

## SECTION 624 - WATER SYSTEM

**624.01 Description.** This work includes installing a new water system or adjusting an existing water system or both according to the contract. \*

The terms "County Water Works System" or "Board of Water Supply (BWS)" will be interchangeable and mean the organization of the respective County where the Contractor does the work. \*

Items of work or materials required not specifically covered by the contract shall conform to the appropriate County Water Works System requirements.

**624.02 Materials.** The Contractor shall furnish jointing materials required to complete the water system work under the contract. |

Concrete for reaction beams, reaction test blocks, and jackets shall be at least Class B and shall conform to Section 601 - Structural Concrete. |

Material shall be new. The Contractor shall handle the material carefully free of defects from manufacture, storage or handling. \*

The Contractor shall inspect and test the pipes, fittings, special castings, gate valves and butterfly valves. \*

The Contractor shall furnish two (2) copies of a manufacturer's Certificate of Test for the pipes, fittings, special castings and valves. The manufacturer shall sign the Certificate of Test properly. The manufacturer shall certify that the manufacturer made the pipes, fittings, special castings and gate valves according to the Water System Standards. If a Certificate of Test is not available, the Engineer will accept a written letter of guarantee for the materials. \*

The Contractor shall furnish the materials required to complete the water system work. \*

Materials shall conform to the following: |

Aggregate for Untreated Base	703.06
Structure Backfill Material	703.20
Trench Backfill Material	703.21
Concrete Bricks	704.02
Lead	705.09
Packing for Lead Joint	705.10

624.02

Cast Iron Pipes, Fittings and Special Castings for Water System	707.01(B)
Copper Service Pipe and Appurtenances	707.11
Reinforcing Steel	709.01
Frames, Grates, Covers & Ladder Rungs	712.07
Pipe Collar for Valve Box	712.22
Precast Concrete Meter and Valve Boxes and Covers	712.23
Valves and Appurtenances	712.24
Fire Hydrant and Appurtenances	712.26

624.03 Construction Requirements.

(A) General. The Contractor shall arrange the work so that no unnecessary or extended interruption in water service or damage to the existing water system and appurtenances occurs. The Contractor shall repair damages to the existing water system and appurtenances at no cost to the State.

Locations of existing water system and appurtenances shown in the contract are approximate. If the Engineer requires changes in alignment, grade or location due to unforeseen conflict with the proposed highway project, the Engineer will be responsible for such alterations and cost.

Existing fire hydrants within the project site shall be accessible to the Fire Engineer. The Contractor shall install the relocated fire hydrants before removing the existing fire hydrants.

The Contractor shall notify the County Water Works System in writing at least one (1) week before commencement of work on the water system.

The Contractor shall arrange with the County Water Works System to cut off unused water mains and service laterals, meter boxes and other appurtenances before commencement of clearing and grubbing and grading operations. The Contractor shall excavate for the "cut off" work.

If a corporation stop shown tapping into a new main is larger than that allowed by the County Water Works System, the Contractor shall install a double hub fitting with boss tapped for appropriate size corporation stop.

Invert grades of water mains and service laterals shall provide the following minimum cover requirements from top of pipe to finished grade:

- (1) Three (3) feet for six (6) inch or larger water mains; |
- (2) Two and a half (2-1/2) feet for four (4) inch water mains; |
- (3) One and a half (1-1/2) feet for copper service laterals. |

Concrete work shall conform to Section 601 - Structural Concrete. |

The Contractor shall construct or reconstruct water manholes \*|  
accordance to Section 604 - Manholes, Inlets and Catch Basins. |

The Contractor shall install reinforcing steel according to Section \*|  
602 - Reinforcing Steel. |

#### (B) Trench Excavation

(1) **General.** The Contractor shall store excavated material \*|  
alongside the trench so as not to obstruct traffic. \*|

If the Contractor cannot store the excavated material properly \*|  
alongside the trench, the Contractor shall haul the excavated \*|  
material away from the work. The Contractor shall stockpile the \*|  
excavated material at convenient locations for later use at no cost  
to the State. |

In fill areas, the Contractor shall compact the fill to the \*|  
subbase or to an elevation four (4) feet above the top of the \*|  
barrel of the pipe whichever is less before the Contractor \*|  
excavates the trench. \*|

The Contractor shall hand expose existing mains to verify  
their locations and depths.

The Contractor shall excavate trenches according to Section \*|  
206 - Excavation and Backfill for Conduits and Structures and as  
modified below.

Trenches necessary for the removal of the existing water  
system and appurtenances shall be sufficient in size and depth to  
permit their removal without damage. The Contractor shall remove \*|  
the materials that the Contractor will salvage carefully. The \*|  
Contractor shall replace the materials damaged at no cost to the \*|  
State. |

The Contractor shall not open the trench more than seven \*|  
hundred fifty (750) feet ahead of the installed and tested pipe. |  
The Engineer will not permit jumps or spaces unless accepted. The \*|  
Contractor shall maintain the excavation according to the contract \*|  
during installation of water systems and placing of backfill.

Trench widths for the various size pipes not encased in  
concrete shall be as specified in Table 624-I.

TABLE 624-I - TRENCH WIDTHS FOR WATER SYSTEM	
Diameter of Pipe inches	Width of Trench inches
42	66
36	54
30	48
24	42
20	36
16	30
12	24
8	24
6	24
4	24
Below 4	12

Trench widths shall not be less than twelve (12) inches. The Contractor may increase the trench widths at no cost to the State. \*

Trench widths for water mains that the Contractor will encase in concrete shall be the width of the concrete jacket plus twenty (20) inches. If the contract requires no form for the jacket, the trench width shall be equal to the width of the concrete jacket. The depth of the trench shall be to the bottom of the concrete jacket. \*

The Contractor shall excavate the trenches to a depth of six (6) inches below the invert grade shown in the contract, provided above for concrete encased mains. The Engineer reserves the right to eliminate the six (6) inches of excavation below the invert grade and the right to raise or lower the invert grade or to change the alignment. \*

The Contractor shall correct the trench excavated below invert grade with trench backfill material and compact thoroughly at no cost to the State. \*

(2) **Bell Holes.** The Contractor shall enlarge the bell holes at pipe joints to provide proper room completing the joints. \*

(3) **Reaction Blocks.** The Contractor shall excavate properly to place reaction and test blocks. \*

(4) **Removal of Mud and Other Unsuitable Material from Trench Bottom.** If the Contractor encounters soft, spongy, or other unsuitable material, the Contractor shall remove material under the pipe to a maximum depth of thirty (30) inches below the invert grade of the pipe. The Contractor shall backfill the space to six (6) inches below the invert grade. \*

inches below the invert grade of the pipe with untreated base. The untreated base shall have a maximum size of one and a half (1-1/2) inch maximum size. The Contractor shall compact the untreated base properly to provide adequate support for the pipe. The Contractor shall continue the compaction until the relative compaction is not less than ninety-five (95) percent. \*

**(5) Sheathing.** If necessary, the Contractor shall properly sheath and brace excavation to render the excavation secure. The Contractor shall remove such sheathing and bracing before completing the backfill. When sheathing is necessary, the Contractor shall widen the width of the trench beyond those specified in Subsection 624.03(B)(1) - General. \*

**(6) Dewatering.** The Contractor shall keep the trenches free from water during the installing and testing of the pipe and backfilling of the trench. The Contractor shall arrange with the respective County, State and private individuals or corporations for the proper disposal of water pumped from the trenches. If such water, due to the Contractor's work, flows across the road, the Contractor shall provide a bridge or other means to prevent this water from contact with passing traffic. The Engineer will not pay extra compensation for difficulties the Contractor may encounter in properly disposal of this water from the trenches. \*

**(7) Service Laterals and Service Connections and Meter Boxes.** The Contractor shall do the necessary excavation and backfill. \*

**(8) Blasting.** If explosives are necessary, the Contractor shall use the utmost care not to endanger life or property. The Contractor shall use only electric detonators for blasting. The Contractor shall not use common fuses. The Contractor shall store and use explosives according to Subsection 107.15 - Use of Explosives or Combustibles. \*

**(9) Connections and Adjustments of Water Mains.** If the Contractor requires connections to or adjustment of existing water mains, the Contractor shall do the necessary excavation, and placing of untreated base, and backfilling. \*

Before trenching for new main, the Contractor shall hand expose the existing main to detect the actual location and grade that the Contractor will connect. The length, width and depth of trenches for exposing the existing main shall be as ordered. \*

The Contractor shall furnish and install the materials, excavate, backfill and do the work required to connect new or relocated meters to house services. |

(10) **Excavation for Manholes.** Excavation and backfill for manholes shall conform to Section 206 - Excavation and Backfill for Conduits and Structures. Excavation for manholes shall be to the dimensions shown in the contract plus an additional twelve (12) inches beyond the dimension lines shown, and to a depth twelve (12) inches below the invert of the valve or as required. \*

(C) **Trench Backfill.**

(1) **General.** The Contractor shall not use adobe, clay or material of similar nature for backfill. When the removal of unsuitable excavated materials from the project creates a shortage of backfill material, the Contractor shall furnish suitable material according to the contract. The Contractor may use material from roadway or other excavation according to the contract. \*

(2) **Preparation of Trench Bottom.** After the Contractor excavates the trench to the proper depth below invert grade, the Contractor shall backfill the trench bottom to the required invert grade with trench backfill material. \*

(3) **Backfilling.** Upon completion of testing of mains and appurtenances, the Contractor shall observe the following steps: \*

(a) For mains twelve (12) inches and smaller, copper pipes, service laterals, services connections and appurtenances, backfilling may commence with pipe cushion material to six (6) inches above the top of pipe. |

For pipe inverts below four (4) foot elevation, City or County Datum or where the Contractor meets water, backfilling with pipe cushion material shall continue to twelve (12) inches above the top of pipe. |

Pipe cushion material shall conform to Subsection 703.21(A) -Trench Backfill Material A. |

(b) For mains sixteen (16) inches and larger, the Contractor shall place pipe cushion material to twelve (12) inches above the top of pipe. \*

(c) While backfilling to the heights specified above the pipe, the Contractor shall compact the cushion material with water. The Contractor shall use a one and a half (1-1/2) inch nozzle curved to the circumference of the installed pipe and of sufficient length to reach the invert of the pipe. The Contractor shall conduct the compaction along the entire length of pipe on alternate sides with each side compacted four (4) times. Settlement greater than one-sixth (1/6) the diameter of pipe will require additional material and compaction. \*

The Contractor shall deposit the remaining backfill material evenly by hand in the pipe trench in layers not exceeding eight (8) inches in loose thickness. The Contractor shall compact each layer thoroughly to not less than ninety-five (95) percent relative compaction. The Contractor shall complete the layer to the top of the trench according to the contract.

Upon completion of the disinfection work, the Contractor shall remove the risers. The Contractor shall then backfill these areas with trench backfill material to the required degree of compaction.

**(D) Laying Pipe.** The Contractor shall inspect and test the pipes and appurtenances thoroughly before installation. The Contractor shall mark the circumference of the spigot ends of the pipe showing the depth of the bell before installation.

The Contractor shall lay each pipe so that the barrel of the pipe shall have bearing along its laying length with the bell end properly set to grade and alignment. The Contractor shall then center the spigot end of the pipe and embed firmly against the bell end of the pipe previously laid with uniform clearance around the bell. The Contractor shall hold the pipe firmly in place by proper blocking on each side of the pipe. The Contractor shall not lay the pipe on blocks.

The Engineer will not allow "springing" or "buckling" of pipe lengths into place between installed pipe or special castings.

The Contractor shall clean and scrape the pipes and appurtenances thoroughly of foreign matter and protuberances. The Contractor shall keep the pipes and appurtenances clean until the Contractor completes assembling of the joint.

If water, mud, or other foreign matter enter the joints before the assembly of the joint and after the Contractor installs the pipe or appurtenances, the Contractor shall open the joint affected. The Contractor shall clean the joints thoroughly before the Contractor replace and reset the pipe or appurtenance.

The Contractor shall keep the trench and pipe free of water. If water enters the pipe, the Contractor shall thoroughly clean the inner portion the pipe before continuing with the installation of the pipe.

If cutting twelve (12) inch and smaller cast iron pipes are necessary, the Engineer will permit "cold cutting" with cold chisel and hammer. The Contractor shall trim the cut edges even and be free from projections.

Pipes sixteen (16) inch and larger shall be "machine cut,". The Engineer will not permit "cold cutting".

If the installation of sleeves is necessary in the pipelines, the Contractor shall contact the space between the ends of the adjoining pipes by welding in place not less than four (4) filler pieces of the same material as the pipe. The filler pieces shall be four (4) inch wide, of suitable length and equally spaced around the circumference of the pipe. \*|

If the Contractor stops laying pipes, the Contractor shall close the openings tightly with cast iron removable plugs held securely in place. \*|

The Contractor shall not use pipes and appurtenances for water mains for other purposes before installation. \*|

**(E) Gate Valves.** The Contractor shall inspect the valves thoroughly to insure their proper working order before installation. If valves under pressure tests show leakage, the Contractor shall stop the leaks. The Contractor shall use proper, standardized tools for operating the valves. The Contractor shall install proper size corporation stops on the sides of the valves shown in the contract. If the Contractor backfills the valves, the Contractor shall remove and replace the corporation stops with brass plugs. The Contractor shall support the valves with blocks as required in the contract. After the Contractor completes the manhole or before the construction of valve boxes, the Contractor shall clean every valve thoroughly of rusts and foreign matters. The Contractor shall give the valve one (1) coat of an accepted corrosion preventive paint. \*|

**(F) Joints for Cast Iron Pipe and Appurtenances.**

**(1) Lead Joints.** To insure proper embedding of the spigot end of the pipe against the bell, the Contractor shall "jack" the pipe "home" after the installation of not more than twelve (12) pieces of pipe. If the Contractor installs valves, the Contractor shall "jack" the valves and pipe "home". The Contractor shall complete the "jacking" of pipe before yarning the joints. \*|

After the Contractor: \*|

(a) centers the pipes or their appurtenances or both properly, \*|

(b) brings to grade and alignment, and \*|

(c) embeds thoroughly against one another, \*|

the Contractor shall clean and caulk each joint thoroughly and tightly so to leave two (2) inches for lead. The Contractor shall run the molten lead in sufficient quantity to fill each joint in one (1) pouring and to provide for a completely filled joint after final caulking. \*|



After the Contractor cools the lead, the Contractor shall caulk each lead joint carefully. The Contractor shall caulk so that the joints are tight but the bell is not overstressed when the Contractor drives the lead up flush with the face of the bell.

The Contractor shall caulk the lead gates as the pipe joint. The Contractor shall not cut off the lead gates.

If the Contractor heats the lead used insufficiently and fills the joint unsatisfactorily, the Contractor shall melt and remove the lead from such joints so as not to overheat the bell of the pipe. The Contractor shall replace the pipes damaged during this removal at no cost to the State. The Contractor shall clean the joint of existing lead before pouring new lead.

**(2) Mechanical Joints.** The Contractor shall clean the bell and the spigot end of the pipe and the rubber gasket thoroughly before assembly. The Contractor shall place the gland, followed by the gasket, over the spigot end of the pipe that the Contractor inserts into the bell. The small side of the gasket and the lip side of the gland shall face the bell. The Contractor shall then push the gasket into position so that the Contractor seats the gasket evenly in the bell as the Contractor moves the gland against the face of the gasket.

The Contractor shall dip the threaded ends of the bolt in fuel oil for lubrication before assembly.

The Contractor shall insert the bolts with threaded ends on the gland side. The Contractor shall screw the nuts by hand and make the nuts hand-tight in pairs (180 degrees apart). The Contractor shall then tighten the bolts alternately (180 degrees apart) to the desired tension with an accepted ratchet wrench, beginning at the bottom, then the top and so on. The normal range of bolt torques that the Contractor will apply to standard cast iron bolts in the joint is as follows:

Bolt Size, Inches	Range of Torque, Foot - Pounds
5/8	40 - 60
3/4	60 - 90
1	70 - 100
1-1/4	90 - 120

The following lengths of wrenches should satisfactorily produce the above range of torques when used by the average worker:

Bolt Size, Inches	Length of Wrench Inches
5/8	8
3/4	10
1	12
1-1/4	14

When the Contractor assembles the joint properly, the distance \*| between the face of the bell and face of the gland shall be uniform \*| around the pipe.

After completion of the joint, the Contractor shall give the \*| bolts one (1) coat of accepted asphalt paint. \*|

(3) Slip Joint. The Contractor shall wipe the gasket seat in the \*| socket of the pipe and gasket with a cloth. The Contractor shall \*| place the gasket in the socket with the large, round end entering \*| first. The Contractor may then spring the gasket into the gasket \*| seat so that the groove shall fit over the bead in the seat.

The Contractor shall then apply a thin film of non-toxic \*| lubricant, as supplied by the manufacturer, to the inner diameter of \*| the gasket for easier insertion of the pipe. Applying a thin film of \*| lubricant may be desirable to the outer portion of the plain end of \*| the pipe for about one (1) inch back from the end.

The Contractor makes the joint by exerting sufficient force on \*| the entering pipe so that the Contractor moves its plain end past \*| the gasket until the pipe makes contact with the base of the socket.

When the Contractor cuts the pipes in the field, the Contractor \*| shall taper the outer portion of the cut end about one-eighth (1/8) \*| inch at an angle of thirty (30) degrees to the centerline of the \*| pipe with a coarse file or portable grinder.

(4) Flanged Ends Joint. The face of the flange shall be true and \*| free of projection. The Contractor shall clean the face of the \*| flange of rust and foreign matter. Gaskets shall be "full face". \*| The Contractor shall cut the gaskets carefully to fit flanges and \*| bolt holes. The Contractor shall bring up the flanges to true \*| alignment and fit the flanges with uniform tension on the bolts. The \*|

Contractor shall tighten the bolts specified for mechanical joints. \*|  
The Contractor shall paint the bolt threads with graphite before \*|  
tightening.

**(G) Installation of Pipes, Service Laterals and Service Connections, Including Appurtenances.**

(1) **General.** This work includes furnishing and installing pipes, service laterals, service connections and its appurtenances at the locations shown in the contract.

"Service lateral" is that portion of the pipe from the water main up to and including the stop cock end of the lateral shown in the contract.

"Service connection" is that portion of the installation from the stop cock end of the service lateral up to and including the stop cock at the meter box shown in the contract.

"Appurtenances" used with "Pipes, Service Laterals and Service Connections" shall mean fittings, corporation stops, valves, bushings, and stop cocks that the Contractor will install in the service lateral and service connections. \*

(2) **Installation.** The Contractor shall thoroughly inspect and test the pipes and its appurtenances before installation. The Contractor shall install the service laterals and service connections at the locations and of the sizes and types shown in the contract. \*

The contract recommends the following procedure for solder joints: \*

(a) The Contractor shall cut the pipe or tube to the desired length with a tube cutter or fine hack saw (32-teeth to the inch). The Contractor shall remove the burrs with a file or scraper. \*

(b) The Contractor shall clean the outer portion of the tube end that fits into the solder cup of the fitting with sand cloth or sand paper. The Contractor shall remove the dark spots. \*

(c) The Contractor shall clean the solder cup of the fitting carefully with a wire brush, sand cloth or sand paper. The Contractor shall remove the dark spots. \*

(d) The Contractor shall use only accepted soldering flux. The Contractor shall brush a light, even coating of flux half way inside the fitting and outer portion of the tube. The Contractor shall not use acid or zinc chloride for flux. \*

(e) The Contractor shall insert the tube into the fittings as far as the tube shall go. The Contractor shall turn the tube back and forth a few times to distribute the flux evenly. The Contractor shall not wipe the joints before the Contractor inserts the tube in place. \*

(f) The Contractor shall heat the fitting uniformly with a torch until solder melts on contact with the heated fitting. The Contractor shall remove the flame from the joint that the Contractor will solder. Using only accepted solders, the Contractor shall feed the solder to the joint at one (1) or two (2) points. The Contractor shall not feed the solder around the full circumference of the tube. When a ring of solder appears around the tube at the fitting, the Contractor shall stop solder feeding and the Contractor shall wipe the excess off with a cloth. \*

(g) If the Contractor makes connections to tubes of one and a quarter (1-1/4) inch diameter and larger, the Contractor shall move the fitting on the tube or tap with a tool handle or mallet as the Contractor feeds the solder. \*

**(H) Pipe Sleeves Through Retaining Walls.** If the Contractor constructs cement rubble masonry walls or concrete retaining walls with later installation of service connections through the retaining walls, the Contractor shall insert suitable pipe sleeves, (2-inch minimum diameter) at locations shown in the contract or ordered. \*

**(I) Fire Hydrants.** The Contractor shall install fire hydrant and appurtenant pipe fittings and valves according to the contract. The Contractor shall install the fire hydrants with the four and a half (4-1/2) inch steamer nozzle faced no more than fifteen (15) degrees to the left or right of the line running from the center of the hydrant and perpendicular to the street curb. The Contractor shall fire hydrants with the barrel vertical. After the Contractor has checked the hydrant for alignment and grade, the Contractor shall wedge the barrel tightly against the side of the trench. The Contractor may remove the wedges after the concrete anchor block poured at the bottom elbow has set. \*

The Contractor shall place the concrete thrust block around the bottom elbow to at least twelve (12) inches above the invert of the elbow. The Contractor shall not disturb the concrete thrust block for a minimum of three (3) days or as ordered. \*

The Contractor shall use standard tools to operate fire hydrants. \*

If there is no standard curbing, the Contractor shall protect the fire hydrants by the installation of curb guards shown in the contract. \*

Before final inspection, the Contractor shall clean the fire hydrants of oil, grease, dirt or other foreign matter. The Contractor shall paint the fire hydrant according to Section 712.26 - Fire Hydrants and Appurtenances.

**(J) Concrete Reaction and Test Blocks, Concrete Jacket, and Reaction Beams.** If the pipeline appurtenances are subject to unbalanced thrust, the Contractor shall brace them properly with plain or reinforced concrete reaction blocks.

Before pouring concrete for concrete reaction and test blocks, concrete jackets, and reaction beams, the Contractor shall fill the pipelines and appurtenances with water. The Contractor shall not place the pipelines and appurtenances under pressure.

For testing purposes, the Contractor shall provide adequate reinforced concrete blocks.

The Contractor shall allow concrete reaction and test blocks, concrete jackets, and reaction beams to cure for seven (7) days before applying pressure in the pipes.

Due to the various types of vertical bends and surrounding ground conditions, the design of the reaction blocks will vary.

The Contractor shall install reinforced concrete jackets around ductile iron pipe at the locations and to the sizes and dimensions shown in the contract.

**(K) Tests.** The pipe and appurtenances shall be subject to a pressure test in the presence of the Engineer.

If the Contractor can isolate sections as a unit, the Contractor shall make a separate test on each section of the pipeline with its appurtenances. If valves are available at each end of the section, the Contractor shall make the test between valves. If valves are not available, the Contractor shall install necessary plugs or caps, properly braced to withstand the required test pressure. When a section of the pipeline is ready for testing, the Contractor shall tap the test holes into the pipe and connect the test holes to the test pump by suitable piping. Between the tap and pump, the Contractor shall install a stop cock. Between the stop cock and the tap, the Contractor shall install a pressure gage.

The Contractor shall fill the section of pipeline that the Contractor will test completely with water. The Contractor shall insure that there are no air pockets. The Contractor shall open the stop cock and raise the hydrostatic pressure to the required pressure as follows:

Class of Pipe	Test Pressure
150	150 psi
250	250 psi
above 250	50 psi above the static pressure of the system

The Contractor shall then shut the stop cock and observe the pressure gage for thirty (30) minutes. During this period the pressure shall not drop more than ten (10) pounds per square inch. \*

The Engineer may require tests to cover sections or combination of sections and make additional tests. \*

The Contractor shall furnish and install equipment and material necessary for the tests. After the Contractor stops the visible leaks and completes the test, the Contractor shall install brass plugs in the holes made for testing purposes. \*

**(L) Connections To and/or Adjusting Existing Mains.** If the Contractor connects to and/or adjusts existing mains, the Contractor shall install the work shown in the contract or as ordered. \*

The Contractor shall notify the Engineer in writing that the Contractor is ready for such work. The Contractor shall deliver this notice not less than seventy-two (72) hours, exclusive of Saturdays, Sundays and holidays of such work. \*

The Contractor shall furnish and have at the work site the necessary materials required for the work. The Contractor shall have completed the necessary excavation or as ordered. \*

If requested by the Engineer, the Contractor shall get the services of a uniform police officer or flagger to direct traffic. \*

The Contractor shall furnish and install the necessary concrete reaction blocks, manholes and complete the backfill and other incidental items of work and material required. \*

The Contractor shall not operate the valves or hydrants unless authorized. The County Water Works System will operate the valves sixteen (16) inches and larger. \*

The Contractor shall furnish and install the material, excavate, backfill and connect new or relocated meters to house services. \*

**(M) Disinfection.** The Contractor shall disinfect and flush the water mains, service laterals, and appurtenances before acceptance. \*|  
\*|

The Contractor shall notify the Engineer and the County Water Works System seventy-two (72) hours before the time for disinfection. The Contractor shall provide connections for disinfection and adequate drainage for disposal of water used in disinfection and flushing.

The Contractor shall furnish and install temporary cleanouts shown in the contract or ordered by the Engineer to ease disinfection of the water mains. After the Contractor disinfects the mains and gets a certification for the disinfection, the Contractor shall remove the temporary cleanout. The Contractor shall furnish a brass plug to replace the corporation stop. \*|  
\*|  
\*|  
\*|  
\*|

**(N) Meter Boxes and Cast Iron Frames and Covers.**

(1) **General.** This work includes furnishing and installing meter boxes and cast iron frames and covers according to the contract. \*|  
\*|

(2) **Installation.** The Contractor shall construct meter boxes of: \*|

(a) sound bricks firmly set in full mortar beds according to standard brick construction, or \*|  
|

(b) of concrete (preferably precast) with necessary reinforcing steel to the sizes and dimensions as required. \*|  
|

The Contractor shall install meter boxes at the locations shown in the contract or as ordered. \*|  
|

The Contractor shall install cast iron frames and covers of the proper size and dimension in full mortar beds at each meter box. The Contractor shall give the cast iron frames and covers one (1) coat of high grade asphaltum paint after installation. \*|  
\*|  
\*|

**(O) Installation of Air Relief Valves and Appurtenances.** The Contractor shall furnish and install air relief valves and appurtenances according to the contract or as ordered. \*|  
\*|  
\*|

"Appurtenances" include pipes, fittings, corporation stops, unions and vertical check valves. The Contractor shall clean the air relief valves thoroughly of rust and foreign matter. The Contractor shall give the air relief valves one (1) coat of an accepted corrosion preventive paint. \*|  
\*|  
\*|

**(P) Water Supply.** The County Water Works System will measure the quantity of water used for construction. The County Water Works System will furnish, install, and disconnect the meter. The Contractor shall arrange with the County Water Works System and shall assume the costs \*|  
\*|  
\*|  
\*|

for such installations and disconnections. The County Water Works System will furnish the Contractor invoices for the cost of installation and disconnection of meters. The Contractor shall also pay for the cost of replacements or repairs resulting from damage to the meter, hydrant and other property used by the Contractor.

The Contractor shall provide and install at no cost to the State water supply equipment and materials necessary to provide an adequate water supply for the proper construction of the water mains. The equipment and materials may include temporary pipe and fittings and pumping and storage facilities.

**(Q) Existing Water System and Appurtenances.** The Contractor shall maintain the existing water system and appurtenances in service during the construction period until the Contractor places the new water system in service and transfers the existing services to the new system.

The Contractor shall notify the Engineer and the County Water Works System immediately of damages to the existing system. The County Water Works System will do the necessary repairs. The Contractor shall be responsible for costs incurred in this work.

If the Contractor desires to relocate the existing system during the construction period, the Contractor shall do the work if accepted by the Engineer.

After the Contractor installs the new system or portions of the new system, the Contractor shall remove the existing meters and reconnect the existing meters to the new system. The new system includes its appurtenances, service laterals, service connections, and boxes. The County Water Works System will send the invoices for work ordered by the State and done by the County Water Works System directly to the State. The County Water Works System will not send invoices of repairs damaged by the Contractor to the existing system. The County Water Works System will not charge or pay the cost of this work to the Contractor.

**(R) Removing, Reinstalling or Returning Existing Pipe.** The Contractor shall clean the existing pipe that the Contractor removes and reinstalls in new locations thoroughly before installing.

The existing pipe includes its appurtenances, fire hydrants, gate valves, and manhole frames and covers. The Contractor shall give the manhole frames and covers one (1) coat of asphalt paint before installing.

The Contractor shall clean thoroughly and return the existing pipe removed and not reinstalled to the County Water Works Storage Yard as ordered by the Engineer.



The Contractor shall be responsible for removing, reinstalling, or returning these existing pipes. The Contractor shall pay for damages to the materials during these operations. \*|

**(S) Abandoning Existing Pipe.** If requested by the Engineer, the Contractor shall expose portions of the abandoned pipe. If the Contractor finds the top of the pipe less than twenty-four (24) inches below the finished grade, the Contractor shall remove the existing pipe and dispose the existing pipe off the right-of-way. If abandoning the pipe in place, the Contractor shall plug the ends of the abandoned pipe with Class C Concrete. The required backfill shall conform to Subsection 206 - Excavation and Backfill for Conduits and Structures. \*|

**(T) Adjusting Existing Manholes.** The Contractor shall reset or adjust the existing manhole frames and covers, if required, according to Section 604 - Manholes, Inlets and Catch Basins. \*|

**(U) Corrosion Protection.** The Contractor shall apply corrosion protection to the pipes, valves and fittings shown in the contract. The type of materials and methods of application shall be as specified in the contract. \*|

**(V) Temporary Cleanouts.** The Contractor shall install temporary cleanouts at the locations shown in the contract or as required to ease disinfection of water mains. After disinfecting and certifying the mains, the Contractor shall remove the temporary cleanouts and plug the taps with brass plugs. \*|

**(W) Valve Markers.** The Contractor shall install valve markers for establishing the location of gate valves and air relief valves at locations shown in the contract or as ordered. \*|

The Contractor shall fill the markers with concrete and set the markers plumb in Class B Concrete footing. The Contractor shall paint the pipe yellow. The Contractor shall paint the top four (4) inches of the markers for air relief valves red. \*|

**(X) Restoration of Existing City and/or County Street and Other Improvements.** Restoration of existing city and/or county streets and other improvements shall conform to Section 627 - Restoration of Existing City and/or County Streets and Other Improvements. \*|

#### 624.04 Method of Measurement.

**(A) Excavation and Backfill.** The Engineer will measure excavation and backfill for pipe and appurtenances and manholes per cubic yard according to Section 206 - Excavation and Backfill for Conduits and Structures, except as modified below. \*|

The Engineer will base the quantity of excavation on in-place measurements as follows: \*|

(1) The quantity of excavation for removal, connections and adjusting of existing water systems and appurtenances will be the actual quantity excavated based on the widths, lengths and depths of trenches as ordered.

(2) The quantity of excavation for the removal of existing pipes and appurtenances other than manholes will be the actual quantity excavated as accepted, including the volume of the pipe or appurtenances or portion thereof removed.

(3) The quantity of trench excavation for pipe and appurtenances including fire hydrants will be the actual quantity computed on the basis of trench widths given in Subsection 624.03(B) - Trench Excavation, and the depth specified hereinafter:

(a) If the contract requires no grading in that area, the Engineer will measure the depths of trenches for pipes from the existing ground line to six (6) inches below the invert grade.

If the contract requires grading in that area, the Engineer will measure the depths from the finished grade to six (6) inches below the invert grade or as ordered.

(b) The Engineer will measure the depths of trenches located in fill area from the bottom of the subbase or four (4) feet above the barrel of the pipe whichever is less to six (6) inches below the invert of the pipe or as directed.

(c) If the contract at locations eliminates excavation to six (6) inches below the pipe invert, measurement for trench excavation will be to the invert grade of the pipe.

(4) The quantity of excavation for concrete reaction beams and reaction or test blocks will be the actual quantity excavated based on the dimensions shown in the contract or as set by the Engineer, exclusive of trench excavation.

The quantity of excavation for trenches for concrete jacketed water mains will be the actual quantity excavated based on the bottom of the jacket and width of the jacket plus twelve (12) inches beyond the jacket width shown or only to the width of the jacket according to the contract.

(5) The quantity of excavation for removal of mud or other suitable material from below the trench grade lines will be the actual quantity removed to the depth as ordered and to the widths specified elsewhere herein under trench excavation.

(6) The quantity of excavation required to expose existing water mains for verifying their locations and depths will be the actual quantity removed, as ordered.

(7) The quantity of excavation for new manholes will be the volume computed from the dimensions shown in the contract plus twelve (12) inches beyond the dimension lines shown and to a depth twelve (12) inches below the invert grade of the valve or as ordered.

(8) The quantity of trench excavation for service laterals will be the actual quantity removed computed on the basis of a trench twelve (12) inches wide and depth as specified in Subsection 624.04(A) - General.

The Engineer will not measure excavation and backfill for service connections for payment. The Engineer will consider them incidental to service laterals.

Excavation for connecting new or relocated meters to existing house services will be the actual quantity removed computed on the basis of a trench twelve (12) inches wide and depth as directed.

**(B) Pipe and Appurtenances.**

(1) **Cast Iron Pipe.** The Engineer will measure cast iron pipe by the linear feet.

(2) **Pipe Hangers.** The Engineer will measure pipe hangers by the actual number of units installed per each.

(3) **Cast Iron Fittings and Special Castings.** The Engineer will compute the total weight of fittings installed from the weights shown in the "Handbook of Cast Iron Pipe" by the Cast Iron Pipe Research Association. If the "Handbook of Cast Iron Pipe" does not show the weight of fitting or special casting, the weight will be the actual weight as marked on the fitting or special casting.

The Engineer will not measure jointing materials such as lead, packing, gland, gasket, bolts and nuts for payment.

(4) **Gate Valves and Butterfly Valves (Hub Ends, Mechanical Joints and Flanged).** The Engineer will measure gate valves and butterfly valves by the actual number of units installed per each.

The Engineer will not measure corporation stops and brass plugs for payment.

(5) **Copper Pipes and Appurtenances.** The Engineer will measure the copper pipe including appurtenances by the linear feet.

**(6) Service Laterals and Service Connections.** The Engineer will \*  
measure service laterals and service connections by the actual \*  
number installed per each type. |

The Engineer will not measure pipe sleeves installed through \*  
retaining walls to ease later installation of service connections \*  
for payment. The Engineer will consider them incidental to the \*  
pipeline work. |

**(7) Zinc-coated Steel or Wrought Iron Pipe.** The Engineer will \*  
measure zinc-coated steel or wrought iron pipe including \*  
appurtenances for payment at the contract unit price per each type \*  
installed. |

**(8) Meter Boxes.** The Engineer will measure the meter boxes by the \*  
actual number of meter box installed per each size. |

**(9) Air Relief Valves.** The Engineer will measure the air relief \*  
valves and appurtenances by the actual number of air relief valve \*  
installed per each. |

**(10) Removal, Cleaning and Reinstallation.** The Engineer will not \*  
measure the removal, cleaning and reinstallation of the materials \*  
from the existing water system. The Engineer will consider them \*  
incidental to such items for reinstallation shown in the contract. \* |

The Engineer will measure the removing, cleaning, painting (if \*  
required) and returning pipes, fittings and appurtenances and gate \*  
valve either by the linear foot, or pound, or each shown in the \*  
proposal. |

**(11) Fire Hydrants and Concrete Curb Guard.** The Engineer will \*  
measure fire hydrants and concrete curb guards by the actual numbers \*  
installed per each. |

The Engineer will not measure the excavation for concrete curb \*  
guards for payment. \* |

**(12) Concrete Reaction and Test Blocks, Concrete Jacket and  
Reaction Beam.** The Engineer will measure the concrete in reaction \*  
blocks, test blocks, jackets and reaction beams by the cubic yard \*  
computed on the dimensions shown in the contract or as set by the \*  
Engineer before placing. |

**(13) Reinforcing Steel.** The Engineer will measure reinforcing \*  
steel according to Section 602 - Reinforcing Steel. \* |

**(14) Corrosion Protection.** The Engineer will not measure the \*  
corrosion protection applied to pipes, valves and fittings for \*  
payment. |

(15) **Pipe Test.** The Engineer will not measure the labor, materials \*| and equipment necessary for pipe test including service laterals \*| and service connections for payment. |

(16) **Valve Markers.** The Engineer will measure the valve markers \*| by the actual numbers installed in place complete. |

#### 624.05 Basis of Payment.

(A) **Trench Excavation.** The Engineer will pay for the accepted \*| quantities of trench excavation according to Section 206 - Excavation \*| and Backfill for Conduits and Structures and modified in Subsection \*| 624.04(A) - Excavation and Backfill. |

The Engineer will not make payment for additional excavation \*| required for sheathing and bell holes. The price shall be full \*| compensation for additional excavation for sheathing and bell holes and \*| furnishing labors, materials, equipment, tools, and incidentals \*| necessary to complete the work. |

#### (B) Pipe and Appurtenances.

(1) **Cast Iron Pipe.** The Engineer will pay for the accepted \*| quantities for the various size cast iron pipes at the contract \*| unit price per linear foot, complete in place. |

(2) **Pipe Hangers.** The Engineer will pay for the accepted \*| quantities for furnishing and installing pipe hangers, including \*| hanger rods, nuts, inserts, lateral bracings, with bronze bolts and \*| nuts at the contract unit price per each, complete in place. \*|

(3) **Cast Iron Fittings and Special Castings.** The Engineer will \*| pay for the accepted quantities for furnishing and installing cast \*| iron fittings and special castings for at the contract unit price \*| per pound, complete in place. |

The price shall be full compensation for furnishing and \*| installing jointing materials such as lead, packing, gland, gasket, \*| bolts, nuts, and furnishing labors, materials, equipment, tools, \*| and incidentals necessary to complete the work. \*|

(4) **Gate Valves and Butterfly Valves.** The Engineer will pay for \*| the accepted quantities for furnishing and installing the various \*| types and sizes of gate valves and butterfly valves at the contract \*| unit price per each, complete in place. |

The price shall be full compensation for furnishing and \*| installing corporation stops and brass plugs, and furnishing \*| labors, materials, equipment, tools, and incidentals necessary to \*| complete the work. \*|

(5) **Copper Pipes.** The Engineer will pay for the accepted \*  
quantities for furnishing and installing the various size copper \*  
pipes at the contract unit price per linear foot, complete in place. \*

The price shall be full compensation for furnishing and \*  
installing the copper pipes and its appurtenances and furnishing \*  
labors, materials, equipment, tools and incidentals necessary to \*  
complete the work. \*

(6) **Service Laterals and Service Connections.** The Engineer will \*  
pay for the accepted quantities for various size service laterals \*  
and various types service connections at the contract unit prices \*  
per each, complete in place. |

The price shall be full compensation for furnishing and \*  
installing the service laterals, service connections, pipe sleeves \*  
installed through retaining walls to ease later installation of \*  
service connections and furnishing labors, materials, equipment, \*  
tools and incidentals necessary to complete the work. \*

(7) **Zinc-coated Steel or Wrought Iron Pipe.** The Engineer will \*  
pay for the accepted quantities for various size zinc-coated steel \*  
or wrought iron pipe including appurtenances at the contract unit \*  
prices per linear foot, complete in place. \*

(8) **Meter Boxes.** The Engineer will pay for the accepted quantities \*  
for furnishing and installing the various types of meter boxes, \*  
including excavation and backfill at the contract unit price per \*  
each, complete in place. |

(9) **Air Relief Valves.** The Engineer will pay for the accepted \*  
quantities for furnishing and installing the various size air relief \*  
valves at the contract unit price per each, complete in place. \*

(10) **Removing, Cleaning and Returning of Existing Water System.** The \*  
Engineer will pay for the accepted quantities for removing, \*  
cleaning and returning of existing water system of the various sizes \*  
of pipe, fittings and appurtenances and valves at the contract unit \*  
price per linear foot, per each, or per pound specified in the \*  
proposal. \*

(11) **Fire Hydrants and Concrete Curb Guard.** The Engineer will pay \*  
for the accepted quantities for furnishing and installing various \*  
heights of fire hydrants and concrete curb guards at the contract \*  
unit prices per each, complete in place. |

The price shall be full compensation for excavating and \*  
furnishing labors, materials, equipment, tools, and incidentals \*  
necessary to complete the work. \*

The Engineer will pay for the accepted quantities for removing, cleaning, painting, and reinstalling or returning fire hydrants at the contract unit price per each. \*

**(12) Concrete Reaction and Test Blocks, Concrete Jacket, and Reaction Beams.** The Engineer will pay for the accepted quantities for concrete reaction and test blocks, concrete jacket and reaction beams at the contract unit price per cubic yard for Class B Concrete according to Section 503 - Concrete Structures, for the quantity placed. \*

If the Contractor requires a redesign of the reaction blocks and jackets because of unauthorized excavation, the Contractor shall pay for the additional cost involved for the redesigned blocks and jackets. \*

**(13) Reinforcing Steel.** The Engineer will pay for the accepted quantities for reinforcing steel according to under Section 602 - Reinforcing Steel. \*

**(14) Corrosion Protection.** The Engineer will not pay for the corrosion protection applied to pipes, valves and fittings separately. The Engineer will consider them incidental to the pipeline work. \*

**(15) Pipe Test.** The Engineer will not pay for the labors, materials, tools, equipment necessary for pipe test including service laterals and service connections separately. The Engineer will consider them incidental to the various contract items in the proposal. \*

**(16) Work to be Done by the County Water Works System.** The County Water Works System will render invoices for work done directly to the State. Such work includes connecting to and cutting of existing water system, installing materials furnished by the Contractor under the appropriate contract items, relocating fire hydrants, relocating or extending service laterals, chlorinating, and other miscellaneous work. \*

The Contractor will pay for work damaged by the Contractor. \*

For Oahu projects, the Engineer will pay for the BWS water development charge. \*

**(17) Services of the Uniform Police Officer.** The Engineer will not pay for cost of the services rendered by the uniform police Officer for directing traffic during connections to and adjusting of existing mains separately. The Engineer will consider them incidental to the various contract items. \*

(18) **Abandoning Existing Cast Iron Pipe.** The Engineer will not pay \*  
 for removing the abandoned portion of the existing mains and \*  
 appurtenances, exclusive of excavation, and other related work and \*  
 materials separately. The Engineer will consider them incidental to \*  
 the various contract items. |

The Engineer will pay for Class C Concrete for plugging the \*  
 open ends of abandoned pipes separately. The Engineer will consider \*  
 them incidental to the various contract items. \*

(19) **Adjusting Existing Manholes.** The Engineer will pay for the \*  
 accepted quantities for adjusting existing manholes to new grades \*  
 according to Section 604 - Manholes, Inlets and Catch Basins. \*

(20) **Water Supply for Construction.** The Engineer will not pay for \*  
 the cost for the installation and disconnection of the meters, used \*  
 for water supply, and replacement and repairs separately. The \*  
 Engineer will consider them incidental to the various contract items \*  
 in the proposal. |

(21) **Temporary Cleanout.** The Engineer will not pay for furnishing \*  
 and installing temporary cleanouts separately. The Engineer will \*  
 consider them incidental to the various contract items. \*

(22) **Valve Markers.** The Engineer will pay for the accepted \*  
 quantities for furnishing and installing valve markers at the \*  
 contract unit price per each, complete in place. |

(23) **Furnishing Material.** The Engineer will pay for the accepted \*  
 quantities for "furnishing only" of materials that the Board of \*  
 Water Supply will install at the respective contract unit prices in \*  
 the proposal. \*

The prices shall include the cost of furnishing jointing \*  
 materials and other accessories and furnishing labors, material, \*  
 equipment, tools and incidentals necessary to complete the work. |

(24) **Manufacturer's Certificate of Test.** The Engineer will not \*  
 pay for the cost of the Manufacturer's Certificate of Test according \*  
 to Subsection 624.02 - Materials. The Engineer will consider them \*  
 incidental to the various contract items. |

The Engineer will make payment under: \*

Pay Item	Pay Unit
_____ - Inch Cast Iron Pipe (Class _____) (_____)	Linear Foot
_____ - Inch Concrete Cylinder Pipe (Class _____)	Linear Foot



_____ - Inch Gate Valve (Class _____) (_____)	Each
_____ - Inch Bevel Geared Gate Valve (Class _____) (_____)	Each
_____ - Inch Spur Geared Gate Valve (Class _____) (_____)	Each
_____ - Inch Butterfly Valve (Class _____)	Each
_____ - Inch Air Relief Valve (_____ psi Minimum working pressure)	Each
_____ - Inch Split Butt Strap	Each
_____ Hub Clamp for _____ - Inch Cast Iron Pipe including Strong Back, Bolts, and Nuts	Each
_____ - Inch Service Clamp with Tap for Appropriate Size Corporation Stop	Each
_____ - Inch x _____ - Inch Tapping Sleeve including _____ - Inch Tapping Valve (Class _____)	Each
_____ - Inch x _____ - Inch Tapping Sleeve including _____ - Inch Bevel Geared Tapping Valve (Class _____)	Each
_____ - Inch Concrete Cylinder Bend (_____ Deg to _____ Deg Inclusive) (Class _____)	Each
_____ - Inch Concrete Cylinder Pipe Nipple (Class _____) Spigot and Plain End (_____ ) long	Each
_____ Cast Iron Fittings (_____)	Pound
_____ (_____ - Feet) Height Fire Hydrant (_____)	Each
Furnishing and Installing Fire Hydrant Curb Guard	Each
Furnishing and Installing _____ - Inch _____ Pipe	Linear Foot
Furnishing and Installing _____ - Inch x _____ - Inch Blow-off Tee, _____ - Inch to fit Cast Iron Pipe	Each
Furnishing and Installing _____ - Inch Removable _____ Tapped for _____ - Inch Pipe Thread	Each
Furnishing and Installing _____ - Inch x _____ - Inch Concrete Cylinder Eccentric Reducer (_____ - Inch Bell and _____ - Inch Reducer)	Each
_____ Valve Marker	Each

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Furnishing and Installing Type _____ Meter Box including Cast Iron Frame and Cover	Each
Furnishing and Installing Steel Pipe Hanger for _____ - Inch Cast Iron Pipe	Each
Furnishing and Installing _____ - Inch Copper Service Laterals with Type _____ Copper Service Connections and All Appurtenances	Each
Furnishing and Installing Steel Pipe Hanger and Lateral Bracing for _____ - Inch Cast Iron Pipe	Each
Furnishing and Installing _____ - Inch Copper Service Lateral with Type _____ Copper Service Connection and All Appurtenances off (_____ Main) (_____)	Each
Removing, Cleaning and Reinstalling _____ - Inch Cast Iron Plug	Each
Removing, Cleaning and Reinstalling _____ - Inch Cast Iron Cap	Each