shall conform to the recommendation of the manufacturer of the pipe being tapped. Tapping sleeves shall be pressure tested. Sleeves shall maintain 150 psi for a minimum of two hours.

532.06 – METHOD OF MEASUREMENTS

Payment for "Tapping Sleeve" shall be included in the unit price bid per each for Tapping Valve and Sleeve. The price established shall be full compensation for furnishing and placing of all materials including tapping sleeve, labor, tools, equipment, and incidentals necessary to complete this item of work.

532.07 – BASIS OF PAYMENT The items measured as provided above will be paid for at the contract unit price bid:

(SIZE) TAPPING VALVE AND SLEEVE EA.

Such payment shall be compensation in full for furnishing all materials, labor, equipment, tools and incidentals, and for performing the work in accordance with these specifications.

SECTION 533 – TAPPING CLAMPS

533.01 – DESCRIPTION

This section covers tapping clamps used for tapping water mains.

533.04 – CONSTRUCTION METHODS

- A) General -Tapping clamps shall have a body with a threaded outlet, seal, and suitable means for attachment to the main. The body shall be made to conform to the outside configuration of the main. Tapping clamps shall be designed to provide a drip-tight connection when used as a service connection

to the main.

- B) Tapping clamps shall be required when tapping other than cast iron or ductile iron pipe. Clamps may be required on older cast-iron and ductile-iron as directed by the Engineer. Tapping clamps shall be the same size as the service line. The reducing of tapping clamps shall not be allowed.
- C) Tapping Clamps shall meet the requirements of Section 510.

533.06 – METHOD OF MEASUREMENTS

Tapping clamp will not measured separately.

533.07 – BASIS OF PAYMENT

All cost of tapping clamps shall be included in the price bid for water services.

Such payment shall be compensation in full for furnishing all materials, labor, equipment, tools and incidentals, and for performing the work in accordance with these specifications.