

**DRAFT**

**SECTION VII  
TECHNICAL SPECIFICATIONS**

**SECTION VII-1  
PIPELINE TECHNICAL SPECIFICATIONS**

**PART 1 – GENERAL**

**1.01 Scope**

Contractor shall furnish all pipe, fittings, materials, equipment, and labor and perform all operations necessary to construct pipelines and appurtenances as specified by the District and as shown by the Drawings. Drawings shall consist of construction drawings, installation drawings, laying drawings, standard drawings, detailed drawings, layout drawings, fabrication drawings, shop drawings, and clarifying diagrams or sketches.

The Work shall consist of all traffic control (including furnishing and installing all barricades, signs, delineators, arrow boards, and flagmen); all utility location and verification (excavating, exposing, and verifying locations, depths, and dimensions of utility facilities); all pavement removal and disposal; all earthwork (including trenching, shoring, dewatering if required, blasting if required, bedding, backfilling, and compacting); furnishing and installing all pipe, fittings, appurtenances, and making all related connections; protecting in place or removing and replacing all existing utilities and public and private improvements; removing and replacing all asphalt and Portland cement concrete pavement; pavement striping and restriping as required; disinfecting and testing all pipelines; disposing of excess soil and rock material; and restoring all areas and improvements to pre-construction conditions.

Contractor shall, upon completion of pipeline construction and appurtenances required herein, initially operate all components of the Work installed or furnished and installed by him, and make any additional adjustments, corrections, repairs, replacements, and reconstructions necessary to provide the District with complete, correctly operating pipelines and appurtenances.

**1.02 Survey Monuments and Construction Stakes**

Contractor shall not disturb or destroy any existing monuments or bench marks. If any survey monuments or bench marks need to be removed and replaced, Contractor shall have all necessary services performed by a licensed land surveyor. If Contractor fails to comply, the District will have said services performed at Contractor's expense.

Before removing any monuments in preparation for construction, Contractor shall have a licensed land surveyor set at least four ties for each monument to be removed and replaced; after construction Contractor shall have the same registered civil engineer or licensed land surveyor replace each monument using the aforementioned ties and file a corner record for each replaced monument.

Unless specified otherwise, Contractor shall use construction stakes and cut sheets for pipeline construction and the District will use them for construction inspection. All construction stakes shall be set by a registered civil engineer or licensed land surveyor. The District must approve cut sheets before actual construction. Contractor shall protect all construction stakes set for construction and he shall restore any construction stakes destroyed or disturbed.

### **1.03 Traffic Control**

Contractor shall prepare, submit, and provide traffic control drawings for construction. Said traffic control drawings shall be approved by the District and agencies having jurisdiction over highways, thoroughfares, and streets prior to starting construction.

Traffic control requirements may be modified by the District or said agencies as conditions warrant. Throughout the Work, Contractor shall inspect traffic control equipment (signs, barricades, arrowboards, and delineators) and shall maintain same in accordance with said traffic control drawings.

All construction signing, lighting, and barricading shall comply with State of California, Department of Transportation "Manual of Uniform Traffic Control Devices", 2003 edition, and MUTCD California Supplement".

### **1.04 Underground Utilities (Subsurface Installations)**

Where underground utility facilities (conductors or conduits for water, gas, sewer, telephone, electric power, cable television, or other utilities) are shown on construction drawings, Contractor shall assume that service facilities (services or laterals for water, gas, sewer, telephone, electric power, cable television, or other utilities) extend from each utility facility to each parcel or property whether or not service facilities are shown.

At least two working days but no more than fourteen calendar days before commencing any excavation on the Work, Contractor shall request Underground Service Alert and non-member companies or utilities to mark or otherwise indicate the locations of their subsurface facilities including, but not limited to, structures including vaults, main conductors or conduits, and service connections or facilities.

Contractor shall comply with applicable laws pertaining to subsurface installations, especially with respect to excavations and permits. Contractor shall specifically comply with applicable provisions of Sections 4215 through 4216.9 of the Government Code. Contractor shall take all actions necessary to maintain a valid inquiry identification number during the Work.

At least ten days in advance, or 1,000 feet minimum ahead of pipeline trenching, Contractor shall excavate, expose, and determine ("pothole") the exact locations, depths, and dimensions of each and every potential interference, including, but not limited to, all facilities shown specifically (depth and location) on construction drawings, or which have been marked by their respective Districts.

Upon learning of the existence or location of any utility facility omitted from or shown incorrectly on construction drawings, or improperly marked or otherwise indicated, Contractor shall immediately notify the District, providing full details as to depth, location, size, and function. Contractor shall immediately notify utility having jurisdiction over facility.

Contractor shall not interrupt or disturb any utility facility without written permission from the Utility or written order from the District. Where protection is required to ensure integrity of utility facilities located as shown on construction drawings or visible to Contractor or marked or otherwise indicated as stated herein, Contractor shall, unless otherwise provided, furnish and place all necessary protection at his expense.

Contractor is advised that the District has no knowledge or information about trench backfill conditions of utility facilities adjacent to or parallel with pipeline being constructed pursuant to these Specifications; therefore, Contractor shall protect against adjacent or parallel trench backfill failure. If adjacent or parallel trench fails, Contractor shall, at his expense, remove and replace said backfill material in accordance with trench backfill requirements herein and remove and replace asphalt concrete pavement and any other improvements damaged in connection therewith.

#### **1.05 Storage of Equipment and Materials**

Contractor shall not store equipment or materials on private or public property without written permission from property owner(s) approving such use.

Contractor shall not park equipment or store materials in public right-of-way except while performing Work. Contractor shall remove equipment from public right-of-way and place it in Contractor's storage or construction yard by the end of each work day. Contractor shall keep materials in Contractor's storage or construction yard until they are needed for the Work.

Storage site or construction yard shall be completely fenced prior to moving any equipment or materials onto site or into yard. Contractor shall control dust in construction yard at all times, from establishing construction yard through construction, and until all Work has been completed and Contractor has moved all equipment, materials, and fencing from site.

### **PART 2 – PRODUCTS**

#### **2.01 Construction Materials**

Contractor shall furnish only approved materials as listed in the District's Standard Drawings or Approved Materials List. All materials shall be new and of the best quality for their intended use. All like materials shall be of one manufacture for any particular project.

Contractor shall, in addition to furnishing other data herein required, submit three signed and dated copies of the list of materials to be used in pipeline and appurtenance construction including but not limited to pipeline installations, pipeline valve installations, air valve installations, blowoff installations, manway installations, service installations, fire hydrant installations, and related appurtenances.

#### **2.02 Bedding and Backfill**

##### **A. Sand Used For Bedding**

Bedding for pipe shall consist of plant manufactured clean sand having a sand equivalent of not less than 30.

B. Backfill in Pipe Zone

Backfill in pipe zone (up to 12" over pipe) shall consist of plant manufactured clean sand having a sand equivalent of not less than 30.

C. Backfill Above Pipe Zone

Backfill above pipe zone to bottom of asphalt within City right-of-way shall be Class 2 base.

D. Imported Backfill Material

Whenever excavated material is unsuitable as backfill material and Contractor is unable to process or screen such material for backfill material or whenever excavated material is insufficient to accomplish backfill and Contractor must secure additional material, Contractor shall import such material and the material and its source shall be approved by the District.

Unless specified otherwise, imported backfill material shall be commercially processed and it shall be selected, clean, loose earth, sand, or gravel (1 inch maximum size). Said material shall be granular and it shall be free of clay, silt, and fine sand. It shall be suitable for compaction with minimum effort.

E. Backfill Completion

Where pavement is not required, trench backfill shall be brought to grade of existing surface and dressed to provide firm, stable, and even surface without ruts or irregularities. It shall conform with grades of existing surface. Where pavement is required, trench backfill shall be brought to subgrade for pavement structure. Pavement shall then be placed in accordance with paving requirements.

**2.03 Ductile Iron Pipe**

A. Scope

Ductile iron pipe and fittings shall conform with applicable provisions of AWWA C104, C105, C110, C111, C115, C150, C151, and C153, latest, as modified herein, by the Drawings, or by the District.

All ductile iron pipe shall be manufactured by organizations which have had not less than ten years successful experience in the manufacture of the type of pipe specified. The District shall approve manufacturer's product before its use.

B. Data to be Submitted by Contractor

Contractor shall furnish three copies of an Affidavit of Compliance in accordance with Section 51-5, AWWA C151, latest. Contractor shall also furnish certifications, three copies each, of the following:

1. Material Certification
  - a. Grade of iron (chemical requirements)
  - b. Flanges
  - c. Nuts and bolts
  - d. Flange gaskets
  - e. Rubber Gaskets
2. Manufacturing Certification
  - a. Hydrostatic Test Reports
  - b. Tensile Test Reports
  - c. Impact Test Reports

Unless specified otherwise, Contractor shall furnish detailed installation or laying drawings showing pipe, fittings, appurtenances, station, and elevation for each fitting, and each change in alignment or slope. Contractor shall submit the installation or laying drawings to the District for acceptance in all cases in time sufficient to allow review and acceptance as hereinafter specified and to accommodate the Contractor's construction schedule.

Installation or laying drawings shall be submitted in triplicate. District will return one (1) set of drawings to Contractor within fifteen (15) days marked either "Accepted", "Rejected", "Revise and Resubmit", "Submit Specified Item", or "Furnish as Corrected". In the last case, all revisions will be clearly shown on the returned set of drawings which shall be considered the accepted drawings and only drawings or prints so corrected shall be used for installation. Contractor shall furnish District five (5) sets of all accepted drawings.

C. Pipe

All pipe shall be ductile iron and shall conform with AWWA C151 (ANSI A21.5, and applicable portions of ASTM A536, Grade 60-42-10), latest, as modified herein by the Drawings, or by the District.

1. Pipe, including standard, random, and special short lengths, shall be Class 300 minimum and, unless specified otherwise, shall have push on joints. Minimum pipe wall thickness shall be as noted by the construction drawings or specified by the District; it shall not be less than noted by the standard drawings. Pipe wall thickness shall be increased if necessary to accommodate threads or grooves or if required for extremely shallow (less than 2.5 feet) or excessively deep (more than 14 feet) pipeline cover. 90 percent of all pipe of any specific class and size,

excluding special short lengths, shall be furnished in standard lengths. The remaining 10 percent may be furnished in random lengths.

2. Standard lengths shall have nominal lengths of 18 feet up to 36 inches in diameter and 20 feet above 36 inches in diameter, plus or minus 1 inch. Random lengths of pipe may be up to 2 feet shorter than standard lengths. Special short lengths shall only be furnished where needed to accommodate specified fittings.
3. Pipe shall have an interior cement mortar lining in accordance with AWWA C104 (ANSI A21.4), latest. Said lining shall be full thickness throughout pipe except for bell which shall be cleaned and lightly sprayed or brushed with an asphaltic or bituminous coating in accordance with AWWA C151 (ANSI A21.51). The interior cement mortar lining shall be moisture cured for at least two days before shipment. To prevent moisture loss during the curing period, ends of pipe shall be kept closed with plastic caps or covers which shall remain in place until installation.

Steam curing may be substituted for moisture curing, providing one hour of steam curing is equivalent to six hours moisture curing and ambient vapor is maintained at relative humidity of 85 percent with temperature ranging between 110 degrees Fahrenheit and 150 degrees Fahrenheit for minimum steam curing period of six hours, after which exterior coating may be applied. The lining shall then be cured for another twelve hours before shipment. Other methods of curing the cement mortar lining may be used providing they are acceptable to the District.

Temperature and shrinkage cracks in cement mortar lining less than 1/16 inch in width or 24 inches in length need not be repaired. Cracks wider than 1/16 inch or longer than 24 inches shall be repaired unless it can be demonstrated to the satisfaction of the District that the cracks will heal autogenously under continuous soaking in water.

4. Pipe shall have an exterior asphaltic or bituminous coating in accordance with AWWA C151 (ANSI A21.51), latest.
5. All pipe shall be furnished with rubber gasketed push-on type joints unless mechanical joints or flanged joints are otherwise specified or permitted. Joint restraints may be required as specified by the District. All joints shall comply with AWWA C111 (ANSI A21.11), latest, as approved by the District.
6. Rubber gaskets shall conform to AWWA C111 (ANSI A21.11) latest.
7. Each pipe shall be marked with the weight, class, or nominal thickness and casting period. The manufacturers mark, year in which pipe was produced and the letters "DI" or "ductile" shall be cast or stamped on the pipe. All required markings shall be clear and legible and all cast marks shall be on or within 2 feet of bell ends.

8. Where restrained joints are required, they shall be accomplished with boltless restrained joint gaskets or components. Restrained joints shall be ductile iron in accordance with applicable provisions of AWWA C111 and C151 (ANSI A21.11 and A21.51, respectively), latest, except as to manufacturer's proprietary dimensions.

Each restrained joint for pipe 4 inches through 12 inches shall consist of a gasket system where stainless steel locking segments molded within the gasket provide restraint for pipe joints or fitting joints.

Each restrained joint for pipe 14 inches through 24 inches shall consist of a gasket system where stainless steel locking segments molded within the gasket provide restraint for pipe joints or fitting joints, or, alternatively, a boltless restrained push-on joint system where ductile iron locking segments inserted through slots in the bell face provide positive axial lock between the bell interior surface and the spigot retainer weldment or gripper ring.

Each restrained joint for pipe 27 inches and larger shall consist of a boltless restrained push-on joint system where ductile iron locking segments inserted through slots in the bell face provide positive axial lock between the bell interior surface and the spigot retainer weldment or gripper ring.

All restraining components must make full contact around the circumference of the pipe, even if it has deflected. Field cut kits shall be composed of full ring gripper rings with serrated edges and shall be compatible with the pipe joints and fitting joints.

D. Fittings

All fittings shall be ductile iron except where fabricated cement mortar lined and cement mortar coated welded steel pipe fittings are specifically permitted or specified. Fabricated cement mortar lined and cement mortar coated fittings shall be flanged and they shall conform with the cement mortar lined and cement mortar coated welded steel pipe fittings specified herein.

Ductile iron fittings shall conform with AWWA C110, C111, and C153 (ANSI A21.10, A21.11, and A21.53, respectively), latest. Unless specified otherwise, fittings shall be push-on joint and comply with AWWA C111 (ANSI A21.11).

Fittings shall have an asphaltic outside coating in accordance with AWWA C110 or C153 (ANSI A21.10 or A21.53), latest, and cement mortar lining in accordance with AWWA C104 (ANSI A21.4), latest. Fittings shall have standard lining thickness and shall be seal coated with asphaltic material or other approved material. The lining process must produce a dense, compacted lining that shall be bonded to the interior of the fitting and have a smooth surface.

Where restrained joints are required, they shall be accomplished with boltless restrained joint gaskets or components and shall comply with all requirements of Section 10.A.3.h. of the Basic Pipeline Specifications. Restrained joint fittings shall be of same joint



design as the restrained joint pipe. Restrained joints shall be ductile iron in accordance with applicable provisions of AWWA C110 and C153 (ANSI A21.10 and A21.53), latest, except as to manufacturer's proprietary dimensions.

E. Testing

All pipe, including standard, random, and special short lengths, furnished shall be tested in the United States in accordance with AWWA C151, latest.

F. Inspection

The District shall at all times have the right to inspect all Work and materials during the course of manufacture. Manufacturer shall furnish the District reasonable facility for obtaining such information as he may desire regarding the progress and manner of the Work and the character and quality of materials used.

G. Loading, Transporting, and Unloading

After the pipe has been tested in accordance with Section 5 above, it shall be loaded on rubber-tired vehicles, and adequately supported and chocked to prevent any damage during transportation, and delivered to the Work site. During loading, unloading, and stringing operations, pipe and fittings shall be moved with care to prevent damage thereto. Unloading shall be accomplished in a workmanlike manner as directed by the manufacturer. Under no circumstances are pipe and fittings to be dropped or bumped in handling.

H. Defective or Damaged Material

Pipe and fittings shall be carefully inspected for defects. Any pipe found to be defective in workmanship or materials or so damaged as to make repair and use impossible shall be rejected and removed from the Work site.

In the event that pipe is damaged, damaged portions may be removed, as approved by the District, and discarded. Remaining sound portions may be used with ductile iron fittings. Contractor shall be responsible for any and all damage to material and he shall stand the expense of repairing or replacing same. Contractor shall take proper precautions to assure that rubber gaskets are protected from oxidation or undue deterioration.

**2.04 Welded Steel Pipe (Cement Mortar Lined and Cement Mortar Coated)**

A. Scope

All welded steel pipe shall conform with applicable provisions of AWWA C200, C205, C206, C207, and C208, latest, and applicable portions of M11 "Steel Pipe Manual", latest, as modified herein, by the Drawings, or by the District.

All welded steel pipe shall be manufactured by organizations with at least ten years successful experience in manufacturing, fabricating, lining, and coating the type of pipe specified. District shall approve manufacturer's methods, equipment, facilities, and operations before performance of any work and manufacturer's completed product before its use.

Standard or special pipe sections and standard or special connections, outlets, and fittings may be manufactured at a single plant, or they may be manufactured at two separate plants (Plant 1: manufacturing of standard sections of lined, coated, and cured steel pipe consisting of steel pipe cylinder formation and lining, coating, and curing; Plant 2: fabricating special pipe sections and standard or special connections, outlets, and fittings using standard sections of manufactured lined, coated, and cured steel pipe). Special pipe sections and standard or special connections, outlets, and fittings fabricated at a separate manufacturing plant shall be comprised of standard pipe cylinders that have been formed, lined, coated, and cured at a single manufacturing plant. The separate manufacturing plant shall use facilities and methods for lining and coating repair and curing equal to the facilities and methods of the manufacturer of the standard sections of lined, coated, and cured steel pipe.

B. Data to be Submitted by Contractor

Contractor shall furnish three copies of an affidavit of compliance in accordance with Section 1.12, AWWA C200, latest, and Section 1.7 AWWA C205, latest. Contractor shall also furnish certifications, three copies each, of the following:

1. Material Certification
  - a. Steel Skelp
  - b. Flanges
  - c. Nuts and Bolts
  - d. Flange Gaskets
  - e. Rubber Gaskets
2. Manufacturing Certification
  - a. Pipe Mill Reports
  - b. Production Weld Test Reports
  - c. Hydrostatic Test Reports
  - d. Outlet Reinforcement Calculations\*
  - e. Pipe Wall Thickness Calculations\*

\* If not shown by the Drawings.

Unless specified otherwise, Contractor shall furnish detailed layout and shop or fabrication drawings showing pipe, lining, coating, reinforcement, joints, fittings, appurtenances, and station and elevation for each fitting and outlet and for each pipe joint at each change in pipe class, alignment, or slope. Contractor shall submit detailed layout and shop or fabrication drawings to the District for acceptance in all cases in time sufficient to allow review and acceptance as hereinafter specified and to accommodate the Contractor's construction schedule.

Installation or laying drawings shall be submitted in triplicate. District will return one (1) set of drawings to Contractor within fifteen (15) days marked either "Accepted", "Rejected", "Revise and Resubmit", "Submit Specified Item", or "Furnish as Corrected". In the last case, all revisions will be clearly shown on the returned set of drawings which shall be considered the accepted drawings and only drawings or prints so corrected shall be used for installation. Contractor shall furnish District five (5) sets of all accepted drawings.

Revisions shown on the shop drawings shall be considered changes necessary to meet the requirements of these Specifications and shall not be taken as the basis of claims for extra charges. Contractor shall accept such revisions or submit others for acceptance. When delays are caused by resubmissions of shop drawings, Contractor shall not be entitled to any damages or extensions of time for such delays.

The District's acceptance of detailed layout and shop or fabrication drawings shall apply only to general arrangement and general compliance and not to specific details and dimensions and their correctness and compatibility. Contractor shall correct any misfits due to any errors in the detailed shop or fabrication drawings. Any fabrication in advance of receipt of detailed layout and shop or fabrication drawings marked "Accepted" or "Furnish as Corrected" shall be at Contractor's risk. Contractor shall furnish the District five sets of all accepted layout and shop or fabrication drawings.

C. Pipe and Fittings

All pipe and fittings furnished shall conform with applicable provisions of AWWA C200, C205, C206, C207, and C208, latest, and applicable portions of AWWA M11, "Steel Pipe Manual", latest, as modified herein, by the Drawings, or by the District.

1. Pipe and fittings shall be Class 150 minimum. Minimum steel cylinder thickness shall be as noted by the construction drawings or specified by the District; it shall not be less than 10 gage or as noted by the standard drawings. All pipe and fittings shall be machine cement mortar lined and machine cement mortar coated.
2. Curved alignment by use of pulled joints will be permitted. Maximum pull permitted from normal closure on one side of joint shall not exceed 1/2 inch for 8 inch pipe or smaller, 3/4 inch for 10 inch through 21 inch pipe, and 1 inch for 24 inch pipe and larger. Maximum joint deflections shall not exceed manufacturer's recommendation or 3 degrees; the more restrictive or lesser deflection shall apply.
3. Where greater curvature is required, Contractor may use fabricated bends as specified by the construction drawings or ordered by the District. For the purpose of reducing angular deflections at pipe joints, Contractor may use pipe sections of less than standard length. Closing courses and short sections of pipe shall be fabricated and installed by Contractor as found necessary in the field.

4. All fittings shall be shop fabricated unless the construction drawings indicate that fittings may be field fabricated, Contractor describes methods of fabrication, and the District specifically approves field fabrication. All fittings shall be fabricated from individual pipe sections, welded together, and lined and coated as described hereafter.

5. Lining of Fittings

- a. The application of cement mortar lining to miters, angles, bends, reducers, and other special sections, the shape of which precludes application by the machine spinning process, shall be accomplished by mechanical placement, pneumatic placement, or hand application and finished to produce a smooth, dense surface.
- b. If the interior of the fitting has not been previously machine lined, wire-fabric reinforcement or ribbon-mesh reinforcement shall be applied to the interior of fittings larger than 24 inches and shall be secured at frequent intervals by tack welding to pipe, by clips or by wire. Repaired areas of machine applied linings at miters, pipe ends, outlets, and other cuts made in the lining for fabrication of the fittings need not be reinforced if the width of the repair area does not exceed 12 inches. Repairs for widths exceeding 6 inches shall be bonded to the steel and adjacent faces of the lining with an approved bonding agent.

Immediately after lining has been completed, pipe and fittings shall be water cured without being disturbed for at least one day before applying the exterior coating, if such a coating is specified. If cement mortar coating is not specified, the lining shall be kept moist for four days before shipment. In either case, the lining shall be cured for at least four days before shipment. To prevent moisture loss during the curing period, ends of the pipe sections shall be kept closed with plastic end caps or covers which will remain in place until time of installation. The date of lining and class of pipe shall be plainly marked on the inside of each fitting.

6. Coatings of Fittings

Mortar coating for pipe bends and other special sections not adaptable to the application of spiral-wire coating reinforcement shall be reinforced with wire fabric or ribbon mesh. The wire fabric or ribbon mesh shall be applied over the surface of the pipe to be coated, and may be held away from the pipe shell with self-furring mesh, furring clips, or an equivalent method. The application of the mortar coating shall be by mechanical or pneumatic means to the specified thickness, except that hand application may be substituted for all specials. After the outside coating has been applied, the pipe and fittings shall be kept continually moist by continuous spraying for at least four days. Provisions shall be made to protect the coating from erosion during sprinkling. The date of coating and class of pipe shall be plainly marked on the inside of each fitting.

D. Pipe Joints

Unless specified otherwise, joints shall conform to the following types. Joints shall be as specified on the construction drawings or by the District. All joints shall be continuity bonded.

1. Rubber Gasket Joints

All rubber gasket joints shall conform with AWWA C200, latest.

2. Flanged Joints

All flanges 4 inches through 12 inches shall conform with AWWA C207, latest, Class E (ring) or ANSI B16.5 Class 150. All flanges larger than 12 inches shall conform with AWWA C207, latest, Class E (ring). All flange bolts shall be standard hex head machine and conform with ASTM A325. All flange nuts shall be heavy hex cold pressed semi-finished steel and conform with ASTM A194-2, 2H.

All flanges shall be fully welded to pipe on both faces, one pass minimum on the inside, and two passes minimum on the outside. Pipe linings shall extend to mating faces of flanges. Bolt threads shall be lubricated with an approved anti-seize compound. Flanges together with bolts and nuts, shall be, once installed, coated with an approved bitumastic material.

3. Swedged Lap Welded Joints

Bell ends shall be formed integrally with pipe cylinders, being swedged out by machine. Bell ends shall be designed and fabricated to withstand design pressure of class of pipe specified and to permit spigot ends (plain end) to enter belled ends approximately 1 inch with clearance of approximately 1/32 inch.

4. Banded Lap Welded Joints

Where lap welded joints are required and swedged lap welded joints cannot be fabricated, belled ends shall be formed by welding steel bands to outside circumferences of plain ends of pipe. Bell ends shall be designed and fabricated to withstand design pressure of class of pipe specified and to permit spigot ends (plain ends) to enter belled ends approximately 1 inch with a clearance of approximately 1/32 inch.

5. Sleeve Couplings

Where sleeve couplings are required, they shall conform with the construction drawings. Pipe coatings at pipe ends shall be held back 12 inches and pipe shall have weld seams ground flush within 12 inches from pipe ends, unless specified otherwise. For above ground applications, pipe ends and sleeve couplings shall be painted. For below ground applications, pipe ends and sleeve couplings shall

be coated with an approved bitumastic material. An approved bitumastic coating shall be substituted for mortar coating within 12 inches of pipe ends. After joints have been coupled, sleeve couplings shall be coated with an approved bitumastic material.

6. Cut-to-Fit Joints

Where cut-to-fit joints are required, they shall conform with the standard drawings and the construction drawings. Pipe coatings at cut-to-fit joints shall be held back as required to permit construction of joints; pipe coatings shall thereafter be added in the field. Field applied pipe coatings shall match manufactured pipe coatings. Contractor shall provide, at his expense, cut-to-fit joints, in addition to those specified, if necessary to accommodate his work and schedule.

7. Shop Testing of Joints and Joint Ends

Every pipe section, standard, or special, shall be hydrostatically tested after joint ends have been completely shop formed and attached in place by welding, as applicable, or dye check tested provided pipe cylinders had been previously hydrostatically tested.

E. Cement Mortar Lining and Cement Mortar Coating

1. General

Cement mortar lining and cement mortar coating shall conform with AWWA C205, latest.

2. Surface Preparation

Prior to lining and coating, pipe shall be cleaned of all loose mill scale, moisture, rust, sand, dust, oil, grease, and other deleterious or objectionable matter both inside and outside.

3. Cement Mortar Lining

a. Mortar

Mortar shall consist of one part Portland cement to three parts (by weight) clean, sharp sand. Unless specified otherwise, cement used for cement mortar shall conform with ASTM C-150, latest, Type II. Sand shall consist of clean, inert, sharp, durable material, maximum grain size being no more than one-half specified minimum lining thickness. Mortar shall be thoroughly mixed and made workable with clear, potable water. All cement mortar shall develop a minimum compressive strength of 2,600 psi minimum at seven days and 4,500 psi minimum at twenty-eight days.

b. Application and Treatment

Cement mortar shall be applied to interior surfaces of pipe with equipment specifically designed for that purpose. Said equipment shall have a retracting feed line that will provide uniform cement mortar distribution throughout pipe length. Pipe shall be slowly rotated in horizontal position while cement mortar is being applied. Each end shall be provided with suitable end dam during spinning operation to control lining thickness and provide square-finished lining end.

Following application of mortar, pipe shall be rotated at sufficient speed to compact lining mortar. Said speed shall be maintained until all excess water has been forced to lining surface. During the spinning operation, surplus water shall be expelled from pipe by blower or other suitable means. Peripheral speed and spinning time shall be sufficient to obtain dense, well compacted lining with smooth surface free from defects. Minimum lining thickness shall be as shown by the standard drawings.

Immediately after lining has been completed, pipe shall be water cured without being disturbed for at least one day. Moisture loss shall be prevented during the curing period.

4. Cement Mortar Coating

a. Mortar

Mortar shall consist of one part Portland cement to three parts (by weight) clean, sharp sand. Materials for cement mortar coating shall be the same as materials for cement mortar lining. All cement mortar shall develop a minimum compressive strength of 2,600 psi minimum at seven days and 4,500 psi minimum at twenty-eight days.

b. Application and Treatment

After pipe interior has been lined, cement mortar shall be applied to outside of pipe through fixed nozzles to form an even, dense, and tightly adhering coating. During coating operation, pipe shall be rotated and moved beneath said fixed nozzles to obtain uniform coating free from defects. Minimum coating thickness shall be as shown by the standard drawings.

Cement mortar coating shall be reinforced with spirally wound steel (reinforcing) wire embedded midway within coating. Reinforcing wire shall be bright basic wire comprised of low carbon, open hearth steel, unannealed after the last draw, with an approximate ultimate tensile strength of 80,000 psi. Said wire shall be No. 14 gage minimum and it shall be placed at a pitch of 1-1/2 inch maximum in the middle third of the coating.

Immediately after coating has been completed, each end of each section shall be cleansed to bare metal and cement mortar shall be troweled and shaped suitable for joint being used. All exposed bare metal shall be cleaned and coated and painted for protection against corrosion. Completed pipe shall then be water cured for at least four days without being disturbed.

F. Manufacturing Inspection

The District shall at all times have the right to inspect Work and materials during the course of manufacture. Manufacturer shall furnish the District reasonable facility for obtaining such information as it may desire regarding progress and manner of work and character and quality of materials used.

G. Loading, Transporting, and Unloading Pipe and Fittings

After pipe and fittings have been manufactured as set forth above, they shall be braced at the plant with wooden struts of adequate size to protect against excessive deflection. Each set of struts (two struts minimum to a set) shall be nailed together at right angles as a unit. Wooden wedges may be used to accomplish proper tight fit for the struts. Bracing shall be located 1 foot in from each end of each pipe section for pipe 24 inches and smaller, and additionally at mid point for pipe 30 inches and larger.

After the struts have been installed, pipe shall be loaded on rubber-tired vehicles, adequately supported and choked to prevent damage during transportation, and delivered to Work site. All bracing shall remain in place until each pipe section has been bedded and backfilled to at least 1 foot above the top of the pipe for pipe 24 inches and larger.

Plastic end caps or covers shall be placed over the ends of pipe following installation of braces to prevent moisture loss during loading, transporting, unloading, and installing; they shall remain in place until installation. If the plastic and caps or covers are damaged (perforated), they shall be replaced immediately.

During loading, unloading, and stringing operations, pipe and fittings shall be moved with care to prevent damage thereto. They shall be moved with nylon chokers or straps of sufficient width, placed at third points (one-third length of pipe from each end), to prevent damage to exterior coating, and they shall be handled in such manner to prevent damage to interior lining. Steel slings shall not be used.

Unloading shall be accomplished in a workmanlike manner by Contractor and every precaution shall be taken to prevent damage to pipe and fittings. Under no circumstances are pipe sections to be dropped or bumped in handling. Any pipe section that becomes damaged shall be repaired if possible and, if not possible in the opinion of the District, it shall be replaced with an undamaged pipe section. When strung, pipe shall be adequately supported and choked to avoid movement until it is installed. It shall also be placed to avoid damage during construction.



## **PART 3 – EXECUTION**

### **3.01 General**

#### **A. Pipelines and Appurtenances**

Pipelines and appurtenances shall be constructed in accordance with these Specifications and the Drawings and as specified by the District.

#### **B. Valves and Appurtenances**

Pipeline valves at pipeline intersections shall be connected directly to pipeline intersection fittings (cross or tee) and, unless specified otherwise, all mainline or side outlet valves shall be located 3 feet minimum from any curb face. Pipeline valves shall not be placed under curb or gutter or in parkway unless approved by the District.

All appurtenances, including but not limited to air valve installations, blowoff installations, and related facilities, such as fire hydrants, fire services, and water services, shall not be installed within 3 feet of curb returns, curb depressions, and driveway approaches, or in inaccessible locations or locations where interferences may restrict facility operation, unless permitted otherwise by the District.

Unless specified otherwise, air valve installations shall be constructed at all pipeline high spots and blowoff installations shall be constructed at all pipeline low spots. Contractor shall construct, at his expense, air valve installations and blowoff installations in addition to those specified, if necessary to accommodate his work and schedule.

#### **C. Pipeline Length**

All pipeline lengths noted by the construction drawings or otherwise specified or referenced shall mean net horizontal constructed lengths and said lengths shall extend through all fittings and appurtenances including bends, outlets, tees, flanges, and valves. Contractor shall provide all pipe necessary to accommodate any vertical alignment of the pipeline and said pipe shall be represented by the net horizontal constructed length.

#### **D. Pipeline Alignment**

All pipelines shall be constructed with no basic variation in horizontal alignment as shown by the Drawings or as specified by the District. Pipelines shall be constructed parallel with centerlines of streets or rights-of-way and appurtenances shall be constructed perpendicular thereto unless the construction drawings specify otherwise. Pipelines may be constructed by the use of pulled joints, short joints, bevels, bends, and elbows, provided pipelines are constructed as specified.

In all non-critical areas and subject to the District's approval, pipelines may be constructed at variance with vertical alignment as shown by the construction drawings by the use of pulled joints, short joints, bevels, bends, and elbows provided pipelines are constructed as specified at pipeline connections and underground interferences, and where pipeline cover is limited. The District will not approve any variation in vertical

alignment until it has determined that proposed alignment is proper and modifications are in order. The costs provided in the bidding schedule for base pipeline installation shall include any costs associated with adjusting the pipeline vertical alignment up to 1 foot upwards or downwards.

E. Pipeline Tolerances

With regard to vertical alignment, pipelines shall be constructed so that actual flow line elevations, measured at pipe joints, are within 0.1 foot of design flow line elevations. Pipelines, when installed, shall have continuous slope upgrade or downgrade, corresponding with design slope, without any high spots.

With regard to horizontal alignment, pipelines shall be constructed so that actual pipeline centerlines, measured at pipe joints, are within 0.1 foot of design pipeline centerlines. Pipelines, when installed, shall closely follow specified horizontal alignment.

Pipeline construction shall conform with construction drawings and layout, shop, fabrication, installation, or laying drawings (design drawings which show flow line elevations and pipeline centerlines) in accordance with the above specified tolerances. Contractor shall make or assist the District in making all necessary measurements, as determined by the District, to confirm or verify compliance with construction tolerances.

F. Pipeline Cover

Pipeline cover as shown by the construction drawings is hereby defined as design cover over pipeline. If field conditions determined during construction staking show that pipe grade changes are required to provide design cover, Contractor shall, at his expense, make required changes in pipeline grade and construct pipeline accordingly.

Pipeline cover from top of pipe to ground surface over pipeline shall not be less than 36 inches. Where future ground surface elevation over pipeline has been established and where actual ground surface is greater, pipeline cover shall be referenced to future (established) ground surface elevation, not actual ground surface elevation.

**3.02 Trench Excavation**

A. General

Unless specified otherwise, pipelines and appurtenances shall be installed in open trench excavations to the depth and in the direction specified by the construction drawings. Excavation for trenches shall include removal of all material of any nature as required for installation of pipe, fittings, or appurtenances and shall include blasting, either sloping or shoring, and all necessary dewatering, if any, all at Contractor's expense.

Contractor is advised that unsuitable earth may be encountered during trenching operations. Where such material is encountered, Contractor shall, at his expense, remove such material, discard it at legal disposal site(s), and thereafter replace it with approved backfill material.

B. Excavation Safety Drawings

Before excavating any earth or soil to a depth of five (5) feet or more, Contractor shall, pursuant to Labor Code Section 6705, submit to the District detailed drawings (hereafter referred to as excavation safety drawings) showing design of shoring, bracing, sloping, or other provisions to be made for worker, individual, or property protection. Said excavation safety drawings shall comply with OSHA Construction Safety Orders (Cal/OSHA or Federal OSHA, whichever is applicable at time of construction) and shall be prepared and certified by a registered civil or structural engineer, engaged by Contractor at his expense, who shall affix his signature and seal to each sheet of said excavation safety drawings. Contractor shall not excavate until the District has received and acknowledged properly certified excavation safety drawings. Contractor shall comply with all other applicable requirements of Labor Code Section 6705 and, as therein provided, no requirements of that Section shall be construed to impose tort liability on District or District's representatives, including District's Engineer.

C. Trench and Bell Hole Sloping or Shoring

Trenches and bell holes shall be adequately sloped or shored so that earth will not slide or settle into trench, so that all existing improvements and utilities (above and below ground) will be fully protected from damage, and so that workers and individuals are protected from injury. At minimum, Contractor shall keep toe of trench spoil at least 5 feet from top of trench. Contractor shall assume full responsibility for all damages caused by inadequate sloping or shoring. Contractor shall make all necessary repairs or perform all reconstruction at his expense and he shall bear all other expenses resulting from such damages.

D. Trench Length, Width, and Depth

Unless specified otherwise, trenches shall be excavated not more than 1,000 feet in advance of pipe laying and open trenches shall be properly barricaded and signed as required for individual and property protection. Trenches shall not be excavated or left open nights, weekends, or holidays.

Unless specified otherwise, all pipeline trenches within pipe zone shall, wherever possible, have vertical sides and minimum widths as specified on the standard drawings, however, trenches shall be sloped or shored as required for worker, individual, and property protection.

Whenever maximum allowable trench width, as shown by the Drawings, is exceeded for any reason, the District may, at its discretion, require Contractor, at his expense, to cradle pipe (Class B Portland cement concrete) or to provide higher class bedding to support pipe as required to limit load on pipe to allowable supporting strength. The District shall approve method of support prior to its use.

Trenches shall be excavated to depths specified by or shown on construction drawings or as otherwise directed by the District. If trench excavation is carried below grade without direction or permission, Contractor shall, at his expense, refill trench to proper grade with moist clean sand, sand and gravel, or other suitable material as approved by the District,

tamped in place to 90 percent relative compaction minimum. Excess excavated material shall be incorporated in backfill or discarded at legal disposal site(s) by Contractor at his expense.

E. Excavated Materials

All material excavated from trench shall be placed for minimum obstruction to traffic (automobile and pedestrian). Gutters shall be kept clear and other provisions shall be made for street or road drainage. Excess excavated material, including material rejected by the District for use as backfill, shall be discarded at legal disposal site(s) by Contractor at his expense.

If pipe, fittings, or appurtenances belonging to the District are uncovered or removed during excavation, they shall be salvaged and deposited as directed by the District. If the District determines that certain materials need not be salvaged, said materials shall be discarded at legal disposal site(s) by Contractor at his expense.

F. Blasting

Blasting for excavation will be permitted only with approval of the District and only after proper precautions have been taken for protection of persons and property, provided Contractor has secured all necessary permits. Blasting shall be limited to specific periods as approved by the District. Any damage caused by blasting shall be repaired by Contractor at his expense. Contractor's blasting methods and procedures shall conform with State and local laws and County and municipal ordinances. Contractor shall post signs warning radio equipment operators that blasting operations are in progress and advising that radio transmissions are prohibited during blasting operations.

**3.03 Trench Bedding**

A. General

Trenches shall have flat bottoms conforming with grades to which pipe is to be laid. Trench bottoms shall be uniform and provide firm and uniform bearing for installed pipeline.

Pipe shall be laid on 4" or 6" bedding sand (see Standard Drawings) so that pipe barrel bears evenly on trench bottom. Bell holes shall be excavated in trench bottom and sides as necessary to permit satisfactory construction and inspection of pipe joints.

B. Unsuitable Soil

Where unstable soil consisting of loose, soft, spongy, or organic earth is encountered, it shall be removed from trench bottom to depth determined in field by the District and trench shall be refilled to proper grade with moist clean sand, sand and gravel, or other suitable material as approved by the District, tamped in place to 90 percent relative compaction minimum. Trench bottom shall be graded flat and prepared to provide firm and uniform bearing for pipe.

Where unyielding soil consisting of rock, rocky earth, or cemented earth is encountered, it shall be removed from trench bottom to at least 9 inches below grade and trench shall be refilled to proper grade with moist clean sand, sand and gravel, or other suitable material as approved by the District, tamped in place to 90 percent relative compaction minimum. Trench bottom shall be graded flat and prepared to provide firm and uniform bearing for pipe.

Unless specified otherwise, Contractor shall, at his expense, remove unsuitable soil, replace it with suitable soil, and discard unsuitable soil at legal disposal site(s). Contractor shall not deposit or store unsuitable soil on private or public property without written permission of property District(s) and without applicable governmental permits pertaining to earthwork, including compaction, and the environment.

### **3.04 Trench Backfill**

#### **A. General**

In addition to meeting backfill requirements specified herein, Contractor shall also comply with backfill requirements established through permits issued by jurisdictions (State, County, City) having control over rights-of-way in which construction is taking place. Whenever the separate requirements conflict with one another, the more stringent shall apply. Backfill shall not commence without prior approval of the District.

Backfill material shall be either select excavated material, screened or washed if necessary, or commercially processed material. Backfill material shall meet separate specific requirements for backfill within pipe zone and backfill above pipe zone. Backfill material meeting pipe zone requirements may be used for above pipe zone backfill material but not the reverse.

After sheeting, shoring, or shields have been removed, all backfill material including pipe zone backfill material shall be compacted to 90 percent relative compaction minimum except that the upper 12 inches of backfill material shall be compacted to 95 percent relative compaction minimum, as verified by field compaction tests. Relative compaction shall be based on maximum dry density determined in accordance with ASTM D-1557, latest. The District will specify where (number & location) compaction tests are to be taken.

Unless specified otherwise, the Developer will have all necessary compaction tests performed by soils engineer of its choosing. Contractor shall notify the Developer and Inspector when any segment of backfill has been compacted and is ready for compaction testing and the Developer will then have such tests performed. The results shall be provided to the Inspector.

Unless determined otherwise, compaction tests will be taken along the pipeline, in the pipe zone, above the pipe zone, and at ground surface or subgrade at 200 foot intervals maximum and along all service runs and fire hydrant runs. Contractor shall furnish all equipment (including shoring), labor, and materials needed for compaction testing. Compaction testing shall be completed and accepted by the District prior to hydrostatic and leakage testing of pipelines and appurtenances.

Within highways, thoroughfares, and streets, Contractor shall, at the end of each work day and by 5:00 PM, unless permitted otherwise, completely backfill trenches with material sufficiently compacted to support traffic. Contractor shall then place 2 inch minimum thickness temporary asphalt concrete pavement over trench; it shall be compacted, rolled smooth with a steel wheeled pavement roller and placed flush with adjacent pavement. Contractor shall maintain and repair backfilled and paved areas to prevent potholes or pavement failures. Highways, thoroughfares, and streets shall be completely open to traffic at night (after 5:00 PM), on weekends, on holidays, and whenever Contractor is not actively working in specific area.

Contractor shall not excavate trenches or install pipe in highways, thoroughfares, and streets on weekends and holidays. Holidays include union holidays, District holidays, and County and municipal holidays. Contractor shall not leave any excavation open overnight or on weekends or holidays.

B. Backfill Within Pipe Zone

Unless specified otherwise, plant manufactured sand with an SE of 30 or greater shall be used in the pipe zone.

Initial backfilling shall be performed as soon as possible after pipe has been laid. Loose, moist backfill material shall be placed in trench simultaneously on each side of pipe to a depth not greater than pipe centerline (springline) or 12 inches (loose measurement), whichever is less, and it shall then be tamped under pipe so that all voids are eliminated and material is compacted to 90 percent relative compaction minimum.

Subsequent backfilling shall be performed immediately following initial backfilling. Loose, moist backfill material shall continue to be placed in trench simultaneously on each side of pipe in lifts not exceeding 12 inches in thickness (loose measurement), with each lift being tamped, until the pipe has been covered by at least 12 inches of well compacted material. Alternatively, backfill material may be densified by water settlement until the pipe has been covered by at least 12 inches of well densified material. Backfilled material shall be tamped or settled to 90 percent relative compaction minimum.

Regardless of compaction or densification technique, care in backfilling shall be exercised to avoid any damage to pipe, fittings, and appurtenances, to avoid any damage to persons or property, and to achieve relative compaction of backfilled material of at least 90 percent minimum.

C. Backfill Above Pipe Zone

Backfill material shall consist of either Class 2 base (within City right-of-way), or moist clean loose earth, sand, gravel, or rock free of clay and silt as well as brush, roots, and organic substances (outside of City right-of-way). From the top of selected backfill in the pipe zone to within 1 foot of ground surface or pavement subgrade, backfill material shall be free of material exceeding 8 inches in greatest dimension. It shall also be compacted to 90 percent relative compaction minimum. Within 1 foot of ground surface or pavement subgrade, backfill material shall be free of material exceeding 2 inches in

greatest dimension and it shall be compacted to 95 percent relative compaction minimum. Rocks shall be mixed with suitable soil to eliminate voids; they shall not be nested. Backfill material shall be well graded.

Backfill material shall be placed in lifts not exceeding 12 inches in thickness (loose measurement) and each lift shall be compacted to 90 percent relative compaction minimum by hand tampers, pneumatic tampers, or mechanical compactors except that the upper 12 inches of backfill shall be compacted with mechanical compactors or compaction equipment, excluding stompers, to 95 percent relative compaction. Alternatively and except for the upper 12 inches of backfill, sandy, granular soils may be densified by water settlement. Trench to be backfilled by water settlement shall be diked at suitable intervals not exceeding 100 feet. Impounded water shall be of sufficient depth so that earth pushed or shoveled into trench will at all times fall into water, becoming completely saturated. If necessary, jetting may augment flooding. Backfill densified by water settlement shall be densified to 90 percent relative compaction minimum. Contractor shall use mechanical compactors or compaction equipment, excluding stompers, to achieve required compaction if required densification is not achieved by water settlement.

### **3.05 Ductile Iron Pipe Installation**

Pipe manufacturer, fitting manufacturer, and material supplier, in addition to the District and the District's representative, shall have access to the Work during installation. Contractor shall use assistance provided by either manufacturer or supplier where required for proper installation of pipe, fittings, or materials; however, Contractor shall limit role of either manufacturer or supplier to advisory service.

All pipe shall be laid true to line and grade and at the locations shown by the construction drawings or as specified. Pipe shall be installed in accordance with applicable provisions of AWWA C600, latest, applicable provisions of Ductile Iron Pipe Research Association "Guide for the Installation of Ductile Iron Pipe", latest, and manufacturer's directions. Bell ends shall be placed uphill unless otherwise permitted.

After pipe has been set in trench, exterior of spigot and interior of bell shall be thoroughly cleaned. Lubricant recommended by pipe manufacturer and as approved by the District shall be applied to rubber gasket. Lubricant shall be water soluble, nontoxic, shall impart no objectionable taste or odor to the water, shall have no deteriorating effects on the rubber gaskets, and shall not support growth of bacteria. Excess lubricant shall be removed. Pipe ends shall be aligned, and spigot shall be pulled into bell with come-along devices, or hoists with chains and slings, unless permitted otherwise. If either the pry bar or the backhoe bucket method is permitted, a timber header shall be placed between the pipe and the pry bar or backhoe bucket before the spigot is pushed into bell.

Curved alignment by use of pulled joints will be permitted. Maximum joint deflection shall be 3 degrees. For purposes of reducing angular deflections at pipe joints, Contractor may install pipe sections of less than standard length.

Whenever cutting of pipe is required, it shall be done with a special cutting tool specifically made for cutting and machining ductile iron pipe. Cut ends and rough edges shall be ground smooth and beveled for push-on joints.

Whenever specified, pipe shall be encased with 8 mil (0.2 mm) thick minimum polyethylene tube lapped 1 foot minimum, and valves and fittings shall be wrapped with polyethylene tube or with polyethylene sheets lapped 1 foot minimum. Polyethylene tube and polyethylene sheets shall be secured in place with suitable adhesive tape. All polyethylene tube and polyethylene sheet encasements shall be installed in accordance with AWWA C105, latest.

As Work progresses, a pipe cleaning tool as approved by the District shall be drawn through pipe to remove dirt, rocks, or other foreign material. At the end of each day's work, all openings in the pipeline shall be plugged with watertight expandable plugs or approved equal.

### **3.06 Welded Steel Pipe**

#### **A. Pipe Installation**

Pipe manufacturer, fitting manufacturer, and material supplier, in addition to the District and the District's representative, shall have access to the Work during installation. Contractor shall use assistance provided by either manufacturer or supplier where required for proper installation of pipe, fittings, or materials; however, Contractor shall limit role of either manufacturer or supplier to advisory service.

Contractor shall not move pipe using dozer blades, backhoe buckets, or the like (sharp metal surfaces). Contractor shall use nylon chokers or straps, not steel slings, in moving, placing, or setting pipe. Nylon chokers or straps shall be placed at third points (one-third length of pipe from each end).

All out-of-round pipe shall be rejected and removed from the Work site immediately. Rejected pipe shall be replaced immediately. Contractor shall not use hammers, bars, wrenches, or other tools to modify pipe ends to accommodate installation.

All pipe ends shall be secured with plastic covers. Said plastic covers shall be left in place until pipe is prepared for installation. If any plastic covers are damaged or destroyed before pipe has been installed, they shall be immediately replaced.

All pipe and fittings shall be laid true to line and grade and at the locations shown by the construction drawings or as specified. Pipe and fittings shall be installed in accordance with applicable sections of AWWA M11, "Steel Pipe Manual". Bell ends shall be placed uphill unless otherwise permitted.

All flanges shall be fully welded to pipe on both faces, one pass minimum on the inside and two passes minimum on the outside. Pipe linings shall extend to mating faces of flanges and pipe coatings shall extend to backs of flanges, tapered as necessary for installation of bolts and nuts. All exposed steel shall be field coated with an approved bitumastic material.

Special care shall be taken to avoid damaging lining or coating during lowering of pipe into trench and making of field joints. Unless specified otherwise, field joints shall be bell and spigot rubber gasket joints, continuity bonded (two evenly spaced bonding clips per joint minimum). Flanged joints, welded joints, and mechanical joints may be required for particular applications.



After pipe has been set in trench, exterior of spigot and interior of bell shall be thoroughly cleaned. Lubricant as recommended by pipe manufacturer and as approved by the District shall be applied to rubber gasket, and said gasket shall then be snapped into place and excess lubricant removed. Lubricant shall be water soluble, nontoxic, shall impart no objectionable taste or odor to water, shall have no deteriorating effects on the rubber gaskets, and shall not support the growth of bacteria.

Before inserting spigots into bells, to make joints, bells shall be hand mortared with quick setting non-shrink commercial grout mixed with an approved bonding agent. Once spigots have been inserted into bells, joints shall be gauged to ensure that gaskets have been properly seated.

For pipe 24 inches and larger, Contractor shall relieve (equalize) gaskets before laying to prevent gaskets from being tight on one side of pipe and slack on the other side, and adversely affecting seal. Contractor shall lift gaskets with a round blunt tool (like the shaft of a screwdriver) and roll it around the circumference of the spigot end at least once and preferably twice.

For pipe less than 24 inches in diameter, sufficient quantities of moist cement mortar shall be placed on interior joining ends of pipe to completely fill space between respective mortar linings. Moist mortar shall be placed only after respective mortar linings have been properly wetted. Moist mortar shall not be placed against dry mortar linings. Excess mortar shall be removed by drawing an approved pipe cleaning tool through the pipe after joints have been made (pipe sections have been joined). For fully welded joints, pipe sections shall be pulled together and restrained with come-along devices, or hoists with chains and slings, and mortar shall be allowed to set for twenty minutes before welding joint. Once joint has been pulled closed and cleaning tool has been drawn through pipe sections, pipe alignment shall not be adjusted, nor shall pipe be bounced or hammered. Come-along devices, or hoists with chains and slings, shall be removed only after joint has been fully welded.

For pipe 24 inches in diameter and larger, cement mortar shall be placed on interior joining ends from inside pipe after it has been set. Moist mortar shall be applied only after mortar linings have been properly wetted. Moist mortar shall not be placed against dry mortar linings. Excess mortar and debris shall be removed by hand or by other means acceptable to and approved by the District.

For cement mortar coated pipe, joint exteriors shall be coated with cement mortar utilizing a joint diaper. Said diaper shall be furnished by pipe manufacturer and shall be centered over joint and securely fastened to pipe. Cement mortar joint mix consisting of one part Portland cement to two parts (by weight) clean, sharp sand, shall contain just enough water to allow mix to be poured into diaper and flow around circumference of joint. Said mix shall be allowed to set prior to backfilling around joint.

Joints shall be completed to provide continuous interior lining and exterior coating. Field lining and coating must equal or exceed shop lining and coating when completed with respect to strength, uniformity, and density and there shall be no voids between lining or coating and steel cylinder.

If cement mortar lining has to be removed, Contractor shall scribe, chisel, and remove the lining using appropriate tools. If cement mortar coating has to be removed, Contractor shall first scribe, then saw cut said coating 3/4 of its thickness, and then remove coating using a chisel driven by a hammer, chipping gun, or other suitable tool. Impact shall be applied parallel with pipe barrel, not perpendicular thereto.

At the end of each day's work, all openings in the pipeline shall be plugged with watertight, expandable plugs or approved equal. Said plugs shall be secured in place so that they cannot be removed by children or animals.

**B. Field Welding**

Whenever field welding is required, Contractor shall attach welding machine ground to pipe only with clamps or other means acceptable to the District unless an alternative means is specified.

Unless specified otherwise, field welded or thrust restrained joints shall consist of flanged joints or fully welded joints. All flanges shall be fully welded to pipe on both faces, one pass minimum on the inside and two passes minimum on the outside. Welded joints shall be made with pipe having ends belled for welding, or alternatively, ends belled for rubber gasket joints, provided pipe manufacturer furnished filler rods of proper diameter, length, and curvature are installed in accordance with pipe manufacturer's recommendations, as approved by District. Belled ends shall not be deformed to accomplish fully welded joints. Full welds for all joints shall be accomplished with two welding passes (beads) minimum.

**C. Field Cement Mortar Lining and Cement Mortar Coating**

Whenever field cement mortar lining and cement mortar coating is permitted by the District for either repair or fabrication, Contractor shall comply with the following procedures:

**1. Cement Mortar Lining**

- a. Contractor shall square the edge of the remaining lining, leaving no feather edge, and shall clean metal surfaces with a stiff wire brush.
- b. Contractor shall apply approved bonding agent to both steel area and edges of adjacent lining. Cement mortar shall then be applied to the area being patched and worked and finished with a trowel until smooth. Contractor shall brush on approved curing compound over the surface of the patch to prevent rapid evaporation of moisture. Otherwise, Contractor shall keep the patched mortar moist by covering it with wet burlap. The pipe shall not be moved until the cement mortar achieves its initial set, not less than three hours.
- c. Cement mortar shall consist of not less than one part cement to three parts sand, thoroughly mixed before any water addition. Cement mortar may be approved commercial, packaged dry mortar mix. Cement mortar shall be mixed separately for each area to be patched. Quantity of water

shall be just sufficient so that when mortar is firmly compressed into a ball, it will hold its shape without slump.

2. Cement Mortar Coating

a. Exterior coating which requires removal around the complete circumference of the pipe shall be repaired by:

1. Removing the coating by chipping with a hammer or chisel, squaring the edges to accept repair patch.
2. Wrapping the area with 2 x 4 x 14 GA self-furring wire mesh or an approved stucco netting and guniting the area being patched.

or

Wrapping the mesh as above and hand troweling mortar onto the area being patched.

3. Applying an approved curing compound to the patched area.
4. Avoiding movement and protecting the pipe until the cement mortar achieves its initial set, not less than three hours.

b. Exterior coating that does not extend around the entire circumference of the pipe shall be repaired by:

1. Removing the coating by chipping with a hammer and chisel, squaring the edges to accept repair patch.
2. Applying by brush an approved bonding agent to both the steel area and the edges of the remaining coating.
3. Applying cement mortar to the area being patched and thoroughly compacting it, with finished patch mounding up above and overlapping (at least 1 inch on all sides) the surrounding coating.
4. Applying an approved curing compound to the patched area. If the repair patch is made on pipe in the ditch, it shall be covered with wet burlap, heavy cloth, or similar material, and dirt shall be placed around and over the patched area by hand before proceeding with placing backfill material.

c. The cement mortar mix proportions shall be the same as for lining repair.

d. If the area to be patched exceeds over half of the pipe circumference, 2 x 4 x 14 GA self-furring wire mesh or an approved stucco netting shall be attached to the pipe prior to the application of the cement mortar.

3. Installation of Repaired Pipe

After the repaired area has achieved initial set, not less than six hours, the pipe section can be installed, providing the patched area of the coating is backfilled with water saturated or wetted soil.

**3.07 Services**

A. Service Taps

Service taps shall be on line with meter boxes which shall be perpendicular to mains. Service and other taps shall be made not closer than 12 inches to a bell, coupling, joint, fitting, or other service. Service taps will be permitted only where complete services are to be installed. Under no circumstances will Contractor be allowed to tap existing mains which are in service. Contractor shall tap existing mains only when said mains are out of service and only when specifically permitted by the District.

1. Ductile Iron Pipe Mains

Service outlets on mains shall be accomplished with double strap bronze service saddles with iron pipe threads.

2. Welded Steel Pipe Mains

Service taps shall be made with couplings welded to the pipe, either during pipe fabrication or field construction, as shown by the standard drawings. Tapping shall be accomplished with a shell cutter. Care shall be exercised to minimize damage to linings and coatings. Damaged linings and coatings shall be repaired or replaced.

3. Testing and Disinfection

Service taps used for testing and disinfection shall comply with service tap requirements for ductile iron or welded steel pipe, whichever is applicable. Unless specified otherwise, they shall be made at top of pipe. Once testing and disinfection have been completed, they shall be plugged. Plug threads shall be wrapped with Teflon tape and plugged tap shall then be coated with approved bitumastic material.

B. Services Extensions

In addition to a service tap, each service shall include a corporation stop, service pipe, a meter stop, a meter box, and all other materials specified by the standard drawings. Unless specified otherwise, service piping shall be continuous from corporation stop to meter stop; it shall not be spliced.

C. Meter Boxes

Meter boxes shall be equal to and interchangeable with those shown on the standard drawings and shall be installed as shown on the standard drawings. They shall be set true to line and grade and shall be flush with concrete curbs and sidewalks.

Meter boxes shall be installed whenever services are installed, even prior to construction of street improvements including concrete curbs and sidewalks. Meter boxes shall be brought to grade upon construction of concrete curbs and sidewalks.

D. Meter Installation

Except as otherwise indicated on the construction drawings or as specified by the District, all meters shall be installed by the District following application for service in accordance with the District's regulations governing water service and any amendments thereto.

**3.08 Field Hydrostatic Test and Leakage Test**

A. Hydrostatic Test

Upon completion of pipeline construction and at least seven days after last concrete thrust device has been placed, pipelines and appurtenances constituting the Work shall be filled with water for twenty-four hours minimum. During filling, Contractor shall see that all air valves are open and operating. After pipelines have been completely filled, they shall be allowed to stand for twelve hours minimum under slight pressure for sufficient time to permit all air to escape. During that same period, Contractor shall examine all fittings, flanges, handholes, and connections for leaks. If any leaks are found, they shall be eliminated.

Test pressures shall be 200 psi and maintained for four hours minimum. Test sections will be selected which give, as nearly as possible, constant pressure throughout section being tested. Normally test pressures will be measured at lowest elevations.

B. Leakage Test

After pressure test has been satisfactorily completed, pipelines and appurtenances shall be tested for leakage at pressure equal to the pressure class of pipe. Contractor shall test pipelines and appurtenances in test sections as designated by the District and required pressures shall be maintained for two hours minimum during which time leakage shall be accurately measured.

Measured leakage shall not exceed the limits set by the following formula unless otherwise specified by the construction drawings.

$$L = \frac{ND(P)^{1/2}}{5000}$$

L is the allowable leakage in gallons per hour for section of pipeline being tested; N is the number of joints (rubber gasket, flanged, or mechanical joints, not swedged or banded lap welded joints) where leakage could occur in the section of pipeline being tested; D is the

nominal diameter (inches) of the pipeline being tested; and P is the weighted average test pressure (psi gauge) within the section of pipeline being tested during the leakage test.

C. General Requirements

1. Required test pressures shall be applied by pump connected to pipeline sections being tested. The District shall approve pump connections to pipeline before testing begins. As part of the Work, and unless specified otherwise, Contractor shall install, at his expense, top outlets (service taps) required for testing.

Contractor shall provide calibrated meters for measurement of leakage, and all pumps, piping, fittings, bulkheads, plugs, valves, gages, power equipment, and manpower necessary for conducting all tests required, all at his expense. Contractor shall furnish the District three copies of all records of all tests performed.

2. Unless specified otherwise, Contractor shall test against test plates for pipelines 12 inches and smaller. Contractor shall not remove said test plates until pipelines have been tested, disinfected, and accepted by the District.
3. Contractor, at his expense, shall locate and repair leaks or other defects which may develop or become apparent during test. Contractor shall excavate, including removal of backfill already placed, and make all repairs necessary for required water tightness, and then replace all excavated material, after which Contractor shall retest repaired pipeline section. Pipeline sections shall be repeatedly repaired and tested until they meet requirements set forth herein.
4. Pipe manufacturer and fitting manufacturer shall have free access to the Work during testing. Any improper act on the part of Contractor which the pipe and fitting manufacturer may observe shall be reported to the District. Pipe and fitting manufacturer shall be free to observe and verify all tests.
5. After completed pipeline and appurtenances or test sections have successfully met test requirements to the satisfaction of the District, the entire pipeline or each test section shall be filled or shall remain filled with water until completion of the Work, unless otherwise ordered by the District.

### **3.09 Conductor Casings and Carrier Pipes**

Wherever required, conductor casings shall be installed. Said casings shall be comprised of either welded steel pipe or reinforced concrete pipe, as specified. Conductor casings shall be bored and jacked into place unless open trench installations are permitted; conductor casings shall not be sluiced or jetted into place. Conductor casings shall be bored and jacked into place from one direction only.

Conductor casings shall be installed to the lines, grades, and depths specified. Unless specified otherwise, Contractor will be permitted a tolerance from horizontal alignment and from vertical alignment of 0.5 percent of conductor length but no more than 1 foot maximum regardless of conductor length.

Unless specified otherwise, methods and equipment used shall be as selected by Contractor and as approved by the District. Said approval shall not relieve Contractor of any responsibility with regard to conductor casing construction. Conductor casings shall have minimum inside diameters at least 12 inches larger than maximum outside diameters of carrier pipes.

Prior to any boring and jacking operations, Contractor shall submit to the District a construction plan consisting of a schedule of operations, details of methods of construction, types of equipment to be used, details of boring and jacking pit including lengths, widths and depths, and shoring and bracing. Said construction plan shall be approved as to sufficiency by the District before any construction is commenced.

Boring and receiving pits shall be shored in accordance with OSHA standards. A 6 foot high chain link fence shall be erected around said pits and said pits shall be protected with Type K barriers. Barriers shall be placed to direct traffic around the pits.

Prior to constructing pits, Contractor shall excavate both sides of each crossing to determine exact locations of facilities to be crossed (horizontal and vertical). Contractor shall adjust casing locations to accommodate crossings based on Contractor's field measurements.

Contractor shall schedule his operation to prevent pits from being open on weekends or holidays. Contractor shall provide traffic control around the pits in accordance with Contractor's approved traffic control drawings.

Contractor shall take all necessary precautions to prevent subsidence of or lifting of existing roadbeds, roadways, and pavements during or following installation of conductor casings. Material excavated during boring and jacking operations shall be removed carefully so as to avoid caving. Voids created during boring and jacking shall be grouted with an approved grout from within the casing once the casing has been installed. Couplings shall be welded to steel casing to permit grouting. Following grouting, threaded plugs shall be inserted into said couplings.

After conductor casing has been constructed, carrier pipe shall be equipped with approved plastic or steel casing insulators of uniform size and spacing and then installed in conductor casing in accordance with aforementioned construction plan as approved by the District. Annulus between conductor casing and carrier pipe shall be filled with sand and the ends shall be capped with plastic or steel end seals or plugged with brick and mortar. Weepholes shall be placed in the bottoms of the end seals or brick and mortar plugs.

Contractor shall backfill boring and jacking pits with material specified for pipeline backfill. Said backfill material shall be compacted to the relative compaction specified which shall be not less than 90%. Contractor shall remove conductor casing and carrier pipe remnants, shoring materials, asphalt, concrete and all other Work related debris. Contractor shall restore paved surfaces.

### 3.10 Miscellaneous Requirements

#### A. Connections to Existing Watermains

The District will make all connections to existing watermains except where otherwise specified. Where a gate valve is required but not specified, the District will install gate valve but will not guarantee it against field hydrostatic and leakage test.

To safeguard against failure of the District's valve, Contractor shall install a test plate for the aforementioned test and, after satisfactory test, remove said test plate and replace it with a 1/8 inch thick minimum ring gasket. The use of any other test appurtenances shall be as approved by the District.

#### B. Field Painting

Contractor shall field paint all aboveground, bare, or exposed piping and appurtenances in accordance with the applicable specifications and drawings.

**END OF SECTION VII-1**



## **SECTION VII-2 DISINFECTION OF PIPING**

### **PART 1 – GENERAL**

#### **1.01 Description**

This section describes requirements for disinfection by chlorination of potable and recycled water mains, services, pipe appurtenances and connections.

#### **1.02 Referenced Standards**

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

American Water Works Association (AWWA)  
B300 Standard for Hypochlorites  
B301 Standard for Liquid Chlorine  
C651 Disinfecting Water Mains

#### **1.03 Service Application**

- A. All water mains and appurtenances taken out of service for inspection, repairs, or other activity that might lead to contamination shall be disinfected before they are returned to service.
- B. All new water mains and temporary high lines shall be disinfected prior to connection to the District's existing system.
- C. All components incorporated into a connection to the District's existing system shall be disinfected prior to installation.

#### **1.04 Submittals**

All submittals shall be in accordance with the General Provisions, Section 01300.

- A. A written disinfection and dechlorination plan signed by a certified chlorinator shall be submitted to the Engineer for review and approval prior to starting disinfection or dechlorination operations. Plan for disinfection method and procedure shall include equipment used to inject the chlorine solution, gauges or scales to measure the rate at which chlorine is injected, qualifications of personnel, testing location and schedule, source of water and water disposal locations. Personnel performing the disinfection shall demonstrate a minimum of five years experience in the chlorination and dechlorination of pipelines.
- B. Qualification of certified testing laboratory.

- C. Four copies of bacteriological test results to the Engineer upon completion of each test.
- D. Emergency Response Plan.

### **1.05 Delivery, Storage and Handling**

Chlorination and dechlorination shall be performed by competent individuals knowledgeable and experienced in the operation of the necessary application and safety equipment in accordance with applicable Federal, State and Local laws and regulations. The transport, storage and handling of these materials shall be performed in accordance with Code of Federal Regulations (CFR) 1910.120 Hazardous Waste Operations and Emergency Response, CFR 49.172 Hazardous Materials Regulations, and the General Industry Safety Orders of the California Code of Regulations, Title 8, Section 5194.

### **1.06 Concurrent Disinfection and Hydrostatic Testing**

The specified disinfection of the pipelines may be performed concurrently with the hydrostatic testing. In the event repairs are necessary, as indicated by the hydrostatic test, additional disinfection may be required by the Engineer in accordance with this specification.

### **1.07 Connection to Existing Mains**

Prior to connection to existing mains, disinfection and bacteriological testing shall be performed in accordance with this specification, and hydrostatic testing shall be performed per Section VII-1. District shall make all connections to an existing system and shall be done only after receipt of acceptable hydrostatic, disinfection and bacteriological test results.

## **PART 2 – MATERIALS**

### **2.01 Chlorine (Gas)**

- A. Liquid chlorine contains 100-percent available chlorine and is packaged in steel containers in net weights of 68.1kg (150 lb.) or 907.2kg (1 ton).
- B. Liquid chlorine shall be used with appropriate gas flow chlorinators, heaters, and injectors to provide a controlled, high-concentration solution feed to the water. The chlorinators and injectors shall be the vacuum-operated type.

### **2.02 Sodium Hypochlorite (Liquid)**

Sodium hypochlorite is available in liquid form in glass or plastic containers, ranging in size from 0.95 L (1 Qt.) to 18.93 L (5 Gal.). The solution contains approximately 10% to 15% available chlorine.

### **2.03 Tablet or Granular Hypochlorite**

Tablet or granular hypochlorite may be used if a solution container is utilized to provide a continuous feed method.

## **PART 3 – EXECUTION**

### **3.01 General**

- A. Disinfection of pipelines shall not proceed until all appurtenances and any necessary sample ports have been installed and the Engineer provides authorization.
- B. Every effort shall be made to keep the water main and its appurtenances clean and dry during the installation process.
- C. All piping, valves, fittings, and appurtenances which become contaminated during installation shall be cleaned, rinsed with potable water, and then sprayed or swabbed with a 5 percent sodium hypochlorite disinfecting solution prior to installation.
- D. Water mains under construction that become flooded by storm water, runoff, or groundwater shall be cleaned by draining and flushing with metered potable water until clear water is evident. Upon completion, the entire main shall be disinfected using a method approved by the Engineer.

### **3.02 Methods**

#### **A. Chlorine (Gas)**

- 1. Only vacuum-operated equipment shall be used. Direct-feed chlorinators, which operate solely from gas pressure in the chlorine cylinder, shall not be permitted. The equipment shall incorporate a backflow prevention device at the point of connection to the potable water source used to fill the line being tested.
- 2. The chlorinating agent shall be applied at the beginning of the system to be chlorinated and shall be injected through a corporation stop, a hydrant, or other approved connection to ensure treatment of the entire system being disinfected.
- 3. Only a certified, licensed chlorination and testing contractor shall perform gas chlorination work. The chlorination contractor must also possess a Grade II Treatment Plant Operator Certification from the State of California.

#### **B. Sodium Hypochlorite Solution (Liquid)**

- 1. Sodium hypochlorite solution shall be used for cleaning and swabbing piping and appurtenances immediately prior to installation and for disinfecting all components of connections to the District's existing system.
- 2. Sodium hypochlorite solution may be used for the initial disinfection of newly installed water mains. The solution shall be applied at a terminus of the system to be chlorinated using an injector which can adjust the amount of solution being injected into the piping system. The solution shall be injected in the appropriate concentration to achieve the specified concentration range of chlorine throughout the entire piping system. Where pumping equipment is used in conjunction with an injector, an integral backflow prevention device shall be used and connected to the potable water supply.

3. Water trucks, pumping equipment, piping, appurtenances and all other equipment in contact with potable water shall be disinfected prior to use.
4. Sodium hypochlorite solution may also be used to increase the total chlorine residual if the concentration from the initial chlorination of the system is found to be low. The solution shall be added to the system in sufficient amounts at appropriate locations to ensure that the disinfecting solution is present at a concentration within the specified range throughout the piping system.

### **3.03 Procedure for Disinfecting Water Mains and Appurtenances**

- A. The pipeline shall be filled at a rate not to exceed 1,135 liters per minute (300 GPM) or a velocity of 0.3m per second (1 foot per second), whichever is less.
- B. Disinfection shall result in a total chlorine concentration of not less than 50-mg/l nor more than 100 mg/l. This concentration shall be evenly distributed throughout the system to be disinfected, using a continuous feed method of chlorination.
- C. All valves shall be operated with the disinfection solution present in the pipeline. All appurtenances such as air-vacuum relief valves, blowoffs, hydrants, backflow prevention devices, and water service laterals shall be flushed with the treated water a sufficient length of time to ensure a chlorine concentration within the specified range in all components of each appurtenance. (Note the limitations for discharge of chlorinated water outlined below.)
- D. The Engineer will verify the presence of the disinfection solution throughout the system by sampling and testing for acceptable chlorine concentrations at the various appurtenances and/or at the test ports provided by the Contractor. Areas of the system found to be below the specified chlorine concentration level shall receive additional flushing as noted above and/or additional disinfection solution as necessary. (Note the limitations for discharge of chlorinated water outlined below.) Addition of disinfection solution after the initial charging of the line shall be made by either the liquid chlorine (gas) method, or the sodium hypochlorite method as directed by the Engineer.
- E. The chlorinated water shall be retained in the system for a minimum of 24 hours. The District Engineer will test the total chlorine residual. The system shall contain a total chlorine residual of not less than 80% of the initial total chlorine residual before the 24-hour soaking period began. If the total chlorine residual has decreased more than 20%, the system shall be soaked for an additional 24-hour period. If the total chlorine residual has not decreased after this additional 24-hour period, the system shall be flushed in accordance with the procedure detailed herein. If the total chlorine residual has decreased, the system shall be flushed in accordance with the procedure detailed herein, and shall be re-disinfected.
- F. Following a successful retention period as determined by the District Engineer, the chlorinated water shall be flushed from the system at its extremities and at each appurtenance, using potable water from a source designated by the District Engineer. The minimum water velocity during flushing shall be 0.9 meters per second (3 feet per second) or as directed by the Engineer. Flushing shall continue until the replacement water in the new system is equal in chlorine residual to the potable source of supply as verified by the District. (Note the limitations for discharge of chlorinated water outlined below.)

- G. The Contractor shall contract with a State certified sampling laboratory to perform sampling, transport samples and perform bacteriological sampling and testing as specified herein.

### 3.04 Discharge of Chlorinated Water

- A. Indiscriminate onsite disposal or discharge to sewer systems, storm drains, drainage courses or surface waters of chlorinated water is prohibited.
- B. All discharge of chlorinated water shall require the neutralizing of the chlorine residual by means of a reducing agent in accord with AWWA C651 and the requirements of this specification.
- C. The reducing agent shall be applied to the water as it exits the piping system. The Contractor shall monitor the chlorine residual during the discharge operations. Total residual chlorine limits in these locations, and for the discharge of chlorinated water from the testing of pipelines to surface waters of the San Diego Region are as follows:

#### Total Residual Chlorine Effluent Limitations

30-Day Average	-	0.002 mg/l
Average Daily Maximum	-	0.008 mg/l
Instantaneous Maximum	-	0.02 mg/l

The various methods of dechlorination available can remove residual chlorine to concentrations below standard analytical methods of detection, 0.02 mg/l, which will assure compliance with the effluent limit. The Contractor will perform all necessary tests and keep records to ensure that the total residual chlorine effluent limitations listed above are met.

- D. In locations where no hazard to the environment is evident based on the joint examination described above, the chlorinated water may be broadcast for dust control on the surface of the immediate site. Care shall be exercised in broadcasting the water to prevent runoff.

### 3.05 Bacteriological Testing

The Contractor shall employ a State certified laboratory to perform bacteriological sampling and testing of all new system installations. The testing methodology employed by the District shall be as set forth in "Standard Methods for the Examination of Water and Waste Water" (current edition). Testing requirements are as set forth in the California Domestic Water Quality and Monitoring Regulations and commensurate with current requirements for surface water testing. The testing laboratory will analyze the samples for the presence of coliform bacteria and heterotrophic-type bacteria (heterotrophic plate count). The evaluation criteria employed by the District for a passing test sample is as follows:

- A. Coliform bacteria: no positive sample, and
- B. Heterotrophic plate count (HPC): 500 colony forming units/ml or less.

### **3.06 Redisinfection**

If the initial disinfection fails to produce satisfactory bacteriological test results, the pipeline system shall be re-flushed and re-sampled. If the second set of samples does not produce satisfactory results, the pipeline system shall be re-chlorinated, flushed, and re-stamped. The chlorination, flushing, and sampling procedure shall continue until satisfactory results are obtained. Re-disinfection and retesting shall be at the Contractor's expense.

### **3.07 Disinfecting Tie-Ins and Connections**

Pipes, fittings, valves and all other components incorporated into connections with the District's existing system shall be spray disinfected or swabbed with a liquid chlorine solution in accordance with AWWA C651 and as specified herein. Upon connection to the main, the line shall be flushed as directed by the District Engineer. Disinfection by this method is generally limited to assemblies of 20' or less in length. Alternate methods such as "pre-disinfection" prior to installation in accordance with AWWA C651 may be required at the discretion of the District Engineer.

**END OF SECTION VII-2**

## SECTION VII-3 GATE VALVES

### PART 1 – GENERAL

#### 1.01 Description

A. General

This section specifies gate valves.

B. Type

Valves shall be of the iron-body, bronze-mounted, resilient-seated solid-wedge or dual disc type.

#### 1.02 References

This section references the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of listed documents, the requirements of this section shall prevail.

ANSI B16	Cast Iron Pipe Flanges and Flanged Fittings
ASTM A126	Gray Iron Castings for Valves, Flanges and Pipe Fittings
AWWA C509	Resilient-Seated Gate Valves for Water and Sewage Systems
AWWA C515	Resilient-Wedge, epoxy coated, Flanged ends

#### 1.03 Quality Assurance

Gate valves 3 inches and larger in size up to and including 12-inches shall be resilient-seated and shall comply with AWWA C500 and AWWA C509, including applicable hydrostatic testing. Gate valves smaller than 3 inches shall be dual disc or solid wedge and shall comply with Fed. Spec. WW-V-54 Class A. Gate valves over 12-inches are not acceptable.

#### 1.04 Submittals

Products data sheets shall be submitted to the District prior to construction.

## PART 2 – PRODUCTS

### 2.01 Materials

Materials of construction shall be as follows:

<u>Components</u>	<u>Material</u>
Body	Ductile Iron
Wedge: 4 inches and smaller 4 inches thru 12-inch	Bronze Cast iron, ASTM A126, Class B
Mounting	Bronze
Stem	Bronze, AWWA C500, Section 3.12
Seat rings	Bronze, Grade A, AWWA C500, Section 3.8

### 2.02 Construction

#### A. General

Exposed gate valves shall be rising stem type. Buried or submerged gate valves shall be of the nonrising stem type. Rising stem valves shall be provided with a stem collar stuffing box and packing gland with teflon braid packing. Nonrising stem valves shall be provided with O-ring stem seals. The body shall be provided with screwed-on seat rings.

#### B. End Connections

Gate valves in buried pipelines 4-inches and larger shall be flanged. Gate valve end connections in exposed pipelines shall be flanged or threaded as specified. Threaded ends shall not be provided on gate valves with end connections larger than 4 inches. End flanges shall be integral with the gate valve body and be faced and drilled in accordance with ANSI B16.1.

#### C. Manual Operators

Unless specified otherwise, valves less than 6-inch size shall be provided with handwheels, and valves 6- inches and larger shall be provided with geared operators.



### 2.03 Manufacturers

Products of the type and size indicated below shall be as manufactured by the indicated company or an approved equal:

A. Gate Valves (4-inch thru 12-inch)

Mueller Company  
AVK

B. Gate Valves (smaller than 4-inch)

Hammond  
Stockham  
Jones

### PART 3 – EXECUTION

#### 3.01 Installation

Gate valves shall be installed in accordance with the manufacturers' recommendations, and in the closed position.

**END OF SECTION VII-3**

**SECTION VII-4  
BUTTERFLY VALVES**

**PART 1 – GENERAL**

**1.01 Description**

A. General

This section specifies butterfly valves for flow shutoff and flow throttling service.

B. Type

Valves shall be rubber seated and stub or through shaft type, with flanged or mechanical pipe couplings.

**1.02 Quality Assurance**

Valves shall be provided at the locations and shall be of the sizes shown on the Plans. The valves shall be designed for the operating and testing pressure of the associated pipeline as specified. Buried valves shall be provided with AWWA operating nut.

**1.03 References**

This section references the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

ASTM A276	Specification for Stainless and Resisting Steel Bars and Shapes
AWWA C504	Standard for Rubber-Seated Butterfly Valves

**1.04 Submittals**

Product data sheets shall be submitted to the District prior to construction.

**PART 2 – PRODUCTS**

**2.01 Materials**

Unless otherwise specified, materials for components shall be as follows:

<u>Component</u>	<u>Material</u>
Shafts	ASTM Type 304 or 316 stainless steel
Discs	Ductile iron or alloy cast iron
Disc seating edge	ASTM A276, Type 304

<u>Component</u>	<u>Material</u>
Seats	Synthetic rubber
Bodies	Ductile iron
Bearings	Reinforced TFE or Nylon
Thrust bearings	ASTM A276, Type 304
Pins and interior threaded parts	ASTM A276, Type 304

## 2.02 Design

- A. Valves shall be the short-body type, designed in accordance with AWWA C504. Valves and valve components shall, as a minimum, conform to Class 150B.
- B. Valve ends shall be flanged. Valve shafts shall be turned, ground, and polished. Valves shall have factory-set thrust bearings.
- C. Seats shall be retained in the valve body by mechanical means without retaining rings, screws, segments or hardware of any kind in the flow stream. Seats shall be a full 360-degree without interruption and have a plurality of grooves mating with the spherical edge of the disc. The seats shall be designed to permit angular misposition of the disc by as much as one degree off center without leaking.

## 2.03 Operators

Valve operator shall be level and traveling nut or worm gear type. Unless otherwise shown or specified, the operator shall be provided with manual actuation mechanism. Buried valve operators shall be designed for submerged service and shall have no external moving parts except the operator input shaft, which shall be Type 316 stainless steel and enclosed in a valve box extension tube.

## 2.04 Manufacturers

Butterfly valves shall be as manufactured by Henry Pratt Company, Mueller, or approved equal.

## PART 3 – EXECUTION

### 3.01 Installation

- A. Exposed butterfly valves shall be installed to permit removal of the valve assembly without dismantling the valve or operator.
- B. Installation shall be in accordance with the manufacturer's printed instructions.

**END OF SECTION VII-4**

## **SECTION VII-5 FIRE HYDRANTS**

### **PART 1 – GENERAL**

#### **1.01 Summary**

Section Includes: Barrel type fire hydrants.

#### **1.02 References**

American Water Works Association (AWWA):  
C 503 – Wet Barrel Fire Hydrants.

#### **1.03 Submittals**

Product data sheets shall be submitted to the District prior to construction.

### **PART 2 – PRODUCTS**

#### **2.01 Materials**

Fire hydrants shall be of the break-off traffic type and shall conform to AWWA C502 with six inch (6") flanged inlet and five-and-a-quarter (5-1/4") inch valve opening. Nozzle threads shall be American National Standard. Operating nut shall be one-and-a-half (1-1/2") inch National Standard pentagon. The main valve shall be equipped with O-ring seals and shall open when turned left or counter-clockwise. Fire hydrants shall be painted safety yellow, as determined by the Engineer and shall be equipped with two (2) two-and-a-half (2-1/2") inch hose nozzles and one (1) four (4") inch pumper nozzle. Wet barrel hydrants may be required where specified. A blue traffic reflector shall be installed with two-part epoxy adhesive. See Standard Drawing No. W-18.

#### **2.02 Manufacturers**

Manufacturers: The following or equal:  
Clow, Model F-860.

### **PART 3 – EXECUTION**

#### **3.01 Installation**

Install hydrants in accordance with District Standards.

**END OF SECTION VII-5**

**SECTION VII-6  
AIR RELEASE AND VACUUM VALVES**

**PART 1 – GENERAL**

**1.01 Description**

The work of this section includes providing combination air release and vacuum valves as indicated, complete and operable, including accessories and drain connections in accordance with the Plans and the District Standard Drawings.

**1.02 Quality Assurance**

Valves shall be provided at the locations and shall be of the sizes shown. The valves shall be designed for the operating and testing pressure of the associated pipeline as specified.

**1.03 References**

This section references the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

ASTM A536            Standard Specifications for Ductile Iron Castings

AWWA C512           Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service

**1.04 Submittals**

Product data sheets shall be submitted to the District prior to construction.

**PART 2 – PRODUCTS**

**2.01 General**

- A. Air and Vacuum relief valves shall be hydrotested in conjunction with the connecting pipelines.
- B. Combination air/vacuum assemblies shall be furnished and installed by the Contractor at the locations shown on the Plans, or as required by the District.
- C. The tap of an air and vacuum valve assembly on buried pipelines shall be no closer than 18-inches to the valve, coupling, joint or fitting.

**2.02 Air and Vacuum Valves**

- A. Air and vacuum valves shall be capable of venting sufficient quantities of air as determined by the manufacturer's approved sizing methods, while pipelines are being filled and allowing air to re-enter while pipelines are being drained.

- B. Air and vacuum valves shall be of the size indicated, with flanged or screwed ends to match the piping
- C. Bodies shall be of high-strength cast iron or ductile iron.
- D. The float, seat, and all moving parts shall be constructed of Type 316 stainless steel.
- E. Seat washers and gaskets shall be of material insuring water tightness with a minimum of maintenance.
- F. Valves shall be designed for minimum 250 psi working pressure, unless otherwise indicated.

### **2.03 Combination Air Valves**

- A. Combination air valves shall combine the characteristics of air and vacuum valves and air release valves by exhausting accumulated air in systems under pressure and releasing or re-admitting sufficient quantities of air, as determined by the manufacturer's approved sizing methods, while system is being filled or drained, respectively.
- B. Combination air valves shall have the same general requirements as specified for air and vacuum valves.

### **2.04 Manufacturers**

Air release and vacuum valves shall be manufactured by Crispin, or approved equal.

## **PART 3 – EXECUTION**

### **3.01 Installation**

- A. All valves shall be installed in accordance with the District Standard Drawings and the manufacturer's printed recommendations.
- B. Air release and vacuum valves shall be installed at high points in piping systems and where indicated.
- C. Combination air/vacuum assemblies shall connect to underground pipes no closer than 18-inches from a bell, coupling, joint or fitting.
- D. Air/vacuum assemblies and valve box assemblies shall be field painted according to District Standards.

**END OF SECTION VII-6**