

624.02

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48 Inspect and test pipes, fittings, special castings, gate valves and butterfly
49 valves. Furnish two copies of manufacturer's certificate of test for pipes, fittings,
50 special castings and valves in accordance with Subsection 106.04 - Material
51 Sample.

52

53 624.03 Construction.

54

55 **(A) General.** Arrange work so no interruption in water service or damage
56 to existing water system and appurtenances occurs. Repair damages made
57 to existing water system and appurtenances at no increase in contract price
58 or contract time.

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

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66 Maintain access for Fire Department to existing fire hydrants within
67 project site. Install relocated fire hydrants before removing existing fire
68 hydrants.

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70 Notify County Water Works System in writing at least one week before
71 commencement of work on water system.

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73 Arrange with County Water Works System to cut off unused water
74 mains and service laterals, meter boxes, and other appurtenances before
75 commencement of clearing, grubbing, and grading operations. Excavate for
76 cut off work.

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78 If corporation stop tapping into new main is larger than that allowed by
79 County Water Works System, install double hub fitting with boss tapped for
80 appropriate size corporation stop.

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

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85 **(1)** Pavement areas: Minimum three feet, sleeve or concrete
86 jacket for six-inch or larger water mains.

87

88 **(2)** Under ditches: Minimum two feet, one foot, if paved.

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90 **(3)** All other areas: Minimum three-foot cover.

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92 **(4)** Highway utility encroachment committee may reduce the three-

93 foot minimum clearance specified above to two feet if ground
94 conditions are ascertained to be rocky material, provided utility lines
95 do not encroach into the pavement structure.

96
97 **(5)** Minimum cover of utility service lines under sidewalk areas and
98 areas adjacent to the right-of-way (outside of shoulder and pavement
99 areas) shall be one-foot six inches.

100
101 Comply with requirements for the Occupational Safety and Health
102 Administration 29 CFR Parts 1910.146, Permit-Required Confined Spaces for
103 General Industry and Hawaii Occupational Safety and Health (HIOSH)
104 Confined Space Standard #12-104-1.

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106 **(B) Trench Excavation.**

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108 **(1) General.** Pile excavated material next to trench, or haul and
109 store to site acceptable to the Engineer. Maintain access to existing
110 driveways, fire hydrants, meters, vehicular traffic and pedestrian
111 walkways.

112
113 In fill areas, compact fill to subbase or to elevation 4 feet above
114 top of pipe barrel, whichever is less, before excavating trench.

115
116 Expose existing mains by hand to verify their locations and
117 depths.

118
119 Excavate trenches in accordance with Section 204 –
120 Excavation and Backfill for Miscellaneous Facilities, and as modified
121 below.

122
123 For removal of existing water system and appurtenances,
124 provide trenches of sufficient size and depth to permit their removal
125 without damage. Carefully remove materials to be salvaged. Replace
126 materials damaged by the Contractor at no increase in contract price
127 or contract time.

128
129 Do not open trench more than 750 feet ahead of installed and
130 tested pipe. Do not construct trench with jumps or spaces unless
131 acceptable to the Engineer. Maintain excavation during installation of
132 water systems and placing of backfill.

133
134 Construct trench widths for various size pipes not encased in
135 concrete in accordance with Table 624.03-1 – Trench Widths for
136 Water System.

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TABLE 624.03-1 – 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

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Increases in widths to those specified in Table 624.03-1 – Trench Widths for Water System may be made at no increase in contract price or contract time.

For water mains encased in concrete, provide trench width of concrete jacket plus 20 inches. If no forms are specified for jacket, provide a trench width equal to width of concrete jacket. Use depth of trench as bottom of concrete jacket.

Excavate trenches to a depth of six inches below invert grade shown in contract documents, except as noted above for concrete encased mains. The Engineer reserves the right to eliminate six inches of excavation below invert grade and the right to raise or lower invert grade, or to change alignment.

Correct trenches over-excavated below specified grade with trench backfill material, compacted, at no increase in contract price or contract time.

(2) Bell Holes. Enlarge bell holes at pipe joints to provide room for completing joints.

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(3) Reaction Blocks. Excavate to place reaction and test blocks.

(4) Removal of Mud and Other Unsuitable Material from Trench Bottom. If soft, spongy, or other unsuitable material is encountered at specified depths, remove material under pipe to maximum depth of 30 inches below invert grade of pipe. Backfill space to 6 inches below invert grade of pipe with untreated base. Use untreated base with maximum aggregate size of 1-1/2 inches. Compact untreated base until relative compaction is not less than 95 percent.

(5) Sheathing. Properly sheath and brace excavation to provide secure excavation. Remove sheathing and bracing before completing backfill. When sheathing is necessary, widen trench beyond those widths specified in Subsection 624.03(B)(1) - General.

(6) Dewatering. Keep trenches free from water while installing and testing pipe and backfilling trench. Comply with NPDES requirements and other applicable regulations. Obtain NPDES construction dewatering permit for discharge of uncontaminated ground water.

(7) Service Laterals and Service Connections and Meter Boxes. Excavate and backfill in accordance with Section 204 – Excavation and Backfill for Miscellaneous Facilities.

(8) Use of Explosives. The use of explosives is not permitted, in accordance with Subsection 104.10 – Use of Explosives.

(9) Connections or Adjustments of Water Mains. If connections to, or adjustments of existing water mains are required, perform necessary excavation, placing of untreated base, and backfilling.

Before trenching for new main, expose existing main by hand to detect actual location and grade for connection. Excavate trench for exposing existing main to length, width, and depth ordered by the Engineer.

Provide materials, excavate, backfill and do work required to connect new or relocated meters to house services.

(C) Trench Backfill.

(1) General. Do not use adobe, clay or material of similar nature for backfill. When removal of unsuitable excavated materials creates

206 shortage of backfill material, furnish suitable material. Material from
207 roadway or other excavation may be used.

208

209 **(2) Preparation of Trench Bottom.** After excavating trench to
210 proper depth below invert grade of pipe, backfill trench bottom to
211 required invert grade of trench with trench backfill material.

212

213 **(3) Backfilling.** Upon completion of testing of mains and
214 appurtenances, conform to following:

215

216 **(a)** For mains 12 inches and smaller, copper pipes, service
217 laterals, services connections and appurtenances, backfill
218 trench with Trench Backfill A material to 6 inches above top of
219 pipe, except as specified in subparagraph (c) below.

220

221 **(b)** For mains 16 inches and larger, place Trench Backfill A
222 material to 12 inches above top of pipe. Use maximum lift of
223 six inches.

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225 **(c)** For pipe inverts below the 4-foot elevation, County
226 datum or in areas where the ground is continuously wet, use
227 gravel material conforming to AASHTO M 43, Size Number 67,
228 encapsulated in permeable separator, to minimum 12 inches
229 above top of pipe or to 12 inches above water level, whichever
230 is higher. Use maximum lift of six inches.

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232 **(d)** Backfill remainder of trench with trench backfill material,
233 conforming to Subsection 703.21 – Trench Backfill Material.

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235 **(e)** Place Trench Backfill A and B materials, and Structural
236 Backfill B material in layers not exceeding six inches in loose
237 thickness. Compact each layer to not less than 95 percent
238 relative compaction conforming to Subsection 203.03(C)(2)
239 Relative Compaction Test.

240

241 Upon completion of disinfection work, remove risers. Backfill
242 these areas with trench backfill material to not less than 95 percent
243 relative compaction.

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245 **(D) Laying Pipe.** Inspect and test pipes and appurtenances before
246 installation. Mark circumference of spigot ends of pipe showing depth of bell
247 before installation.

248

249 Lay each pipe so barrel of pipe has bearing along its laying length with
250 bell end properly set to grade and alignment. Center spigot end of pipe and
251 embed firmly against bell end of pipe previously laid with uniform clearance

252 around bell. Hold pipe firmly in place by proper blocking on each side of
253 pipe. Do not lay pipe on blocks.

254

255 For cathodic protected pipe, handle pipe and appurtenances with
256 slings cushioned along areas in contact with pipe and appurtenances to
257 protect pipe coating.

258

259 Do not use springing or buckling of pipe lengths as means of fitting
260 them into place between installed pipe or special castings. Clean and scrape
261 pipes and appurtenances of foreign matter and protuberances. Keep pipes
262 and appurtenances clean until assembly of joint is completed.

263

264 If water, mud, or other foreign matter enter joints before assembly of
265 joint, and after installation of pipes or appurtenances, open joints affected
266 and clean joints before replacing and resetting pipes or appurtenances.

267

268 Keep trench and pipe free of water. If water enters pipe, clean inner
269 portion of pipe before continuing with pipe installation.

270

271 Cold cutting with cold chisel and hammer will be allowed for 12-inch
272 and smaller cast iron pipes. Trim cut edges to be even and free from
273 projections.

274

275 Pipes 16 inch and larger shall be machine cut.

276

277 If installation of sleeves is necessary in pipelines, contact space
278 between ends of adjoining pipes by welding in place not less than four filler
279 pieces of same material as pipe. Use filler pieces 4 inches wide, of suitable
280 length, and equally spaced around circumference of pipe.

281

282 When pipe laying is stopped, close openings tightly with cast iron
283 removable plugs held securely in place.

284

285 Do not use pipes and appurtenances for water mains for other
286 purposes before installation.

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288 **(E) Gate Valves.** Inspect valves to ensure their proper working order
289 before installation. If valves under pressure tests show leakage, stop leaks.
290 Use proper, standardized tools for operating valves. Install proper size
291 corporation stops on sides of valves as specified. When backfilling valves,
292 remove and replace corporation stops with brass plugs. Support valves with
293 blocks as specified. After completing manhole, or before constructing valve
294 boxes, clean valve of rust and foreign matter. Paint valve with one coat of
295 corrosion preventive paint acceptable to the Engineer.

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(F) Joints for Ductile Iron Pipe and Appurtenances.

(1) Mechanical Joints. Clean bell and spigot end of pipe and rubber gasket before assembly. Place gland, followed by gasket, over spigot end of pipe that is inserted into bell. Face small side of gasket and lip side of gland towards bell. Push gasket into position so that gasket seats evenly in bell as gland is moved against face of gasket.

Dip threaded ends of bolts in fuel oil for lubrication before assembly.

Insert bolts with threaded ends on gland side. Screw nuts by hand and make nuts hand-tight in pairs (180 degrees apart). Tighten bolts alternately (180 degrees apart) to desired tension with ratchet wrench acceptable to the Engineer, beginning at bottom, then top and so on. Conform normal range of bolt torques for standard cast iron bolts in joint to Table 624.03-2 – Bolt Torques.

TABLE 624.03-2 – BOLT TORQUES	
Bolt Size, Inches	Range of Torque, Foot - Pounds
5/8	40 - 60
3/4	60 - 90
1	70 - 100
1-1/4	90 - 120

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Provide uniform distance around pipe between face of bell and face of gland. After completion of joint, paint bolts with one coat of asphalt paint.

(2) Slip Joint. Wipe gasket seat in socket of pipe and gasket with cloth. Place gasket in socket with large, round end entering first. Spring gasket into gasket seat so that groove fits over bead in seat.

Apply thin film of non-toxic lubricant, as supplied by manufacturer, to inner diameter of gasket to facilitate insertion of pipe. Apply thin film of lubricant to outer portion of plain end of pipe for about 1 inch back from end.

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Construct joint by exerting sufficient force on entering pipe to move its plain end past gasket until pipe makes contact with base of socket.

When cutting pipes in field, taper outer portion of cut end approximately 1/8 inch at angle of 30 degrees to centerline of pipe with coarse file or portable grinder.

(3) Flanged Ends Joint. Provide flange with face true and free of projection. Clean face of flange of rust and foreign matter. Use full face gaskets. Cut gaskets carefully to fit flanges and bolt holes. Bring up flanges to true alignment and fit flanges with uniform tension on bolts. Tighten bolts specified for mechanical joints. Paint bolt threads with graphite before tightening.

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

(1) General. Service Lateral is that portion of installation from water main up to and including stopcock end of lateral. Service Connection is that portion of installation from stopcock end of service lateral up to and including stop cock at meter box.

Appurtenances used with Pipes, Service Laterals and Service Connections means fittings, corporation stops, valves, bushings, and stop cocks that will be installed in service lateral and service connections.

(2) Installation. Install service laterals and service connections at specified locations and of sizes and types specified.

Conform to following procedure for solder joints:

(a) Cut pipe or tube to desired length with tube cutter or fine hacksaw (32-tooth blade). Remove burrs with file or scraper.

(b) Clean outer portion of tube end that fits into solder cup of fitting with sandcloth or sandpaper. Remove dark spots.

(c) Before soldering, ensure pipe end section is circular in shape and not deformed. Use shaping/sizing tools on non-circular sections to provide proper connection.

(d) Clean solder cup of fittings carefully with wire brush, sandcloth, or sandpaper. Remove dark spots.

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(e) Use no-lead flux acceptable to the Engineer. Brush light, even coating of flux onto outside of tube and half way into inside of fitting. Do not use acid or zinc chloride.

(f) Insert tube into fittings as far as tube will go. Turn tube back and forth few times to distribute flux evenly. Do not wipe joints before inserting into place.

(g) Heat fitting uniformly with torch until solder melts on contact with heated fitting. Remove flame from joint to be soldered. Using only solders acceptable to the Engineer, feed solder to joint at one or two points. Do not feed solder around full circumference of tube. When ring of solder appears around tube at fitting, stop solder feeding and wipe excess off with cloth.

(h) For connections to tubes of 1-1/4 inch diameter and larger, move fitting on tube or tap with tool handle or mallet as solder is fed to break surface tension and ensure even distribution of solder.

(i) Conform to County Water System Standards for corrosion control requirements for copper services.

(3) Pipe Sleeves Through Retaining Walls. When constructing cement rubble masonry walls or concrete retaining walls with later installation of service connections through retaining walls, insert 2-inch minimum diameter pipe sleeves at locations indicated in contract documents.

(H) Fire Hydrants. Install fire hydrant and appurtenant pipe fittings and valves as indicated in contract documents. Install fire hydrants with 4-1/2 inch steamer nozzle faced no more than 15 degrees to left or right of line running from center of hydrant and perpendicular to street curb. Install fire hydrants with barrels vertical. After checking hydrant for alignment and grade, wedge barrel tightly against side of trench. Wedges may be removed after concrete anchor block placed at bottom elbow has set.

Place concrete thrust block around bottom elbow to at least 12 inches above invert of elbow. Do not disturb concrete thrust block for minimum of three days, or as ordered by the Engineer.

Use standard tools to operate fire hydrants.

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If there is no standard curbing, protect fire hydrants with installation of curb guards.

Before final inspection, clean fire hydrants of oil, grease, dirt or other foreign matter. Paint fire hydrant in accordance with Subsection 712.26 – Fire Hydrants and Appurtenances.

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

For testing purposes, provide reinforced concrete blocks in accordance with County Water Works System Standards.

Cure concrete reaction and test blocks, concrete jackets, and reaction beams for seven days before applying pressure in pipes.

Due to various types of vertical bends and surrounding ground conditions, design of reaction blocks will vary. Costs for reaction block redesign due to unauthorized excavation shall be at no increase in contract price or contract time.

Install reinforced concrete jackets around ductile iron pipe as specified in contract documents.

(J) Testing. Pipes and appurtenances are subject to pressure tests in presence of the Engineer.

Whenever any section can be isolated as unit, perform separate test on each section of pipeline with its appurtenances. If valves are available at each end of section, perform test between valves. If valves are not available, install necessary plugs or caps, properly braced to withstand required test pressure. When section of pipeline is ready for testing, tap test holes into pipe and connect test holes to test pump with suitable piping. Between tap and pump, install stop cock. Between stop cock and tap, install pressure gage furnished by County Water Works System.

Fill section of pipeline to be tested completely with water. Ensure that there are no air pockets. Open stopcock and raise hydrostatic pressure to required pressure in accordance with Table 624.03-3 – Test Pressure.

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TABLE 624.03-3 – TEST PRESSURE	
Class of Pipe	Test Pressure
150	150 psi
250	250 psi
above 250	50 psi above static pressure of installed system

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Shut stopcock and observe pressure gage for 30 minutes. For acceptance, pressure shall not drop more than 10 pounds per square inch, during this period.

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The Engineer may require tests to cover sections or combination of sections, and may require additional tests.

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Provide equipment and material necessary for tests. After stopping visible leaks and completing tests, install brass plugs in holes made for testing purposes.

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(K) Connections to or Adjusting of Existing Mains. Notify the Engineer in writing before proceeding with connections to, or adjusting of existing mains. Deliver this notice three working days before commencing with this work.

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Furnish materials required for work, and complete necessary excavation.

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Provide concrete reaction blocks and manholes, and complete backfill and other incidental items of work.

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Do not operate valves or hydrants unless authorized by the Engineer. County Water Works System will operate valves 16 inches and larger.

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Provide material, excavate, backfill and connect new or relocated meters to house services.

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(L) Disinfection. Flush and disinfect water mains, service laterals, and appurtenances before acceptance. Notify the Engineer and County Water Works System 72 hours before time for disinfection. Provide connections for disinfection. Properly dispose water used in disinfecting and flushing in accordance with applicable Department of Health and NPDES requirements.

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Provide temporary cleanouts at locations indicated in contract documents to ease disinfecting of water mains. After disinfecting mains and receiving certification for disinfecting, remove temporary cleanouts. Provide brass plugs to replace corporation stops.

(M) Meter Boxes and Cast Iron Frames and Covers.

(1) General. Construct meter boxes and cast iron frames and covers.

(2) Installation. Construct meter boxes of:

(a) Bricks set in full mortar beds in accordance with standard brick construction.

(b) Precast concrete with necessary reinforcing steel.

Install meter boxes at locations indicated in contract documents. Install cast iron frames and covers of proper size and dimension in full mortar beds at each meter box. Paint cast iron frames and covers with one coat of high grade asphaltum paint.

(N) Air Relief Valves and Appurtenances. Construct air relief valves and appurtenances. Appurtenances include pipes, fittings, corporation stops, unions and vertical check valves. Clean air relief valves of rust and foreign matter. Paint air relief valves with one coat of corrosion preventive paint acceptable to the Engineer.

(O) Water Supply for Construction. County Water Works System will measure quantity of water used for construction. County Water Works System will provide and disconnect meter. Arrange with County Water Works System and pay costs for such installations and disconnections. County Water Works System will furnish invoices for cost of installation and disconnection of meters. Pay for cost of replacements or repairs resulting from damage to meter, hydrant and other property used.

Provide water supply equipment and materials necessary to provide adequate water supply for proper construction of water mains. Equipment and materials may include temporary pipes and fittings, pumping, and storage facilities.

(P) Maintaining Existing Water System. Maintain existing water system in service during construction period, and until new water system is placed in service and existing services are transferred to new system.

624.03

542 Immediately notify the Engineer and County Water Works System of
543 damages to existing system. County Water Works System will do necessary
544 repairs. County Water Works System will bill the Contractor for costs
545 incurred in this work.

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547 After installing new system or portions of new system, remove existing
548 meters and reconnect existing meters to new system. New system includes
549 its appurtenances, service laterals, service connections, and boxes. For
550 work ordered by State, and to be done by County Water Works System
551 personnel, County Water Works System will send invoices directly to State.
552 County Water Works System will not charge or pay cost of this work to the
553 Contractor.

554
555 **(Q) Removing, Reinstalling or Returning Existing Pipe.** Clean existing
556 pipe that is to be removed and reinstalled in new locations before installing.

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558 Existing pipe includes its appurtenances, fire hydrants, gate valves,
559 and manhole frames and covers. Paint manhole frames and covers with one
560 coat of high-grade asphaltum paint.

561
562 Clean and return existing pipe removed and not reinstalled to County
563 Water Works Storage Yard as ordered by the Engineer.

564
565 Assume responsibility for removing, reinstalling, or returning these
566 existing pipes. Pay for damages to materials during these operations.

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568 **(R) Abandoning Existing Pipe.** If ordered, expose portions of
569 abandoned pipe. If top of pipe is less than 24 inches below finished grade,
570 remove and dispose existing pipe off right-of-way. If abandoning pipe in
571 place, plug ends of abandoned pipe with Class C concrete. Backfill in
572 accordance with Section 204 – Excavation and Backfill for Miscellaneous
573 Facilities.

574
575 **(S) Corrosion Protection.** Apply corrosion protection to pipes, valves
576 and fittings as specified in County Water System Standards. Use specified
577 materials and methods of application.

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580 **(T) Valve Markers.** Install valve markers for establishing location of gate
581 valves and air relief valves.

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583 Fill markers with concrete and set markers plumb in Class B concrete
584 footing. Paint pipe yellow. Paint top 4 inches of markers for air relief valves
585 red.

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587 **624.04 Measurement.** Water system will be paid on a lump sum basis.
 588 Measurement for payment will not apply.

589 **624.05 Payment.** The Engineer will pay for accepted water system on a contract
 590 lump sum basis. Payment will be full compensation for work prescribed in this
 591 section and contract documents.

592 The Engineer will pay the following pay item when included in proposal
 593 schedule:

594 Pay Item	595 Pay Unit
596 Water Systems	Lump Sum

597
 598 The Engineer will pay for:

599
 600 **(A)** Excavation and backfill under Section 204 – Excavation and Backfill
 601 for Miscellaneous Facilities.

602 **(B)** Concrete in reaction blocks, test blocks, jackets, and reaction beams
 603 under Section 503 – Concrete Structures.

604 **(C)** Reinforcing steel under Section 602 – Reinforcing Steel.
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607 **END OF SECTION 624**