



STANDARD SPECIFICATIONS

**Vista Irrigation District
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VISTA IRRIGATION DISTRICT

STANDARD SPECIFICATIONS

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**SECTION 01000 – PROCURING WATER AND RECLAIMED WATER
FROM THE VISTA IRRIGATION DISTRICT**

PART 1 – GENERAL

1.1 AVAILABILITY OF PROJECT DESIGN GUIDELINES

A. The Project Design Guidelines packet is available at the Engineering Department or on our website at <https://www.vidwater.org/engineering-information>

- Site Plan Review by District
- Water System Design Standards
- District Project Requirements

Part 1 – General Information

Part 2 – Guide to the Statement of Cost, Planning, Construction, and Acceptance for Construction of a Water System for the Project

- I. Information
- II. Planning Requirements
- III. Construction Requirements
- IV. Requirements for Acceptance of Water System (either by District forces or by Owner/Developer)

Part 3 – Detailed Improvement Plan Requirements

- Construction Contract (sample)
- Fire Flow Information Request (sample)

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**SECTION 01010 - RULES AND REGULATIONS FOR THE USE
OF RECLAIMED WATER WITHIN THE
VISTA IRRIGATION DISTRICT**

PART 1 - GENERAL

1.1 AVAILABILITY OF RULES AND REGULATIONS

- A. The *Rules and Regulations for the Use of Reclaimed Water Within the Vista Irrigation District* are available at the District office for reproduction cost.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION (Not used)

END OF SECTION

SECTION 01020 - GENERAL REQUIREMENTS

PART 1 - DEFINITIONS AND TERMS

1.1 The Standard Specifications and Standard Drawings adopted by the Board of Directors of the VISTA IRRIGATION DISTRICT apply to the construction and installation of facilities which, upon Board acceptance, will be incorporated into the DISTRICT's system. Unless otherwise modified or supplemented by plans, specifications or other contract documents, including the agreement and general and special conditions approved by the Board, the Standard Specifications and Standard Drawings shall be observed.

A. Facilities and replacements are acquired by the DISTRICT by three means:

1. WORK Contracted by DISTRICT: Where the DISTRICT selects and employs a contractor to perform the required work and pays the cost thereof.
2. WORK Contracted by Others: Where the OWNER or DEVELOPER of property selects and employs a CONTRACTOR to perform the required WORK and pays the cost thereof, with or without any later DISTRICT participation in said cost.
3. WORK Performed by DISTRICT Forces: Where DISTRICT employees perform the required WORK with or without the DISTRICT receiving reimbursement therefor.

If requirements vary depending upon the means of acquisitions, the Standard Specifications or Contract Documents will so indicate.

1.2 Wherever used in these General Requirements or in other Contract Documents or Standard Specifications, the intent and meaning of the following terms shall be interpreted as follows:

A. DISTRICT

The word DISTRICT shall mean the Vista Irrigation District, a public agency.

B. Board of Directors

The words Board of Directors or Board shall mean the Board of Directors of the Vista Irrigation District.

C. DISTRICT ENGINEER

The word DISTRICT ENGINEER or ENGINEER, wherever not qualified, shall mean the General Manager of the Vista Irrigation District acting either directly or through the General Manager's properly authorized agents, such agents acting severally within the scope of the particular duties entrusted to them.

D. Private ENGINEER or Project ENGINEER

The words Private ENGINEER or Project ENGINEER shall mean an engineer registered or licensed in California who is qualified to act as an agent of the owner or an individual in preparing plans for facilities to be accepted by the DISTRICT and incorporated into the DISTRICT system thereafter. The term includes persons registered or licensed in the State of California as Civil Engineers or Structural Engineers.

E. CONTRACTOR

For the purposes of this Specification, and where applicable, the word CONTRACTOR shall be meant to include any person, firm, corporation or partnership whose purpose is the development of property. The CONTRACTOR shall at all times be represented on the Project in person or by a duly designated agent or superintendent. Instructions or information given by the ENGINEER to the CONTRACTOR's superintendent or agent on the Project shall be considered as having been given to the CONTRACTOR. For the purposes of this Specification, and where applicable, the word Developer shall be synonymous with the word CONTRACTOR.

F. Plans

The word Plans shall mean the official plans, profiles, typical cross-sections, working drawings, detail drawings, or exact reproductions thereof, approved by the ENGINEER, which show the locations, character, dimensions and details of the work to be done.

G. Record Drawings

The words Record Drawings shall mean the plans which have been "as-built" to reflect and include all changes made during the course of construction of the Project. The Record Drawings shall be submitted to the DISTRICT on 5 mil thick photo mylars prior to DISTRICT acceptance of the Project.

H. Laboratory

The word Laboratory shall mean the firm approved by the DISTRICT to test materials and work involved in the Project.

I. License

The word License shall mean that the CONTRACTOR installing any new facilities within the DISTRICT shall possess, prior to start of the Project, a License, defined by the latest edition of the California Contractor's License Law and Reference Book, specified as:

1. Class A or C-34 for Water Installations

J. Project, The Work

The words Project, or The Work shall mean the entire public improvement proposed to be constructed in whole or part.

K. Agencies

Whenever used in these Specifications, the following abbreviations shall refer to the agency shown:

	<u>AGENCY</u>	<u>ADDRESS</u>
AASHTO	American Assoc. of State Highway and Transportation Officials	444 N. Capital St. Washington, D.C. 20004
AWWA	American Water Works Association, Inc.	6666 W. Quincy Denver, CO 80235
ASTM	American Society for Testing and Materials	1916 Race Street Philadelphia, PA 19103
ASA	American Standards Association	70 East 45th Street New York, NY 10017
ACI	American Concrete Institute	P.O. Box 19150 Detroit, MI 48219
ANSI	American National Standards Institute	1430 Broadway New York, NY 10018
ASME	American Society of Mechanical Engineers	345 E. 47th Street New York, NY 10017
AWS	American Welding Society	550 N.W. Le Jeune Rd. Miami, FL 33135

(continued)	<u>AGENCY</u>	<u>ADDRESS</u>
CAL/ OSHA	State of California Occupational Safety and Health Administration	1006 Fourth Street Sacramento, CA 95814
CRSI	Concrete Reinforcing Steel Institute	228 N. La Salle St. Chicago, IL 60601
NACE	National Association of Corrosion Engineers	1440 South Creek Dr. Houston, TX 77084
NFPA	National Fire Protection Agency	Battery March Park Quincy, MA 02269
NSF	National Sanitation Foundation	P.O. Box 130140 Ann Arbor, MI 48113
SDG&E	San Diego Gas and Electric Company	101 Ash Street San Diego, CA 92102
SSPC	Steel Structures Painting Council	4400 Fifth Ave. Pittsburgh, PA 15213

L. Words or Definitions

Whenever in the Specifications or upon the Plans, the words "directed", "required", "permitted", "ordered", "designated", "prescribed", or words of like import are used, it shall be understood that the directions, requirements, permission, order, designation, or prescription of the ENGINEER is intended and similarly the words "approved", "acceptable", "satisfactory" or words of like import, shall mean approved by, or acceptable to, or satisfactory to the ENGINEER, unless otherwise expressly stated.

PART 2 - LEGAL RELATIONS AND RESPONSIBILITY

2.1 GENERAL

A. Laws to be Observed

1. The CONTRACTOR shall keep itself fully informed of all laws, ordinances and regulations which in any manner affect those engaged or employed in the work, or the materials used in the work, or which in any way affect the conduct of the work, and of all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the same.

2. If any discrepancy or inconsistency is discovered in the Plans, Drawings, Specifications, or other Contract Documents in relation to any such law, ordinance, regulation, order or decree, the CONTRACTOR shall forthwith report the same to the ENGINEER in writing.
3. The CONTRACTOR shall at all times observe and comply with all such existing laws, ordinances, regulations, orders and decrees, and shall protect and indemnify the DISTRICT, the Board of Directors, the ENGINEER and all of its and their officers, employees and agents, against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by the CONTRACTOR or the CONTRACTOR's employees.

B. Permits and Licenses

1. The CONTRACTOR shall obtain all necessary permits and licenses for the construction of the Project, pay all fees required by law and comply with all laws, ordinances, rules and regulations relating to the work and to the preservation of public health and safety.

C. Patents

1. The CONTRACTOR shall assume all costs arising from the use of patented materials, equipment, devices or processes used on or incorporated in the work and agrees to indemnify and save harmless the DISTRICT, the Board of Directors, and the ENGINEER and their duly authorized representatives from all suits of law, or action of every nature for, or on account of, the use of any patented materials, equipment, devices, or processes.

D. Public Convenience and Safety

1. The CONTRACTOR shall so conduct operations as to cause the least public obstruction and inconvenience to public travel.
2. Convenient access to driveways, houses and buildings along the line of work shall be maintained in good condition.
3. No crossing or intersecting street or road shall be closed without the approval of the agency having jurisdiction over the roadway.
4. Traffic control plans, detours, and road closures shall be approved by the agency having jurisdiction over the roadway.

5. The CONTRACTOR shall furnish, erect and maintain such fences, barriers, lights and signs as are necessary or required by CAL/OSHA or by other State and Local Agencies to give adequate warning to the public at all times of any dangerous conditions to be encountered as a result of the construction work.
6. Fire hydrants on or adjacent to the WORK shall be kept accessible to fire fighting equipment at all times.

E. Use of Explosives

1. Blasting for excavation will be permitted only after securing approval of the ENGINEER and only when proper precautions are taken for the protection of persons and property.
2. Any damage caused by blasting shall be repaired and paid for by the CONTRACTOR.
3. The CONTRACTOR's method of blasting and procedure shall conform to state laws and local ordinances.
4. Precautions should be taken to post signs warning operators of radio equipment to stop transmitting in any area in which blasting operations are in progress.
5. During blasting, seismic readings shall be taken, recorded, and furnished to the DISTRICT.

F. Preservation of Property

1. All trees and shrubbery that are not to be removed, and pole lines, fences, signs, survey markers and monuments, buildings and structures, conduits, pipelines under or above ground, sewer and water lines, all highway or street facilities and any other property improvements or facilities within or adjacent to the work shall be protected from injury or damage.
2. If ordered by the ENGINEER, the CONTRACTOR shall provide and install suitable safeguards to protect such objects from injury or damage.
3. Should such objects be injured or damaged by reason of the CONTRACTOR's operation, they shall be replaced or restored at the CONTRACTOR's expense, to a condition as good as when the CONTRACTOR entered upon the work, or as good as required by Specifications, subject to the ENGINEER's approval.
4. The fact that any such pipe or other underground facility is not shown on the Plans shall not relieve the CONTRACTOR of responsibility as stated herein.

5. It shall be the CONTRACTOR's responsibility to ascertain the existence of any underground improvements or facilities which may be subject to damage.

G. Responsibility for Damages

1. The DISTRICT, the Board of Directors, the ENGINEER or their employees or authorized agent shall not be answerable or accountable in any manner for any loss or damage that may happen to the work or any part thereof, or for any material or equipment used in performing the work, or for injury or damage to any person or persons, either workmen or the public, or for damage to adjoining property from any cause whatsoever during the progress of the work, or any time before the expiration of the one (1) year warranty period.
2. The CONTRACTOR shall indemnify and hold harmless the DISTRICT, the Board of Directors, the ENGINEER and their employees or authorized agents from any suits, claims or actions brought by any person or persons for or on account of any injuries or damages sustained or arising in the construction of the work.

H. Personal Liability

1. Neither the Board of Directors, the ENGINEER, nor any other officer, employee or authorized agent of the DISTRICT shall be personally responsible for any liability arising under the Contract.

I. CONTRACTOR's Responsibility for Work

1. The CONTRACTOR shall be responsible for all damages to persons or property that occur as a result of fault or negligence in connection with the performance of the Contract, and shall be responsible for proper care and protection of all materials delivered and work performed until completion and final acceptance by the DISTRICT.
2. The CONTRACTOR shall take adequate precautions in protecting existing curbs, gutters, trees, sidewalks, pavements, utilities, adjoining property and structures, and avoid damage thereto, and shall be completely responsible for the repair of damage thereto caused by construction operations.
3. The CONTRACTOR shall shore up, brace, underpin and protect as may be necessary, all foundations and other parts of all existing structures adjacent to and adjoining the site of the project which are in any way affected by the excavation or other operations connected with the performance of the work under this Contract.

4. Whenever any notice is required to be given by the DISTRICT or the CONTRACTOR to any adjacent or adjoining landowner or other party before commencement of any work under this Contract, such notice shall be given by the CONTRACTOR, unless otherwise directed by the DISTRICT.
5. The CONTRACTOR shall indemnify the DISTRICT, and hold it harmless from any damages on account of settlements or the loss of lateral support of adjoining property, or from all loss and expense, and from all damages for which the DISTRICT may become liable in consequence of such injuries or damage to trees and to adjoining and adjacent structures and their premises.
6. In an emergency affecting the safety of life or property, including adjoining property, the CONTRACTOR, without special instructions or authorizations, is authorized to act to prevent such threatened loss or injury, and the CONTRACTOR shall so act as though instructed to do so by the DISTRICT.

J. Mutual Responsibility of CONTRACTORS

1. If through acts of neglect on the part of the CONTRACTOR, any other CONTRACTOR or any subcontractor shall suffer loss or damage on the work, the CONTRACTOR agrees to settle with such other CONTRACTOR or subcontractor by agreement or arbitration, if such other CONTRACTOR shall assert any claim against the DISTRICT on account of any damage alleged to have been so sustained, the DISTRICT shall notify the CONTRACTOR, who shall indemnify and save harmless the DISTRICT against any such claim.
2. Nothing herein contained shall be interpreted as granting to the CONTRACTOR exclusive occupancy of the site of the project.
3. The CONTRACTOR shall not cause any unnecessary hindrance or delay to any other CONTRACTOR working on the project.

K. Notice and Service Thereof

1. Any notice required or given by one party to the other shall be in writing and shall be dated and signed by the party giving such notice or by a duly authorized representative of such party.
2. Any such notices shall not be effective for any purpose whatsoever unless served in the following manner:
 - a. If the notice is given to the DISTRICT, by personal delivery thereof to the ENGINEER, or by depositing the same in the United States mail, enclosed in a sealed envelope addressed to the DISTRICT, to

the attention of said ENGINEER, postage shall be prepaid and registered.

- b. If the notice is given to the CONTRACTOR by personal delivery thereof to said CONTRACTOR or to an authorized representative at the site of the project or by depositing the same in the United States mail, enclosed in a sealed envelope addressed to said CONTRACTOR's regular place of business or such other address as may have been established for the conduct of the work under this Contract. Postage shall be prepaid.

L. Warranty of Title

1. No materials, supplies or equipment for the work under this Contract shall be purchased subject to any chattel mortgage or under a conditional sales contract or other agreement by which an interest therein or any part thereof is retained by the seller or supplier.
2. The CONTRACTOR warrants clear and good title to all materials, supplies and equipment installed and incorporated in the work, and agrees upon completion of all work to deliver the premises, together with all improvements and appurtenances constructed or placed thereon by the CONTRACTOR to the DISTRICT free from any claims, liens, encumbrances, or charges, and further agrees that neither the CONTRACTOR nor any person, firm or corporation furnishing any material or labor for any work covered by the Contract shall have any right to a lien upon the premises or any improvement or appurtenance thereon, provided that this shall not preclude the CONTRACTOR from installing metering devices or other equipment of utility companies or of municipalities, the title of which is commonly retained by the utility company or the municipality.
3. Nothing contained in this Article, however, shall defeat or impair the right of such persons furnishing materials or labor under any bond given by the CONTRACTOR for their protection, or any right under any law permitting such persons to look to funds due the CONTRACTOR, in the hands of the DISTRICT.
4. The provisions of this Article shall be inserted in all subcontracts and material contracts, and notices of its provisions shall be given to all persons furnishing materials for the work when no formal contract is entered into for such materials.

M. Prohibitive Interests

1. No officer of the DISTRICT who is authorized in such capacity and on behalf of the DISTRICT to negotiate, make, accept or approve, or to take part in negotiating, making, accepting or approving any architectural, engineering, or any subcontract in connection with the construction of

the project, shall become directly or indirectly interested personally in this Contract or any part thereof.

2. No officer, employee, architect, attorney, engineer or inspector of or for the DISTRICT who is authorized in such capacity and on behalf of the DISTRICT to exercise any executive, supervisory or other similar function in connection with the construction of the project, shall become directly or indirectly interested personally in this Contract or any part thereof.

PART 3 - GUARANTEE

3.1 GENERAL

- A. Besides guarantees required elsewhere, the Contractor guarantees all work for a period of one (1) year after the date of acceptance of the work by the DISTRICT's Board of Directors and shall repair and replace all such work, together with any other work which may be displaced in so doing, that may prove defective in workmanship and/or materials within the one-year period from date of acceptance, without expense whatsoever to the District, ordinary wear and tear and unusual abuse or neglect excepted.

This section does not in any way limit the guarantee on any items for which a longer guarantee is specified or on any items for which a manufacturer or supplier gives a guarantee for a longer period. CONTRACTOR agrees to act as a co-guarantor with such manufacturer or supplier and shall furnish DISTRICT all appropriate guarantee or warranty certificates upon completion of the project. No guarantee period whether provided for in this section or elsewhere shall in any way limit the liability of the CONTRACTOR or his sureties or insurers under the indemnity or insurance provisions of these General Provisions.

- B. Whenever defective material or workmanship is discovered, the CONTRACTOR shall make all repairs, at no expense to the DISTRICT, within seven (7) calendar days after receipt of the written notice.
- C. In the event of failure to comply with the provisions of the guarantee within seven (7) calendar days after notice in writing, the DISTRICT is authorized to have the defects repaired and made good at the expense of the CONTRACTOR who shall pay the cost thereof on demand.
- D. Where immediate attention is required, as determined by the ENGINEER, the DISTRICT shall have the right to repair the defect or damage and to charge the CONTRACTOR with the cost of materials, equipment and labor.

END OF SECTION

SECTION 01030 - EXISTING FACILITIES

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes requirements for connection to and abandonment of existing water facilities.

1.2 CONDITION OF EXISTING FACILITIES

- A. The DISTRICT does not warranty the condition of existing facilities.

1.3 LOCATION

- A. The CONTRACTOR shall be responsible for determining in advance the location, vertical elevations, alignment, and pipe outside diameters, joints, materials of construction, and shape of all existing pipelines to which connections are to be made.

PART 2 - PRODUCTS

- A. All materials used in making the connection to or removing the facility from service shall conform to the applicable sections of these specifications.

PART 3 - EXECUTION

3.1 CONNECTION TO EXISTING FACILITIES

- A. Unless otherwise shown on the plans, specified herein, or directed by the DISTRICT, all connections shall be performed by the DISTRICT, unless approved otherwise.
- B. If approved otherwise, the CONTRACTOR shall make the connection in accordance with the DISTRICT's Tie-In Resolution 97-35 included in Part 4, Appendix to this section.
- C. The CONTRACTOR shall furnish all pipe and materials including furnishing all labor and equipment necessary to make the connections, all required excavation, backfill, pavement replacement, lights, and barricades.
- D. The CONTRACTOR may be required to provide high-lines, and fittings as part of the equipment for making the connections. The CONTRACTOR shall assist the DISTRICT in alleviating any hardship incurred during the shutdown for connections.

- E. Where connections are made to existing valves, the CONTRACTOR shall furnish and install all temporary blocking and/or anchors as required by the DISTRICT, and the CONTRACTOR shall replace the gate well and valve box to the proper grade.
- F. Only DISTRICT's personnel shall be authorized to operate existing valves. The CONTRACTOR shall be held responsible for any and all damage resulting from unauthorized operation of DISTRICT's existing facilities.
- G. The CONTRACTOR will dewater existing mains, as required, in the presence of the DISTRICT.
- H. The DISTRICT may postpone or reschedule any shutdown operation if for any reason the DISTRICT feels that the CONTRACTOR is improperly prepared with competent personnel, equipment, or materials to proceed with the connection.
- I. If progress is inadequate during the connection operation to complete the connection in the time specified, the DISTRICT shall order necessary corrective measures. All costs for corrective measures shall be paid by the CONTRACTOR.
- J. Where connections to existing water mains are made by wet tapping, the CONTRACTOR shall perform all required excavation and shall furnish the tapping saddle and valve. The CONTRACTOR will install the tapping saddle and valve and the DISTRICT will make the wet tap. The CONTRACTOR shall pour the thrust block, complete all compaction and backfill, make closure, set valve casing and valve box, make all necessary pavement repairs and complete the installation in accordance with the Plans and these Specifications.
- K. The CONTRACTOR shall pothole all tie-in locations at the beginning of the project to determine:
 - 1. Pipe size (O. D.) and type (Class)
 - 2. Elevation, grade and alignment
 - 3. If tie-in can be made at indicated location
(Pipe shall be exposed a minimum of 3 feet either side of connection point to assure no collars are in the tap area)
 - 4. If tie-in conflicts with existing utilities
 - 5. The new line shall be within 3 inches of line and grade of the existing line at the tie-in point.

Note: Any discrepancies shall be brought to the attention of the DISTRICT prior to proceeding.

- L. The new pipeline shall not be connected to an existing facility until the new pipeline has successfully passed all pressure and disinfection tests and the DISTRICT has given approval to proceed with the connection.
- M. No work to the existing facilities shall be done until pressure and disinfection tests are completed.

3.2 REMOVAL OF EXISTING MAINS AND APPURTENANCES FROM SERVICE

- A. Existing mains and appurtenances shall be removed from service at the locations shown on the plans or as directed by the DISTRICT.
- B. Existing pipe ends shall be filled with concrete or per the requirements of the agency having jurisdiction.
- C. Existing pipe and appurtenances may be removed from the ground, in which case backfill and restoration of surface shall be completed.
- D. Removed pipe and appurtenances may be temporarily stockpiled on the job in a location that will not disrupt traffic or be a safety hazard. Disposal shall be the responsibility of the CONTRACTOR.
- E. Before excavating for laying mains that are to replace existing pipes and/or services, the CONTRACTOR shall make proper provisions for the maintenance and continuation of service as directed by the DISTRICT.
- F. An abandoned water service shall be closed and capped at the corporation stop. The meter box and curb stop shall also be removed.

PART 4 - APPENDIX

1.1 RESOLUTION NO. 97-35 - Resolution Of The Board Of Directors Of Vista Irrigation District Setting The Procedure To Be Used In Permitting Private Contractors To Perform The Work Necessary To Connect (Tie-In) A Privately Installed Water System To A DISTRICT (Publicly) Owned Water Main.

WHEREAS, it is the policy and desire of the Vista Irrigation District to perform all connections to its own water mains, and

WHEREAS, Resolution No. 95-43 was rescinded on March 13, 1996, and

WHEREAS, Resolution No. 96-09 expired on August 31, 1997, and

WHEREAS, it is the intention of the Board of Directors to permit private contractors, under certain circumstances, to perform tie-ins to DISTRICT water lines.

NOW, THEREFORE, BE IT RESOLVED that upon special request, the DISTRICT will allow a private contractor to perform a tie-in of a water main, constructed by a CONTRACTOR, to a DISTRICT-owned water main when, in the opinion of the DISTRICT's General Manager, such permission would be in the best interests of the DISTRICT, the DISTRICT's customers and developer, and

BE IT FURTHER RESOLVED, that circumstances to be considered when granting permission for the tie-in shall include the lead time for DISTRICT forces to complete the work, the impact of a water main shutdown on the DISTRICT's operations systems and customers, and other factors that may make it desirable for the developer to perform the work, and

BE IT FURTHER RESOLVED, that all requests for a private CONTRACTOR to perform a tie-in to a DISTRICT-owned water main will be evaluated on a case-by-case basis, and will not be granted without the approval of the General Manager, and

BE IT FURTHER RESOLVED, that when a private contractor has been granted approval to perform tie-ins on District-owned water mains, the CONTRACTOR and the District must perform the procedure below:

1. District shall assure that the private contractor posses a Class A - General Engineering license or a Class C-34 "Pipeline" license to perform work in the State of California. CONTRACTOR must demonstrate their ability to perform the work by presenting evidence of successful performance on past projects of similar nature. Qualifying experience shall be submitted to the DISTRICT and must include information as listed on "Exhibit A"; and
2. Shutdowns of DISTRICT-owned water lines will be made at the request of the CONTRACTOR, but at the discretion of the DISTRICT, generally on Tuesdays, Wednesday, and/or Thursdays.

3. The District may refuse to shut down a water line on the day requested by the CONTRACTOR due to operational circumstances (i.e., business cannot withstand a shutdown of water at that time; other connecting distribution systems are out of service at the same time; high water demands by customers; etc.) or other reasonable concerns by the DISTRICT. No request will be denied for arbitrary reasons.
4. The CONTRACTOR shall make a written request for a shutdown to the DISTRICT's Inspector before the close of business on Monday of the week prior to the requested day of shutdown.
5. Prior to the CONTRACTOR making this shutdown request, the CONTRACTOR must:
 - a. Pothole the connection point(s) to determine the location of all pipe joints that will be affected by the tie-in and identify all possible obstructions to verify that the connection can be made according to the plans submitted by the CONTRACTOR's engineer and previously approved by the DISTRICT.
 - b. Provide to the Inspector a copy of the appropriate road agency's excavation permit and a copy of the shipping list of materials to be used for the tie-in. If the material shipping list is not available at this time, it may be provided under number 6 below.
 - c. Provide to the Inspector a list of the personnel (by trade, not necessarily by name) who will be performing the tie-in.
6. The CONTRACTOR shall deliver to the site, twenty-four (24) hours in advance of the shutdown, all materials and equipment that will be used for the tie-in. The materials and equipment must be inspected by the Inspector for conformance with the DISTRICT's Approved Materials List and verification that the equipment has been adequately disinfected.
7. All pipe removed by the CONTRACTOR shall be properly disposed of in accordance with all applicable laws and regulations. The proper manifest for AC pipe shall be delivered to the Inspector.
8. If the connection is to be done by the "wet-tap" method, the CONTRACTOR shall excavate the connection point, install the tapping sleeve and tapping gate valve. DISTRICT forces will make the actual "wet-tap."
9. The DISTRICT will, at all times, make the decision of the appropriateness and readiness for the shutdown. The Inspector may cancel the shutdown, up to the last minute, if:

- a. The CONTRACTOR is not ready at the designated time; e.g., labor, materials or equipment are not present. The CONTRACTOR will be charged for the work already performed by Vista Irrigation District (VID), and for the rescheduled shutdown. The CONTRACTOR should request an additional shutdown as required under numbers 1 through 5 above.
- b. In the opinion of the Inspector, the weather will severely impact the length of the shutdown, quality of the finished work product or ability of the CONTRACTOR to perform the WORK. The CONTRACTOR will be charged for the WORK already performed by VID, and for the rescheduled shutdown. The CONTRACTOR should request an additional shutdown as required under numbers 2 through 6 above.
- c. VID Operations personnel determine that the shutdown is not timely due to the reasons in number 3 above, or due to unforeseen circumstances. No additional charges will be made to the CONTRACTOR by VID. The CONTRACTOR will only be allowed another shutdown and no compensation will be made to the CONTRACTOR by VID. VID will make all efforts to reschedule the shutdown as soon as possible.

END OF SECTION

SECTION 01300 - CONTRACTOR SUBMITTALS

PART 1 - GENERAL

1.1 GENERAL

- A. All submittals by the CONTRACTOR shall be submitted to the ENGINEER.
- B. Unless otherwise noted, within 14 days after the date of commencement as stated in the Notice to Proceed, the CONTRACTOR shall submit the following items to the ENGINEER for review:
 - 1. A list of submittals with scheduled submission dates. This list shall include specification section number, description of the submittal, scheduled submission date, and anticipated approval date. The CONTRACTOR's schedule shall be based on a minimum of one resubmittal for each shop drawing and sample.
 - 2. A list of all permits and licenses the CONTRACTOR is required to obtain, indicating the agency required to grant the permit, the expected date of submittal for the permit, and required date for receipt of the permit.
- C. The CONTRACTOR shall be responsible for identifying and delivering all submittals and/or permits required by the Contract Documents.
- D. The CONTRACTOR shall submit a Storm Water Pollution Plan (SWPPP), where applicable, in accordance with the National Pollution Discharge Elimination System General Permit for storm water discharge associated with construction activities prior to commencing clearing and grubbing operations..
- E. The CONTRACTOR shall submit, where applicable, a grading plan for interim grading conditions. The grading plan must be approved by the DISTRICT prior to commencement of work.

1.2 SHOP DRAWINGS

- A. The term "Shop Drawings" as used herein shall be understood to include detailed design calculations, shop drawings, fabrication and installation drawings, erection drawings, lists, graphs, catalog sheets, data sheets, and similar items.
- B. Wherever called for in the Contract Documents, the CONTRACTOR shall furnish to the DISTRICT for review, 4 copies, plus a reproducible copy of each shop drawing submittal.

- C. The CONTRACTOR shall submit, as applicable, the following for all prefabricated or manufactured structural, mechanical, electrical, plumbing, and process systems and equipment.
1. Wiring and control diagrams of systems and equipment.
 2. Complete manufacturer's specifications, including materials descriptions and paint system.
 3. Samples of finish colors for selection.
 4. Requirements for storage and protection prior to installation.
 5. Installation procedures.
 6. List of all requested exceptions to the Contract Documents and/or variations from the specified equipment.
- D. All shop drawing submittals shall be accompanied by a transmittal form. Any submittal not accompanied by such a form, or wherever all applicable items on the form are not completed, will be returned for resubmittal.
1. The transmittal forms shall be sequentially numbered. Resubmittals shall have the original submittal number with an alphabetic suffix.
 2. CONTRACTOR, Subcontractor and/or Supplier shall be identified; pertinent drawing sheet and detail number(s) and specification section number shall be identified on the transmittal forms, as appropriate. On standard drawings or data sheets, clearly indicate model and option being proposed and strike out all non-relevant data.
 3. All submittals must be capable of being scanned electronically for filing on a computer file.
- E. A separate transmittal form shall be used for each specific item or class of material or equipment for which a submittal is required.
- F. Transmittal of a submittal of various items using a single transmittal form will be permitted only when the items taken together constitute a manufacturer's "package" or are so functionally related that expediency indicates review of the group or package as a whole.
- G. A multiple-page submittal shall be collated into sets, and each set shall be stapled or bound, as appropriate, prior to transmittal to the ENGINEER.
- H. Except as may otherwise be indicated herein, the ENGINEER will return two (2) prints of each submittal to the CONTRACTOR with comments noted thereon, within 30 calendar days following their receipt by the ENGINEER. It is considered reasonable that the CONTRACTOR shall make a complete

and acceptable submittal to the ENGINEER by the second submission of a submittal item.

- I. The OWNER reserves the right to withhold monies due the CONTRACTOR to cover additional costs of the ENGINEER's and DESIGN CONSULTANT's review beyond the second submittal.
- J. The ENGINEER's and DESIGN CONSULTANT's maximum review period for each submittal, will be 30 days. Therefore, for a submittal that requires a second submittal before it is complete, the maximum period for that submittal could be 60 days.
- K. If 2 copies of a submittal are returned to the CONTRACTOR marked "NO EXCEPTIONS TAKEN," formal revision and resubmission of said submittal will not be required.
- L. If 2 copies of a submittal are returned to the CONTRACTOR marked "AMEND AS NOTED", formal revision and resubmission of said submittal will not be required, unless specifically required.
- M. If a submittal is returned to the CONTRACTOR marked either "AMEND AND RESUBMIT" or "REJECTED-RESUBMIT," the CONTRACTOR shall revise said resubmittal and shall resubmit the required number of copies of said revised submittal to the ENGINEER.
- N. Fabrication of an item shall be commenced only after the DESIGN CONSULTANT has reviewed the pertinent submittals and the ENGINEER has returned copies to the CONTRACTOR marked either "NO EXCEPTIONS TAKEN" or "AMEND AS NOTED."
- O. Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis for changes to the contract requirements.
- P. All CONTRACTOR shop drawing submittals shall be carefully reviewed by an authorized representative of the CONTRACTOR, prior to submission to the ENGINEER.
- Q. Each submittal shall be dated, signed, and certified. No consideration for review by the ENGINEER of any CONTRACTOR submittals will be made for any items which have not been so certified by the CONTRACTOR. All non-certified submittals will be returned to the CONTRACTOR without action taken by the ENGINEER, and any delays caused thereby shall be the total responsibility of the CONTRACTOR.
- R. The CONTRACTOR MANAGER's and DESIGN CONSULTANT's review of CONTRACTOR shop drawing submittals shall not relieve the

CONTRACTOR of the entire responsibility for the correctness of details and dimensions.

- S. The CONTRACTOR shall assume all responsibility and risk for any misfits due to any errors in CONTRACTOR submittals. The CONTRACTOR shall be responsible for the dimensions and the design of adequate connections and details.
- T. The ENGINEER may schedule a submittal conference to provide for a rapid review of a submittal, should the project schedule warrant such a review. The ENGINEER, DESIGN CONSULTANT, CONTRACTOR, and a qualified manufacturer's representative shall attend the submittal conference.

1.3 CONTRACTOR'S SCHEDULE

- A. The CONTRACTOR's construction schedules and reports shall be prepared and submitted to the ENGINEER in accordance with DISTRICT Standards.

1.4 SAMPLES

- A. Whenever, in the Specifications, samples are required, the CONTRACTOR shall submit not less than four (4) samples of each such item or material to the ENGINEER for review by the DESIGN CONSULTANT.
- B. Samples, as required herein, shall be submitted for acceptance a minimum of 30 days prior to ordering such material for delivery to the job site, and shall be submitted in an orderly sequence so that dependent materials or equipment can be assembled and reviewed without causing delays in WORK.
- C. All samples submitted to the ENGINEER shall be individually and indelibly labeled or tagged, indicating thereon all specified physical characteristics and the manufacturer's name for identification. Upon receiving acceptance by the DESIGN CONSULTANT, 2 sets of the samples will be returned to the CONTRACTOR by the ENGINEER. One set of samples will be retained by the DESIGN CONSULTANT, and one set of samples shall remain at the job site with the ENGINEER until completion of the WORK.
- D. Unless indicated otherwise, all colors and textures of specified items presented in sample submittals shall be from the manufacturer's standard colors and standard materials, products, or equipment lines. If the samples represent non-standard colors, materials, products, or equipment lines and their selection will require an increase in contract time or price, the CONTRACTOR will clearly indicate same on the transmittal page of the submittal.

1.5 OWNER'S MANUAL

- A. The CONTRACTOR shall submit technical operation and maintenance information for each item of mechanical, electrical and instrumentation equipment in an organized manner in the OWNER'S MANUAL. The OWNER'S MANUAL shall be written so that it can be used and understood by the OWNER'S operation and maintenance staff.
- B. The OWNER'S MANUAL shall be subdivided first by specification section number; second by equipment item; and last, by "part." "Parts" shall conform to the following (as applicable):

- 1. Part 1 - Equipment Summary

- a. Summary: A summary table shall indicate the equipment name, equipment number, and process area in which the equipment is installed.
- b. Form: The ENGINEER will supply an Equipment Summary Form for each item of mechanical, electrical and instrumentation equipment in the WORK. The CONTRACTOR shall fill in the relevant information on the form and include it in Part 1.

- 2. Part 2 - Operational Procedures

- a. Procedures: Manufacturer-recommended procedures for the following shall be included in Part 2:

- Installation

- Adjustment

- Start-up

- Location of controls, special tools or other equipment required, or related instrumentation needed for operation

- Operating Procedures

- Load Changes

- Calibration

- Shutdown

- Troubleshooting

- Disassembly

- Realignment

- Testing of proper settings for all pressure relief valves, low and high pressure switches and other protection devices

- List of all electrical relay settings including alarm and contact settings

- 3. Part 3 - Preventive Maintenance Procedures

- a. Procedures: Preventive maintenance procedures shall include all manufacturer-recommended procedures to be performed on a

periodic basis, both by removing and replacing the equipment or component and by leaving the equipment in place.

- b. Schedules: Recommended frequency of preventative maintenance procedures shall be included. Lubrication schedules, including lubricant SAE grade and type, and temperature ranges shall be covered.

4. Part 4 - Parts List

- a. Parts List: A complete parts list shall be furnished, including a generic description and manufacturer's identification number for each part. Addresses and telephone numbers of the nearest supplier and parts warehouse shall be included.
- b. Drawings: Cross-sectional or exploded view drawings shall accompany the part list.

5. Part 5 - Wiring Diagrams

- a. Diagrams: Complete internal and connection wiring diagrams for electrical equipment items shall be furnished.

6. Part 6 - Shop Drawings

- a. Drawings: Approved shop or fabrication drawings, complete with dimensions shall be included.

7. Part 7 - Safety

- a. Procedures: Safety precautions to be taken when operating and maintaining the equipment or working near it.

8. Part 8 - Documentation

- a. All equipment warranties, affidavits, and certifications required by the Technical Specifications shall be included.

C. The CONTRACTOR shall furnish to the ENGINEER seven (7) identical OWNER'S MANUALS. Each set shall consist of one or more volumes, each of which shall be labeled and bound in a standard size, 3-ring, loose leaf, vinyl plastic hard cover binder suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches. A table of contents indicating all equipment in the manuals shall be prepared.

D. OWNER'S MANUALS shall be submitted in final form to the ENGINEER not later than the 75 percent of construction completion date. All discrepancies

found by the CONSTRUCTION MANGER in the OWNER'S MANUALS shall be corrected by the CONTRACTOR within 30 days from the date or written notification by the CONSTRUCTION MANGER.

- E. Incomplete or unacceptable OWNER'S MANUALS at the 75 percent construction point shall constitute sufficient justification to withhold the amount stipulated in the Contract Documents from any monies due the CONTRACTOR.
- F. When available from the equipment vendor, the CONTRACTOR shall submit one copy of available sections of the final OWNER'S MANUAL in an electronic media format. The information shall be provided on a 3-1/2 inch disk in either Word for Windows or ASCII files.

1.6 SPARE PARTS LIST

- A. The CONTRACTOR shall furnish to the ENGINEER seven (7) copies of spare parts information for all mechanical, electrical, and instrumentation equipment.
- B. The spare parts list shall include the current list price of each spare part.
- C. The spare parts lists shall be limited to those parts which each manufacturer recommends be maintained by the OWNER in inventory at the facility site.
- D. Each manufacturer or supplier shall indicate the name, address, and telephone number of its nearest outlet of spare parts to facilitate the OWNER in ordering.
- E. The CONTRACTOR shall cross-reference all spare parts lists to the equipment numbers designated in the Contract Documents.
- F. The spare parts lists shall be labeled and bound in standard size, 3-ring, loose leaf, vinyl plastic hard cover binders suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches.

1.7 RECORD DRAWINGS

- A. The CONTRACTOR shall keep and maintain, at the job site, one record set of Drawings. On these, it shall mark all project conditions, locations, configurations, and any other changes or deviations which may vary from the details represented on the original Contract Drawings, including buried or concealed construction and utility features which are revealed during the course of construction. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the locations indicated, or which were not indicated on the Contract Drawings.

- B. Record drawings shall be supplemented by any detailed sketches as necessary or directed to indicate fully, the WORK as actually constructed. These master record drawings of the CONTRACTOR's representation of as-built conditions, including all revisions made necessary by addenda and change orders shall be maintained up-to-date during the progress of the WORK.
- C. In the case of those drawings which depict the detail requirement for equipment to be assembled and wired in the factory such as motor control centers and the like, the record drawings shall be updated by indicating those portions which are superseded by change order drawings or final shop drawings, and by indicating appropriate reference information describing the change orders by number and the shop drawings by manufacturer, drawing, and revision numbers.
- D. Record drawings shall be accessible to the ENGINEER at all times during the construction period.
- E. Final payment will not be acted upon until the CONTRACTOR-prepared record drawings have been delivered to the ENGINEER. Said up-to-date record drawings shall be in form of a set of prints with carefully plotted information overlaid in red.
- F. Upon substantial completion of the WORK and prior to final acceptance, the CONTRACTOR shall finalize and deliver a complete set of record drawings to the ENGINEER for transmittal to the OWNER, conforming to the construction records of the CONTRACTOR. This set of drawings shall consist of corrected drawings on mylar reproducibles showing the reported location of the WORK. The information submitted by the CONTRACTOR in the Record Drawings will be assumed to be correct, and the CONTRACTOR shall be responsible for the accuracy of such information, and for any errors or omissions which may appear on the Record Drawings as a result.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.1 SCHEDULE FOR SUBMITTING

- A. The CONTRACTOR is to recognize the time and sequence related to the submittals required by the Contract Documents. Therefore, the CONTRACTOR shall demonstrate competency in preparing and delivering submittals.
- B. The CONTRACTOR will not be granted additional contract time or compensation due to delays associated with submittals. In addition, the costs associated with expedited review of a submittal or a submittal conference may

be withheld from monies due the CONTRACTOR by the OWNER to cover additional costs of the ENGINEER's and DESIGN CONSULTANT's review.

END OF SECTION

SECTION 02000 - EARTHWORK

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes all earthwork required for construction of the WORK. Such earthwork shall include the loosening, removing, loading, transporting, depositing, and compacting in its final location of all materials wet and dry, as required for the purpose of completing the WORK.
- B. Fill material is defined as material used to raise the level of a portion of the site to the line and grade indicated. Backfill material is defined as material used to refill an excavation.

1.2 REFERENCE SPECIFICATIONS

- A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the latest edition of the Standard Specifications for Public Works Construction (SSPWC) together with the latest edition of the Regional Supplement Amendments.

1.3 REGULATORY REQUIREMENTS

- A. The WORK of this Section shall comply with current versions and revisions, of the following:
 - 1. Construction Safety Orders, Division of Industrial Safety, State of California.
 - 2. California Department of Transportation Traffic Manual.

1.4 SHOP DRAWINGS AND SAMPLES

- A. The following shall be submitted in compliance with Section 01300:
 - 1. The CONTRACTOR shall comply with the provisions for “Shoring and Bracing Drawings” in Section 6705 of the California Labor Code.
 - 2. The CONTRACTOR, prior to beginning any trench or structure excavation 5 feet deep or over shall submit to the DISTRICT and shall be in possession of the DISTRICT’s written acceptance of the CONTRACTOR’s detailed plan showing design of all shoring, bracing, sloping of the sides of excavation, or other provisions for worker protection against the hazard of caving ground during the excavation of such trenches or structure excavation. If such plan varies from the shoring system established in the Construction Safety Orders of the State of California, such alternative system plans shall be prepared by a civil or structural engineer licensed in the State of California.

3. Copies of relevant and necessary excavation permits.
4. Samples of imported material. Samples shall be submitted in accordance with SSPWC, Subsection 306-1.3.5.
5. Such other samples of materials as the ENGINEER may require.

1.6 SOIL TESTING

- A. All soil testing shall be done in accordance with SSPWC, Section 211, and by a testing laboratory of the DISTRICT's choice. Cost shall be borne by DISTRICT if CONTRACTOR is hired by DISTRICT. Cost shall be borne by DEVELOPER if CONTRACTOR is hired by DEVELOPER.
- B. Where soil material is required to be compacted to a percentage of maximum density, the maximum density shall be determined in accordance with the requirements of SSPWC, Subsection 211-2. In case the tests of the fill or backfill show non-compliance with the required density, the CONTRACTOR shall accomplish such remedy as may be required to ensure compliance. Subsequent testing to show compliance shall be by a testing laboratory selected by the DISTRICT and shall be at the CONTRACTOR's expense.

PART 2 - PRODUCTS

2.1 FILL AND BACKFILL MATERIALS

- A. Fill and backfill material shall consist of select material obtained from the excavation, imported material, granular bedding material, or unclassified material.
- B. The CONTRACTOR shall import at his expense materials in excess of the approved material obtained from excavation as required to complete the fill, backfill, and grading WORK as indicated.
- C. Select material shall consist of primarily granular material encountered in the excavation which is free of vegetation, organic matter, debris, rocks larger than 3 inches in diameter and other unsuitable material, and shall have an expansion index less than 30 (less than 20 for footings and floor slabs) as determined by UBC Standard No. 29-2, plasticity index of 10 or less, a liquid limit of 30 or less and shall be approved as select material by the ENGINEER.
- D. Imported material shall conform to the same specifications as select material defined above. In addition, the imported materials shall have a minimum sand equivalent of 30 as determined by California Test Method No. 217.
- E. Imported material placed in areas to be planted shall be able to support normal plant growth. Obtain approval of the ENGINEER prior to transporting imported material.

- F. Bedding material, defined as that material 6 inches below bottom of pipe, supporting, surrounding and extending to 1 foot above the top of a pipe, shall be in accordance with SSPWC, Subsection 306-1.2.1.
- G. Unclassified material shall conform to SSPWC, Subsection 300-4.

2.2 ROCK PRODUCTS

- A. Rock products, consisting of crushed rock, rock dust, gravel, sand, and stone for riprap shall be clean, hard, sound, durable, uniform in quality and free of disintegrating material, organic matter, oil alkali, or other deleterious substance, and shall, unless otherwise specified, conform with requirements of SSPWC, Subsection 200-1.

2.3 UNTREATED BASE MATERIALS

- A. Untreated base materials shall conform with the requirements of SSPWC, Subsection 200-2.
- B. Materials for use as untreated base or subbase shall be as specified by the DISTRICT.

2.4 TOPSOIL

- A. Topsoil shall be designated as Class A (imported), Class B (select), or Class C (unclassified), and shall conform with the requirements of SSPWC, Subsection 212-1.1. The ENGINEER shall determine the suitability of topsoil prior to use.

PART 3 - EXECUTION

3.1 GENERAL

- A. The CONTRACTOR shall perform earthwork as necessary to complete the WORK as shown on the Contract Drawings and specified herein.
- B. The CONTRACTOR shall take the necessary precautionary measures to prevent dust or other nuisances which might be created by reason of its activities. The necessary precautionary measures shall conform to the requirements of SSPWC, Subsection 7-8. The requirements specified in Subsection 7-8 shall be extended to include paved surfaces.
- C. All types of earthwork, including trench, structural and general excavation, fill, backfill and compaction, shall conform to applicable requirements of SSPWC, Section 300, and to the requirements specified herein.

3.2 SITE PREPARATION

- A. Areas to be excavated, filled, graded, and to be occupied by permanent construction or embankments shall be prepared by clearing and grubbing.

Clearing and grubbing shall conform to the applicable requirements of SSPWC, Subsection 300-1.

3.3 EXCAVATION

A. GENERAL

1. Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. Unless otherwise directed, the removal of said materials shall conform to the lines and grades shown.
2. Unless otherwise provided, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill.
3. The CONTRACTOR shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations, and all pumping, ditching, or other measures for the removal or exclusion of water as required by Section 02140.
4. Excavations shall be sloped or otherwise supported in a safe manner in accordance with the rules, orders, and regulations of the Division of Industrial Safety and the State of California.

B. Unclassified Excavation

1. Unclassified excavation shall consist of all excavation, including roadways, unless separately designated.
2. Unsuitable material shall be excavated and disposed of in accordance with the requirements of SSPWC, Subsection 300-2.2.
3. Wet material, if unsatisfactory for the specified use on the project solely because of high moisture content, may be processed to reduce the moisture content, or may be required to be removed and replaced with suitable material in accordance with the requirements of SSPWC, Subsection 300-2.2.2.
4. The removal and disposal of slide and slipout material shall be in accordance with SSPWC, Subsection 300-2.4.
5. Excavation slopes shall be finished in conformance with the lines and grades shown, and in accordance with SSPWC, Subsection 300-2.5.
6. Surplus material shall be disposed of off-site, and in accordance with SSPWC, Subsection 300-2.6.

C. Structure Excavation

1. Structure excavation shall consist of the removal of material for construction of foundations for bridges, retaining walls, headwalls, culverts, buildings, or other structures, and shall be in accordance with SSPWC, Subsection 300-3.
2. Cofferdams for foundation construction shall be constructed in accordance with SSPWC, Subsection 300-3.2.
3. The treatment of foundation material shall be in accordance with SSPWC, Subsection 300-3.3.

D. Underground Conduit Excavation

1. Excavation for underground conduits shall be in accordance with SSPWC, Subsection 306-1.1 and the requirements contained herein.
2. Unless otherwise shown or ordered, excavation for pipelines and utilities shall be open-cut trenches.
3. The manner of bracing excavations shall be as set forth in rules, orders and regulations of the Division of Industrial Safety of the State of California, and in accordance with the requirements of SSPWC, Subsection 306-1.1.6.
4. The maximum amount of open trench permitted in any one location shall be 500 feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day. The above requirements for backfilling or use of steel plate will be waived in cases where the trench is located further than 100 feet from any traveled roadway or occupied structure. In such cases, however, barricades and warning lights conforming to requirements set forth in the California Department of Transportation Traffic Manual shall be provided and maintained.
5. Where pipelines are to be installed in embankment fills, the fill shall be constructed to a level at least 18 inches above the top of the pipe before the trench is excavated.

E. OVER-EXCAVATION

1. Trenches shall be over-excavated beyond the depth shown when required by the ENGINEER. Such over-excavation shall be to the depth ordered. The trench shall then be backfilled to the grade of the bottom of the pipe.
2. All work specified in this Section shall be performed by the CONTRACTOR at no additional cost to the DISTRICT when the over-

excavation ordered by the ENGINEER is less than 1 foot below the limits shown.

3. When the over-excavation ordered by the ENGINEER is 1 foot or greater below the limits shown, additional payment will be made to the CONTRACTOR for that portion of the work which is located below said 1 foot distance.
4. Any over-excavation carried below the grade ordered or indicated shall be backfilled to the required grade with the specified material and compacted. Such work shall be performed by the CONTRACTOR at no additional cost to the DISTRICT.

F. Excavation in Lawn Areas

1. Where excavation occurs in lawn areas, the sod shall be carefully removed and stockpiled to preserve it for replacement.
2. Excavated material may be placed on the lawn; provided, that a drop cloth or other suitable method is employed to protect the lawn from damage.
3. The lawn shall not remain covered for more than 72 hours.
4. Immediately after completion of backfilling [and testing of the pipeline], the sod shall be replaced in a manner so as to restore the lawn as near as possible to its original condition.
5. CONTRACTOR shall provide new sod if removed sod has remained stockpiled for more than 72 hours.
6. The CONTRACTOR shall restore the lawn irrigation system removed or damaged due to excavation operations to a condition equal to the previous condition.

G. Excavation in Vicinity of Trees

1. Except where trees are shown to be removed, trees shall be protected from injury during construction operations. No tree roots over 2 inches in diameter shall be cut without written permission of the ENGINEER.
2. Trees shall be supported during excavation by means previously reviewed by the ENGINEER.

H. Rock Excavation

1. Rock Excavation shall include removal and disposal of the following
 - a. All boulders measuring $1/3$ of a cubic yard or more in volume

- b. All rock material in ledges, bedding deposits, and unstratified masses which cannot be removed without systematic drilling and blasting
 - c. Concrete or masonry structures which have been abandoned
 - d. Conglomerate deposits which are so firmly cemented that they possess the characteristics of solid rock and which cannot be removed without systematic drilling and blasting
2. Said rock excavation shall be performed by the CONTRACTOR; provided that, should the quantity of rock excavation be affected by any change in the scope of the WORK, an appropriate adjustment of the contract price will be made.

3.4 FILL AND BACKFILL

A. General

1. Fill and Backfill shall be placed in accordance with the applicable provisions of SSPWC, Section 300, and the requirements stated herein.
2. Backfill shall not be dropped directly upon any structure or pipe.
3. Backfill shall not be placed around or upon any structure until the concrete has been properly cured in accordance with the specifications and has attained sufficient strength to withstand the loads imposed.
4. Backfill around water retaining structure shall not be placed until the structures have been tested, and the structures shall be full of water while backfill is being placed.
5. Except for drainrock materials being placed in over-excavated areas or trenches, backfill shall not be placed until all water is removed from the excavation.

B. Placing and Spreading of Materials

1. Materials shall be placed and spread evenly in layers.
2. During the spreading, each layer shall be thoroughly mixed as necessary to promote uniformity of materials in each layer.
3. Where the material moisture content is below the optimum moisture content, water shall be added and mixed before it is placed in the trench for backfill.
4. Where the material moisture content is too high to permit the specified degree of compaction, the material shall be dried until the moisture content is satisfactory.

5. When compaction is achieved using mechanical equipment the layers shall be evenly spread so that when compacted, each layer shall not exceed 8 inches in thickness.

C. Compaction Requirements

1. Compaction tests shall be performed in accordance with SSPWC, Subsection 211-2.
2. The relative compaction of fill, backfill, and base material shall be in accordance with SSPWC, Section 300, with the following exceptions:
 - a. Subgrade where trench has been over-excavated 95%
 - b. One foot layer of crushed aggregate backfill in over-excavated trench. Where trench is over-excavated more than 2 feet, minimum of 2 layers shall be compacted. 95%
 - c. Pipe zone for flexible and rigid pipe: 95%
 - d. Fill beneath structures, including water containing structures: 95%

D. Unclassified Fill

1. All fill shall be of unclassified material unless separately designated. Construction of unclassified fill, including preparing the area on which fill is to be placed, and the depositing, conditioning, and compacting of fill material shall be in accordance with SSPWC, Subsection 300-4.

E. Structure Backfill

1. Backfill at structure shall be select material placed in accordance with SSPWC, Subsections 300-3.5 and 300-4.5.

F. Underground Conduit Backfill

1. Bedding around pipe shall be bedding material placed in accordance with the requirements of SSPWC, Subsection 306-1.2.
2. Backfill above shall be considered as starting 1 foot above the pipe or conduit, or at the subgrade for cast-in-place structures such as manholes, transition structures, junction structures, vaults, and valve boxes.
3. Backfill at underground conduits shall be select material placed and densified according to SSPWC, Subsection 306-1.3.

3.5 PREPARATION OF SUBGRADE UNDER IMPROVEMENT

- A. The preparation of subgrade for pavement, curbs and gutters, driveways, sidewalks and other roadway structures shall be in accordance with SSPWC, Subsection 301-1.

3.6 UNTREATED BASE

- A. Spreading and Compacting
 - 1. Aggregate base material shall be spread and compacted in accordance with SSPWC, Subsection 301-2.

END OF SECTION

SECTION 02100 - PIPELINE CONSTRUCTION

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes providing requirements for pipelines, including pipe, joints, specials, and appurtenances, complete and in place.

1.2 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300.

- 1. Shop Drawings

- a. Post-installation videotape and inspection reports.
- b. Detailed line layout and marking diagrams which indicate the specific number of each pipe and fitting and the location of each pipe and direction of each fitting in the completed line. In addition, the line layouts shall include:
 - 1. The pipe station and top of pipe elevation at all changes in grade or horizontal alignment.
 - 2. The station and top of pipe elevation to which the bell end of each pipe will be laid.
 - 3. All elements of curves and bends, both in horizontal and vertical alignment.
 - 4. The limits of each reach restrained and/or welded joint, or of concrete encasement.
- c. Drawings for joint restraint systems.
- d. Drawings of thrust blocks.
- e. Construction staking field survey notes and cut sheets.

- 2. Design calculations

- a. Design calculations for joint restraint systems using reinforced concrete encasement of pressure pipe and fittings.
- b. Design calculations for thrust blocks.

1.3 INSPECTION

- A. Factory Inspection

- 1. All pipe may be subject to inspection at the place of manufacture in accordance with the provisions of the referenced standards as supplemented by the requirements herein.
- 2. Where the pipe specifications indicate, the DISTRICT and/or the CONTRACTOR shall perform inspection of pipe, or coatings, or linings.

3. The CONTRACTOR shall be responsible for all costs associated with inspection and testing of materials, products, or equipment at the place of manufacture.
4. If the factory location is more than 50 miles from the job site, the CONTRACTOR shall be responsible for the meal, travel, and lodging costs for two DISTRICT designated inspectors for the number of days necessary to complete such inspections. The CONTRACTOR shall not be responsible for salary or salary related costs for either individual.

PART 2 - PRODUCTS

2.1 PIPE AND APPURTENANCES

- A. Pipe materials, coatings and linings, and appurtenances of the sizes and types indicated on the Drawings shall comply with all applicable Specification Sections.

PART 3 - EXECUTION

3.1 GENERAL

- A. The DISTRICT shall be notified of property which must be relocated and of existing public utilities and franchise holders which must be relocated and the reasonable time for doing so. The DISTRICT shall contact the utility or franchise holder and request relocation.
- B. The CONTRACTOR shall be responsible for the relocation and protection of existing utilities.
- C. The CONTRACTOR shall protect and maintain all underground and surface utility structures, drains, and other obstructions encountered in the progress of the WORK specified herein.
- D. All sections of the WORK to be done shall be staked in the field in a manner consistent with the lines and grades as shown on the plans. The DISTRICT shall have no responsibility for any staking unless the WORK is contracted directly with the DISTRICT and staking is covered in the Special Provisions of the contract between the DISTRICT and the CONTRACTOR. All staking shall be based on top of pipe. The CONTRACTOR shall examine carefully all construction stakes and by visual inspection of stakes, string lines and headers set therefrom, interpret and confirm that the line and grade information is in accordance with the plans. If there is an apparent error or lack of understanding as to what is meant by staking, the CONTRACTOR shall request an interpretation of staking before proceeding with the WORK.

3.2 DEWATERING

- A. Install and operate a continuous dewatering system capable of maintaining the groundwater level 2 feet below the excavated trench bottom.

- B. Only well points located on both sides of the trench shall be used for dewatering, unless otherwise approved by the DISTRICT.
- C. The dewatering system shall be operated 7 days per week, 24 hours per day with water level as indicated above until backfilling is completed.
- D. As field conditions necessitate, adjustments to the trench shoring and bracing methods to achieve soil stability adjustments shall be made at no additional cost to the DISTRICT.

3.3 EXCAVATION

- A. Trench width shall be in accordance with the provisions of Standard Drawings as supplemented by the requirements herein.
- B. Trench subgrade shall be stabilized by compaction to 95 percent relative density.
- C. Where trench bottom has been over-excavated, bedding shall be compacted to 95 percent in 1-foot thick layers.

3.4 INSTALLATION

- A. Pipe shall be installed in accordance with the pipe manufacturer's recommendations, applicable provisions of SSPWC, and the requirements referenced herein.
- B. Where indicated that the grade or alignment of the pipe is obstructed by existing utility structures such as conduits, ducts, or pipes, the obstruction shall be supported until it is relocated, removed, or reconstructed by the CONTRACTOR in cooperation with owners of utility structures.
- C. All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench. Pipe shall be kept clean during and after the laying. All openings in the pipe line shall be closed with water tight expandable type sewer plugs or PVC test plugs at the end of the each day's operation or whenever the pipe openings are left unattended. The use of burlap, wood, or other similar temporary plugs will not be permitted.
- D. The CONTRACTOR shall smooth out any burrs, gouges, or welded splatter and repair other defects prior to laying the pipe.
- E. Immediately prior to placing each section of pipe in final position for jointing, the bedding shall be checked for firmness and uniformity of surface.
- F. Pipe shall be laid directly on the bedding material. No blocking shall be permitted and the bedding shall form a continuous, solid bearing surface for the full length of the pipe. Excavation shall be adequate to facilitate removal of handling devices after pipe is laid.
- G. Bell holes shall be formed at the ends of the pipe to prevent point loading at the bells or couplings and to facilitate placement of grout bonds. Excavation shall be adequate to permit access to the joints.

- H. Where necessary to raise or lower the pipe due to unforeseen obstructions or other causes, the DISTRICT may direct a change in the alignment or the grades. Such changes shall be made by the deflection of joints, by the use of bevel adapters, or by the use of additional fittings. However, in no case shall the deflection in the joint exceed the maximum deflection recommended by the pipe manufacturer. No joint shall be misfit any amount which will be detrimental to the strength and integrity of the finished joint.
- I. Wherever possible, pipe shall be laid with the bell end up.
- J. The CONTRACTOR shall install all pipe, fittings, closure pieces, bends, reducers, wyes, tees, crosses, outlets, manifolds, and other specials, bolts, nuts, gaskets, jointing materials, and all other appurtenances as indicated and as required to provide a complete and workable installation.
- K. No pipe or appurtenances shall be installed when the interior or exterior surfaces show cracks or other defects that may be harmful as determined by the DISTRICT. Damaged interior and exterior surfaces shall be repaired to the satisfaction of the DISTRICT or a new undamaged pipe or appurtenance shall be provided.
- L. Where curved alignments are indicated, deflecting the joints shall be permitted only in accordance with the written instructions of the pipe manufacturer and these specifications.
- M. Where a smaller radius of curvature is required than can be accommodated by the deflecting joints, sections of pipe with beveled ends may be laid unless fabricated bends are indicated. Maximum joint deflection and maximum bevel for different pipe sizes and joint designs shall be in accordance with the pipe manufacturer's recommendations and these specifications.
- N. Cutting and machining of the pipe shall be in accordance with the pipe manufacturer's standard procedures for this operation. Pipe shall not be cut with a cold chisel, standard iron pipe cutter, nor any other method that may fracture the pipe, produce ragged, uneven edges or otherwise impair the condition of the pipe.
- O. Sheet piling used for shoring shall extend at least 2 feet below the bottom of the trench. After completion of pipe laying, it may be removed by cutting at least 12 inches above the top of the pipe. No vibratory methods for pile removal shall be accepted, and piling lower than 12 inches above the top of the pipe shall be left in place.

3.5 THRUST BLOCKS

- A. Thrust blocks shall be constructed where shown on the plans and where directed by the DISTRICT in accordance with the DISTRICT's Standard Drawings. In general, thrust blocks will be placed at all angles greater than 5 degrees, at changes in pipe size, at fittings, at hydrant ells, and at valves.
- B. The area and design of the bearing surface shall be as per the DISTRICT's Standard Drawings or approved design calculations.
- C. The bearing surface shall be against undisturbed ground in all cases, except where unstable conditions are encountered. In unstable conditions, the bearing surface shall be

as directed by the DISTRICT.

- D. Unless otherwise directed by the DISTRICT, the blocking shall be placed so that the pipe and fitting joints are accessible for repair.
- E. Metal harness of tie rods and pipe clamps shall be used to prevent movement if shown on the plans or directed by the DISTRICT.
- F. Exposed steel rods and clamps shall be coated per the requirements of Section 04000, Paintings and Coatings.
- G. Reinforcing steel tie-down rods shall be used on all line valves.
- H. The depth of thrust blocks below valves shall conform with the size of the valve and shall be cut into the side of the trench a minimum of 12 inches on each side.
- I. Concrete for thrust blocks shall be Class 450-C-2000.

3.6 SLOPE PROTECTION

- A. Cutoff walls shall be required where ground profile over the pipeline exceeds a 20 percent slope (20 feet vertical in 100 feet horizontal). Cutoff walls shall be constructed in accordance with the San Diego Area Regional Standard Drawings or as approved by the DISTRICT.
- B. In areas shown on the plans, slope protection terraces shall be constructed. Terraces shall be terraces or ditches constructed at approximately 30 degrees to the centerline of the pipe with a maximum spacing of 50 feet. The exact pattern and spacing shall be determined in the field by the DISTRICT to give the required protection.

3.7 SITE RESTORATION

- A. Backfill and compacted soil shall be in accordance with the provisions of the reference standards as supplemented by the requirements herein.
- B. Place subgrade and base materials in accordance with the provisions of the reference standards as supplemented by the requirements herein
- C. Damaged pavement, curbs, gutters, and sidewalks, shrubs, and trees shall be replaced as indicated in SSPWC "Green Book" Standard Specifications For Public Works Construction Subsection 306-1.5.2.

3.8 WARNING/IDENTIFICATION TAPE

- A. Warning/Identification tape shall be installed to identify location of underground utilities and to act as a warning against accidental excavation of buried utilities. Warning/Identification tape shall be used on all underground water and recycled water mains, and all related appurtenances. Warning/Identification tape shall also be used on cathodic protection wiring systems.

- B. Tape shall be an inert, non-metallic plastic film formulated for prolonged underground use that will not degrade when exposed to alkalis, acids and other destructive substances commonly found in soil.
- C. Tape shall be colored to identify the type of utility intended for identification. Printed and tape message and tape color shall be as follows:

<u>Printed Message</u>	<u>Tape Color</u>
Caution: Waterline Buried Below	Blue
Caution: Recycled Buried Below	Purple
Caution: Cathodic Protection Cable Buried Below	Red

- D. Tape shall be minimum .004”thick x 6” wide with a printed message on one side.

3.9 TRACER WIRE

- A. Tracer wire shall be installed on all buried water and recycled water mains and services for the purpose of providing a continuous signal path used to determine pipe alignment after installation.
- B. Tracer wire shall be #10 AWG solid copper UF type wire with cross-linked polyethylene insulation. The insulation shall be a white in color. Tracer wire shall be selected from the Approved Material List.
- C. Wire splices (at pipe tees, crosses and laterals) shall be accomplished using a direct bury silicone-filled capsule tube with standard wire nut or silicone-filled wire nut connectors of the appropriate size selected from the Approved Material List.

3.10 BLOWOFF ASSEMBLIES

- A. Blowoff assemblies shall be furnished and installed at the locations shown on the plans and at all low points or locations required by the DISTRICT in accordance with the DISTRICT’s Standard Drawings for removing water or sediment from the pipeline. Blowoff assemblies shall be sized as shown below:
 1. 2-inch blowoff assembly – pipeline sizes 10-inch and smaller.
 2. 4-inch blowoff assembly – pipeline sizes 12-inch through 16-inch.
 3. 6-inch blowoff assembly – pipeline sizes 18-inch and larger.
- B. The assembly shall be installed at the ends and at low points in the pipe or as shown on the Approved Plans. The pipeline tap for the blowoff assembly shall be no closer than 18 inches to a valve, bell, coupling, joint, or fitting unless it is at the end of the main.
- D. Blowoff assemblies shall not be connected to any sewer, submerged in any stream, or installed in any manner that will permit back siphoning into the distribution system. Blowoff assemblies shall not be placed along curbs, gutters or other areas where water surface runoff may submerge the assembly.

3.11 DISINFECTION AND PRESSURE TESTING

- A. Water mains, services, and appurtenances shall be disinfected and pressure tested in accordance with Sections 02600 and 02610, respectively.

END OF SECTION

**SECTION 02110 - ASBESTOS CEMENT PIPE REPAIRS,
DEMOLITION, AND DISPOSAL**

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes the repair, demolition, and disposal of asbestos cement pipe (ACP).

1.2 REFERENCED SPECIFICATIONS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section.
1. AWWA C213 Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
 2. AWWA C400 Asbestos-Cement Transmission Pipe 4 inch through 16 inch for Water and Other Liquids.
 3. AWWA C401 The Selection of Asbestos Cement Distribution Pipe, 4 inch through 16 inch for Water and Other Liquids.
 4. AWWA C402 Asbestos-Cement Transmission Pipe 18 inch through 42 inch for Potable Water and Other Liquids.
 5. AWWA C403 The Selection of Asbestos-Cement Transmission and Feeder Main Pipe, 18 inch through 42 inch.
 6. AWWA C800 Underground Service Line Valves and Fittings.

PART 2 - PRODUCTS

2.1 GENERAL

- A. ACP shall be used only as authorized by the DISTRICT for connections to existing ACP systems. All connections shall be made at existing joints. Field cutting of ACP shall not be permitted.
- B. ACP installations, other than for repairs and connections shall not be considered by the DISTRICT.
- C. The manufacturer of each shipment of pipe may be required to supply a statement certifying that each length of pipe has been subjected to the tests specified for ACP, and has been found to meet all requirements of the aforementioned AWWA Standards and as specified herein.
- D. The pipe and couplings shall be carefully inspected for defects. Any length of pipe, couplings or gaskets 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 job site the day defect is discovered.

2.2 ASBESTOS CEMENT PIPE

- A. ACP shall be a minimum of Class 150.
- B. The pipe and couplings shall comply with the latest edition of the AWWA Standards.
- C. Pipe ends shall be step machined to provide automatic end separation without the use of mechanical spacers. When assembled, the pipe will have only two rubber rings per coupling.
- D. ACP shall be provided in standard lengths of 13 feet, 6 feet 6 inches (6'-6"), 3 feet 3 inches (3'-3"), and 19 inches. Random lengths shall not be permitted.
- E. Cast iron fittings shall be used for all bends where deflections exceed maximum allowable deflection.

2.3 ASBESTOS CEMENT PIPE SADDLES

- A. Bronze double strap saddles shall be used on pipe sizes 8 inch through 16 inch. The saddle body shall be manufactured from cast bronze in accordance with ASTM B62 or B584 and AWWA C800. The gasket shall be Buna N.
- B. A fabricated steel saddle shall be used for all connections on pipe sizes larger than 16 inch.
- C. The carbon steel used in the fabricated steel saddle shall have a minimum yield strength of 30,000 psi. The bolts and nuts shall be stainless steel, Type 316. The entire sleeve shall be shop coated with 8 to 10 mils of fusion bonded powder epoxy in accordance with AWWA C213.
- D. No wet taps will be allowed where the outlet is the same size as the main.
- E. Fabricated steel and cast iron saddles shall have a minimum 1/2 inch threadolet or coupling for testing.
- F. Cast iron saddles shall be shop coated with 8 to 10 mils of liquid epoxy.

PART 3 - EXECUTION

3.1 GENERAL

- A. The CONTRACTOR shall install all repair and connection pipe, closure sections, fittings, valves and appurtenances shown on the plans including bolts, nuts, gaskets, and jointing materials.
- B. The CONTRACTOR shall maintain the inside of the pipe clean, sanitary, and free from foreign materials. At all times when the work of installing pipe is

not in progress, all openings into the pipe and the ends of the pipe in the trenches shall be kept tightly closed to prevent the entrance of animals and foreign materials.

- C. Where closure sections are required by the CONTRACTOR's laying operations, the sections shall be installed in accordance with the manufacturer's installation guide and shall only be used with the approval of the DISTRICT.
- D. The radius of curvature of the trench shall determine the maximum length of pipe section that can be used without exceeding the allowable deflection at a joint.
- E. Combined deflections at rubber gasket or flexible coupling joints shall not exceed 2 1/2 degrees.
- F. Use of 3 feet-3 inch (3'-3") or 19 inch pipe sections shall only be permitted with the approval of the DISTRICT.
- G. Any ACP water line(s) being abandoned shall be abandoned in place unless otherwise noted.

3.2 ABANDONMENT AND DISPOSAL

- A. If it is necessary to remove any abandoned ACP line(s) and/or appurtenances to accommodate improvements, the ACP line(s) and/or appurtenances shall be removed and salvaged if requested by the DISTRICT; otherwise, ACP shall be removed and disposed of in accordance with all applicable laws.
- B. All work involved in the removal, salvage or disposal of ACP shall be the responsibility and at the expense of the CONTRACTOR.
- C. All scrap ACP shall be properly manifested and prepared for transport following the criteria of the County of San Diego Department of Public Works, Solid Waste Division. The scrap material shall be delivered to a landfill permitted for disposal of non-friable asbestos containing materials.
- D. County of San Diego landfills do not accept friable asbestos-containing materials for disposal. Friable asbestos-containing materials are regulated as hazardous waste (22 CCR 66261.24). A friable material is defined as material that can be crumbled, pulverized, or reduced to powder in the hand.

County of San Diego landfills do accept non-friable asbestos-containing pipe (ACP) under the following conditions:

- 1. Small pieces of A/C pipe less than three feet long must have all broken edges encapsulated (sealed) with an approved product and double wrapped in a durable 6 mil plastic which is properly sealed to prevent expulsion of dust particles.

2. Intact A/C pipe over three feet long does not have to be double wrapped in 6 mil plastic. Any broken edges, however, must be encapsulated with an approved product. Certane 1000 Post Removal Encapsulant or equal.
 3. Make an appointment for disposal with the Solid Waste Division Office at least two working days prior to requesting disposal. Inform the appropriate Field Services section of appointment date and time.
 4. Asbestos containing pipe will be accepted into the landfill if the pipe is intact and if all broken edges are encapsulated using approved products and techniques. Small pieces of asbestos containing pipe less than three feet long must have any broken edges adequately encapsulated and it must be double wrapped in a durable 6 mil plastic which is properly sealed to prevent the expulsion of dust particles.
 5. The landfill will accept a maximum of two packaged loads per day per generator, unless prior approval has been obtained from the Solid Waste Division.
 6. Each load must be accompanied by a Department of Public Works Non-Hazardous, Non-Infectious Special Waste Manifest.
 7. All loads may be subject to inspection by County personnel prior to admittance to the landfill.
- E. The completed Generator copy (yellow) manifest shall be returned to the DISTRICT.

3.3 INSTALLATION

- A. Proper care shall be used to prevent damage in handling, moving, and placing the pipe. Tools and equipment satisfactory to the DISTRICT shall be provided and used by the CONTRACTOR.
- B. The pipe shall not be dropped, dragged, or handled in a manner that will cause bruises, cracks, or other damage.
- C. All pipe, fittings, valves, and other pipeline materials shall be lowered into the trench in a manner that prevents damage.
- D. Rubber rings for pipe joints shall be stored and protected in a proper manner to prevent deterioration.
- E. All material damaged in the course of installation shall be identified and removed from the job site.
- F. Pipe sections shall be laid by mechanical means in the trench to true alignment and grade in accordance with the drawings. The pipe grade shall be approved by the DISTRICT.

- G. Bell holes shall be excavated at each joint to permit proper assembly and inspection of the entire joint.
- H. Field cutting of ACP will not be permitted. All connections shall be made at existing joints.
- I. The CONTRACTOR shall be permitted to utilize Poly Vinyl Chloride (PVC) Pressure Pipe, 4-12 Inches for Water (Section 02500) in lieu of ACP. This general approval shall be limited for use of PVC to "milled over all" (MOA) pipe sections with a maximum six feet six inch (6'-6") pipe length. PVC pipe sections shall be provided by a DISTRICT approved manufacturer.
- J. The CONTRACTOR shall provide six feet six inch (6'-6") pipe lengths (shorts) on both sides of fittings. Other size shorts shall be permitted only with prior approval of the DISTRICT.
- K. The CONTRACTOR shall take all necessary precautions to prevent the pipe from floating due to water entering the trench from any source. The CONTRACTOR shall assume full responsibility for any damage due to this cause; and shall, at their own expense, restore and replace the pipe to its specified condition and grade before any displacement occurred due to floating.
- L. Fittings shall be temporarily supported by placing concrete blocks under the bells until thrust blocks and supports are poured so that the pipe is not subjected to the weight of the fitting.
- M. Concrete thrust blocks of the size shown on the Standard Drawings or as instructed by the DISTRICT, shall be provided at the locations of all fittings and valves, at not additional cost to the DISTRICT.

END OF SECTION

SECTION 02200 - SMALL PIPE FITTINGS AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this section includes materials and installation of copper tubing, copper, brass, and bronze pipe fittings and appurtenances.

1.2 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300.
 - 1. Manufacturer's catalog data, descriptive literature and assembly drawings. Show dimensions and materials of construction by specification reference and grade.

PART 2 - PRODUCTS

2.1 COPPER TUBING AND FITTINGS

- A. Tubing
 - 1. Copper tubing shall conform to the requirements of ASTM B88 for seamless copper water tube.
 - 2. Copper tubing shall be true, smooth, and clean on both inside and outside and free from any cracks, seams, or other defects.
 - 3. Copper tubing shall be truly cylindrical, of the full specified outside and inside diameters, and of uniform thickness of metal.
- B. Piping located above ground or suspended within vaults shall be Type L.
- C. Buried copper piping shall be Type K.
- D. Fittings
 - 1. Fittings shall conform to ASTM B75 or B152, and ANSI B16.22.
 - 2. Fittings may have flared end connections for 1 inch copper and sweat by threaded for 1-1/2 inch and 2 inch copper.
- E. All solder shall be silver conforming to ASME SFA5.8, BCuP5.
- F. Cored solder shall not be permitted.

2.2 BRASS PIPE, NIPPLES, AND FITTINGS

- A. Short threaded nipples, brass pipe and fittings shall conform to ASTM B43, regular wall thickness.
- B. Threads shall conform to ANSI B2.1.

2.3 BRONZE APPURTENANCES

- A. Items specified herein shall be manufactured of bronze conforming to ASTM B 62, "Composition Brass or Ounce Metal Castings."
- B. For PVC pipe sizes smaller than 12 inches, 1 to 2 inch service saddles shall be the single strap type and shall have a full body circle clamp.
- C. For PVC pipe sizes larger than 12 inch, epoxy coated fabricated carbon steel saddles or ductile iron tapped tees shall be used.
- D. For 1 to 2 inch service saddles used on 16 inch and smaller ACP, pipe shall be the double strap brass saddle. See Sections 02500, 02510.
- E. Corporation stops shall be manufactured of bronze.
- F. Angle meter stops shall be manufactured of bronze.
- G. Customer service valves shall be manufactured of bronze with lever-type handle.

2.4 FLANGES, GASKETS, BOLTS, AND NUTS

- A. Connect to flanged valves and fittings with bronze flanges conforming to ANSI B16.24, Class 125 or Class 150, to match the connecting flange. Use threaded end companion flanges.
- B. Gaskets for flanged-end fittings shall be made of synthetic rubber and shall be fullface or drop-in type, 1/8 inch thick.
- C. Nuts and bolts shall be hexagonal head bolts and hexagonal head nuts conforming to ASTM Designation: 307, Grade B or SAE Grade 2, cadmium plated. All bolt threads shall be lubricated with graphite or oil prior to installation.

PART 3 - EXECUTION

3.1 COPPER TUBING AND FITTINGS

- A. Tubing shall be cut square and burrs shall be removed. Inside and outside of fitting and pipe ends shall be cleaned. Annealing of fittings and tubing shall be prevented when making connections. Do not miter joints for elbows or notch straight runs of pipe for tees.

- B. Bends in soft copper tubing shall be long sweep. Bends shall be shaped with shaping tools. Bends shall be formed without flattening, buckling, or thinning the tubing wall at any point.
- C. Brazing procedures shall be in accordance with Articles XII and XIII, Section IX, of the ASME Boiler and Pressure Vessel Code. Stick type lead free silver solder shall be used on all DISTRICT facilities.
- D. Soldering shall conform to AWS C3.4 and the manufacturer's recommendations. Solder shall penetrate to the full depth of the cup in joints and fittings.
- E. Buried tubing shall be installed a minimum of 30 inches below finished street grade, unless approved by the DISTRICT, with some slack to provide flexibility in the event of a load due to settlement, expansion or contraction. The tubing shall be bedded, and covered with 12- inches of select material. Appropriate identification tape shall be installed on top of the select material.
- F. All 2-inch size services shall be installed with straight lengths of soft copper water tube, Type K.

3.2 SERVICE SADDLES

- A. Service saddles shall be compatible with the size and type of pipe receiving the saddle in accordance with the manufacturer's recommendations and shall be selected from the Approved Materials List.
- B. Service saddles shall be no closer than 18 inches to a valve, coupling, joint, or fitting.
- C. Installation of a service saddle on any machined section of Asbestos Cement Pipe shall NOT be permitted.
- D. The surface of the pipe shall be clean and all loose material removed to provide a hard, clean surface.
- E. Service saddles shall be tightened firmly to ensure a tight seal; however, care shall be used to prevent damage or distortion of either the corporation stop or service saddle by over tightening. A torque wrench shall be used in tightening to comply with manufacturer torque specifications.
- F. The tap into the pipe shall be made in accordance with the pipe manufacturer's recommendation.

3.3 FLANGE BOLTS AND NUTS

- A. Bolt threads shall be lubricated with a DISTRICT approved anti-seize compound.
- B. Flanged pipe shall be set with the flange bolt holes straddling the pipe vertical centerline.

3.4 INSULATING BUSHINGS AND UNIONS

- A. Pipe or fittings made of nonferrous metals shall be isolated from ferrous metals by nylon insulating pipe bushings.
- B. PVC bushings shall not be permitted.

END OF SECTION

SECTION 02300 – DUCTILE-IRON FITTINGS

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes materials and installation procedures for ductile-iron fittings for potable and recycled water systems.

1.2 REFERENCE STANDARDS

- A. 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.

AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings

AWWA C110 - Ductile-Iron and Gray-Iron Fittings

AWWA C153 - Ductile-Iron Compact Fittings

1.3 SERVICE APPLICATION

- A. Ductile-iron fittings shall be used as needed in conjunction with the installation of PVC pipe and ductile-iron pipe in locations shown on the Approved Plans.

1.4 DESIGN REQUIREMENTS

- A. General

- 1. Ductile-iron fittings shall be manufactured per AWWA C110 and C153. Gray-iron or cast-iron fittings shall not be used. Gray iron or cast-iron flanges shall not be used.

- 2. Ductile-iron fittings shall be mechanical, flanged, or push-on joints in accordance with AWWA C110 and C153.

- 3. Except as amended herein, or otherwise shown on the Approved Plans, joints for ductile-iron fittings shall have a pressure rating equal to or greater than the adjacent piping.

- B. Unless otherwise specified, ductile-iron flanged fittings shall be integrally cast in accordance with AWWA C110, rated at a working pressure of 1,724 KPa (250 psi). Gray-iron or cast-iron flanged fittings are not permitted.

- C. The exterior surfaces of all ductile-iron fittings shall be factory-coated with a minimum one (1) mil thick petroleum asphaltic material, per AWWA C110 and C153.

- D. All ductile-iron fittings shall be cement-mortar lined and seal-coated in accordance with AWWA C104. Cement-mortar shall be in accordance with ASTM C 150, Type II or Type V.

1.5 QUALITY ASSURANCE

- A. The manufacturer of each shipment of ductile-iron fittings shall be required to supply a statement certifying that each lot or load of fittings has been subjected to and met the tests specified for ductile-iron fittings per AWWA C110 and C153, as applicable.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, storage, and handling of ductile-iron fittings shall follow the recommendations of AWWA C600 and shall also be as specified herein:
 - 1. Handling of fittings shall be performed with lifts, cranes, or other suitable equipment and devices. Slings, hooks, or pipe tongs shall be padded and used in such a manner as to prevent damage to the fittings, linings, and coatings. The fittings shall not be dropped or dragged.
 - 2. During transport, fittings shall be supported and secured against movement using padded devices in such a manner to prevent damage.
 - 3. Stored fittings shall be protected from damage and kept free from dirt and foreign materials by closing the ends of the pipe. Other pipeline materials shall be protected by appropriate packaging or wrapping. Gaskets shall be stored in a cool location out of direct sunlight. Bolts, nuts, and washers shall be handled and stored in a dry location.
 - 4. Maintain plastic end caps on all fittings in good condition until the pipe is ready to be installed in the trench. Periodically open the plastic end caps and spray clean potable water inside fittings for moisture control.
 - 5. Under no circumstances shall ropes or other handling devices be attached through the interior of fittings.

1.7 POLYETHYLENE WRAP

- A. Polyethylene wrap shall be installed for buried ductile-iron fittings in accordance with Section 04200.

PART 2 - MATERIALS

2.1 DUCTILE-IRON FITTINGS

- A. Ductile-iron fittings and appurtenant components and materials shall be selected from the Approved Materials List and in accordance with the Standard Drawings.

2.2 GASKETS

- A. Mechanical-joint rubber gasket configuration and materials shall comply with AWWA C111 and shall be in accordance with the applicable joint type and pressure rating of the pipe system.

- B. Flange gaskets shall be 3.2 mm (1/8") thick aramid fiber bound with nitrile for all sizes of pipe. Gaskets shall be drop in or full-face type with pre-punched holes.
- C. If soil is contaminated with organic solvents or petroleum products are encountered during the course of the WORK, alternate gasket materials or joint treatment may be required by the DISTRICT Engineer.

2.3 BOLTS AND NUTS FOR FLANGES

- A. Bolts and nuts shall be in accordance with Section 02200 and shall be selected from the Approved Materials List.

2.4 PAINTING AND COATING

- A. Buried ductile-iron fittings shall receive a shop applied asphaltic coating in accordance with AWWA C 151.
- B. The DISTRICT may require alternative coatings based on special conditions and the Corrosion Engineer's recommendations. Additional coating requirements shall be shown of the drawings.
- C. Materials for coating of ductile-iron fittings located above ground and in structures shall be in accordance with Section 04000.

2.5 IMPORTED GRANULAR MATERIAL FOR PIPE AND TRENCH ZONES

- A. Imported granular material for use in pipe and trench zones shall be in accordance with Section 02000.

2.6 CONCRETE

- A. Concrete for thrust, anchor, and support blocks shall be in accordance with Section 03000.

PART 3 - EXECUTION

3.1 GENERAL

- A. Ductile-iron fittings shall be installed in accordance with manufacturer's recommendations.

3.2 TRENCHING, BACKFILLING AND COMPACTING

- A. Trenching, backfilling and compacting shall be performed in accordance with Section 02000.

3.3 POLYETHYLENE WRAP

- A. Polyethylene wrap shall be used for the buried installation of ductile iron fittings and shall be installed in accordance with Section 04200.

3.4 FLANGED FITTINGS

- A. Flanged fittings shall be installed where indicated on the Approved Drawings.
 - 1. Bolt holes shall straddle the vertical centerline.
 - 2. The bolts, nuts and flange faces shall be thoroughly cleaned by wire brush prior to assembly.
 - 3. Bolts and nuts shall be lubricated with a DISTRICT approved grease for protection of buried nuts and bolts.
 - 4. Nuts shall be tightened in an alternating “star” pattern to the manufacturer’s recommended torque.
 - 5. Coat the exterior of exposed flanges, bolts and nuts located above ground or within vaults in accordance with Section 04000.

3.5 MECHANICAL – JOINT FITTINGS

- A. Install mechanical-joint fittings per AWWA C600 and the manufacturer’s recommendations.
- B. Prior to installation of the mechanical join, clean the socket and plain end of the pipe. Lubricate both the gasket and plain end of the pipe within approved lubricant per AWWA C111 immediately prior to slipping the gasket onto the plain end of the pipe.

3.6 SUPPORT FOR DUCTILE-IRON FITTINGS

- A. All ductile-iron fittings require concrete support blocks in accordance with Section 02100 to prevent the fittings weight from being carried by the adjacent pipe.

3.7 THRUST AND ANCHOR BLOCKS

- A. Concrete thrust and anchor blocks shall be installed in accordance with the Approved Plans, Section 02100 and the Standard Drawings.

3.8 JOINT RESTRAINT SYSTEMS

- A. Joint restraint lengths along new pipelines shall be as shown on the Approved Plans. If the installation of concrete thrust blocks is not practical and the use of joint restraint systems are approved by the DISTRICT Engineer, calculations indicating joint restraint lengths along new pipelines shall be submitted to the DISTRICT Engineer for approval.

END OF SECTION

SECTION 02400 - STEEL PIPE, MORTAR LINED AND COATED

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes providing mortar-lined and mortar-coated steel pipe, including fittings and specials, complete in place.

1.2 REFERENCE SPECIFICATIONS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section.

1.	AWWA	C200	Steel Water Pipe 6 Inch and Larger
2.	AWWA	C205	Cement-Mortar Protective Lining and Coating for Steel Water Pipe-4 Inch and Larger-Shop Applied
3.	AWWA	C206	Field Welding for Steel Water Pipe Fittings
4.	AWWA	C207	Steel Pipe Flanges
5.	AWWA	C208	Dimensions for Fabricated Steel Water Pipe Fittings
6.	AWWA	C602	Cement-Mortar Lining of Water Pipelines 4-inch and Larger-In Place
7.	AWWA	M11	Steel Water Pipe - A Guide for Design and Installation

1.3 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300.

1. Shop drawings
 - a. Shop drawings showing dimensions and details of pipe, joint fittings, fitting specials, valves and appurtenances.
 - b. Joint and fitting wall construction details which indicate the type and thickness of cylinder; the position, type, size, and area of reinforcement; manufacturing tolerances; and all other pertinent information required for the manufacture of the product.
 - c. Joint details shall be submitted where deep bell or butt strap joints are required for control of temperature stresses.
 - d. Fittings and specials details such as elbows, reducers, wyes, tees, crosses, outlets, connections and test bulkheads, and nozzles or other specials where shown which indicate amount and position of all reinforcement. All fittings and specials shall be properly reinforced to withstand the internal pressure, both circumferential and longitudinal, and the external loading conditions as indicated in the Contract Documents.
 - e. Material lists and steel reinforcement schedules which include and describe all materials to be utilized.

- f. Full and complete information regarding location, type, size, and extent of all welds shall be shown on the shop drawings. The shop drawings shall distinguish between shop and field welds.
- g. Shop drawings shall indicate by welding symbols or sketches the details of the welded joints, and the preparation of parent metal required to make them.

2. Design Calculations

- a. Calculations supporting selected wall thickness.
- b. Calculations supporting welded joint design.

B. Certificates

- 1. The CONTRACTOR shall furnish a certification stating that all pipe, special fittings, and other products or materials furnished under this Section of the Specifications comply with AWWA C200 and C205.

C. Test Reports

- 1. The CONTRACTOR shall furnish certified reports of the following tests:
 - a. Physical and chemical properties of all steel.
 - b. Hydrostatic test reports.
 - c. Results of production weld tests.
 - d. Upon request by the DISTRICT, mill test reports on each sheet from which steel is rolled will be submitted.

1.4 INSPECTION

A. Factory Inspection

- 1. All pipe shall be subject to inspection at the place of manufacturer in accordance with the provisions of AWWA C200 and C205, respectively, as supplemented by the requirements herein.
- 2. The CONTRACTOR shall notify the DISTRICT in writing of the manufacturing starting date not less than 14 calendar days prior to the start of any phase of the pipe manufacture.

1.5 WELDING

- A. All welding procedures used to fabricate pipe shall be prequalified under the provisions of AWS D1.1.
- B. Welding procedures shall be required for, but not necessarily limited to, longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.
- C. All welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used.
- D. Welders shall be qualified under the provisions of AWS D1.1 by an independent local, approved testing agency not more than 6 months prior to commencing work on the pipeline. Machines and electrodes similar to those used in the WORK shall be used in qualification tests.
- E. The CONTRACTOR shall furnish all material and bear the expense of qualifying welders.

1.6 TESTING

- A. Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of AWWA C200 and C205, as applicable.
 - 1. Shop Testing of Steel Pipe
 - a. After the joint configuration is completed and prior to lining with cement-mortar, each length of pipe of each diameter and pressure class shall be shop-tested and certified to a pressure of at least 80 percent of the yield strength of the pipe steel.
 - b. Production weld tests shall be conducted in compliance with AWWA C200. In addition to the frequency of tests required in AWWA C200, weld tests shall be conducted on each 2,000 feet of production welds and at any other times there is a change in the welding procedure or welding equipment.
 - 2. Shop Testing of Steel Plate Special
 - a. Upon completion of welding, but before lining and coating, each special shall be bulkheaded and tested under a hydro-static pressure of not less than 1-1/2 times the design pressure; provided, that if straight pipe used in fabricating the specials has been previously tested and meets the requirements of the applicable piping Section, no further hydrostatic testing will be required; or provided, that all other welded seams are tested by the liquid penetrant inspection procedure conforming to ASTM E165, under Method "B" and "Leakage Testing" or where applicable by the soap and compressed air method at an air pressure of 25 psi. Any pin holes or porous welds which may be revealed by the test shall be chipped out and rewelded and the special retested.
 - b. No outside coating shall be applied over a seam prior to testing; however, mortar lining may be applied over a seam prior to hydrostatic testing, but under

such conditions said pressure test shall be held on the pipe or fitting for a period of not less than 30 minutes.

- B. The CONTRACTOR shall perform said material tests at no additional cost to the DISTRICT. The DISTRICT shall have the right to witness all testing conducted by the CONTRACTOR; provided, that the CONTRACTOR's schedule is not delayed for the convenience of the DISTRICT.
- C. In addition to those tests specifically required, the DISTRICT may request additional samples of any material including mixed concrete and lining and coating samples for testing by the DISTRICT. The additional samples shall be furnished at no additional cost to the DISTRICT.
- D. All expenses incurred in making samples for certification of tests shall be borne by the CONTRACTOR.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Mortar lined and coated steel pipe shall conform to AWWA C200 and C205, subject to the following supplemental requirements. The pipe shall be of the diameter and class shown, shall be furnished complete with rubber gaskets or welded joints, as indicated in the Contract Documents, and all specials and bends shall be provided as required for a complete piping system.
- B. Specials are defined as fittings, closure pieces, bends, reducers, wyes, tees, crosses, outlets, manifolds, and other steel plate specials, wherever located, and all piping above ground or in structures.
- C. Dimensions of fabricated steel pipe fittings shall comply with AWWA C208.
- D. Pipe 14 inches in diameter and larger, the inside diameter after lining shall not be less than the nominal diameter specified or shown.
- E. Pipe smaller than 14 inches in diameter may be furnished in standard outside diameters.
- F. The pipe lining shall have smooth dense interior surfaces and shall be free from fractures, excessive interior surface crazing and roughness.
- G. Closures and correction pieces shall be provided as required so that closures may be made due to different headings in the pipe laying operation and so that correction may be made to adjust the pipe laying to conform to pipe stationing shown on the Drawings.
- H. The CONTRACTOR shall be fully liable for the cost of replacement or repair of pipe and specials which are damaged.
- I. The CONTRACTOR shall legibly mark all pipes and specials in accordance with the laying schedule and marking diagram. Each pipe shall be numbered in sequence and said number shall appear on the laying schedule and marking diagram in its proper location for installation.

- J. All special pipe sections and fittings shall be marked at each end indicating the top. The word “top” shall be painted or marked on the outside top spigot end of each pipe section.

2.2 STRUTTING

- A. Adequate strutting shall be provided on all specials, fittings, and straight pipe so as to avoid damage to the pipe and fittings during handling, storage, hauling, and installation. In addition, the following requirements shall apply:
1. The strutting shall be placed as soon as practicable after the mortar lining has been applied and shall remain in place while the pipe is loaded, transported, unloaded, installed and backfilled at the jobsite.
 2. The strutting materials, size, and spacing shall be adequate to support the earth backfill plus any greater loads which may be imposed by the backfilling and compaction equipment.
 3. Any pipe damaged during handling, hauling, storage, or installation due to improper strutting shall be repaired or replaced.
 4. The details of the strutting assembly shall be submitted for review by the CONTRACTOR prior to the start of pipe manufacture.

2.3 PIPE DESIGN CRITERIA

A. General

1. The pipe shall be steel pipe, mortar-lined and mortar-coated, with rubber gasketed or field welded joints as shown. The pipe shall consist of steel cylinder, either shop-lined or lined-in-place with portland cement-mortar with an exterior coating of cement mortar.
2. The pipe shall be designed, manufactured, tested, inspected, and marked according to applicable requirements of AWWA C200 except as hereinafter modified.
3. The pipe shall be of the diameter and indicated pressure class. The minimum steel cylinder thickness for each pipe size shall be as indicated.
4. Maximum pipe lengths for laying shall be 40 feet with shorter lengths provided as required.

B. Cylinder Thickness for Internal Pressure

1. For resistance to internal pressure, the thickness of the steel cylinder shall not be less than the greater of that determined by the following formulas:

$$\text{a. } T = \frac{P_w D/2}{Y/S_t} \qquad \text{b. } T = \frac{P_t D/2}{Y/S_w}$$

Where: T = Steel cylinder thickness, inches
D = Outside diameter of steel cylinder, inches

- P_w = Design working pressure, psi
- P_t = Design transient pressure, psi
- Y = Specified minimum yield point of steel, psi
- S_w = Safety factor of 2.0 at design working pressure
- S_t = Safety factor of 1.5 at design transient pressure

D. Unless otherwise indicated, P_w shall be assumed to equal the indicated pipe pressure class and P_t shall be assumed to equal $1.33 P_w$. In no case shall the design stress (Y/S_w) exceed 16,500 psi at design working pressure, P_w , nor shall the design stress (Y/S_t) exceed 22,000 psi at design transient pressure, P_t , nor shall the steel shell thickness be less than No. 10 gauge (0.135 in.) or the nominal pipe diameter divided by 240, whichever is greater, as show in the following table:

<u>Nominal Pipe Diameter (in.)</u>	<u>Minimum Cylinder Thickness (in.)</u>
6 - 30	0.135
36	0.150
42	0.175
48	0.200
54	0.225

E. Upon determination of cylinder thickness, for internal pressure, deflection of the pipe shall be checked by the following formula:

$$\text{Defl}_x = \frac{DKW^3}{EI + 0.0614 E'r^3}$$

Where: Defl_x = Vertical deflection of pipe in inches, not to exceed 0.015 times the nominal diameter.

D = Deflection lag factor (1.0-1.5)

K = Bedding constant (0.1)

W = Vertical load on pipe, lb/in (see Notes 1 and 2)

r = Mean radius of pipe shell, inches

EI = Pipe wall stiffness, lb-in (see Note 3)

E' = Modulus of soil reaction, lb/in² (1100 for 90 percent Standard Proctor; 1500 for 95 percent Standard Proctor; 2500 for 100 percent Standard Proctor, i.e., cement crushed rock)

Note 1: In the determination of the vertical load on the pipe, W , the trench condition shall normally apply unless an actual embankment condition exists or the trench width exceeds the transition width, in which case the embankment condition shall apply. Yard piping shall always be designed for an embankment condition. The CONTRACTOR is cautioned that depth of covers less than 3 feet, if permitted, shall be investigated for concentrated wheel loads.

Note 2: For depths of cover of 10 feet or greater, the earth load shall be computed assuming the trench/embankment condition as applicable. For depths of cover of less than 10 feet, HS-20 live load shall be included. For depths of cover of 3 feet or less, HS-20 live load plus impact shall be included. The determination of live load and impact factors shall be as recommended by AASHTO in “Standard Specifications for Highway Bridges.”

Note 3: Value of EI is based on the sum of the pipe wall stiffness, mortar lining and coating, and steel cylinder, assuming that it acts as a three-part laminar ring which considers no bond between the steel cylinder and the applied lining and coating. The term “pipe wall stiffness” as used herein is defined as EI, where “E” is the modulus of elasticity (E=30,000,000 psi for steel and E=4,000,000 psi for mortar) and “I” is the transverse moment of inertia per unit length of pipe wall, the factors in the forgoing expression to be dimensionally compatible.

Trench Condition:

$$W_d = C_d w B_d^2$$

Where: W_d = Earth load, lb/ft

C_d = Load coefficient

K_u' = 0.13

w = Unit weight of full, lb/cu ft 120 lb/ft³

B_d = Trench width at top of pipe, feet

Positive Projecting Embankment Condition:

$$W_c = C_c w B_c^2$$

Where: W_c = Earth load, lb/ft

C_c = Load coefficient

K_u = 0.13

w = Unit weight of full, lbs/cf 120 lb/ft³

B_c = Trench width at top of pipe, feet

r_{sd} = Settlement ratio

P = Projection ratio

- F. If the calculated deflection, $Defl_x$, exceeds 0.015 times the nominal diameter, the composite pipe section shall be thickened or the quality of pipe zone backfill shall be improved to achieve a higher soil modulus.

2.4 DESIGN SPECIALS

- A. Except as otherwise provided herein, materials, fabrication and shop testing of straight pipe shall conform to the requirements of AWWA C200. Dimensions for fittings shall conform to AWWA C208. The minimum thickness of plate for pipe from which specials are to be fabricated shall be the greater of that determined by the following two formulas:

$$a. \quad T = \frac{P_w D}{2 Y S_w} \qquad b. \quad T = \frac{P_t D}{2 Y S_t}$$

Where: T = Steel cylinder thickness, inches

D = Outside diameter of steel cylinder, inches

P_w = Design working pressure, psi

P_t = Design transient pressure, psi

Y = Specified minimum yield point of steel, psi

S_w = Safety factor of 2.0 at design working pressure

S_t = Safety factor of 1.5 at design transient pressure

- B. In no case shall the design stress at design working pressure (Y/S_w) for mortar-coated steel pipe exceed 16,500 psi or 22,000 psi at design transient pressure (Y/S_t), nor shall plate thickness be less than the thickness of adjacent mainline pipe or the following:

<u>Nominal Pipe Diameter (in.)</u>	<u>Pipe Manifolds Piping Above Ground Piping in Structures</u>	<u>Elbows Bends Reducers</u>
24 and under	3/16 - inch	10 - ga.
25 to 48	1/4 - inch	1/4 - inch
over 48	5/16 - inch	5/16 - inch

- C. Pipe installed on saddle supports shall be designed to limit the longitudinal bending stress to a maximum of 10,000 psi. Design shall be in accordance with the provisions of Chapter 7 of AWWA M-11.

2.5 MATERIALS

- A. Pipe manufactured under AWWA C200 shall be fabricated from sheet conforming to the requirements of Table 1 in Section 2. All longitudinal and girth seams, whether straight or spiral, shall be butt welded using an approved electric-fusion-weld process.

- B. All steel used for the fabrication of pipe shall have a maximum carbon content of 0.25 percent, a maximum sulfur content of 0.015 percent, and shall have a minimum elongation of 22 percent in a 2-inch gauge length.
- C. All steel used in fabricating pipe which exceeds 1/2-inch in thickness shall be tested for notch toughness using the Charpy V-Notch test in accordance with ASTM A370. The steel shall withstand a minimum impact of 25 ft. lb. at a temperature of 30 degrees F.
- D. Steel shall be fine-grained, fully kilned and manufactured by the continuous casting process.
- E. Cement for mortar shall conform to the requirements of AWWA C205; provided that cement for mortar lining shall be Type II and mortar lining shall be Type II. Fly ash or pozzolan shall not be used as a cement replacement.

2.4 JOINT DESIGN

A. GENERAL

1. The standard field joint for steel pipe shall be either a single-welded lap joint or a rubber-gasketed joint for all pipe sizes up to and including 54-inch diameter and shall be single-welded lap joint for pipe sizes above 60-inch diameter. Double welded joints with air taps for air pressure testing shall be provided where shown.
2. Mechanically coupled, or flanged joints shall be required where shown.
3. Butt-strap joints shall be used only where required for closures or where shown, or approved by the DISTRICT.
4. The joints furnished shall have the same or higher pressure rating as the abutting pipe.
5. Shop-applied interior linings and exterior coatings shall be held back from the ends of the pipe as indicated or as otherwise acceptable to the DISTRICT.
6. Where indicated, restrained joints shall be field-welded joints. Designs shall include considerations of stresses induced in the steel cylinder, the joint rings, and any field welds, caused by thrust at bulkheads, bends, reducers, and line valves resulting from the design working pressure. All joints to be field welded for thrust restraint shall have the joint rings attached to the cylinder with double fillet welds. Calculations for the number of joints that need to be welded on each side of all vertical and horizontal angle points shall be furnished to the DISTRICT at no additional cost to the DISTRICT.
7. For field welded joints, design stresses shall not exceed 50 percent of the indicated minimum yield strength of the grade of steel utilized, or 16,500 psi, whichever is less, for the part being examined when longitudinal thrust is assumed to be uniformly distributed around the circumference of the joint. At the CONTRACTOR's option, the steel cylinder area may be progressively reduced from the point of maximum thrust to the end of the restrained length.

B. Lap Joints

1. Preparation for field welding shall be in accordance with AWWA C200.
2. The method used to form, shape and size bell ends shall be such that the physical properties of the steel are not substantially altered. Unless otherwise approved by the DISTRICT, bell ends shall be formed by an expanding press or by being moved axially over a die in such a manner as to stretch the steel plate beyond its elastic limit to form a truly round bell of suitable diameter and shape. No process will be permitted in which the bell is formed by rolling. Faying surfaces of the bell shall be essentially parallel, but in no case shall the bell slope vary more than 2 degrees from the longitudinal axis of the pipe.

C. Bell and Spigot Ends

1. The CONTRACTOR shall require the pipe manufacturer to submit details complete with significant dimensions and tolerances and also to submit performance data indicating that the proposed joint has performed satisfactorily under similar conditions. In the absence of a history of field performance, the results of a test program shall be submitted.
2. The method used to form, shape and size bell ends shall be such that the physical properties of the steel are not substantially altered.
3. Unless otherwise approved by the DISTRICT, bell ends shall be formed by an expanding press or by being moved axially over a die in such a manner as to stretch the steel plate beyond its elastic limit to form a truly round bell of suitable diameter and shape. No process will be permitted in which the bell is formed by rolling.
4. Unless otherwise approved by the DISTRICT, spigot ends with rolled gasket grooves shall be non-destructively tested by the dye penetrant or magnetic particle method for the full circumference, especially at the weld seam area.
5. Faying surfaces of the bell and spigot shall be essentially parallel, but in no case shall the bell slope vary more than 2 degrees from the longitudinal axis of the pipe.
6. Actual yield strength of the steel used in the spigot rolling operation (i.e. yield strength values in mill certifications and subsequent destructive test results) shall be limited to 50,000 psi.
7. For bell-and-spigot ends with rubber gaskets, the clearance between the bells and spigots shall be such that when combined with the gasket groove configuration and the gasket itself, will provide watertight joints under all operating conditions when properly installed.
8. Full and complete information regarding location, type, size, and extent of all welds shall be shown on the shop drawings. The shop drawings shall distinguish between shop and field welds. Shop drawings shall indicate by welding symbols or sketches the details of the welded joints, and the preparation of parent metal required to make them. Joints or groups of joints in which welding sequence or technique are especially important shall be carefully controlled to minimize shrinkage stresses and distortion.

D. Flanges

1. AWWA C207, Class D flanges (matching ANSI/ASME B16.1, Class 125 flanges for bolt hole size and drilling) shall be used for pressures up to 150 psi.
2. AWWA C207, Class E flanges (matching ANSI/ASME B16.1, Class 125 flanges for bolt hole size and drilling) shall be used for pressures between 150 psi and 250 psi.
3. AWWA C207, Class F flanges (matching ANSI/ASME B16.1, Class 250 flanges for bolt hole size and drilling) shall be used for pressures between 250 psi and 300 psi or when Class 250 butterfly valves or other appurtenances using flanges corresponding to AWWA C207 Class F are required.
4. Flanges shall be flat-faced type only. Segmented flanges shall not be used.

2.7 CEMENT-MORTAR LINING OF PIPE

A. General

1. Except as otherwise required, interior surfaces of all steel pipe, fittings, and specials shall be cleaned and lined in the shop with cement-mortar lining applied centrifugally in conformity with AWWA C205.
 2. The progress of the application of mortar lining shall be regulated in order that all hand work, including the repair of defective areas is cured in accordance with the provisions of AWWA C205.
 3. During the lining operation and thereafter, the pipe shall be maintained in a round condition by suitable bracing or strutting.
 4. The lining machine shall be of a type that has been used successfully for similar work.
 5. If lining is damaged or found faulty at delivery site, the damaged or unsatisfactory portions shall be replaced with lining conforming to these Specifications at no additional cost to the DISTRICT.
- B. The minimum lining thickness shall be in accordance with AWWA C200, Table 1 of Section 4.
- C. The pipe shall be left bare where field joints occur as indicated. Ends of the linings shall be left square and uniform. Feathered or uneven edges will not be permitted.
- D. Defective linings, as determined by the DISTRICT, shall be removed from the pipe wall and shall be replaced to the full thickness required. Defective linings shall be cut back to a square shoulder in order to avoid feathered edged joints.
- E. Cement-mortar for patching shall be the same materials as the mortar for machine lining, except that a finer grading of sand and mortar richer in cement shall be used when field inspection indicates that such mix will improve the finished lining of the pipe.

- F. For all pipe and fittings with plant-applied cement-mortar linings, the pipe manufacturer shall provide a polyethylene or other suitable bulkhead on the ends of the pipe and on all special openings to prevent drying out of the lining. All bulkheads shall be substantial enough to remain intact during shipping and storage until the pipe is installed.
- G. Cement-Mortar Lining for Field Application
 - 1. The materials and design of in-place cement-mortar lining shall be in accordance with AWWA C602 and the following supplementary requirements.
 - a. Portland cement shall conform to Type II, ASTM C150.
 - b. Pozzolanic material shall not be used in the mortar mix.
 - c. Admixtures shall contain no calcium chloride.
 - d. The minimum lining thickness shall be as indicated for shop-applied cement-mortar lining and the finished inside diameter after lining shall be as shown.

2.8 CEMENT MORTAR COATING OF PIPE

- A. The exterior surfaces of pipe which will be exposed to the atmosphere inside structures or above ground shall be thoroughly cleaned and then given a shop coat of rust-inhibitive primer and a finish coat conforming to the requirements of Section 04000.
- B. All pipe for buried service, including bumped heads, shall be coated with a 1-inch minimum thickness of reinforced cement-mortar coating.
 - 1. Exterior surfaces of pipe or fittings passing through structure walls shall be cement-mortar coated six (6) inches beyond the inside wall face.
 - 2. Unless otherwise specified, the reinforcement for the coating of pipe sections may be spiral wire, wire fabric, or wire mesh in accordance with AWWA C205.
 - 3. The welded wire fabric shall be securely fastened to the pipe with welded clips or strips of steel.
 - 4. The wire spaced 2 inches on centers shall extend circumferentially around the pipe. The ends of reinforcement strips shall be lapped 4 inches and the free ends tied or looped to assure continuity of the reinforcement.

2.9 FABRICATION OF SPECIALS

- A. General
 - 1. Specials and fittings shall conform to dimensions stipulated in AWWA C208.
 - 2. Reinforcement for wyes, tees, outlets, and nozzles shall be designed in accordance with AWWA Manual M-11. Reinforcement shall be designed for the pressure indicated and shall be in accordance with the Standard Details.

3. Specials and fittings shall be equal in pressure design strength and shall have the same lining and coating as the adjoining pipe.
 4. Unless otherwise specified, the minimum radius of elbows shall be 2.5 times the pipe diameter and the maximum miter angle on each section of the elbow shall not exceed 11-1/4 degrees.
- B. Fittings may be fabricated from pipe that has been mechanically lined or coated.
- C. Access manholes with covers shall be as indicated. All threaded outlets shall be forged steel suitable for 3000 psi service.
- D. Outlets 12-inch and smaller may be fabricated from Schedule 30 or heavier steel pipe in the standard outside diameters, i.e. 12-3/4 inch, 10-3/4 inch, 8-5/8 inch, 6-5/8 inch, and 4-1/2 inch.
- E. The design of outlet reinforcement shall be in accordance with the procedures given in Chapter 12 of AWWA Manual M-11, except that the design pressure, P, used in the M-11 procedure shall equal the greater of $1.25 P_w$ or $0.9376 P_t$. Unless otherwise indicated, outlets 2 inches in diameter and smaller need not be reinforced.
- F. In lieu of saddle or wrapper reinforcement as required by the design procedure in Manual M-11, pipe or specials with outlets may be fabricated in their entirety of steel plate having a thickness equal to the sum of the pipe wall plus the required reinforcement.
- G. Where required by the M-11 design procedure crotch plate reinforcement shall be furnished.
- H. Steel welding fittings shall conform to ASTM A234.
- I. Ends for Mechanical-Type Couplings
1. Except as otherwise required, where mechanical-type couplings are indicated, the ends of pipe shall be banded with Type C collared ends using double fillet welds. Where pipe 12-inch and smaller is furnished in standard schedule thicknesses, and where the wall thickness equals or exceeds the coupling manufacturer's minimum wall thickness, the pipe ends may be grooved.
- J. Lining
1. All requirements pertaining to thickness, application and curing of lining indicated for straight pipe shall apply to specials, with the following proviso. If the special cannot be lined centrifugally, it shall be lined by hand. In such case, the lining shall be reinforced with 2-inch by 4-inch No. 12 welded wire fabric positioned approximately in the center of the lining. The wires spaced 2-inches on center shall extend circumferentially around the pipe with the fabric securely fastened to the pipe. Splices shall be lapped 4 inches and the free ends tied or looped to assure continuity.

- K. Coating
 - 1. All requirements pertaining to thickness, application and curing of coating for straight pipe shall apply to specials. Pipe above ground or in structures shall be field painted as required in Section 04000.
- L. Specials and fittings that cannot be mechanically lined and coated shall be lined and coated by hand-application, using the same materials as are used for the pipe and in accordance with the applicable AWWA C602 Standards. Coating and lining applied in this manner shall provide protection equal to that indicated for the pipe.
- M. Areas of lining that have been damaged by such fabrication shall be repaired by hand-applications in accordance with applicable AWWA C602 Standards.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPE

- A. Immediately before placing each section of pipe in final position for jointing, the bedding for the pipe shall be checked for firmness and uniformity of surface to support the pipe for its full length.
- B. When the pipe is being laid, it shall be turned and placed where possible, so that any slightly damaged portion will be on top. The damaged area shall be repaired for the protection of any exposed steel.
- C. All damaged areas along the pipe shall be repaired using materials and methods acceptable to the DISTRICT.
- D. Moderate deflections and long radius curves may be made by means of beveled joint rings, by pulling standard joints, by using short lengths of pipe, or a combination of these methods; provided that pulled joints shall not be used in combination with bevels.
- E. The maximum total allowable angle for beveled joints shall be 5 degrees per pipe joint.
- F. The maximum allowable angle for pulled joints shall be in accordance with the manufacturer's recommendations or the angle which results from a 3/4 inch pull out from normal joint closure, whichever is less.
- G. All horizontal deflections or fabricated angles shall fall on the alignment. [In congested city streets or at other locations where underground obstructions may be encountered, the chord produced by deflecting the pipe shall be no further than 6 inches from the alignment indicated.]
- H. All vertical deflections shall fall on the alignment and at locations adjacent to underground obstructions, points of minimum earth cover, and pipeline outlets and structures. The pipe angle points shall match the angle points indicated.

- I. For pipe wall thicknesses of 3/8-inch or less, the maximum radial offset (misalignment) for submerged arc and gas metal arc welded pipe shall be 0.1875 times the wall thickness or 1/16-inch, whichever is larger.
- J. For pipe wall thickness greater than 3/8-inch, the maximum radial offset shall be 0.1875 times the wall thickness or 5/32-inch, whichever is smaller.
- K. Bevels shall be provided on the bell ends.
- L. Mitering of the spigot ends will not be permitted.
- M. For pipe 24 inches in diameter and larger, pipe struts shall be left in place until backfilling operations have been completed.
- N. Struts in pipe smaller than 24 inches may be removed immediately after laying, provided that the deflection of the pipe during and after backfilling does not exceed that indicated. After the backfill has been placed, the struts shall be removed and shall remain property of the CONTRACTOR.
- O. The openings of all pipe and specials where the pipe and specials have been cement-mortar lined in the shop shall be protected with suitable bulkheads to maintain a moist atmosphere and to prevent unauthorized access by persons, animals, water or any undesirable substance. The bulkheads shall be so designed to prevent drying out of the interior of the pipe. The CONTRACTOR shall introduce water into the pipe to keep the mortar moist where moisture has been lost due to damaged bulkheads.

3.2 RUBBER GASKETED JOINTS

- A. Immediately before jointing pipe, the spigot end of the pipe shall be thoroughly cleaned, and a clean rubber gasket lubricated with a NSF approved vegetable-based lubricant shall be placed in the spigot groove.
- B. The volume of the gasket shall be "equalized" by moving a metal rod between the gasket and the spigot ring around the full circumference of the spigot ring.
- C. The bell of the pipe already in place shall be carefully cleaned and lubricated with a NSF approved vegetable-based lubricant. The spigot of the pipe section shall then be inserted into the bell of the previously laid joint and telescoped into its proper position.
- D. Tilting of the pipe to insert the spigot into the bell will not be permitted.
- E. After the pipe units have been joined, a feeler gauge shall be inserted into the recess and moved around the periphery of the joint to detect any irregularity in the position of the rubber gasket. If the gasket cannot be "felt" all around, the joint shall be disassembled. If the gasket is undamaged, as determined by the DISTRICT, it may be reused, but only after the bell ring and gasket have been relubricated.

3.3 WELDED JOINTS

- A. General
 - 1. Field welded joints shall be in accordance with AWWA C206.

2. Where exterior welds are performed, adequate space shall be provided for welding and inspection of the joints.
3. During installation of welded steel pipe in either straight alignment or on curves, the pipe shall be laid so that the lap joint clearance, at any point around the circumference of the joint, shall comply with the requirements of AWWA C206.
4. Unless double fillet welds are indicated, field welded lap joints may, at the CONTRACTOR's option, be made on either the inside or the outside of the pipe.
5. Butt straps, where used or required, shall be a minimum of 6 inches wide, the same thickness as the pipe wall and shall provide for a minimum of 3/4 inch lap at each pipe joint.
6. The pipe ends shall be cut straight on joints where butt straps are used for realignment, adjustment, or deflection, and fillet welds shall be made as indicated.
7. After the pipe and pipe joint are properly positioned in the trench, the length of pipe between joints shall be backfilled to at least 1 foot above the top of the pipe. Care shall be exercised during the initial backfilling to prevent movement of the pipe and to prevent any backfill material from being deposited on the joint.
8. Prior to the beginning of the welding procedure, any tack welds used to position the pipe during laying shall be removed. Any annular space between the faying surfaces of the bell and spigot shall be equally distributed around the circumference of the joint by shimming, jacking, or other suitable means. The weld shall then be made in accordance with AWWA C206. Where more than one pass is required, each pass except the first and final one shall be peened to relieve shrinkage stresses; and all dirt, slag, and flux shall be removed before the succeeding bead is applied.
9. As soon as practicable after welding of each joint, all field-welded joints shall be tested by the liquid penetrant inspection procedure conforming to the requirements of ASTM E165 under Method "B" and "Leak Testing." All defects shall be chipped out, rewelded and retested.
10. Following tests of the joint, the exterior joint spaces shall be coated in accordance with these specifications after which backfilling may be completed.

3.4 JOINT COATING AND LINING

- A. The interior and exterior joint recesses shall be thoroughly wiped clean and all water, loose scale, dirt and other foreign material shall be removed from the inside surface of the pipe.
- B. The cement for joint grout and mortar shall be portland cement acceptable under ASTM C150 and shall be of the same type used for the pipe coating.
- C. After the pipe has been laid and after sufficient backfill has been placed between the joints to hold the pipe securely in place, the outside annular space between pipe sections shall be completely filled with grout formed by the use of polyethylene foam-lined fabric bands.

- D. The grout shall be composed of one part cement to not more than 2 parts sand, thoroughly mixed with water to a consistency of thick cream.
- E. The grout space prior to filling shall be flushed with water so that the surface of the joint to be in contact with the grout will be thoroughly moistened when the grout is poured.
- F. The joint shall be filled with grout by pouring from one side only, and shall be rodded with a wire or other flexible rod or vibrated so that the grout completely fills the joint recess by moving down one side of the pipe, around the bottom of the pipe and up the opposite side. Pouring and rodding the grout shall be continued to allow completion of the filling of the entire joint recess in one operation.
- G. Grouting of the outside joint spaces shall be kept as close behind the laying of the pipe as possible except that in no case shall grouting be closer than 3 joints of the pipe being laid.
- H. Grout Bands (Diapers)
 - 1. The grout bands or heavy-duty diapers shall be polyethylene foam-lined fabric with steel strapping of sufficient strength to hold the fresh mortar, resist rodding of the mortar and allow excess water to escape.
 - 2. The foam plastic shall be 100 percent closed cell, chemically inert, insoluble in water and resistant to acids, alkali and solvents.
 - 3. The fabric backing shall be cut and sewn into 9-inch wide strips with slots for the steel strapping on the outer edges.
 - 4. The polyethylene foam shall be cut into strips 6 inches wide and slit to a thickness of 1/4-inch which will expose a hollow or open cell surface on one side.
 - 5. The foam liner shall be attached to the fabric backing with the open or hollow cells facing toward the pipe.
 - 6. The foam strip shall cover the full interior circumference of the grout band with sufficient length to permit an 8-inch overlap of the foam at or near the top of the pipe joint.
 - 7. Splices to provide continuity of the material will be permitted.
 - 8. The polyethylene foam material shall be protected from direct sunlight.
- I. The polyethylene foam-lined grout band shall be centered over the joint space with approximately equal widths extending over each pipe end and securely attached to the pipe with steel straps. After filling the exterior joint space with cement grout, the flaps shall be closed and overlapped in a manner that fully encloses the grout with polyethylene foam. The grout band shall remain in position on the pipe joint.

J. Joint Lining

1. After the backfill has been completed to final grade, the interior joint recess shall be filled with mortar of stiff consistency mixed in proportions of one part cement to 2 parts sand.
2. The mortar shall be tightly packed into the joint recess and troweled flush with the interior surface, and all excess shall be removed.
3. At no point shall there be an indentation or projection of the mortar exceeding 1/16-inch.
4. For pipe smaller than 24 inches in diameter, before the spigot is inserted into the bell, the bell shall be daubed with mortar containing one part cement to 2 parts sand. The spigot end then shall be forced to the bottom of the bell and excess mortar on the inside of the joint shall be swabbed out.

K. The lining machine shall be of a type that has been used successfully for a similar size of pipe. No ball ("rabbit") shall be used. These joints shall be video taped by the CONTRACTOR or hand holes shall be provided at each joint, all at no additional cost to the DISTRICT.

L. The CONTRACTOR shall perform all work in a thorough and workmanlike manner by trained personnel, under the supervision of experienced personnel skilled in machine application of cement-mortar lining to pipelines of size comparable to this work.

M. Curing of the in-place cement-mortar lining shall be in accordance with AWWA C602.

N. The CONTRACTOR shall provide additional protective devices as required to ensure that the airtight covers, which maintain a moist condition in the pipeline, are not damaged.

O. Defective areas encompassing the full diameter of the pipe shall be replaced by machine wherever the length measured along the pipe centerline is greater than 5 feet; otherwise defective areas may be replaced by hand.

END OF SECTION

SECTION 02410 - COLD-APPLIED PLASTIC TAPE COATING

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes materials and application of cold-applied plastic tapes on steel pipe in accordance with AWWA C209 and C214 with a 1-inch thick reinforced cement mortar armor coat in accordance with AWWA C205, as modified herein.

1.2 REFERENCE SPECIFICATIONS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:
- | | | | |
|----|------|-------|---|
| 1. | AWWA | C205 | Cement Mortar Protective Lining and Coating for Steel Water Pipe |
| 2. | AWWA | C209 | Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines. |
| 3. | AWWA | C214 | Tape Coating Systems for the Exterior of Steel Water Pipelines |
| 4. | AWWA | C216 | Heat-Shrinkable Cross-Linked Polyolefin Coatings for Steel Water Pipe and Fittings |
| 5. | NACE | RP-02 | High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation |
| 6. | SSPC | SP-1 | Solvent Cleaning |
| 7. | SSPC | SP-6 | Commercial Blast Cleaning |

1.3 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300.
1. Shop Drawings
 - a. Manufacturer's product data.
 - b. Tape application method approved by tape manufacturer to minimize voids at weld seams; shipping and storage method approved by tape manufacturer to minimize disbondment of free ends of tape.
 - c. The names and qualifications of the workers and supervisors to be employed on the coating operation a minimum of 14 days prior to the start of taping operations.
 2. Certificates
 - a. Certification of test results of physical and performance characteristics of each batch of primer and each tape material specified herein.

- b. A certificate of compliance stating that tape materials and work furnished hereunder will comply or has complied with the requirements of these specifications and AWWA C209 and C214.
- c. Certification of primer and each tape material shall be substantiated by the tape manufacturer's production quality control test results. The tape manufacturer shall supply test data on each batch used.

1.4 QUALIFICATIONS OF MANUFACTURERS

- A. Manufacturer to demonstrate a minimum of five years successful application of tape coating system on large diameter steel water pipelines as specified herein.
- B. Supervisors of tape coating operations with at least two years continuous recent experience shall be assigned in the application of tape and coating systems for steel pipe.

1.5 INSPECTION

- A. All coating work shall be performed in the presence of the DISTRICT. Any coatings applied in the absence of the DISTRICT may be rejected.
- B. The DISTRICT shall be provided with reasonable facilities and space, at the CONTRACTOR'S expense, for the inspection, testing, and obtaining of any information required to determine the characteristics of the material to be used. The DISTRICT shall be furnished at least two electrical pipe coating flaw detectors at the plant and one electrical pipe coating flaw detector per pipe installation heading in the field to aid in the inspection of the tape coating.
- C. Free access shall be provided to the DISTRICT to plants of the manufacturer furnishing the materials and to the worksite.

PART 2 - PRODUCTS

2.1 COLD-APPLIED PLASTIC COATING

- A. Cold-applied plastic tape coating shall be applied in accordance with AWWA C209, AWWA C214, and as specified herein.
- B. Plant and field applied primer and plastic tape, and plant and field applied repair tape by a single manufacturer shall be furnished.
- C. Materials shall meet or exceed the physical properties of tape materials for plant and field application criteria listed when tested in accordance with the methods described in AWWA C209 and AWWA C214, Section 4.12, "Coating System Tests."
- D. Tape coating systems shall consist of an exterior cold-applied plastic tape on the bare metal surface of steel pipe with a cement mortar coating applied over the tape system. Tape coating systems are specified for:

1. Normal plant cold-applied tape.
2. Plant cold-applied tape for special sections, connections and fittings, and plant repairs of cold-applied tape.
3. Field joint, field coated fittings and repair of field cold-applied tape.

2.2 PRIMER

A. Primer shall be comprised of 100 percent butyl rubber with resins for adhesion, cathodic disbonding and stress corrosion cracking inhibitors. The primer shall be Polyken #1039 primer with the following properties:

1. Percent Solids: $\geq 18\%$
2. Flash Point: $> + 109^{\circ}\text{F}$
3. Viscosity: Thin syrup

2.3 STORAGE PRIMER

A. Storage primer on the exposed steel at the tape cutbacks shall be Polyken #1039 primer with the following properties:

1. Color: Black
2. Base: Synthetic natural rubber and resins
3. Solvent: Naphtha, toluene blend
4. Total Solids: 19 percent by weight
5. Viscosity: Thin syrup
6. Flash Point: $> + 10^{\circ}\text{F}$

2.4 PLANT COLD-APPLIED PLASTIC TAPE SYSTEM

A. Anti-corrosion inner layer tape shall be Polyken #989, with the following properties:

1. Tape Color: Black
2. Backing: Consist of a minimum 98 percent blend of high and low density polyethylene with the remaining portion a blend of colorants and stabilizers.
3. Adhesive: Consist of a 100 percent butyl based elastomer with resins for adhesion, cathodic disbonding, and long-term in-ground performance.

4. Thickness: Total thickness 20 mil: Backing, 9 mil; Adhesive, 11 mil. Tolerance: -5%, +10%.
5. Tensile Strength at Break: ≥ 30 lb/in width
6. Elongation at Break: ≥ 200 percent
7. Adhesion to Steel: ≥ 100 oz/in width
8. Adhesion to Primed Steel: ≥ 300 oz/in width
9. Adhesion to Backing: ≥ 40 oz/in width
10. Dielectric Strength: ≥ 20 kv
11. Insulation Resistance: 1×10^{12} ohms
12. Water Vapor Transmission: < 0.2 gm/100 in²/24 hr @ 70° F
13. Cathodic Disbonding at 68° F for 30 days: 0.2 in² (ASTM G8)
14. Shear Resistance at 68° F for 4 weeks: 0.2 mm/day
15. Hydrolytic Stability, 200 hrs at 98° CH₂O, Adhesion: > 150 oz/in
16. Thermal Stability, 2000 hrs at 100° C air, Adhesion: > 150 oz/in

B. First mechanical outer layer tape shall be Polyken #955, with the following properties:

1. Tape Color: Gray
2. Thickness: Total thickness 30 mil: Backing 25 mil; Adhesive, 5 mil. Tolerance: -5%, +10%.
3. Tensile Strength: ≥ 45 lb/in width
4. Elongation: ≥ 200 %
5. Adhesion to Backing: 40 oz/in width

6. Water Vapor Transmission: < 0.2 gm/100 in²/24 hr @ 70° F
7. Dielectric Strength: ≥ 25 kv

C. Second mechanical outer layer tape shall be Polyken #956 UV1 having UV protection properties as follows. Provide certification of UV protection.

1. Tape Color: White
2. Backing: Consist of a minimum 96 percent blend of high and low density polyethylene with the remaining portion a blend of colorants and stabilizers.
3. Adhesive: Consist of a 100 percent butyl based elastomer with resins for adhesion, and long term in-ground performance.
4. Thickness: Total thickness 30 mil: Backing 25 mil; Adhesive 5 mil. Tolerance: -5%, + 10%.
5. Tensile Strength: ≥ 55 lb/in width
6. Elongation: ≥ 200%
7. Adhesion to Backing: 60 oz/in width
8. Water Vapor Transmission: < 0.2 gm/100 in²/24 hr @ 70° F
9. Dielectric Strength: ≥ 25 kv

D. Total coating system shall be the Polyken YGIII system, with the following properties:

1. 100% Polyethylene based backings with colorants and stabilizers.
2. 100% Butyl based elastomers.
3. Adhesion to Steel: ≥ 100 oz/in
4. Adhesion to Backing: ≥ 60 oz/in width
5. Adhesion to Primed Steel: ≥ 300 oz/in
6. Tensile Strength: ≥ 85 lb/in width
7. Elongation: > 200%

- 8. Dielectric Strength: ≥ 20 kv
- 9. Insulation Resistance: 1×10^{12} ohms
- 10. Water Vapor Transmission: < 0.2 gm/100 in²/24 hr @ 70° F
- 11. Cathodic Disbonding @ 68° F for 30 days: 0.2 in² (ASTM G8)
- 12. Shear Resistance at 68° F for 4 weeks: 0.2 mm/day
- 13. Impact: 90 in-lbs.
- 14. Penetration: 11-15%

2.5 PLANT COLD-APPLIED TAPE PLASTIC COATINGS FOR SPECIAL SECTIONS, CONNECTIONS AND FITTINGS, AND PLANT REPAIR COLD-APPLIED PLASTIC TAPE MATERIAL

A. Anti-corrosion inner layer shall be Polyken #932-50, with the following properties:

- 1. Backing: Consist of a minimum 96 percent blend of high and low density polyethylene with the remaining portion a blend of colorants and stabilizers.
- 2. Adhesive: Consist of a 100 percent butyl based elastomer with resins for adhesion, cathodic disbonding, and long-term in-ground performance.
- 3. Thickness: Total thickness 50 mil: Backing 40 mil; Adhesive 40 mil. Tolerance -5%, +10%.
- 4. Tensile Strength: ≥ 25 lb/in width
- 5. Elongation: $\geq 150\%$
- 6. Adhesion to Steel: 225 oz/in width
- 7. Adhesion to Backing: 60 oz/in width
- 8. Water Vapor Transmission: < 0.2 gm/100 in²/24 hr @ 70° F
- 9. Dielectric Strength: ≥ 28 kv

B. Mechanical layer outer tape for plant fittings and plant repair cold-applied plastic tape shall be Polyken #955, with the following properties:

1. Backing: Consist of a minimum 96 percent blend of high and low density polyethylene with the remaining portion a blend of colorants and stabilizers.
2. Adhesive: Consist of a 100 percent butyl based elastomer with resins for adhesion, and long-term in-ground performance.
3. Thickness: Total thickness 30 mil: Backing 25 mil; Adhesive 5 mil. Tolerance -5%, +10%.
4. Tensile Strength: ≥ 45 lb/in width
5. Elongation: $\geq 200\%$
6. Adhesion to Backing: 40 oz/in width
7. Water Vapor Transmission: < 0.2 gm/100 in²/24 hr @ 70° F
8. Dielectric Strength: ≥ 25 kv

2.6 FIELD JOINT, FIELD COATED FITTINGS, AND FIELD REPAIR COLD-APPLIED PLASTIC TAPE

A. Joint filler tape to be Polyken #939, with the following properties:

1. Tape Color: Black
2. Thickness: 125 mil
3. Elongation: $> 600\%$
4. Solids Content: 98% minimum
5. Penetration Hardness: 85-105 DMM (300 GM moving load)
6. Low Temperature Flexibility: No cracking when bent around a 1 inch mandrel at -10° F
7. Chemical Resistance: No visible deterioration after 30 days immersion in the following solutions: 5% Caustic Potash; 5% HCL; 5% H₂SO₄; Saturated HS

B. Field joint, field fitting, and field repair outer layer tape shall be Polyken #932-50, as specified herein.

2.7 FIELD JOINT USING ALTERNATIVE HEAT-SHRINKABLE PIPE JOINT SLEEVES

- A. The sleeve shall consist of an irradiated and cross-linked polyethylene backing and a heat- activated adhesive layer that bonds to the pipe surface and common tape pipe coating such as polyethylene, polyurethane, and coal tar based coatings.
- B. Sleeves shall be provided in strip form pre-cut to length by the manufacturer specifically for the pipe diameter on which it is to be used. The width of the sleeve shall be such that it will overlap the tape pipe coating by 3 inches on each side of the joint.
- C. Packaging shall protect individual sleeves from damage and prevent adherence to other sleeves or the packaging material. Store the product away from extremes in temperature and out of the rain or other moisture sources.
- D. The product manufacturer shall demonstrate conformance with AWWA C216. The product manufacturer shall demonstrate that the sleeve will retain its corrosion protection properties when applied prior to internal joint welding. The manufacturer must demonstrate that the sleeve has been tested on large diameter pipe after three internal weld beads have been fully laid down. Use heat-shrinkable pipe joint sleeves manufactured by Canusa, Raychem, or District approved equal.

2.8 MORTAR OVERCOAT

- A. Cement shall be Type II, low alkali conforming to ASTM C-150. Mortar overcoat thickness shall be 1 inch.
- B. Sand shall conform to ASTM C 33 with 100 percent of the sand passing through a No. 4 sieve.
- C. Water shall be free of organic materials and shall have a pH of 7.0 to 9.0, a maximum chloride concentration of 500 mg/l, and a maximum sulfate concentration of 500 mg/l.
- D. Reinforcement shall be welded wire fabric 2-inch by 4-inch mesh, ungalvanized conforming to ASTM A 185 or spiral ribbon wire per AWWA C 205 Section 4.5.5. Wire with excessive rusting shall not be used.

PART 3 - EXECUTION

3.1 COLD-APPLIED PLASTIC TAPE COATING

- A. Apply plastic tape coating in accordance with AWWA C214, C209, and as modified herein.
- B. The tape manufacturer shall furnish a representative to provide assistance during the initial application of all tape materials to ensure proper installation.
- C. The tape manufacturer's representative shall be retained for a minimum of five (5) consecutive working days of tape coating for each project heading.

- D. At the completion of the five (5) day period, the tape material manufacturer's representative shall meet with the CONTRACTOR and DISTRICT to review and update the tape coating operation plan. If, in the opinion of the DISTRICT, significant modifications to the tape coating operations are identified in the initial five (5) day inspection period, the tape material manufacturer's representative shall be retained for an additional length of time, as necessary to correct all deficiencies in the application of the tape coating system.
- E. The tape manufacturer's representative shall be retained by the CONTRACTOR for the duration of the work and shall respond to periodic field problems and questions from the CONTRACTOR and DISTRICT within a sufficient time period so as not to cause delay in the installation and backfill of pipe. Costs incurred for retention of the tape manufacturer's representative shall be borne by the CONTRACTOR.
- F. Modifications to the pipe manufacturer's tape coating operation shall be properly documented and submitted within three (3) working days to the DISTRICT in accordance with shop drawing submittal procedures.
- G. Holiday Detection For Tape Coating
1. Prior to the application of the mechanical outer layer tapes, the inner layer tape shall be electrically tested for any flaws in the coating with a suitable holiday detector as approved by the DISTRICT.
 2. The total tape coating system shall be tested a second time immediately prior to installing cement mortar coating.
 3. The detector for both tests shall impress a voltage conforming to NACE Standard RP-02.
 4. The voltage to be used to electrically test the tape shall be included in the manufacturer's fabrication plan.
 5. All holidays shall be clearly marked electrically or otherwise detected, due to flaws, or mishaps, upon discovery, and immediately repaired.
 6. Discontinue wrapping of the first mechanical outer layer tape of any pipe section until the detected holiday has been repaired.
 7. Repairs shall be performed using methods specified herein. After the repair, retest the affected areas with the holiday detector prior to the application of the outer layer wrap. This process will be done until the coating has successfully passed the test.

3.2 STRAIGHT RUN PIPE APPLICATION

- A. For straight run pipe, plant applied conditions, the cold-applied plastic tapes shall be a four layer system consisting of: (1) primer; (2) corrosion prevention tape (inner layer); (3) mechanical protective tape (first outer layer); and (4) mechanical protective tape (second outer layer).

- B. Perform the entire coating operation as a one station operation where the pipe is supported at the ends in a manner which will permit the application of the primer, plastic tape, and cement mortar coating. Do not allow additional handling following the initial setup of the pipe section, from application of primer, tape coating, and cement mortar coating. No application involving rollers to support the pipe during the primer application, plastic tape, or cement mortar coating application will be permitted.
- C. Perform the entire coating operation by experienced workers skilled in the application of cold-applied plastic tapes and cement mortar coating under qualified supervisors. The DISTRICT is to be immediately informed of any personnel changes associated with the pipe coating operation.
- D. All equipment for blasting and application of the tape coating system shall be of such design and condition to comply with all the requirements of these specifications. Immediately repair or replace equipment which, in the opinion of the DISTRICT, does not produce the required result. Include equipment and a repair procedure for correction of defective tape application for use under this specification in the steel pipe fabrication plan. Make available for review a copy of this portion of the fabrication plan, and any updates, at the location of the coating operation, and a repair procedure for correcting defective tape application.
- E. Remove the exterior weld bead along the entire exterior surface of the pipe. The exterior weld bead shall be flush with the exterior surface of the pipe with a tolerance of plus 1/64-inch. Removal of the weld bead is to be conducted in such a manner that no gouging or nicking of the plate surface will occur. This operation is to result in a smooth exterior surface with no ridges or valleys which may result in bridging or disbonding of the tape from the surface of the pipe.
- F. Surface preparation shall conform to AWWA C214 and the following:
 - 1. Basic pipe shall be clean of all foreign matter such as mud, mill lacquer, wax, coal tar, asphalt, oil, grease, or any contaminants. Wash off any chemical solutions used in cutting or welding with hot water and allow the surface to dry. Remove welding slag or scale from all welds by wire-brushing, hammering, or other satisfactory means. Remove welding splash globules prior to priming.
 - 2. Prior to blast cleaning, inspect surfaces and, if required, preclean in accordance with the requirements of SSPC SP-1, Solvent Cleaning, to remove oil, grease, and all foreign deposits. Remove visible oil and grease spots by solvent wiping. Use only approved solvents that do not leave any residue. Include in the manufacturer's fabrication plan the cleaning solvent applications procedure and safety precautions. Preheating to remove oil, grease, and mill scale will be permitted; provided that the pipe is to be cement mortar lined in the field; and provided all pipe is preheated in a uniform manner to avoid distortion. Do not exceed preheat temperatures of 500 degrees Fahrenheit.
 - 3. Use on all affected steel-plate work, suitable and effective measures for eliminating the inclusion of gas forming elements, or other detrimental conditions, in any of the shop or field welds which results in any condition found to be detrimental to the successful application and bonding of primer, plastic tape, and cement mortar

coating. Said measures to include time-curing the pipe sufficiently, thoroughly neutralizing the gas forming elements, or other approved treatment.

G. Blast cleaning shall conform to AWWA C214 and the following:

1. Blast the pipe surface using a commercially available shot grit mixture to achieve a prepared surface equal to that which is specified in SSPC SP-6, Commercial Blast Cleaning.
2. For plant mortar-lined pipe, perform blast cleaning of said exterior surfaces after the initial curing of the spun mortar lining. Perform the exterior blast cleaning in such a manner as not to endanger the mortar lining in the pipe. Completely remove corrosion and foreign substances from the exterior of the pipe in the blast cleaning operation, and apply primer immediately after completion of blast cleaning.
3. The shot grit mixture shall not exceed 40 percent shot to 60 percent grit. The shot grit mixture is to be determined prior to the start of blast cleaning operations and this mixture ratio is not to be modified throughout the duration of the blast cleaning operations without the written approval of the DISTRICT.
4. Achieve from abrasive blasting an anchor pattern profile a minimum of 1.0 mil, but not exceeding 2.0 mils. Provide anchor pattern standards in the form of a 3-dimensional standard plate which depicts a commercial blast profile. Prepare a sample of the blasted surface on a representative steel plate measuring 6-inches by 1/4-inch or purchase standard industry plate samples of various blast finishes for comparisons. Purchase standard plates from NACE, meeting NACE TM-01-75, and conforming to NACE No. 3 standard using grit. Establish by agreement with the DISTRICT the visual standards that meet the specified anchor pattern and degree of cleanliness. Upon the establishment of the said standards, seal the steel plate using a clear acrylic coating, moisture proof plastic bag, or other approved means to protect the plate from surface contamination or corrosion. Use this plate as a visual comparator during the blast cleaning and coating operations. Measure the anchor pattern or profile of the blasted surface using comparator tape as specified herein.
5. Inspect the blast cleaned exterior pipe surface for adequate surface preparation prior to application of the primer. Surface comparator tapes are to be used by the manufacture in at least eight random areas, selected by the Engineer, along any given 40-foot length of pipe. The results of the surface comparator tapes are to be documented on the quality control sheet for each pipe section.
6. Coat each pipe section with primer and tape within the same day of being blast cleaned. Do not allow blasted and/or blasted and primed pipe to sit overnight. All blasted and primed pipe must be coated by the end of the day. No coating will be permitted on pipe sections showing evidence of rust.

H. Primer application shall conform to AWWA C214 and the following:

1. Prior to primer application, clean the pipe surface free of foreign matter such as sand, grease, oil, grit, rust particles, and dirt.

2. Apply the primer in a uniform thin film at the coverage rate recommended by the manufacturer for the state of dryness of the primer prior to the application of the inner layer of tape.
3. Make available at all times, primed surfaces for inspection prior to the application of the inner layer tape.
4. Maintain adequate safety precautions, as outlined in the manufacturer's fabrication plan, throughout the application of the primer.
5. Limit the application of primer to that length of pipe which can be taped within the same work day. Pipe coated with primer which was not taped within the same work day shall be rejected at the discretion of the Engineer. The primer shall be removed and the surface shall be reprimed.
6. Protect primer coated pipe sections from moisture, dirt, sand, and other potentially contaminating materials.
7. Protect priming operations from or suspend during times of high wind. Sections not adequately protected shall be rejected by the DISTRICT. If rejection occurs due to contamination of the primer, completely remove the primer from the exterior of the pipe section and reprime the surface.
8. Thoroughly mix the primer by agitation using an approved mixer powered by air or explosion proof electric motor. Continuously mix and agitate primer during application to prevent settling or lumping.
9. Apply primer only to a dry pipe surface. Whenever the ambient air temperatures are cold enough to cause gelling of the primer, the use of heaters will not be permitted to return the primer back to a fully liquid state. Use new primer at a minimum of 40° F.
10. Apply storage primer to the exposed steel pipe at tape cutbacks to prevent oxidation of the cleaned metal surface. Spray apply minimum of 1.5 mils and maximum of 2.5 mils of storage primer to exposed steel per the manufacturer's recommendations. Do not place storage primer on the edge of the steel plate.
11. The solvent of the primer and storage primer shall be certified by the manufacturer stating compliance with air pollution control rules and regulations and all requirements of agencies and other governmental bodies having jurisdiction. Include air pollution control rules and regulations regarding the application of the primer in the manufacturer's fabrication plan.

I. Inner Layer Tape Application

1. Apply the inner layer tape directly onto the primed surface using approved mechanical dispensing equipment to assure adequate, consistent tension on the tape as recommended by the tape manufacturer.
2. Rollers shall be used to apply pressure on the tape as it comes in contact with the pipe.

3. Necessary adjustments to mechanical application equipment to assure a uniform tight coating shall be made.
4. A tight, smooth, mechanically induced, wrinkle-free coating shall be maintained throughout the application process.
5. The application of tension shall be such that the width of tape will be reduced between 1-1/2 to 2 percent of tape width prior to the pull. A pressure readout gauge and chart recorder, suitable to the DISTRICT, with the tape let-off machine to document the tape tension during application shall be provided.
6. The inner layer tape shall be applied at a minimum roll temperature of 70° F. The temperature of the tape within 12 inches of the point of contact with the pipe surface shall be continuously monitored.
7. A chart recorder, suitable to the DISTRICT, shall be used to document the temperature of the tape during application. Sections where the tape application tension and temperature are not maintained within manufacturer's recommendations shall be rejected and the tape removed from the entire pipe section and reapplied.
8. The inner tape layer shall be continuously electronically tested at 6,000 volts immediately following application of the tape by a holiday tester permanently mounted to the tape application station and equipped with an indicator light and audio buzzer, suitable to the DISTRICT, to alert the workers of the presence of holidays in the coating system.
9. The inner layer tape shall be spirally wrapped for longitudinally welded pipe. For spiral welded pipe, the angle of the inner layer tape shall be wrapped as parallel as practicable to the spiral weld of the pipe or as approved by the DISTRICT. Provide a one (1) inch nominal tape overlap, minimum overlap 3/4 inch.
10. Splice each new roll by overlapping the new tape over the end of the preceding roll by at least 6 inches. Perform this end lap splice by hand or by a mechanical applicator such that the splice is wrinkle free and maintains the continuity of the inner wrap coating. Maintain the wrapping angle of the new roll parallel to that of the previous roll.
11. Provide cutbacks 10 inches from and parallel to the end of the pipe. Perform cutbacks using a cutting device that is guided from the end of the pipe to insure a uniform, straight cutback.

J. Mechanical Outer Layer Tape Application

1. The first mechanical outer layer of tape shall be applied over the inner layer tape using the same type of mechanical equipment used in the application of the inner layer tape.
2. No overlap splice of the other layer coinciding with the overlap splice of the inner layer will be permitted.

3. A minimum 6-inch separation between overlap of splices shall be provided.
4. Two mechanical outer layers of tape shall be provided as specified herein.
5. The inner layer tape shall be electrically tested, inspected, and approved prior to the application of the second mechanical outer layer tape. Both mechanical outer layer tapes shall be maintained smooth, tight, and wrinkle-free.
6. Mechanical outer layer tapes shall be applied in accordance with the requirements for the inner layer tape, except that the minimum tape roll application temperature shall be 90° F.
7. Monitoring for tension and temperature will be required for the mechanical outer layer tapes. The use of rollers to apply pressure on the tape is not required during application of the mechanical outer layer tapes.
8. The complete tape system shall be tested prior to coating as specified herein.

K. Storage Primer

1. Application of storage primer shall conform to AWWA C214 as modified herein.
2. Prior to storage primer application, clean the pipe surface free from foreign matter such as sand, grease, oil, grit, rust, particles, and dirt.
3. The primer shall be thoroughly mixed by agitation using an approved mixer powered by air or explosion proof electric motor. The primer shall be continuously mixed and agitated during application to prevent settling or lumping.
4. Primer shall be applied to a dry pipe surface. Whenever the ambient air temperatures are cold enough to cause gelling of the primer, the use of heaters will not be permitted to return the primer back to a fully liquid state. Use new primer at a minimum of 40° F.
5. Storage primer shall be applied to the exposed steel pipe at tape cutbacks to prevent oxidation of the cleaned metal surface. Spray apply minimum of 1.5 mils and maximum of 2.5 mils of storage primer to exposed steel per the manufacturer's recommendations. Storage primer shall not be applied on the edge of the steel plate.
6. The solvent of the primer and storage primer shall be certified by the manufacturer stating compliance with air pollution control rules and regulations and all requirements of agencies and other governmental bodies having jurisdiction. Include air pollution control rules and regulations regarding the application of the primer in the manufacturer's fabrication plan.

L. Mortar Overcoat

1. Apply cement mortar overcoating in accordance with Section 02400 and AWWA C205 immediately after the application of the tape coating layers. Allow 3-1/2 inch cut back beyond the edge of the tape coating.

2. Allow the mortar to cure properly before the pipe section is removed from the coating fixture and placed on rollers and timbers.

3.5 PLANT COATED FITTINGS

- A. Fittings which cannot be machine coated in accordance with AWWA C209 shall be coated using materials as specified herein.
- B. Weld bead preparation, surface preparation, blast cleaning, primer and tape application shall be as specified for straight run pipe.
- C. An inner layer tape with 1-inch nominal, 3/4-inch minimum, tape overlap on all plant coated fittings shall be applied.
- D. An outer layer of cold-applied plastic tape as specified herein with a 55 percent overlap on all plant coated fittings shall be applied.
- E. The total tape coat system for plant coated fittings shall have a minimum thickness of 110 mils.
- F. When more than 30 percent of the tape coating is removed from the circumference of the pipe for the installation of fittings, remove the tape coating system remaining on the pipe. Reprime and retape the fitting and pipe in accordance with these specifications.
- G. All completed tape coated fittings shall be tested in the presence of the DISTRICT with an electrical flaw detector prior to installation of cement mortar coating. Applied voltage shall be in the range of 11,000 to 15,000 volts. All holidays found shall be repaired.
- H. The procedure described herein for tape coating repair for fittings and field joints shall be followed. Cement mortar coating defects shall be repaired in accordance with these specifications.
- I. Cement mortar coating shall be applied in accordance with Section 02400 and AWWA C205 over the tape coated fittings immediately after completion of tape coating, testing, and inspections.

3.6 FIELD COATING JOINTS

- A. Field cold-applied plastic tape coating shall be in accordance with AWWA C209, as modified herein.
- B. Prior to welding any field joints, an 18-inch strip of heat resistant material shall be wrapped over the entire coated pipe sections on each side of the joint to be welded to avoid damage to the plant applied coating by the hot weld spatter. The coated portion of the pipe shall not be used for grounding.
- C. Immediately prior to exterior welding of the pipe for double welded lap joints, storage primer will be removed. Wire brush area to be welded per the manufacturer's recommendations.

- D. No tape coating will be permitted until the welding has been completed and the pipe section has cooled sufficiently so as not to damage the integrity of the tape coating system.
- E. Trapped air under the tape in the joint shall not be permitted.
- F. After joint welding, flash rusting shall be removed by mechanical means such as a wire brush. The weld, storage primed steel and all exposed steel shall be wire brushed. All burrs and weld slags shall be removed to achieve a smooth surface.
- G. The pipe surface shall be cleaned free of mud, mill lacquer, wax, tar, grease, or any foreign matter. Visible oil or grease shall be removed using an approved solvent that will not leave any residue on the pipe surface. The pipe surface shall be free of any moisture and all foreign matter prior to the application of primer.
- H. Prior to the application of the field applied tape coating, plant applied tape coating shall be tested in the presence of the DISTRICT with an electrical flaw detector. All holidays and physical damage to the plant applied tape coating shall be repaired prior to application of the field applied tape coating.
- I. Irregularities in joints shall be filled with elastameric joint filler.
- J. Primer shall be applied by brush or roller (4 mil wet, 1 mil dry).
- K. After primer has dried, tape shall be applied to the joint and extended a minimum of 3-inches onto the mill coat. End splices shall be a minimum of 6-inches and shall be staggered. The tape coating shall overlap at least 3-inches on the adjacent tape wrap. Maintain 55 percent overlap on all field joint tape to produce a minimum thickness of 100 mils.
- L. Tape with sufficient tension to conform with the surface irregularities shall be applied. The finished wrap shall produce a smooth, wrinkle-free surface.
- M. The final applied tape coating shall be tested in the presence of the DISTRICT with an electrical flaw detector. All holidays and physical damage to the final applied tape coating shall be repaired prior to application of the mortar coating.
- N. Mortar coating shall be applied in accordance with Section 02400 and AWWA C205, over the tape coated joint immediately upon completion of tape wrapping, testing, and inspections. Mortar at field joints shall overlap the shop-applied mortar overcoat a distance of not less than 5 inches. The thickness of the mortar across the joint shall be 1-inch minimum.

3.7 COATING OF FIELD JOINTS USING ALTERNATIVE HEAT-SHRINKABLE PIPE JOINT SLEEVES

- A. Field installed heat-shrinkable pipe joint sleeves shall be in accordance with AWWA C216, as modified herein.

- B. Protect the tape pipe coating from heat and weld splatter damage at welded joints by wrapping an 18-inch-wide strip of heat resistance material completely around the coated pipe sections covering the exposed tape pipe on each side of the joint prior to welding. Do not sue the coated portion of the pipe for grounding.
- C. Do not apply the joint sleeve until all welding has been completed and the pipe has cooled sufficiently so as to not damage the heat-shrinkable pipe joint sleeve.
- D. After joint welding, remove all weld slag, flash rusting and storage primer on the exposed steel by mechanical means, such as a wire brush. Remove all burrs and weld slag to achieve a smooth surface.
- E. Lightly abrade the tape pipe coating with course sandpaper to a distance of 2 inches beyond the end of the sleeve or up to the mortar overcoat.
- F. Clean the exposed steel pipe and adjacent tape pipe coatings free of dirt, mud, mill scale, wax, tar, grease, or any foreign matter. Remove visible oil or grease using an approved solvent that will not leave any residue on the pipe surfaces.
- G. Pack irregular surfaces in the joint with elastomeric joint filler. The edges of bell ends or butt-strapped joints shall be beveled to remove sharp edge. Apply a compatible elastomeric filler tape to provide a 2:1 slope such that there is a smooth transition across the step. More than one strip of filler tape may be required. The elastomeric tape shall be pressed into the joint to eliminate voids.
- H. Pre-heat the pipe surface using two workers with minimum 300,000 BTU propane torches with a flame spreader tip. The target pipe steel temperature is 140°F and 100°F for the coating. Apply sleeve quickly after heating to minimize heat loss. Apply the sleeve with the release liner attached.
- I. With the sleeve (in strip form) rolled up from both ends, center over top of pipe. Center the sleeve over the weld such that it overlaps the pipe tape coating by 3-inches on both sides. Allow material to drape over both sides of pipe.
- J. Adjust the sleeve so that the two ends meet (overlap per manufacturer's instructions) at the 4 o'clock position allowing a gap of no more than 1 inch between the sleeve and the pipe at the bottom. Pull the lower sections of material around the bottom quadrant of the pipe and bring up to the top of the pipe.
- K. Pull back the release liner 2-3 feet from the underlap end and apply heat gently to the adhesive from the top of the pipe to the underlap end and press down to pipe surface.
- L. Remove release liner from entire sleeve and ensure that sleeve is still properly positioned. Drape over pipe and insure that it is centered properly and that there is proper overlap at the closure. Gently heat the closure and press down firmly all corners.
- M. Continue heating the closure and press down with gloved hand or roller until a good bond is realized. Use a roller to firmly press down this area and ensure that no air is trapped.

- N. Once the closure is established use torches to anchor the sleeve by heat and pressure at the 5 and 7 o'clock positions. Begin shrinking the sleeve in the center from below first and gradually working to the top quadrant. Slowly spread to the ends of the sleeve until full recovery is achieved and the sleeve is taught.
- O. While shrinking press down the sleeve with gloved hand or roller to push out air and insure that the adhesive begins to ooze out from the edges. Do not permit trapped air under the sleeve. Finish off area of closure and underlap with a roller.
- P. Inspect the final applied joint sleeve in the presence of the District's Representative. A properly completed application will have no trapped air pockets and no scorched or overheated areas. Repair all damage to the final applied joint sleeve and tape pipe coatings prior to application of the mortar coating.
- Q. Apply mortar joint coating and reinforcement over heat-shrink joint sleeve and tape pipe coatings using fabric diapers to retain the mortar. Apply the mortar coating immediately upon completion of joint sleeve and inspection. Mortar at field joints shall overlap the shop-applied mortar overcoat a distance of not less than 5 inches. The thickness of the mortar across the joint shall be 1-inch minimum.

3.8 TAPE COATING REPAIRS

- A. Plant and field cold-applied plastic repair tapes shall be furnished and installed in accordance with AWWA C209 using plant and field tape materials as specified herein.
- B. Cold-applied plastic repair tapes from the same manufacturer as the plant applied plastic tape manufacturer shall be provided.
- C. Repair tapes and primer shall be completely compatible with the tape system used for straight run pipe.
- D. Damage in the form of holidays, flaws or mishaps found in the total coating system shall be repaired by removing the outer layer tapes and inner layer tape from the damaged area of the pipe. The damaged area shall be thoroughly cleaned using methods and materials approved by the DISTRICT. The methods and materials to be used in repairing the damaged areas will depend on the type and cause of damage.
- E. After cleaning, a suitable primer shall be applied, followed by a patch of repair tape over the affected area. The patch repair tape shall be overlapped over the undamaged coating a minimum of 4 inches in all directions. The repaired area shall be retested with a holiday detector.
- F. An outer layer tape shall be wrapped over the repaired area. At the discretion of the DISTRICT, depending on the extent of the repair area, the outer layer tape shall be wrapped around the entire circumference of the pipe.
- G. If the outer layer tapes are damaged and holidays or other flaws are not detected in the inner layer tape at the same area, the repair of the inner layer tape may not be necessary; however, if the damage is determined by the DISTRICT, to be severe enough to jeopardize the integrity of the inner layer tape, the DISTRICT will direct the CONTRACTOR to repair the inner layer tape. If such action is taken, the outer layer tapes shall be removed up to the boundaries of the damaged area, taking care not to

damage the inner layer tape any further. Before replacing the outer layer tapes, a holiday detector shall be applied to the inner layer tape to determine that no damage has been made to this primary tape coating during the outer layer removal process.

- H. Repair of the outer layer tapes shall be performed in accordance with the requirements as described above. The repair tape shall be overlapped over the undamaged coating a minimum of 4 inches in all directions.
- I. When the repair area tests show no holiday, a notation to the area indicating the test is satisfactory shall be applied.
- J. Cement mortar coating shall be applied over the cold-applied plastic tape coating.

3.9 COATED PIPE PROTECTION

- A. All coated surfaces shall be protected from damage prior to and during the pipe installation in accordance with these specifications. Coated pipe shall be handled using two, minimum 12-inch wide belt slings on spreader bars.
- B. The pipe shall be rested in saddles not less than 36 inches wide shaped to the outside diameter of the coated pipe during transportation.
- C. The saddles shall be in contact with the bottom of the pipe along an arc of at least 60 degrees.
- D. Saddles shall be completely lined with not less than 5/8-inch thick rubber belting. This belting shall overlap the edges of the saddles not less than 3-inches.
- E. No nails nor any other fasteners that may damage the coated pipe will be permitted in installing the rubber belting on saddles.
- F. Damaged pipe and coatings will be rejected. Rejected pipe may be repaired and retested when in the judgment of the DISTRICT an acceptable repair can be achieved.

END OF SECTION

SECTION 02420 - FABRICATED STEEL PIPE AND SPECIALS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing fabricated steel pipe, specials and connections to new and existing piping. Polyurethane and fusion bonded epoxy lining and coating material shall be furnished only by an OWNER-approved manufacturer.

1.2 REFERENCE SPECIFICATIONS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:
1. ANSI B16.3 Malleable Iron Threaded Fittings, Class 150 and 300
 2. ANSI B16.11 Forged Steel Fittings, Socket-Welding and Threaded
 3. ASTM A 36 Structural Steel
 4. ASTM A 47 Ferritic Malleable Iron Castings
 5. ASTM A 53 Pipe, Steel Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 6. ASTM A 105 Forgings, Carbon Steel, for Piping Components
 7. ASTM A 106 Seamless Carbon Steel Pipe for High-Temperature Service
 8. ASTM A 197 Cupola Malleable Iron
 9. ASTM A 234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
 10. ASTM A 283 Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars
 11. ASTM A 536 Ductile Iron Castings
 12. ASTM A 570 Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality
 13. ASTM A 572 High Strength Low Alloy Columbium-Vanadium Steels of Structural Quality
 14. ASTM D 16 Definition of Terms Relating to Paint, Varnish, Lacquer, and Related Products

15. ASTM D 471 Test Method for Rubber Property - Effect of Liquids
16. ASTM D 2240 Test Method for Rubber Property - Durometer Hardness
17. ASTM D 4060 Test Method for Abrasion Resistance for Organic Coatings by the Taber Abraser
18. ASTM D 4541 Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
19. ASTM E 96 Test Method for Water Vapor Transmission of Materials
20. AWWA C200 Steel Water Pipe 6 In. and Larger
21. AWWA C203 Coal-Tar Protective Coatings and Linings for Steel Water Pipelines--Enamel and Tape--Hot-Applied
22. AWWA C205 Cement-Mortar Protective Lining and Coating for Steel Water Pipe--4 In. and Larger--Shop Applied
23. AWWA C208 Dimensions for Fabricated Steel Water Pipe Fittings
24. AWWA C209 Cold-Applied Tape Coating for Special Sections, Connections, and Fittings for Steel Water Pipelines.
25. AWWA C213 Fusion-Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipeline
26. AWWA C600 Installation of Ductile-Iron Water Mains and Their Appurtenances
27. AWWA C602 Cement-Mortar Lining of Water Pipelines - 4-In. and Larger - In Place
28. AWWA M11 Steel Pipe--A Guide for Design and Installation
29. SSPC SSPC: The Society for Protective Coatings Specifications

1.3 SUBMITTALS

A. The following shall be submitted in compliance with Section 01300:

1. Shop Drawings

- a. Shop drawings showing dimensions and details of pipe joint fittings, fitting specials, valves and appurtenances.
- b. Detailed layout, spool or fabrication drawings showing pipe spools, spacers, adapters, connectors, fittings and pipe supports not indicated in the Contract Documents.

- c. Shoring and bracing drawings in accordance with Section 02000.
- d. Manufacturer's technical data and installation instructions.

2. Design Calculations

- a. Calculations and drawings for anchorage where applicable.

1.4 INSPECTION

A. Factory Inspection

- 1. All pipe shall be subject to inspection at the place of manufacture in accordance with the provisions of the referenced standards as supplemented by the requirements herein.
- 2. The CONTRACTOR shall notify the OWNER in writing of the manufacturing starting date not less than 14 calendar days prior to the start of any phase of the pipe manufacture.
- 3. During the manufacture of the pipe, the OWNER shall be given access to all areas where manufacturing is in process and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

1.5 TESTING

A. Except as modified herein, pipe shall be tested in accordance with the requirements of this Section and AWWA C200 and C205 respectively, as supplemented by the requirements herein.

- 1. The OWNER shall have the right to witness all testing conducted by the CONTRACTOR; provided, that the CONTRACTOR's schedule will not be delayed for the convenience of the OWNER.
- 2. All expenses incurred in obtaining samples for testing shall be borne by the CONTRACTOR at no increased cost to the OWNER.
- 3. In addition to those tests specifically required, OWNER may request additional samples of any material for testing by the OWNER. The additional samples shall be furnished at no additional cost to the OWNER.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Fabricated steel pipe and joints shall comply with SSPWC Section 207-10.2.
- B. Linings and coatings, except for cement mortar, shall be inspected electrically for continuity at the place of application.

2.2 STEEL PIPE

- A. Steel pipe shall comply with ASTM A 53 (Type E or S), ASTM A 106 or AWWA C200
- B. Schedule 40 for pipe 10 inches diameter and smaller, and schedule 80 for pipe larger than 10 inches diameter shall be used, except as otherwise indicated.
- C. Steel Pipe Fabricated to meet requirements of AWWA C200:
 - 1. Fabricated pipe shall comply with ASTM A 36, ASTM A 572 (Grade 42), ASTM A 570, (Grades 33 and 36), or ASTM A 283 (Grade D), except that ASTM A 53 and ASTM A 106 pipe shall be grade B, straight or spiral seam.
 - 2. Pipe shall have minimum wall thickness of 7 gauge for pipe 24 inches in diameter and smaller, and a minimum wall thickness of 1/4-inch for pipe larger than 24 inches diameter.

2.3 FITTINGS

- A. Threaded Steel Fittings
 - 1. Threaded steel fittings shall comply with ASTM A 47, ASTM A 197 or ANSI B16.3.
- B. Forged Steel Fittings
 - 1. Forged steel fittings shall comply with ASTM A 234, ASTM A 105 or ANSI B16.11.
- C. Fabricated Steel Fittings
 - 1. Fabricated steel fittings shall comply with AWWA C208
- D. Grooved Fittings
 - 1. Grooved fittings shall comply with full-flow cast fittings, or segmentally welded fittings with grooves or shoulders designed and fabricated for standard grooved-end piping.

E. Cast Fittings

1. Cast fittings shall comply with ductile iron conforming to ASTM A 536 or malleable iron conforming to ASTM A 47.

2.4 PIPE LINING

A. Where indicated, pipe linings shall comply with the following:

1. Surfaces shall be prepared in accordance with SSPC-SP 10 for Near White Blast Cleaning, and the lining shall be applied as recommended by the manufacturer.
2. Pipe and fittings shall be centrifugally lined with cement mortar complying with AWWA C205. If the special cannot be lined centrifugally, it shall be lined by hand in compliance with AWWA C602.
3. Fittings and specials larger than 24 inches, not fabricated from centrifugally formed straight sections, shall require 2-inch by 4-inch WO.5 x WO.5 gage self-furring wire mesh reinforcement for hand-applied lining. Wire mesh shall be positioned approximately in the center of the lining. The wires spaced 2 inches on centers shall run circumferentially around the pipe with the fabric securely fastened to the pipe. Splices shall be lapped 4 inches and the free ends tied or looped to assure continuity.

B. Glass Lining

1. Pipe and fittings shall be glass lined with a vitreous material to a minimum thickness of 10 mils.
2. Pipe and fittings shall have all internal welds ground smooth and voids and slag holes ground out, rewelded and ground smooth.
3. Glass lining shall provide continuous coverage when tested by a low voltage holiday detector.

2.5 PIPE COATING

A. Where indicated, pipe coatings shall comply with the following:

1. Coal-tar protective coating shall be a multi-layer coal-tar enamel fibrous glass mat and mineral glass felt wrap conforming to AWWA C203 except as indicated below:
2. Pipe surfaces shall be prepared by solvent cleaning (SSPC-SP1) followed by blasting to at least Commercial Blast Cleaning (SSPC-SP6) conditions.
3. Pipe temperatures shall be at least 85 degrees F.
4. Primer shall be in accordance with AWWA C209.

5. Specially processed coal-tar pitch combined with inert filler, having no asphalt or petroleum of natural origin, of [Type 1], shall be applied hot.
6. Glass fiber wrap shall be non-woven, either reinforced or non-reinforced, glass fiber mat uniformly impregnated with material compatible with coat-tar enamel.
7. Primer plus coal-tar enamel shall be 3/32 inch thick, plus or minus 1/32 inch.
8. The entire coated surface of the pipe shall be electrically tested for continuity.

$$V = 1250[T]^{1/2}$$

Where: V = Test voltage, volts

T = Total coating system thickness, mils

2.6 PREFABRICATED TAPE COATING

- A. Tape coating shall be in accordance with Section 02410. Holiday testing shall be calculated from:

$$V = 1250[T]^{1/2}$$

Where: V = Test voltage, volts

T = Total tape coating system thickness, mils

2.7 POLYURETHANE COATING AND LINING

- A. Polyurethane material shall be a 1 to 1 polyol resin to isocyanate resin 2-component mixture, of [Type V] according to ASTM D 16.
- B. Pipe surfaces shall be prepared by solvent washing (SSPC-SP1) followed by near white blast (SSPC-SP10) with an angular profile of at least 2.5 microns.
- C. Pipe temperatures shall be at least 5 degrees F warmer than the dewpoint in the area of the application equipment. Pipe shall be warmed if necessary.
- D. Material components shall be stored at temperatures warmer than 50 degrees F and shall not be stored longer than 6 months. Older components shall not be used.
- E. The entire pipe surface coated and lined with polyurethane shall be tested at 200 volts per mil for holidays after curing. Every holiday shall be repaired as indicated below.
- F. Entire pipe surface shall be inspected visually. Pipe with sharp protuberances or significant sags, dimples, or curtains will not be accepted.

- G. The OWNER will select one section of pipe from each lot of 20 sections for thickness testing by the CONTRACTOR. Tests shall be made by a Type 1 magnetic thickness gage. OWNER will designate locations for spot measurements taken at the points of an equilateral triangle 3 inches on a side: the triangles shall be located at both ends, in the middle, and at the midpoints of each half of the pipe, plus 5 randomly-selected individual points.
- H. No single spot measurement shall be less than 75 percent of the indicated minimum nominal thickness.
- I. The average of three spot measurements from any triangle shall not be less than 80 percent of the indicated minimum nominal thickness.
- J. The average of all spot measurements on a pipe shall not be less than the indicated minimum nominal thickness.
- K. Sections of pipe selected by the OWNER for thickness testing will also be tested by the OWNER for delamination by scoring and prying with a pocket knife.
- L. If the tested pipe complies with the thickness criteria above and shows no sign of delamination by knife test, all pipe in the lot of 20 will be considered as complying with requirements and the tested pipe may be repaired for installation.
- M. If the tested pipe fails either test, five additional sections from the same lot will be tested in similar fashion, and if all five pass all tests, then the lot, except for the pipe which failed, will be considered in compliance. If any of the additional sections fail, the entire lot will be considered non-compliant and shall not be used.
- N. Holidays and cut ends shall be repaired by solvent cleaning, roughening with coarse sand paper, and application of brushable 2-component material recommended by the manufacturer for such purposes. Overlap the acceptable coating and lining at least one inch in all directions. Mix repair material and apply in accordance with the manufacturer's recommendation.

PART 3 -- EXECUTION

3.1 INSTALLATION

- A. Pipe shall be installed in accordance with AWWA M-11, Chapter 16.
- B. Sleeve-type pipe couplings shall be installed in accordance with AWWA M-11.
- C. Pipe lining and coatings at field joints shall comply with Section 04100.

- D. Buried couplings and valves shall be field coated complying with Section 04000.

END OF SECTION

SECTION 02500 – POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section includes materials and installation procedures for polyvinyl chloride (PVC) pressure pipe and appurtenances for potable and recycled water systems.

1.2 REFERENCE SPECIFICATIONS

- A. 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.

AWWA	C900	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. for Water Transmission and Distribution
AWWA	C905	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. for Water Transmission and Distribution
AWWA	C909	Molecularly Oriented Polyvinyl Chloride Pressure Pipe
AWWA	M23	PVC Pipe - Design and Installation
Uni-Bell		Handbook of PVC Design and Construction

1.3 SERVICE APPLICATION

- A. PVC pipe will be used to transport and distribute potable water or recycled water as indicated on the Approved Plans.
- B. In accordance with their AWWA designations PVC pipe shall be used for pipe sizes as follows:
 - 1. C900 & C909 PVC pipe shall be used for mains and related appurtenances sized 4” through 12”
 - 2. C905 PVC pipe shall be used for mains sized 14” through 48”

1.4 DESIGN REQUIREMENTS

- A. PVC pipe shall be provided in standard 20 foot lengths, unless otherwise specified, detailed or required on the approved plans. The use of 10’ and 15’ lengths shall be allowed. Random lengths are not allowed. Field cut lengths of pipe for tie-ins and stub-outs may not be shorter than 4 feet in length and must be approved by the DISTRICT.
- B. All PVC pipe entering or exiting a fitting shall be a minimum length of 10 feet unless approved otherwise by DISTRICT.
- C. Horizontal Radius: In areas where it is required to lay the pipe along a curve, the use of deflection couplings will be used to form the arc. The pipe shall not be bent to form the arc, nor shall the pipe be deflected within integral bells or ductile-iron fittings. Unless otherwise approved by the DISTRICT Engineer, PVC pipe shall be installed using 5°

deflection couplings (2 ½° at each bell) to form arcs with radii no less than the minimum noted below.

<u>Pipe Length Used</u>	<u>Minimum Radius</u>
20'	229'
10'	115'
Combination (refer to Section 3)	76'

1.5 FITTINGS

Ductile-iron fittings shall be used for the installation of pipe appurtenances 4" and larger in accordance with Section 02300.

1.6 SERVICE SADDLES FOR PVC PIPE

A. Service saddles shall be used for installation of pipe appurtenances 2" and smaller in accordance with Section 02200.

1.7 TAPPING SLEEVES

A. Tapping sleeves shall be compatible with the size and type of pipe receiving the sleeve in accordance with the manufacturer's recommendations and shall be selected from the Approved Materials List.

B. Tapping sleeves shall be installed a minimum of 3 feet from the edge of the sleeve to any pipe joint or other sleeve. Multiple taps of 6 inches or larger shall not be made in the same joint of pipe without the approval of the DISTRICT.

1.8 QUALITY ASSURANCE

A. The manufacturer of each shipment of pipe shall be required to supply a statement certifying that each lot or load of pipe has been subjected to the tests specified for PVC pipe, and has been found to meet all the requirements of AWWA C900/C909 & C905 as applicable.

B. PVC pipe shall carry a current certification of the National Sanitation Foundation (NSF) as acceptable to use in the transport of potable water.

C. PVC pipe and couplings shall bear indelible identification markings as required by AWWA C900/C909 and C905. In addition, all pipe shall bear a "home mark on the spigot end to indicate proper penetration when the joint is made. The pipe markings for PVC pipe for recycled water systems shall include the designated "RECYCLED WATER" in addition to the identification markings required by AWWA.

D. A fabricated two-part carbon steel sleeve shall be used for wet tap connections. The carbon steel used in the sleeve shall have minimum yield strength of 30,000 psi. The bolts and nuts shall be stainless steel, Type 316. The entire sleeve shall be shop coated with a minimum of 8 mils of fusion bonded powder epoxy in accordance with AWWA C213.

E. No wet taps will be allowed where the outlet is the same size as the main.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. PVC pipe shall be stored in supplier's yards and on the job site in accordance with AWWA M23 and the manufacturer's recommendations. Store PVC pipe in the field by supporting the pipe uniformly in accordance with AWWA M23. Pipe shall not be stacked higher than 4' or with weight on the bell ends.
- B. Cover stored PVC pipe with an opaque material to protect it from the sun's ultraviolet radiation. PVC pipe that has been subjected to excess ultraviolet radiation as identified by color fading or chalking shall not be used. The determination as to the acceptability of PVC pipe shall rest solely with the DISTRICT Engineer.
- C. PVC pipe that has been contaminated in any way with petroleum products (on the inside or outside of the pipe) shall not be used.
- D. For pipe older than 24 months, the DISTRICT will require information on the pipe storage during the period. The DISTRICT reserves the right to reject pipe older than 24 months or to require retesting and recertification by the pipe manufacturer.

PART 2 - PRODUCTS

2.1 POLYVINYL CHLORIDE PIPE

- A. PVC pressure pipe and appurtenant components and materials shall be selected from the Approved Materials List. Provide pipe with cast-iron equivalent outside diameter, and integral wall-thickened bell and spigot ends.
- B. PVC pipe in sizes 4" through 12" shall comply with the requirements of AWWA C900 or C909, Class 305 (DR14).
- C. PVC pipe in sizes 14" through 48" shall comply with the requirements of AWWA C905, Class 235 (DR18) or as shown on the Approved Plans.

2.2 DEFLECTION COUPLINGS

PVC deflection coupling that allow for 2 ½° deflection at each bell for a maximum of 5° total deflection shall be selected from the Approved Materials List.

2.3 FITTINGS

Ductile-iron fittings shall be in accordance with Section 02300 and selected from the Approved Materials List. The fittings shall have mechanical joint type or push-on type joints manufactured specifically for PVC pipe.

2.4 CONCRETE

Concrete used for thrust, anchor, and support blocks shall be in accordance with Section 03000.

2.5 JOINT RESTRAINT

Joint restraint systems may be used when shown on the Approved Plans or with prior approval of the DISTRICT Engineer. CONTRACTOR shall submit shop drawing and catalog data for restraint system in accordance with Section 01300. Joint restraint systems shall be selected from the Approved Materials List.

2.6 IMPORTED GRANULAR MATERIAL FOR PIPE AND TRENCH ZONES

Imported granular material for use in pipe and trench zones shall be in accordance with Section 02000.

2.7 TRACER WIRE

Tracer wire shall be installed with all water mains and services in accordance with Section 02100 and selected from the Approved Materials List. Wire shall be placed on the top centerline of the pipeline and shall run continuously along the entire length of pipe prior to placement of trench backfill. Wire shall be mechanically and electrically continuous throughout the pipeline, including within pipe casings. Tracer wire shall be secured to the pipe at 5' intervals with plastic adhesive 10 mil tape. Splices shall be installed only when necessary and shall be made using wire connectors selected from the Approved Materials List.

2.8 WARNING/IDENTIFICATION TAPE

Warning/Identification tape shall be installed for PVC water mains and services, in accordance with Section 02100 and selected from the Approved Materials List.

PART 3 - EXECUTION

3.1 GENERAL

- A. At all times when the work of installing pipe is not in progress, including worker break times, the ends of the pipe shall be closed with tight-fitting, vermin-proof and childproof caps or plugs. Do not permit trench water to enter the pipe. Do not place tools, clothing, or other materials in the pipe. The CONTRACTOR shall maintain the interior of the pipe in a sanitary condition free from foreign materials at all times.
- B. Proper care shall be used to prevent damage in handling, moving and placing the pipe. All pipe, fittings, valves, and other pipeline materials shall be lowered into the trench in a manner that prevents damage. The pipe shall not be dropped, dragged or handled in a manner that will cause bruises, cracks, or other damage. PVC pipe that has been gouged, scratched, or otherwise damaged shall be subject to rejection at the discretion of the DISTRICT Engineer.
- C. Where pipe lengths less than the standard 20' are required, the pipe sections shall be installed in accordance with the manufacturer's installation guide (with the exception of deflection at the bell and spigot, which is not allowed) and shall only be used as specified herein or with the approval of the DISTRICT Engineer. The minimum pipe length permitted is 5', except at tie-ins, where the minimum pipe length permitted is 4', when approved by the DISTRICT Engineer.

3.2 TRENCHING, BACKFILLING AND COMPACTION

Trenching, bedding, backfilling and compaction operations shall be performed in accordance with Section 02000.

3.3 DEWATERING

Dewatering of trench excavations shall be performed in accordance with Section 02100. If flooding of the trench does occur, the CONTRACTOR shall immediately dewater and restore the trench. Damaged or altered pipelines, appurtenances, or trench materials shall be repaired or replaced as directed by the DISTRICT Engineer.

3.4. PIPE INSTALLATION

When the work requires and the size of the pipe allows entry of personnel into the pipe, the CONTRACTOR shall comply with Federal and State regulations for confined space entry. Work inside pipelines shall not be undertaken until all tests and safety provisions for confined space entry have been performed and the area is verified as safe to enter.

The CONTRACTOR shall furnish and install all pipe, specials, fittings, closure pieces, valves, supports, bolts, nuts, gaskets, jointing materials, and all other appurtenances as shown on the Approved Plans and as required to provide a complete and workable installation.

Install pipe in the trench as follows:

- A. Inspect each section of pipe prior to lowering the pipe into the trench. Thoroughly clean the ends of the pipe. Remove foreign matter and dirt from the inside of the pipe and keep clean during and after installation.
- B. Install pipe according to the manufacturer's approved order of installation to the proper lines and grades in accordance with the Approved Plans and as follows:
 - 1. Install pipe uphill if the grade exceeds ten percent (10%).
 - 2. Installation tolerance for the pipe shall not vary more than 2" horizontally or 1" vertically from the alignment and elevations shown on the Approved Plans.
 - 3. Install the pipe such that the identification markings on each pipe section are continuously aligned for the total length of the pipeline alignment. Orient the strip marking upward to the 12 o'clock position (top) of the trench opening.
- C. The pipe shall have a firm bearing along its full length, and bell holes shall be provided at each joint to permit visual inspection of the joint and prevent the pipe from being supported by the bell end or coupling.
- D. The beveled end of the pipe shall be removed prior to insertion into a mechanical joint fitting.
- E. Field cutting and milling shall be performed in accordance with the manufacturer's written instructions to equal the quality of shop- fabricated ends.

F. Pipe Assembly

1. Push-On Type: Assemble the pipe joint using a lubricant selected from the Approved Materials List. Insert the spigot end into the bell or coupling to the proper insertion mark. Check that the elastomeric ring has not left the groove during assembly by passing a feeler gauge around the completed joint. Drive spigot ends of the pipe into bell ends in accordance with the manufacturer's recommendations. Stabbing shall not be permitted.
2. Mechanical – Joint Type: Assembly of mechanical joint fittings shall be in accordance with the manufacturer's recommendations regarding installation.

G. PVC pipe shall not be bent, nor shall PVC pipe be deflected at pipe connections other than deflection couplings. Install deflection couplings selected from the Approved Materials List for horizontal and vertical changes in direction not greater than 5°, and for installation of pipe through curves. Pipe sections of differing lengths may be used as follows to facilitate the installation of pipelines through curves.

1. Allowable lengths of pipe sections through curves are 20' or 10' only.
2. No more than two 5' pipe sections may be used in succession without being separated by a 20' or 10' section. Pipe layout through curves is subject to approval by the DISTRICT Engineer. In no case shall the minimum radius be less than 76'.

END OF SECTION

SECTION 02600 - DISINFECTION OF PIPING

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes requirements for disinfection of water mains, services, appurtenances and connections by chlorination.

1.2 REFERENCE STANDARDS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this section.

- 1. AWWA B300 Hypochlorites
- 2. AWWA B301 Liquid Chlorine
- 3. AWWA C651 Disinfecting Water Mains

1.3 SUBMITTALS

- A. A written disinfection and dechlorination plan, including all methods and equipment to be used, shall be signed by the person responsible for performing the WORK and shall be submitted to the DISTRICT for approval prior to starting disinfection operations.

PART 2 - PRODUCTS

2.1 LIQUID CHLORINE (GAS)

- A. Liquid chlorine shall contain 100-percent available chlorine packaged in steel cylinders in net weights of 150 LB or 1 ton.
- B. Liquid chlorine shall be used with appropriate gas flow chlorinators, heaters, and injectors to provide a controlled high concentration solution feed. The chlorinators and injectors shall be vacuum operated type.

2.2 SODIUM HYPOCHLORITE (LIQUID)

- A. Sodium hypochlorite is available in liquid form in glass or plastic containers, ranging in size from 1 QT to 5 GAL. This liquid solution contains approximately 10 percent to 15 percent available chlorine.
- B. Sodium hypochlorite to be used for pipeline disinfection shall be tested for consistency of strength.

PART 3 - EXECUTION

3.1 GENERAL

- A. All water mains, water services, appurtenances, and connections, if any, shall be disinfected in accordance with AWWA C651 except as modified herein. The slug method shall not be permitted.
- B. All new water mains and temporary high lines shall be disinfected, sampled and pass bacteriological testing before they are connected to the DISTRICT's existing system. 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.
- C. All water mains and appurtenances taken out of service for inspection, repairs or other activities that might lead to contamination shall be disinfected, sampled and pass bacteriological testing before they are returned to service.
- D. The CONTRACTOR shall be responsible for documenting all disinfection practices performed in making pipeline connections, repairs or for other reasons that the DISTRICT may require.
- E. High concentrations of particulates generally containing bacteria prevent even very high chlorine concentrations from contacting and killing such organisms. Therefore, water mains and appurtenances shall be maintained clean and dry during the installation process.
- F. Pipe, valve and fitting materials which, in the opinion of the DISTRICT, becomes overly contaminated shall be cleaned by mechanical means and then swabbed with a 5-percent hypochlorite disinfecting solution prior to installation or replaced if directed by the DISTRICT.
- G. Water mains under construction flooded by storm water, run off, sewage or groundwater, shall be cleaned of the flood water by draining and flushing with metered potable water, equipped with an approved BFD. The section exposed to the flood water shall be chlorinated, per Section J below.
- H. Disinfection of pipelines shall not proceed until authorized by the DISTRICT.
- I. Disinfection of pipelines shall not proceed until all appurtenances have been installed.
- J. Disinfection shall result in an initial minimum total chlorine concentration of 50 mg/l. This concentration shall be evenly distributed throughout the system to be disinfected. 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 the 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.

- K. During the disinfection process, all valves shall be operated. Appurtenances shall be flushed with the treated water a sufficient length of time to insure a chlorine concentration of 50 mg/1 in each appurtenance.

3.2 METHODS

A. Liquid Chlorine (Gas)

1. Liquid chlorine (gas) shall be used to disinfect all potable water pipelines and temporary high lines, regardless of size or material composition unless the DISTRICT approves the use of hypochlorite solution upon CONTRACTOR request.
2. Only a certified, licensed chlorination and testing CONTRACTOR shall perform gas chlorination WORK. Only vacuum type equipment shall be used. Direct-feed chlorinators which operate solely from gas pressure in the chlorine cylinder shall not be permitted.
3. Injection feed waters will be required to have an approved BFD at the supply water source point to the chlorine injector.
4. 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.
5. All Federal, State and Local laws, ordinances, orders, etc., shall be strictly adhered to.

B. Sodium Hypochlorite Solution

1. Sodium hypochlorite solution shall be used for cleaning and swabbing materials immediately prior to installation.
2. Sodium hypochlorite solution shall be used, only as directed by the DISTRICT, to adjust the total chlorine residual to 50 mg/1 after the initial filling and liquid (gas) chlorination of the system.
3. Sodium hypochlorite shall be added to the system in the amount and in the places as directed by the DISTRICT.
4. The pump equipment to be used for the injection of sodium hypochlorite solution shall be approved by the DISTRICT.
5. Sodium hypochlorite solution shall not be used as a substitute for liquid chlorine (gas) chlorination, unless approved by DISTRICT as primary disinfection agent.
6. Injection pumps or feed injectors will be required to have an approved BFD at the supply water point of connection.

3.3 CONCURRENT TESTING

- A. Disinfecting the mains and appurtenances, hydrostatic testing, and the retention time may run concurrently for the required 24-hour period. In the event repairs are necessary, additional disinfection maybe required by the DISTRICT. This disinfection shall be made by either the liquid chlorine (gas) method, or the sodium hypochlorite method, as directed by the DISTRICT.

3.4 FLUSHING

- A. Flushing of pipeline systems shall adhere to the requirements of AWWA C651.
- B. In order to obtain sufficient scouring and cleaning of the pipeline system, proper water velocity during the flushing operation is necessary. The minimum water velocity during flushing shall be 2.5 feet per second (fps), but 3 fps is recommended.
- C. The CONTRACTOR shall be responsible for the installation of appropriate temporary piping and connections necessary to attain the prescribed flushing velocity.
- D. After the 24-hour retention period, and upon approval from the DISTRICT, the chlorinated water shall be flushed from the system at its extremities and at each appurtenance. Flushing shall continue until the replacement water in the new system is equal chemically and bacteriologically to the permanent source of supply.
- E. The environment to which the chlorinated water is to be discharged shall be inspected by the CONTRACTOR. If there is any question that the chlorinated discharge will cause damage to the environment, a dechlorinating agent shall be applied to the water as it exits the piping system to neutralize the chlorine residual.
- F. Where necessary, Federal, State and Local regulatory agencies should be contacted to determine special provisions for the disposal of highly chlorinated water.
- G. When required by the local authority (City, County, or State), the CONTRACTOR may be responsible for recovering flushed water containing chlorine residual to meet storm water regulations.
- H. Under no circumstances shall the DISTRICT be responsible for loss or damage resulting from such disposal.

3.5 BACTERIOLOGICAL TESTING

- A. The DISTRICT shall perform bacteriological sampling and testing of all new system installations. The testing methodology employed by the DISTRICT is as set forth in "Standard Methods for the Examination of Water and Waste Water" (current edition).
- B. Testing requirements are as set forth in the California Domestic Water Quality and Monitoring Regulations and commensurate with current requirements for surface water testing.
- C. The DISTRICT 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 currently as follows:

1. coliform bacteria: no positive sample, and
 2. heterotrophic plate count (HPC): less than 500 colony forming units/ml
- D. Failure to pass said examination shall require the CONTRACTOR to take remedial steps as deemed necessary by the DISTRICT, and as detailed herein.

3.6 REDISINFECTION

- A. If the initial disinfection fails to produce satisfactory bacteriological results, the pipeline system shall be re-flushed and shall be resampled.
- B. If the second set of samples does not produce satisfactory results, the pipeline system shall be re-chlorinated by the liquid chlorine (gas) method, flushed, and resampled. This chlorination, flushing, and sampling procedure shall continue until satisfactory results are obtained.
- C. Re-disinfection and re-testing shall be at the CONTRACTOR's expense.

END OF SECTION

SECTION 02610 - PRESSURE TESTING OF PIPELINES

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes requirements for hydrostatic and leakage testing of pressure pipelines and appurtenances for transmission and distribution mains.

1.3 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300.
 - 1. Pressure test bulkhead locations and design calculations, water supply details including backflow preventors, flow meters, valves and drains.
 - 2. Requests for use of water from waterlines of DISTRICT 48 hours in advance.
 - 3. Provide a recent record of pressure gauge calibrations.
 - 4. Provide records of each pipe section during testing. Test records shall include:
 - a. Date of test.
 - b. Identification of pipeline, or pipeline section, tested or retested.
 - c. Identification of pipeline material.
 - d. Identification of pipe specification.
 - e. Test pressure.
 - f. Remarks: Leaks identified (type and location), types of repairs, or corrections made.
 - g. Certification by CONTRACTOR that the leakage rate measured conformed to the specifications.
 - h. Test duration.
 - i. Allowable losses.
 - j. Actual losses.

PART 2 - PRODUCTS

2.1 TEST BULKHEADS

Design and fabricate test bulkheads per Section VIII of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code. Materials shall comply with Part UCS of said code. Design pressure shall be at least 2.0 times the specified test pressure for the section of pipe containing the bulkhead. Limit stresses to 70 percent of yield strength of the bulkhead at the bulkhead design pressure. Include air-release and water drainage connections.

2.2 TEST OUTLETS AND TEMPORARY VALVES

Provide additional outlets and temporary valves for releasing air or apply the test where automatic air valves or other outlets are available in the pipeline. Construct the outlets in the

same manner as for a permanent outlet and after use seal with a blind flange, pipe cap, or plug and coat equal to the adjacent pipe.

2.3 TEST FLUID AND TEMPORARY PIPING

Use only potable water for the hydrostatic pressure test. Provide an approved and certified reduced pressure backflow prevention assembly if source of potable water is from public waterlines. Provide temporary piping to convey and dispose of the test fluid used in the pipeline. Disconnect and remove temporary piping after complying with the allowable leakage.

2.4 TEST EQUIPMENT

Provide calibrated pressure gauges, pipes, pumps, meters, and other equipment necessary to perform the hydrostatic pressure test.

PART 3 - EXECUTION

3.1 GENERAL

All testing shall be performed in the presence of the DISTRICT. Subject the pipeline and appurtenances to a hydrostatic pressure test after the pipe has been laid and backfilled for required restraint. Allow concrete pipe anchors, collars, encasements and thrust blocks to cure prior to pressure testing. Allow concrete structures to attain the specified 28-day compressive strength prior to testing. Existing facilities will be operated by or under the direction of the DISTRICT only. When the DISTRICT furnishes and installs valves at takeoffs from its existing system, the CONTRACTOR shall omit a length of pipe, provide adequate blocking and test the piping independently of the DISTRICT's existing system. Test shall not be made against DISTRICT furnished or installed valves.

3.2 CLEANING

A. In pipelines less than 24-inches in diameter, before conducting hydrostatic tests, flush pipes with water to remove dirt and debris. Maintain flushing velocity of at least 3 fps. Flush pipes for the minimum time period as given by the formula below and as required to thoroughly clear the pipeline of dirt and debris.

$$T = \frac{2L}{3}$$

Where:

T = flushing time (seconds)

L = pipe length (feet)

B. In pipes 24-inches or larger in diameter, clean the pipe using high-pressure water jet, sweeping, scrubbing, or equally effective means. All water, sediment, dirt, and foreign material accumulated during this cleaning operation shall be discharged, vacuumed, or otherwise removed from the pipe.

3.3 TESTING AND DISENFECTION SEQUENCE

- A. Perform required disinfection after the completion of hydrostatic testing per Section 02600. Disinfection and hydrostatic testing may be carried on simultaneously upon approval of the DISTRICT.

3.4 LENGTH OF TEST SECTION

- A. Test the pipeline in sections. In any one test, do not exceed more than 2,500 feet, or as directed by the DISTRICT.

3.5 INITIAL PIPELINE FILLING FOR HYDROSTATIC TESTING

- A. Maximum rate of filling with test fluid shall not cause water velocity in the pipeline to exceed 1 fps. Expel air from the pipeline while filling and prior to testing. Provide necessary outlets to fill and test pipeline. When testing cement mortar lined piping, fill the pipe to be tested with potable water and allow it to soak for at least 48 hours to absorb water before conducting the pressure test.

3.6 PRESSURE AND DURATION OF HYDROSTATIC TEST

- A. Before applying the specified test pressure, care shall be taken to release all air within the pipe and appurtenances to be tested. Air shall be released through services, fire hydrants, air releases valves, or other approved locations. The test shall be conducted with valves in the open position.
- B. A five (5) hour hydrostatic test shall be performed after the pipe and all appurtenances have been installed and after any trench backfill compaction with heavy duty compaction has been completed. The hydrostatic test pressure shall be 50 psi above the class rating of the pipe, or 250 psi, whichever is less, or as otherwise directed by the DISTRICT Engineer. Hydrostatic test pressure will be 250 psi at the lowest point of the section being tested but not less than 200 psi at the highest section.

The test pressure shall be applied and continuously maintained by pumping for a period of (4) hrs. During the pumping phase of the test, the test pressure shall be maintained at not less than ninety-five percent (95%) of the specified test pressure at all times.

At the end of the fourth (4th) hour, the pressure shall meet the requirements stated above. Pumping shall then be disconnected for one hour and the drop in pressure shall be recorded. Pumping shall then be resumed to restore the initial test pressure, and the quantity of water pumped into the line shall be accurately measured. Leakage shall be considered as the total amount of water pumped into the pipeline during the final test period. The allowable leakage for above ground and buried piping having threaded, soldered, welded, flanged, push-on joint, mechanical joint, and rubber gasket joint shall be zero.

If the leakage exceeds the allowable loss, the leak points shall be located and repaired as required by the DISTRICT Engineer. All defective pipe, fittings, valves, and other appurtenances discovered shall be replaced with sound material. Additional disinfection shall be performed as necessary. The Hydrostatic test shall be repeated until the leakage does not exceed the rate specified above. All visible leaks shall be similarly repaired.

The test duration for PVC pressure pipe may be reduced to two (2) hours upon approval of the DISTRICT.

3.7 BULKHEAD AND TEST FACILITY REMOVAL

- A. After a satisfactory test, remove test bulkheads and other test facilities, restore the pipe lining and coatings, and fill the pipeline section tested with water and maintain it full until disinfection of pipeline at the completion of the contract. The CONTRACTOR shall assume all responsibility for any damage to the pipeline as a result of pressure imposed during the operations of filling the pipeline with water and conducting the tests.

END OF SECTION

SECTION 03000 - CONCRETE

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

A. The WORK of this Section includes concrete materials, mixing, placement, formwork, reinforcement and curing.

PART 2 - PRODUCTS

2.1 CONCRETE

- A. All Portland cement concrete shall conform to the provisions of Section 201, 202 and 303 of the Standard Specifications for Public Work Construction (Green Book), latest edition.
- B. The following classes of concrete, as described in the Green Book, Section 201-1.1.2, shall be used:

CLASSES OF CONCRETE		
Class	Type of Work	Max. Slump (Inches)
560-C-3250	All reinforced structures, manhole bases, piers, vaults	4
450-C-2000	Anchors, thrust blocks, encasements, cradles, and miscellaneous unreinforced concrete	4

Maximum water/cement ratio for each of the above classes shall be 0.55.

C. In certain circumstances, rapid setting concrete may be required. Calcium chloride or other accelerating admixtures shall be added to the concrete mix as directed by the DISTRICT.

2.2 GROUT

- A. Grout shall be composed of one (1) part Type II Portland Cement to one and one-half (1-1/2) parts sand.
- B. The sand shall be washed, well-graded sand such that all will pass a No. 8 sieve.
- C. Water shall be clean potable water. The quantity of water to be used in the preparation of grout shall be the minimum required to produce a mixture sufficiently workable for the purpose intended.

- D. Grout shall attain a minimum compressive strength of 2,000 psi in 28 days.
- E. Rapid setting, non-shrink, "5-minute" grout may be required in certain circumstances.

2.3 REINFORCING STEEL

- A. Reinforcing steel shall conform to ASTM A 615, Grade 60.
- B. Reinforcing steel shall be fabricated in accordance with the current edition of the Manual of Standard Practice, published by the Concrete Reinforcing Steel Institute.
- C. Reinforcing steel shall be delivered to the site bundled and tagged for identification.

2.4 WELDED WIRE FABRIC

- A. Welded wire fabric shall conform to ASTM 185.

2.5 TIE WIRE

- A. Tie wire shall be a minimum of 16 gage, black, soft annealed.

2.6 BAR SUPPORTS

- A. Bar supports in beams and slabs exposed to view after form stripping shall be galvanized or plastic coated.
- B. Concrete supports shall be used for reinforcement in concrete placed on grade.

2.7 FORMS

- A. Forms shall be accurately constructed of clean lumber.
- B. Forms shall be braced to provide sufficient strength and rigidity to hold the concrete and to withstand the necessary pressure and consolidation without deflection from the prescribed lines.
- C. The surface of forms against which concrete is placed shall be smooth and free from irregularities, dents, sags or holes. The surface shall leave uniform form marks conforming to the general lines of the structure.

PART 3 - EXECUTION

3.1 FORMWORK

- A. The CONTRACTOR shall notify the DISTRICT a minimum of one working day before his intended placement of concrete to enable the DISTRICT to

check the form lines, grades, and other required items before placement of concrete.

- B. Before placing concrete, the form surface shall be clean and coated with form oil of high penetrating qualities where applicable.
- C. Unless otherwise indicated on the plans, all exposed sharp concrete edges shall be 3/4-inch chamfered.

3.2 REINFORCEMENT

- A. Reinforcing steel shall be placed in accordance with the current edition of Recommended Practice for Placing Reinforcing Bars, published by the Concrete Reinforcing Steel Institute.
- B. All reinforcing steel shall be of the required sizes and shapes and placed where shown on the drawings or as directed by the DISTRICT.
- C. Straightening or re-bending of reinforcing steel in a manner that will damage the material shall not be permitted.
- D. Bars with bends not shown on the drawings shall not be permitted
- E. All steel shall be cold bent - heat shall not be used.
- F. All bars shall be free from rust, scale, oil, or any other coating which would reduce or destroy the bond between concrete and steel.
- G. Reinforcement steel shall be positioned in accordance with the drawings and secured by using annealed wire ties or clips at intersections. Reinforcement steel shall be supported by concrete or metal supports, spacers, or metal hangers.
- H. Metal clips or supports shall not be placed in contact with the forms.
- I. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.
- J. Bars additional to those shown on the drawings, which may be found necessary or desirable by the DISTRICT for the purpose of securing reinforcement in position, shall be provided by the CONTRACTOR at no expense to the DISTRICT.
- K. Reinforcement shall be placed a minimum of 2 inches clear of any metal pipe or fittings.
- L. Reinforcement shall be secured in position such that it will not be displaced during the placement of concrete.
- M. All reinforcing steel and wire mesh shall be completely encased in concrete.

- N. Reinforcing dowels shall be secured in place prior to placing concrete. Dowels shall not be pressed into the concrete after the concrete has been placed.
- O. Minimum lap for all reinforcement shall be 40 bar diameters.
- P. Additional reinforcement shall be placed around the pipe or openings as indicated on the drawings.
- Q. Wire mesh reinforcement shall be rolled flat before being placed in the form. Wire mesh shall be tied and supported to prevent movement during concrete placement.
- R. Welded wire fabric shall be extended to within 2 inches of the edges of the slab. Splices shall be lapped at least 1 1/2 courses of the fabric and a minimum of 6 inches. Laps and splices shall be tied securely at ends and at least every 24 inches with 16-gage black annealed steel wire. The fabric shall be pulled into position as the concrete is placed by means of hooks. Concrete shall be worked under the steel to ensure that it is at the proper distance above the bottom of the slab.

3.3 EMBEDDED ITEMS

- A. All embedded bolts, dowels, anchors and other embedded items shall be held correctly in place in the forms before concrete is placed.

3.4 MIXING AND PLACING CONCRETE

- A. Concrete, either ready mix or batch mixed, shall be placed in the forms before taking its initial set.
- B. No concrete shall be placed in water except with permission of the DISTRICT.
- C. As the concrete is placed in the forms, or in excavations to be filled with concrete, it shall be thoroughly settled and compacted throughout the entire layer by internal vibration and tamping bars.
- D. All concrete surfaces upon or against which the concrete is to be placed, and to which new concrete is to adhere, shall be roughened, thoroughly cleaned, wetted, and grouted before the concrete is deposited.

3.5 CONCRETE FINISHING

- A. Immediately upon the removal of forms, all voids shall be neatly filled with cement mortar.
- B. Surfaces of concrete to be permanently exposed to view must be smooth, free from projections, and thoroughly filled with mortar.
- C. Exposed surfaces of concrete not finished against forms, such as horizontal or sloping surfaces, shall be screeded to a uniform surface and worked with suitable tools to a light broom finish.

3.6 PROTECTION AND CURING OF CONCRETE

- A. The CONTRACTOR shall protect all concrete against damage.
- B. Exposed surfaces of new concrete shall be protected from the direct rays of the sun and frost by being kept damp for at least two weeks after the concrete has been placed, or by using an approved curing process.

END OF SECTION

SECTION 03100 - PRECAST CONCRETE VAULTS

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes the materials and installation of precast concrete vaults.

1.2 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300.
 - 1. Submit manufacturer's product data on precast items.
 - 2. Manufacturer's product data shall contain the following information:
 - a. Dimensions of vault.
 - b. Thickness of walls.
 - 3. Shop drawings showing reinforcing and materials of construction by ASTM reference and grade.
 - 4. Submit manufacturer's catalog data on electrical items and equipment specified herein.
 - 5. Submit electrical wiring plan and a single line diagram.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Sectional precast concrete vaults may be used where specified on the drawings or approved by the DISTRICT.
- B. Vault walls shall not exceed eight (8) feet nor be less than six (6) feet, as measured from the vault floor to the top of the vault wall, unless approved by the DISTRICT.

2.2 PRECAST CONCRETE VAULT

- A. Precast concrete vaults and covers shall be manufactured in a plant especially designed for that purpose and shall conform to the shapes and dimensions indicated on the plans.
- B. Design loads shall consist of dead load, live load, impact load, and loads due to water table and any other loads which may be imposed upon the structure. Live loads shall be for HS-20 per AASHTO standard specifications for highway bridges. Design wheel load shall be 16 kips. The live load shall be

that which produces the maximum shears and bending moments in the structure.

- C. Minimum wall thickness shall be 8 inches.
- D. Concrete shall be Class 560-C-3250.

2.3 VAULT ACCESS DOORS

- A. Vault access doors shall be fabricated aluminum, 4 feet wide by 4 feet long, unless otherwise specified by the DISTRICT. Access doors shall mount flush with the surrounding area.
- B. Access doors shall be equipped with heavy brass hinges, stainless steel pins, compression spring operators, an automatic hold-open arm with release handle and a locking device, to receive a padlock.
- C. All vaults located within roadways shall have H-20 rated traffic doors. Vaults in other locations shall have parkway doors, unless otherwise specified by the DISTRICT.
- D. Access doors shall be Type JD-AL as manufactured by the Bilco Company, New Haven, Conn., or equal.

2.4 LADDERS

- A. Ladders shall be of aluminum construction. Rung diameter shall be 1 inch minimum, with 12 inches between rungs, and 18 inches between side bars. Ladders shall exceed the requirements of CAL/OSHA and ANSI Standards.
- B. Material for ladders shall be high strength 6061-T6 aluminum alloy.
- C. Appropriate Bilco, or equal, ladder-up safety post for each ladder installation shall be provided.

2.5 SUMP

- A. Vault floor shall contain an 18 inch diameter hole for installation of a 24 inch deep sealed sump with a removable expanded metal safety grate. The vault floor shall be constructed such that there is a positive slope to the sump. A minimum 6-inch drain shall be provide where applicable or as directed by the DISTRICT.
- B. Sump Pump shall be Zoeller Model #M53, or equal.

2.6 EQUIPMENT

- A. Electrical
 - 1. Humidistat shall be Honeywell Model #H46C1000, or equal.

2. Load Center shall be GE Model TLM-612RH with Type THQL-GFCI Plug-In breaker, or equal.
3. Fused Safety Switch shall be GE Model # TH3221RH, or equal.
4. Lights shall be Hubbell Incandescent Wall Mounted, Model #NVX15GHG with NVB accessory, or equal. (A minimum of two lights shall be required for each vault.)
5. Light Switch shall be Hubbell Model #1221 with #1795 cover plate, or equal.
6. Ground Fault Receptacle shall be Hubbell Model #GF-5362 with WP-26 Wall Plate, or equal.

B. Vents

1. All vaults shall be equipped with vents as shown on the drawings.
2. Vents shall be constructed from 6 inch C-900 PVC pipe and fittings. Fittings shall be socket welded type.
3. Each vault shall have 2 vents, one upper and one lower. The exhaust fan shall discharge into the bottom vent.
4. Exhaust Fan shall be ILG Industries, Inc. Model PV. Fan shall be sized for 6 volume changes per hour.
5. A Type 304 stainless steel insect screen shall be installed over vent openings above ground.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. The CONTRACTOR shall prepare an excavation large enough to accommodate the structure and permit grouting of openings and backfilling operations.
- B. The bottom of the structure shall be placed on 6 inches of compacted, crushed rock subbase, and graded level to the elevation as shown on the plans.
- C. Vault excavations shall be backfilled with imported granular material to a minimum relative density of 90 percent.

3.2 INSTALLATION

- A. Openings or "knockouts" in precast concrete vaults shall be located as shown on the drawings and shall be sized sufficiently to permit passage of the largest dimension of pipe and/or flange.

- B. Upon completion of installation, all voids or openings in the vault walls around pipes shall be filled with 3,000 psi non-shrink grout.
- C. After the structure and all appurtenances are in place and approved, backfill shall be placed to the original groundline or to the limits designated on the plans.
- D. All joints between precast concrete vault sections shall be made watertight. The plastic joint sealing compound shall be installed according to the manufacturer's recommendations to provide a watertight joint which remains impermeable throughout the design life of the structure. The outside of the entire structure shall be coated with an approved water proofing material.
- E. Access doors shall be built up such that the hatch is flush with the surrounding surface unless otherwise specified on the drawings or by the DISTRICT. The CONTRACTOR is responsible for placing the cover at the proper elevation where paving is to be installed and shall make all necessary adjustments so that the cover meets these requirements.
- F. Ladders shall be installed using Type 316 stainless steel capsule anchors.
- G. Ladders shall be attached a minimum of 3 places to the vault wall.
- H. Ladder shall be centered under access door opening.

3.3 ELECTRICAL

- A. Conduits, switches, breakers, receptacles and equipment shall be installed per NFPA 70 (National Electric Code), latest edition.
- B. All electrical materials used shall be moisture proof and suitable for wet locations.
- C. The exhaust fan shall energize when:
 - 1. The access door is opened.
 - 2. The humidistat signals a rise in humidity.
 - 3. Manually operated.

END OF SECTION

SECTION 04000 - PAINTINGS AND COATINGS

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes materials and application of painting and coating systems for the following surfaces:
 - 1. Submerged Metal
 - 2. Exposed Metal
 - 3. Wood

1.2 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300.
 - 1. Manufacturer's technical and material safety data sheets for the products to be applied. Data sheets shall contain the following information:
 - a. Percent solids by volume.
 - b. Recommended surface preparation.
 - c. Recommended thinners.
 - d. Statement verifying that the specified prime coat is recommended by the manufacturer for use with the specified intermediate and finish coats.
 - e. Application instructions including recommended equipment and temperature limitations.
 - f. Minimum and maximum recommended dry-film thickness per coat for prime, intermediate, and finish coats.
 - g. Curing requirements and instructions.
 - 2. The name of the company and abrasive to be used, the generic type of abrasive, and the CARB certification.

PART 2 - PRODUCTS

2.1 PAINTING AND COATING SYSTEMS

- A. General
 - 1. Coating products shall conform to San Diego Air Pollution Control District Rule 67.0, where products cannot contain more than 350 grams per liter (2.80 lbs.) of volatile organic material per gallon of coating

product applied. The following index lists the permissible painting and coating systems according to service and their corresponding generic coating type.

PAINT COATINGS SYSTEM INDEX		
COATING SYSTEM		GENERIC TYPE
Submerged Metal Coating System		
System 5	Submerged or Intermittently Submerged Metal, Potable Water	Epoxy
Exposed Metal Coating Systems		
System 15	Exposed Metal, Atmospheric Weathering Environment	Alkyd
System 20	Exposed Metal, Exterior	Synthetic Enamel
Plaster, Wood, Masonry and Drywall Coating System		
System 60	Plaster, Wood, Masonry and Drywall	Acrylic Latex

The systems are described in further detail in the following Sections. Included are the required surface preparation, prime coat, intermediate coat as required, topcoat, and coating thickness for each coating. Minimum dry-film thicknesses shall be as specified.

2.2 SYSTEM 5

A. Submerged or Intermittently Submerged Metal, Potable Water

1. Type: Two component, three coat epoxy system.
2. Service Conditions: For use with steel structures, piping, valves, or equipment in potable water service.
3. Surface Preparations: Surface preparation shall be in accordance with SSPC-SP 10.
4. Coating Systems: Apply three coats of Ameron 395, Kop-Coat Hi-Gard, Engard 460 HS, or equal. Apply to a minimum dry film thickness of 12 mils total.

2.3 SYSTEM 15

A. Exposed Metal, Atmospheric Weathering Environment

1. Type: Gloss alkyd enamel with minimum volume solids content of 46% with alkyd primer.
2. Service Conditions: For use on exterior metal and piping subject to sunlight and weathering.
3. Surface Preparation: Surface preparation shall be in accordance with SSPC-SP 6.
4. Prime Coats: Provide Kop-Coat 622HB, Ameron 5105, Engard 126 HS, or equal. Apply to a minimum dry film thickness of 2 mils.
5. Finish Coats: Provide two coats Kop-Coat 500HB Enamel; two coats Ameron 5401HS; two coats Engard 222 HS; 1.5 mils each coat; or equal.

2.4 SYSTEM 20

A. Exposed Metal, Exterior

1. Type: Gloss synthetic enamel with OSHA safety color coding.
2. Service Conditions: For use on exterior metal piping appurtenances, such as valve box lids, hydrant heads, guard posts, air valve enclosures, and water sample point enclosures.
3. Surface Preparation: SSPC-SP 1. Apply one coat of vinyl wash primer on galvanized, zinc, or bronze surfaces. Use Sinclair No. 7113, or equal.
4. Prime Coats: Sinclair No. 15N (non-ferrous or ferrous) or No. 14N (galvanized or zinc), 1.5 mils or equal.
5. Finish Coats: Provide two coats Sinclair No. 7500 (OSHA White), No. 7571 (OSHA Yellow), No. 7572 (OSHA Orange), No. 7573 (OSHA Green), or No. 7574 (OSHA Blue), 2 mils each coat; or equal.

2.5 SYSTEM 60

A. Plaster, Wood, Masonry and Drywall

1. Type: Acrylic latex coating having a minimum volume solids of 40%.
2. Service Conditions: For use in coating weather-exposed or enclosed concrete masonry, drywall, wood, and plaster.
3. Surface Preparation: Surfaces shall be dry, clean, and free of contaminants.
4. Prime Coats: Self-priming.
5. Finish Coats: Provide two coats Tnemec Series 6, Tneme-cryl, 2 mils each; two coats Kop-Coat 600, 2 mils each; or equal.

2.6 ABRASIVES FOR SURFACE PREPARATION

- A. Abrasives used for dry unconfined blast cleaning shall conform to the requirements of the State of California Air Resources Board (CARB) Executive Order G-425. Abrasives that are currently certified by CARB and appear on the Approved Abrasives List shall be used.
- B. Abrasives used for preparation of iron and steel surfaces shall be one of the following:
 - 1. 16 to 30 or 16 to 40 mesh silica sand or mineral grit.
 - 2. 20 to 40 mesh garnet.
 - 3. Crushed iron slag, 100% retained on No. 80 mesh.
 - 4. SAE Grade G-40 or G-50 iron grit.
- C. In the above gradations, 100% of the material shall pass through the first stated sieve size and 100% shall be retained on the second stated sieve size.

PART 3 - EXECUTION

3.1 WEATHER CONDITIONS

- A. Paint shall not be applied in the rain, wind, snow, mist, and fog or when steel or metal surface temperatures are less than 5 degrees F above the dew point.
- B. Paint shall not be applied when the relative humidity is above 85% or the temperature is above 90 degrees F.
- C. Paint shall not be applied when temperature of metal to be painted is above 120 degrees F.
- D. Paint shall not be applied if air or surface temperature is below 40 degrees F or expected to be below 40 degrees F within 24 hours.
- E. Epoxy, acrylic latex, and polyurethane shall not be applied on an exterior or interior surface if air or surface temperature is below 60 degrees F or expected to drop below 60 degrees F in 24 hours.

3.2 SURFACE PREPARATION

- A. Do not sandblast or prepare more surface area than can be coated in one day. Remove all sharp edges, burrs, and weld spatter. Do not sandblast PVC, CPVC, or FRP piping or equipment. Do not sandblast epoxy, enamel coated, or fusion-bonded epoxy pipe that has already been factory coated, except to repair scratched or damaged coatings.
- B. Surface preparation shall conform with the SSPC specifications as follows:
 - 1. Solvent Cleaning SP 1
 - 2. Hand Tool Cleaning SP 2

3.	Power Tool Cleaning	SP 3
4.	White Metal Blast Cleaning	SP 5
5.	Commercial Blast Cleaning	SP 6
6.	Brush-Off-Blast Cleaning	SP 7
7.	Pickling	SP 8
8.	Near-White Blast Cleaning	SP 10

- C. Where the words "solvent cleaning," "hand tool cleaning," "wire brushing," "blast cleaning" or similar words are used in these specifications or in paint manufacturer's specifications, they shall be understood to refer to the applicable SSPC (Steel Structure Painting Council, Surface Preparation Specifications, ANSI A159.1) specifications listed above.
- D. Dust blasting shall be defined as cleaning the surface through the use of very fine abrasives, such as siliceous or mineral abrasives, 80 to 100 mesh. A fine etch shall be applied to the metal surface to clean the surface of any contamination or oxide.
- E. Oil and grease shall be removed from metal surfaces in accordance with SSPC-SP 1. Use clean cloths and cleaning solvents and wipe dry with clean cloths. Surfaces shall be free of film or grease before sandblasting.
- F. Weld spatter and weld slag shall be removed from metal surfaces and rough welds, beads, peaked corners, and sharp edges shall be ground smoothly in accordance with SSPC-SP 2 and SSPC-SP 3.
- G. Welds shall be neutralized with a chemical solvent that is compatible with the specified coating materials. Clean cloths and chemical solvent shall be used. Wipe dry with clean cloths. Residue shall be removed from cleaned surfaces.

3.3 ABRASIVE BLAST CLEANING

- A. Dry abrasive blast cleaning shall be used for metal surfaces. Abrasives shall not be used in automatic equipment that has become contaminated. When shop or field blast cleaning with handheld nozzles, blast particles shall not be recycled or reused.
- B. After blast cleaning and prior to application of coating, surfaces to be coated shall be dry cleaned by dusting, sweeping, and vacuuming to remove residue from blasting. The specified primer or touch-up coating shall be applied within the period of an eight-hour working day. Coating shall not be applied over damp or moist surfaces. Prior to application of primer or touch-up coating, blast cleaned surfaces not coated within said eight-hour period shall be re-cleaned.
- C. Area of work shall be maintained in a clean condition. Blasting particles shall not accumulate and constitute a nuisance or hazard.
- D. During blast cleaning, damage to adjacent coatings shall be prevented. Blast cleaning and coating shall be scheduled such that dust, dirt, blast particles, old coatings, rust, mill scale, etc., will not damage or fall upon wet or newly coated surfaces.

3.4 PAINTING SYSTEMS

- A. All materials of a specified painting system, including primer, intermediate, and finish coats, shall be produced by the same manufacturer. Thinners, cleaners, driers, and other additives shall be as recommended by the paint manufacturer for the particular coating system.
- B. Paints shall be delivered to the jobsite in original, unopened containers.

3.5 PAINT MIXING

- A. Multiple-component coatings shall be prepared using all contents of the container for each component as packaged by the paint manufacturer. Partial batches shall not be used. Multiple-component coatings that have been mixed beyond their pot life shall not be used. Small quantity kits for touchup painting and for painting other small areas shall be provided. Only the components specified and furnished by the paint manufacturer shall be mixed. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

3.6 PROCEDURES FOR THE APPLICATION OF COATINGS

- A. Conform to the requirements of SSPC-SP 1. The recommendations of the coating manufacturer including the selection of spray equipment, brushes, rollers, cleaners, thinners, mixing, drying time, temperature and humidity of application, and safety precautions shall be followed.
- B. Stir, strain, and keep coating materials at a uniform consistency during application. Each coating shall be applied evenly, free of brush marks, sags, runs, holidays, and other evidence of poor workmanship. A different shade or tint shall be used on succeeding coating applications to indicate coverage where possible. Finished surfaces shall be free from defects or blemishes.
- C. Thinners shall not be used unless recommended by the coating manufacturer. If thinning is permitted, the maximum allowable amount of thinner per gallon of coating material shall not be exceeded. Coating materials shall be stirred at all times when adding thinner. Do not flood the coating material surface with thinner prior to mixing. Coating materials shall not be reduced more than is absolutely necessary to obtain the proper application characteristics and to obtain the specified dry-film thicknesses.
- D. Dust, blast particles, and other debris shall be removed from blast cleaned surfaces by dusting, sweeping, and vacuuming. Ventilator fans shall be permitted to clean airborne dust to provide good visibility of working area prior to coating applications. Dust shall be removed from coated surfaces by dusting, sweeping, and vacuuming prior to applying succeeding coats.
- E. Coating systems shall be applied to the specified minimum dry-film thicknesses as measured from above the peaks of the surface profile.
- F. Primer shall be applied immediately after blast cleaning and before any surface rusting occurs, or any dust, dirt, or any foreign matter has

accumulated. Surfaces that have surface colored or become moist prior to coating application shall be recleaned by blast cleaning.

- G. A brush coat of primer on welds, sharp edges, nuts, bolts, and irregular surfaces shall be applied prior to the application of the primer and finish coat. The brush coat shall be done prior to and in conjunction with the spray coat application. The spray coat shall be applied over the brush coat.

3.7 SURFACES NOT TO BE COATED

- A. The following surfaces shall not be painted unless otherwise noted on the Drawings or in other Standard Specification Sections. Protect during the painting of adjacent areas:
 - 1. Cement mortar coated pipe and fittings.
 - 2. Stainless steel.
 - 3. Metal plates/nameplates or letters.
 - 4. Concrete surfaces.
- B. Copper tubing, red brass piping and PVC piping except where such piping occurs in rooms where the walls are painted, or required for color coding.
- C. Buried pipe unless specifically required in the piping specifications.

3.8 PROTECTION OF SURFACES NOT TO BE PAINTED

- A. Surfaces not intended to be painted shall be removed, masked, or otherwise protected. Drop cloths shall be provided to prevent paint materials from falling on or marring adjacent surfaces.

3.9 SURFACES TO BE COATED

- A. Surfaces shall be coated as described below:
 - 1. Buried piping shall be coated as described in the various piping specifications.
 - 2. Valves shall be coated as described in the various valve specifications.
 - 3. Exposed surfaces of enclosures, guard posts, and valve boxes shall be coated as described in the particular specifications for the above items.

3.10 DRY FILM THICKNESS TESTING

- A. Coating thickness specified for metal surfaces shall be measured with a magnetic-type dry-film thickness gage. The finish coat (except zinc primer and galvanizing) shall be tested for holidays and discontinuities with an electrical holiday detector, low-voltage, wet-sponge type. Measuring equipment shall be provided by the CONTRACTOR. A detector as manufactured by Tinker and Razor or K-D Bird Dog shall be provided by the CONTRACTOR. A dry-film thickness gage as manufactured by Mikrotest or

Elcometer shall be provided by the CONTRACTOR. Each coat shall be checked for correct dry-film thickness. Measurements shall not be done within eight hours after application of the coating.

- B. If the item has an improper finish color or insufficient film thickness, clean and topcoat the surface with the specified paint material to obtain the specified color and coverage. Hand or power-sand visible areas of chipped, peeled, or abraded paint, feathering the edges. Then prime and finish coat in accordance with the specifications. Work shall be free of runs, bridges, shiners, laps or other imperfections.

END OF SECTION

SECTION 04100 - FUSION-BONDED EPOXY LININGS AND COATINGS

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes materials, application and testing of one part, fusion-bonded, heat cured, thermosetting, 100% solids epoxy linings and coatings on steel, cast iron and ductile iron equipment, such as valves, mechanical clamp-type couplings, and transition couplings. Fusion-bonded epoxy shall not be applied to aluminum, brass, bronze, copper, plastic, rubber, or stainless steel surfaces.

1.2 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300.
1. Manufacturer's technical and material safety data sheets for the products to be applied. Data sheets shall contain the following information:
 - a. Description of the physical and chemical properties of the epoxy coating.
 - b. Description of the application and curing procedure.
 - c. Coating application test records for measuring coating thickness and holiday detection for each item.
 - d. Description of repair procedures used.

PART 2 - PRODUCTS

2.1 SHOP APPLIED EPOXY LINING AND COATING

- A. Lining and coating shall be a 100% solids, thermosetting, fusion-bonded, dry powder epoxy resin. The following items shall be provided: Scotchkote 134, 135, 203, or 206; "Pipe Clad" 1500 Red by Lilly Powder Coatings; or equal. Epoxy lining and coating shall meet or exceed the following requirements:

Hardness (Minimum)	Barcol 17 (ASTM D 2583) Rockwell 50 ("M" Scale)
Abrasion Resistance (Maximum Value)	1,000 cycles: 0.05 gram removed 5,000 cycles: 0.115 gram removed ASTM D 1044, Tabor CS 17 wheel, 1,000 gram weight
Adhesion (Minimum)	3,000 psi (Elcometer)
Tensile Strength	7,300 psi (ASTM D 2370)
Penetration	0 mil (ASTM G 17)

Adhesion Overlap Shear, 1/8-inch steel panel, 0.010 glue line	4,300 psi (ASTM D 1002)
Impact (Minimum Value)	100 inch-pounds (Gardner 5/8-inch diameter tup)

2.2 FIELD APPLIED EPOXY COATING FOR PATCHING

- A. A two-component, 80% solids, liquid resin, such as Scotchkote 306 or equal shall be used.

PART 3 - EXECUTION

3.1 SHOP APPLICATION OF FUSION-BONDED EPOXY

A. General

1. Grind surface irregularities, welds, and weld spatter smooth before application of epoxy.
2. Allowable grind area shall not exceed 0.5 square feet per location, and the maximum total grind area shall not exceed 2 square feet per item or piece of equipment. An item, pipe, or piece of equipment which does not meet these requirements shall not be used.
3. Surface imperfections, such as slivers, scales, burrs, weld spatter, and gouges shall be removed. Grind outside sharp corners, such as outside edges of flanges, to a minimum radius of 1/4-inch.
4. The pipe, item, or piece of equipment shall be uniformly preheated prior to blast cleaning to remove moisture from the surface. The preheat shall be sufficient to ensure that the surface temperature is at least 5°F above the dew point temperature during blast cleaning and inspection.
5. Sandblast surfaces per SSPC SP-5. Beveled pipe ends shall be protected from abrasive blast cleaning.
6. Phosphoric acid wash shall be applied to the pipe, item, or piece of equipment after sandblasting. The average temperature, measured in three different locations, shall be 80°F to 130°F during the acid wash procedure.
7. The acid wash shall be 5% by weight phosphoric acid solution.

8. The duration in which the acid is in contact with the surface shall be determined by using the average temperature as tabulated below:

Pipe Temperature (°F)	Contact Time (Seconds)
80	52
85	45
90	36
95	33
100	28
105	24
110	21
130	10

After the acid wash has been completed, the acid shall be removed with demineralized water having a maximum conductivity of 5 micromhos/cm at a minimum nozzle pressure of 2,500 psi.

- B. Lining and coating shall be applied by the electrostatic spray or fluidized bed process. Minimum thickness of lining or coating shall be 8 mils. Heat and cure per the epoxy manufacturer's recommendations. The heat source shall not leave a residue or contaminant on the metal surface. Oxidation of surfaces prior to coating shall not be permitted to occur. Flash rusting of the surfaces before coating shall not be permitted.

3.2 SHOP APPLICATION OF FUSION-BONDED EPOXY

- A. In addition to the above requirements, lining and coating shall be applied per AWWA C213 except as modified herein.
- B. Grind a minimum of 0.020-inch off the weld caps on the pipe weld seams before beginning the surface preparation and heating of the pipe.

3.3 QUALITY OF LINING AND COATING APPLICATIONS

- A. Cured lining or coating shall be smooth and glossy, with no graininess or roughness. The lining or coating shall have no blisters, cracks, bubbles, underfilm voids, mechanical damage, discontinuities, or holidays.

3.4 SHOP TESTING OF LINING AND COATING

- A. General
1. Test linings and coatings, interior and exterior, with a low-voltage wet sponge holiday detector in accordance with AWWA C213, Section 5.3.3 and as specified herein. If the number of holidays or pinholes for flat or smooth surfaces such as pipe is fewer than one per 10 square feet of coating surface, repair and retest. If the number of holidays or pinholes for valves, couplings, and fittings is 5 or less per item, repair and retest. Holidays and pinholes shall be repaired by applying the coating manufacturer's recommended patching compound to each holiday or pinhole and retested. If the number of holidays or pinholes exceeds these allowable

quantities, the entire lining or coating shall be removed and the pipe or item shall be recoated and retested.

2. Measure the coating thickness at three locations on each item or piece of equipment or pipe section using a coating thickness gauge calibrated at least once per eight-hour shift. Record each measured thickness value. Where individual measured thickness values are less than the specified minimum thickness, measure the coating thickness at three additional points around the defective area. The average of these measurements shall exceed the specified minimum thickness value, and no individual thickness value shall be more than 2 mils below or 3 mils above the specified minimum value. If a section of the pipe, item, or piece of equipment does not meet these criteria, remove the entire lining or coating and recoat the entire item or piece of equipment.
3. The OWNER will conduct an independent field inspection of the lining and coating for compliance with the above criteria. Coated items failing his/her inspection will be subject to rejection.

3.5 SHOP TESTING OF LINING AND COATING OF PIPE

- A. In addition to the above requirements, check for coating defects on the weld seam centerlines. There shall be no porous blisters, craters, or pimples lying along the peak of the weld crown.

3.6 FIELD REPAIRS

- A. Scratches and damaged areas incurred while installing fusion bonded epoxy coated items shall be patched with a two-component, 80% solids (minimum), liquid epoxy resin. Damaged areas shall be wire brushed and sandblasted per SSPC SP-10. Lightly abrade or sandblast the lining or coating on the sides of the damaged area before applying the liquid epoxy coating. A two-part epoxy coating shall be applied to damaged linings and coatings to areas smaller than 20 square inches. Patched areas shall overlap the parent or base coating a minimum of 1/2-inch. If a damaged area exceeds 20 square inches, the entire lining and coating shall be removed and the entire item or piece of equipment and shall be recoated and retested. The liquid epoxy coating shall be applied to a minimum dry-film thickness of 12 mils.

END OF SECTION

SECTION 04200 - POLYETHYLENE SHEET ENCASEMENT

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes materials, application, and inspection of polyethylene sheet encasement for buried flanges, fittings, couplings, valves, and appurtenances.

1.2 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300.
 - 1. Manufacturer's catalog literature and product data sheets describing the physical, chemical and electrical properties of the encasement material.

PART 2 - PRODUCTS

2.1 POLYETHYLENE MATERIAL

- A. The encasement shall consist of a polyethylene sheet of at least 8 mils thickness conforming to AWWA C105.

2.2 PLASTIC ADHESIVE TAPE

- A. A 2-inch wide plastic adhesive tape such as Calpico Vinyl Tape, Polyken 900, or equal shall be used.

PART 3 - EXECUTION

3.1 APPLICATION OF SHEET ENCASEMENT TO BURIED VALVES

- A. Valves shall be wrapped with a flat sheet of polyethylene. The sheet shall be placed under the valve and folded in half. The sheet shall be extended to the valve stem and secured in place with 2-inch wide plastic adhesive tape. The second layer shall be applied and secured with tape. Concrete and support blocks shall be poured after the wrap has been properly placed and inspected

3.2 APPLICATION OF SHEET ENCASEMENT TO BURIED FITTINGS, COUPLINGS, AND APPURTENANCES

- A. Buried ferrous metal pipe fittings, couplings, adapters, and appurtenances shall be wrapped with polyethylene sheet. The adjoining pipe or fitting shall be overlapped a minimum of one-foot and secured in place with 2-inch wide plastic adhesive tape. A second layer shall be applied and secured with tape around the barrel of the connecting pipe to prevent the entrance of soil. Concrete anchor and thrust blocks shall be poured after the wrap has been placed and inspected. Tracer wire shall be installed outside of the wrap.

3.3 REPAIR OF POLYETHYLENE MATERIAL

- A. Polyethylene material that is damaged during construction shall be repaired. Use polyethylene sheet, place over damaged or torn area, and secure in place with 2-inch wide plastic adhesive tape.

END OF SECTION

SECTION 04300 - COLD APPLIED WAX TAPE COATING

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes materials and application of a three part, cold applied wax tape coating system for buried piping. The coating system shall be in accordance with AWWA C217 and as modified herein.

1.2 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300.
1. Manufacturer's catalog data sheets.
 2. Manufacturer's application instructions.

PART 2 - PRODUCTS

2.1 PRIMER

- A. Primer shall be a blend of petroleum, plasticizer, and corrosion inhibitors having a paste-like consistency. The primer shall have the following properties:

- | | |
|----------------|--------------------------|
| 1. Color | Brown |
| 2. Pour Point | 100°F to 110°F |
| 3. Flash Point | 350° |
| 4. Coverage | 1 gallon/100 square feet |

- B. Primer shall be Trenton Wax Tape Primer or equal.

2.2 WAX TAPE

- A. Wax tape shall consist of a synthetic-fiber felt, saturated with a blend of microcrystalline wax, petroleum, plasticizer, and corrosion inhibitors, forming a tape coating that is easily formable over irregular surfaces. The tape shall have the following properties:

- | | |
|------------------------|----------------|
| 1. Color | Brown |
| 2. Saturant Pour Point | 115°F to 120°F |
| 3. Thickness | 50 to 70 mils |
| 4. Tape Width | 6 inches |
| 5. Dielectric Strength | 100 volts/mil |

- B. Wax tape shall be Trenton No. 1 Wax Tape or equal.

2.3 PLASTIC WRAPPER

- A. Wrapper shall be a polyvinylidene chloride plastic with three 50-gauge plies wound together as a single sheet. The wrapper shall have the following properties:
- | | |
|---------------|----------|
| 1. Color | Clear |
| 2. Thickness | 1.5 mils |
| 3. Tape Width | 6 inches |
- B. Plastic wrapper shall be Trenton Poly-Ply or equal.

PART 3 - EXECUTION

3.1 WAX TAPE COATING APPLICATION

- A. Surfaces shall be clean and free of all dirt, grease, water, and other foreign material prior to the application of the primer and wax tape.
- B. Primer shall be applied by hand or brush to all surfaces of the pipe, fitting, flanges, and bolts to be wrapped by wax tape. The primer shall be worked into all crevices, around bolts and nuts, into the threads, and shall completely cover all exposed metal surfaces. The primer shall be extended beyond the indicated limits of application a minimum of 3 inches onto adjacent surfaces of the piping.
- C. Wax tape shall be applied immediately after the primer application. The tape shall be worked into the crevices around the fitting or flanges. Short lengths of tape shall be cut, placed over each bolt head and nut, and worked into the crevices. The wax tape shall be wrapped spirally around the pipe and across the fitting or flanges. A minimum overlap of 55 percent of the tape width shall be used.
- D. The tape shall be worked into the crevices and contours of irregularly shaped surfaces and smoothed out so that there is a continuous protective layer with no voids or spaces under the tape.
- E. The completed wax tape coating installation shall be overlapped with the plastic wrapping material. Wrap spirally around the pipe and across the fitting or flanges. Use a minimum overlap of 55 percent of the tape width and apply two layers or applications of overwrap. Plastic wrapper shall be secured to pipe with adhesive tape.

3.2 POLYETHYLENE ENCASEMENT

- A. Completed wax tape coating system shall be wrapped with polyethylene sheet per Section 04200 and secured around the adjacent pipe circumference with adhesive tape.

END OF SECTION

SECTION 05100 - VALVES, GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes providing general requirements for all valves including epoxy coating, installing, adjusting, and testing of valves and where buried valves are indicated, valve boxes to grade, with covers, stem extensions, and position indicators. Refer to the specific valve Section for additional requirements.

1.2 REFERENCE SPECIFICATIONS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section.
- | | | | |
|----|------|-------|---|
| 1. | ANSI | B16.1 | Pipe Flanges and Flanged Fittings, Class 25, 125, and 250 |
| 2. | AWWA | C213 | Fusion Bonded Epoxy Coatings and Linings |
| 3. | AWWA | C503 | Wet-Barrel Fire Hydrants |
| 4. | AWWA | C504 | Rubber Seated Butterfly Valves |
| 5. | AWWA | C506 | Backflow Prevention Devices-Reduced Pressure Principle and Double Check Valve Types |
| 6. | AWWA | C509 | Resilient-Seated Gate Valves for Water Supply Service |
| 7. | AWWA | C515 | Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service |
| 8. | AWWA | C550 | Protective Interior Coatings for Valves and Hydrants |

1.3 SUBMITTALS

- A. Unless otherwise indicated in the specific valve Section, the following shall be submitted in compliance with Section 01300.
1. Manufacturer's installation, operations, and maintenance instructions.
 2. Schedule of valves indicating valve identification and location.
 3. Detail drawings showing laying lengths, valve dimensions and orientation, pressure rating, valve actuators, all valve parts and materials of construction.
 4. Manufacturer's certification that products comply with the indicated requirements, AWWA standards, and have been manufactured within the last 5 years.
 5. Prior to shipment, manufacturer affidavit of compliance for hydrostatic, epoxy, and actuator testing per the indicated requirements.

1.4 MANUFACTURER TESTING AND FIELD INSPECTION

- A. Prior to shipping, the manufacturer shall test each valve in accordance with the requirements of this Section and the AWWA standards indicated, and provide an affidavit of compliance that each valve supplied has successfully completed the tests.

1. After the actuator has been mounted and adjusted and the valve completely assembled, hydrotest each valve in both directions under the test pressures and differential pressures specified by AWWA.
 2. Dry film thickness and holiday detection test each valve in compliance with Section 04100-3.4.
 3. Operate each valve from the fully closed to fully open to fully closed positions.
- B. Prior to installation, valves shall be field-tested by the OWNER for compliance with the indicated requirements. Valves failing the inspection will be subject to rejection.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Valve ends shall be compatible with the piping system shown on the Approved Drawings and, unless otherwise shown, valves shall be the same size as the line in which they are installed.
- B. Valves shall be provided complete with operating extension stems, gear actuators, operating nuts, handwheels, and all equipment required for operation.
- C. Shut-off valves, 6-inch and larger, shall have operators with position indicators.
- D. Buried valves shall be provided with valve boxes and covers containing position indicators, and valve extensions.
- E. All valves must have been manufactured within the last five (5) years.
- F. Gasket material and installation shall conform to manufacturer's recommendations.

2.2 VALVE ACTUATORS

- A. Where indicated, valves shall include electric actuators recommended by the manufacturer.
- B. Actuators of the same type shall be furnished by the same manufacturer.
- C. Valve actuators, regardless of type, shall be installed, adjusted, and tested by the valve manufacturer at the place of manufacture.

2.3 EXTENSION STEMS FOR BURIED VALVES

- A. Where the depth of the valve is such that the operating nut is more than 5 feet below grade, operating extension stems shall be provided to bring the operating nut to a point 18 inches below the surface of the ground and/or valve box cover in accordance with the DISTRICT's Standard Drawings, Section 09000.

- B. Valve stem extensions shall have a 2-inch square operating nut, be of a solid design (no pinned couplings permitted) with guides, and be at least as large as the valve stem it operates.
- C. Provide intermediate stem guide for extensions more than 7 feet long.

2.4 VALVE WELLS

- A. Provide a valve stand for each buried valve and construct in accordance with the DISTRICT's Standard Drawings, Section 09000. Construct lid of cast iron and design for traffic loading. Castings shall be smooth, clean, and free from blisters, blowholes, and shrinkage. Cast on the lid the words "VID" and "WATER." Lids shall be South Bay Foundry B 52 or equal. Construct valve can inserts of 20 gauge galvanized steel sheets as manufactured by R.K. Industries or equal. Pipe sleeves shall be 8-inch Class 305 PVC pressure pipe conforming to AWWA C900. The valve well shall rest on two 2"x2"x12' long redwood blocks or the concrete valve blocking. Pipe shall be sawn or machine cut on each end. No beveled section or bell will be allowed in the well. A 2-piece lid (1208-N) are required where concrete or pavers are installed.
- B. Final adjustment to finish grade may be made with an 8-inch Class 305 PVC ring of 1-inch minimum thickness or other means acceptable to the DISTRICT. The pavement shall be finished around the cover so that the cover can easily be removed without damaging the pavement.

2.5 PROTECTIVE LINING AND COATING

- A. Except where otherwise indicated, ferrous surfaces, exclusive of stainless steel surfaces and flange faces, in the water passages and exterior surfaces of all valves 4 inch and larger, shall be fusion-bonded epoxy lined and coated conforming to Section 04100 and NSF 61 approved, with a minimum dry film thickness of 8 mils.
- B. Coat machined, polished and non-ferrous metal surfaces with corrosion prevention compounds which shall be maintained during storage and until equipment begins operation.

2.6 VALVE IDENTIFICATION

- A. Except as otherwise indicated, a label shall be provided on all valves.
- B. Valves shall have the name of the manufacturer, the valve pressure rating, year valve was manufactured, and the size of the valve cast or molded onto the valve body or bonnet, or shown on a permanently attached plate.

2.7 STORAGE AND HANDLING

- A. Materials shall be stored to permit easy access for identification and inspection purposes. Valves shall be kept off the ground using pallets, platforms, or other supports. Valves shall not be stacked.
- B. Valves and packaged materials shall be protected from corrosion, deterioration, and sun damage.

2.8 CONCRETE AND POLYETHYLENE SHEET ENCASEMENT

- A. Concrete support block and polyethylene sheet encasement for buried valves shall be in accordance with Sections 03000 and 04200, respectively.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Valves, operating units, stem extensions, valve stands and accessories shall be installed in accordance with the manufacturer's installation instructions.
- B. Install valves with the bolt holes straddling the vertical centerline of pipe and the operating nut in the vertical position unless otherwise noted on the Approved Drawings. Exposed valves shall be installed to provide easy access for operation, removal, and maintenance and to prevent interference between valve operators and structural members or handrails. Where combinations of valves, sensors, switches, and controls are indicated, the combinations shall be properly assembled and installed to ensure that systems are compatible and operating properly.
- C. Valves shall be independently supported to prevent stresses on the pipe. Buried valves shall have concrete support blocks installed in accordance with Section 03000 and the DISTRICTS's Standard Drawings, Section 09000. The concrete shall be placed so that valves and valve operators will be accessible for repairs or replacement
- D. Install polyethylene sheet encasement on buried valves in accordance with Section 04200.
- E. Disinfection and flushing of valves shall be in accordance with Section 02600, as part of the process of disinfecting the main pipeline. Valves shall be operated during the disinfection period to completely disinfect all internal parts.
- F. Valves shall be hydrostatically tested in conjunction with the pipeline in which they are installed in accordance with Section 02610.

END OF SECTION

SECTION 05110 - BUTTERFLY VALVES

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes materials and installation of epoxy coated butterfly valves. Refer to Section 05100 for additional general requirements.

1.2 REFERENCE SPECIFICATIONS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section.
 - 1. ANSI B16.1 Pipe Flanges and Flanged Fittings, Class 25, 125 and 250
 - 2. ANSI B16.5 Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special
 - 3. AWWA C213 Fusion Bonded Epoxy Coating
 - 4. AWWA C504 Rubber Seated Butterfly Valves
 - 5. AWWA C550 Protective Interior Coatings for Valves and Hydrants

1.3 SERVICE APPLICATION

- A. The DISTRICT requires the use of gate valves for all distribution and transmission pipe sizes. The DISTRICT, at its sole discretion, may allow the use of butterfly valves in certain operating conditions and only for 16-inch and larger transmission mains.

1.4 SUBMITTALS

- A. Provide submittals in compliance with Section 05100.

1.5 MANUFACTURER TESTING AND FIELD INSPECTION

- A. Butterfly valves shall be tested and inspected in compliance with AWWA C504 and Section 05100.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Butterfly valves shall be rubber-seated type in accordance with the requirements of AWWA C504 in all respects, except as may be specifically modified herein. Both workmanship and material shall be of the very best quality and shall be entirely suitable for the service conditions specified.
- B. Class 150B butterfly valves shall be used when static pressures are less than 150 psi. Where static pressures exceed 150 psi, Class 250B butterfly valves shall be used.

- C. Valves shall be of the latest manufactured type which meet requirements as specified herein and which shall have replacement parts available for a minimum ten (10) year period.
- D. Valves shall be satisfactory for frequent operation after long periods of inactivity. Valve discs shall rotate 90 degrees from the full open position to the tight shut position.
- E. Shaft seals shall be designed for use with standard split-V type packing or other approved seals, and the interior passage shall not have any excessive obstructions or stops.
- F. Cartridge-type valve seats, or valves employing snap rings to retain the rubber seats, will not be acceptable. The rubber seat shall be mounted in the valve body.
- G. On valves 30 inches and larger, the valve port diameter shall not be reduced more than 1-1/2 inches of the nominal pipe diameter.
- H. See Section 05100-2.1 for additional general requirements.

2.2 RUBBER-SEATED BUTTERFLY VALVES

A. Materials

1. Type: Tight-closing, rubber seated in conformance with AWWA C504 except as modified herein. Valves will be manually operated and shall be opened by rotating the operating nut or hand wheel in a counterclockwise direction. Valves shall have an AWWA C504 Class B designation, suitable for a maximum velocity of 16 feet per second in the upstream pipe section.
2. Bodies: Bodies shall be ductile iron as defined within AWWA C504, with integrally-cast hubs for shaft bearings. All valves shall be short body designed for the shutoff pressure specified with a factor of safety of not less than five. All valves shall have flat faced flanged ends with dimensions and drilling patterns conforming to ANSI B16.1 Class 150/250.
3. Discs: Ductile iron or cast iron as defined within AWWA C504. The disc edge shall have a corrosion-resistant edge for mating with the rubber seat and shall be machined or ground through 360 degrees of the seat. All keys and pins used to secure the valve disc to the shaft shall be of stainless steel or monel construction. All other pins and fasteners employed in the disc assembly shall be of austenitic stainless steel.
4. Shafts: Turned, ground, polished and fabricated from Type 304, stainless steel or monel. The shafts shall be of one or two piece construction and designed for a factor of safety of not less than five for the rated shutoff pressure and the maximum torque required. Connection of the valve disc to the shaft shall be suitable for the service conditions specified. The outboard end of the shafts shall be permanently marked to show the disc position in relation to the shaft.
5. Seats: Natural or synthetic rubber mounted in the valve body and which, together with the mating seat surface, shall be designed to provide tight closure at the shutoff

pressures specified herein. Seats which form, or are incorporated in the flange gasketing will not be acceptable. The mating surfaces for valve seats shall be Type 316 stainless steel. Rubber seats shall be field adjustable around the full 360-degree circumference and shall be replaceable without dismantling the operator, disc or shaft and without removing the valve from the pipeline. Adjusting segments and retainer screws, if used, shall be Type 316 stainless steel. If retaining segments are used, the bolts used to attach the retainer to the body shall not penetrate the rubber seat. The seats shall be retained by both cementing and vulcanizing and an additional approved positive means of retention. The positive retention shall be by means of corrosive-resistant device such as wedge-action segmented retainers or heavy stainless steel rings, epoxy-filled hollow rubber seats inserted in an inverted wedge-shaped recess, or other approved means. Design of the seats shall permit the valve to remain in a closed position with full unbalanced pressure on either side of the disc and adjoining pipeline flange on the other side removed without bulge or water penetration under the seat.

6. Bearings: Self-lubricating sleeve type. Thrust bearings shall be provided to keep the disc centered regardless of valve position.
7. Shaft seals: Valves shall be furnished with stuffing boxed. The packing shall be split self-adjusting "V" type of conventional type. Gland assemblies for conventional packing shall be of cast bronze with Type 316 stainless steel studs and nuts.
8. All bolts, nuts and studs shall conform to ASTM A307, Grade B; or ASTM A354. Bolts and nuts shall have hexagon heads.

2.3 MANUAL ACTUATORS

- A. Actuators shall conform to AWWA C504.
- B. Except as otherwise indicated, buried butterfly valves shall be equipped with a 2-inch square operating nut and position indicator with a maximum input torque of 150 pounds required to operate the valve.
- C. Actuators for valves located above ground or in vaults and structures shall have handwheels with a maximum input torque of 80 pounds required to operate the valve. The minimum hand wheel diameter shall be 12 inches. The actuator shall be equipped with a dial indicator which shows the position of the valve disc.
- D. Valves 30 inches and larger shall be equipped with worm-gear actuators, lubricated and sealed to prevent entry of dirt or water into the actuator at a water pressure of 40 feet of head, and totally enclosed and self-locking.
- E. Traveling nut actuators may be used on valves 24 inches or less.
- F. Actuators shall require a minimum of 40 turns and maximum of 100 turns to rotate the disc from fully open to fully closed position.
- G. Manual valve actuators shall turn clockwise to close unless otherwise specified. Valves shall indicate the direction of operation.

- H. All valve actuators shall be watertight, designed for buried or submerged uses. Actuators shall be fully gasketed, sealed, and factory-packed with grease, and gears shall be permanently lubricated and totally enclosed.
- I. Actuators shall be designed to hold the valve disc in any intermediate position without creeping or fluttering.
- J. Adjustable stops shall be provided to prevent overtravel in either position, field adjustable without having to remove the actuator from the valve, and able to withstand a minimum pull of 300 pounds at the full open and full closed positions without damage to the actuator or the valve.
- K. The valve manufacturer shall be responsible for mounting the actuator to the valve, at the valve manufacturer's facility.
- L. See Section 05100-2.2 for additional requirements.

2.4 VALVE APPURTENANCES AND OTHER REQUIREMENTS

- A. See Section 05100-2 for requirements on extension stems, valve wells, protective lining and coating, valve identification, storage and handling, concrete support blocks, and polyethylene sheet encasement.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with Section 05100.
- B. Exposed butterfly valves shall be installed to permit removal of valve assembly without dismantling the valve or operator.

END OF SECTION

SECTION 05120 - GATE VALVES

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes materials and installation of epoxy coated gate valves. Refer to Section 05100 for additional general requirements.

1.2 REFERENCE SPECIFICATIONS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section.

- | | | | |
|----|------|------|---|
| 1. | AWWA | C213 | Fusion Bonded Epoxy Coatings and Linings |
| 2. | AWWA | C509 | Resilient-Seated Gate Valves for Water Supply Service |
| 3. | AWWA | C515 | Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service |
| 4. | AWWA | C550 | Protective Interior Coatings for Valves and Hydrants |

1.3 SERVICE APPLICATION

- A. Resilient-seated or reduced-wall, resilient-seated (resilient-wedge) gate valves shall be used to isolate and depressure pipeline segments for repairs, modifications, inspections, and/or maintenance.
- B. The DISTRICT requires the use of gate valves for all distribution and transmission pipe sizes. The DISTRICT, at its sole discretion, may allow the use of butterfly valves in certain operating conditions and only for 16-inch and larger transmission mains.

1.4 SUBMITTALS

- A. Gate valves 12 inches and smaller shall be selected from the Approved Materials List and include the testing certifications listed in Section 05100.
- B. Gate valves 14 inches and larger require full submittals in compliance with Section 05100.

1.5 MANUFACTURER TESTING AND FIELD INSPECTION

- A. Gate valves shall be tested and inspected in compliance with AWWA C509 or AWWA C515, and Section 05100.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Gate valves shall be resilient-seated or reduced-wall, resilient-seated (resilient-wedge) type in accordance with the requirements of AWWA C509 or AWWA C515 in all

respects, except as may be specifically modified herein. Both workmanship and material shall be of the very best quality and shall be entirely suitable for the service conditions specified. Valves shall be of the size and class indicated.

- B. Valves 14-inch and larger installed in horizontal pipes with horizontal stems shall be fitted with bronze slides, tracks, rollers, and scrapers to assist the travel of the gate assembly.
- C. Quick opening valves shall have quick opening levers and cams in lieu of handwheel operators.
- D. See Section 05100-2.1 for additional general requirements.

2.2 RESILIENT SEATED AND REDUCED-WALL, RESILIENT SEATED (RESILIENT WEDGE) GATE VALVES (3 INCH AND LARGER)

A. MATERIALS

1. Valves shall be ductile-iron in conformance with AWWA C509 or AWWA C515 except as modified herein.
2. Valves shall have a non-rising stem (NRS), opening by turning counter clockwise and provided with a 2-inch square operating nut with arrow cast in metal to indicate direction of opening, ductile-iron bodies with flanged, bell, or mechanical joint ends, flanged bonnet, low-zinc bronze or stainless steel stem, O-ring seals.
3. All bolts and nuts shall be Type 316 stainless steel, and stem nuts shall be independent of the wedge.
4. Wedge (gate) shall be fully encapsulated with a bonded-in-place ethylene propylene diene monomer (EPDM) elastomeric covering. Minimum thickness of the rubber seating area shall be ¼”.
5. Each valve shall have a smooth unobstructed waterway free from any sediment pockets.
6. Stuffing boxes shall be O-ring seal type with two rings located in the stem with at least one seal located above the thrust collar. A low friction torque reduction thrust bearing shall be provided in the stuffing box.

2.3 GATE VALVES (SMALLER THAN 3 INCH)

- A. Gate valves, smaller than 3 inches, shall be heavy duty type for industrial service, with threaded or soldered ends.
- B. The bodies shall have threaded tops or union bonnets, fabricated of bronze conforming to ASTM B62, with bronze stems, solid edges, metal handwheels, and Teflon impregnated packing.
- C. Buried valves shall have non-rising stems.

- D. Exposed valves (above ground) shall have rising stems, where applicable.
- E. Valves shall have a minimum pressure rating of 125 psi, steam, or 200 psi coldwater except as otherwise indicated.

2.4 VALVE APPURTENANCES AND OTHER REQUIREMENTS

- A. See Section 05100-2 for requirements on extension stems, valve wells, protective lining and coating, valve identification, storage and handling, concrete support blocks, and polyethylene sheet encasement.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Gate valves shall be installed in accordance with Section 05100.

END OF SECTION

SECTION 05130 - AIR RELEASE AND VACUUM VALVES

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes providing above ground air release valve, air and vacuum valve, and combination air valve assemblies, and below ground manual air release valve assemblies, as indicated, complete and operable, including accessories and drain connections in accordance with the DISTRICT's Standard Drawings.
- B. The term "air valve" is used generically in this specification to refer to requirements common to all of the specified air release valves, air and vacuum valves, and combination air valves.

1.2 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300.
 - 1. Shop Drawings
 - a. Manufacturer's catalog data.
 - b. Manufacturer's installation instructions.
 - c. Manufacturer's certification that products comply with the indicated requirements.
 - 2. OWNER's Manual
 - a. Manufacturer's catalog data.
 - b. Manufacturer's installation and operations instructions.
 - c. Manufacturer's maintenance procedures.
 - d. List of special tools.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Air valve assemblies shall be furnished and installed by the CONTRACTOR at the locations shown on the Plans, or as required by the DISTRICT.
- B. Combination air valve assemblies shall be sized as shown below:

1. 2-inch combination air valve – pipeline sizes 12-inch and less.
2. 4-inch combination air valve – pipeline sizes 14-inch through 20-inch.
3. 6-inch combination air valve – pipeline sizes 24-inch through 36-inch.

2.2 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 piping.
- C. Bodies shall be of high-strength cast 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 a material insuring water tightness with a minimum of maintenance.
- F. Valves shall be designed for minimum 150 psi water-working pressure, unless otherwise indicated.

2.3 AIR-RELEASE VALVES

- A. Air-release valves shall vent accumulating air while system is in service and under pressure and be of the size indicated and shall meet the same general requirements as specified for air and vacuum valves except that the vacuum feature will not be required.
- B. Air-release valves shall have the same general requirements as specified for air and vacuum valves

2.4 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 a system is being filled or drained, respectively.
- B. Combination air valves shall have the same general requirements as specified for air and vacuum valves.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General

1. The tap for air valve assemblies shall be installed on a section of pipe no closer than 18 inches to a valve, bell, coupling, joint, or fitting.
2. Air valve assemblies shall be disinfected and hydrotested in conjunction with the connecting pipelines.

B. Air Release Valve, Air and Vacuum Valve, and Combination Air Valve Assemblies

1. All valves shall be installed in accordance with the manufacturer's printed recommendations.
2. Assemblies shall be installed in the piping system at peaks and sharp grade changes, and where indicated or required by the District.
3. Valves shall be field coated according to Specification Section 04000.
4. Valves shall be installed above ground with security cover.
5. Valves shall be installed with a sanitary vent screen to the exhaust port of the valve, unless otherwise directed by the DISTRICT.
6. Assemblies shall have an isolation valve to permit future maintenance. Isolation valves installed above ground will have the capability to be locked out. Isolation valves installed below ground will be required to have a debris cap with a locking device.

C. Manual Air Release Valve Assemblies

1. Assemblies shall be installed in the piping system at dead-end main and isolation valve high points, and where indicated or required by the District.

END OF SECTION

SECTION 05140 - MISCELLANEOUS VALVES

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing miscellaneous valves as indicated, complete and operable, including accessories and operators.

1.2 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300.

1. Shop Drawings

- a. Manufacturer's catalog data.
- b. Manufacturer's installation instructions.
- c. Manufacturer's certification that products comply with the indicated requirements.

2. OWNER's Manual

- a. Manufacturer's catalog data.
- b. Manufacturer's installation and operations instructions.
- c. Manufacturer's maintenance procedures.
- d. List of special tools.

PART 2 - PRODUCTS

2.1 BALL VALVES (6-inch and larger)

A. Construction

- 1. Except as otherwise indicated, ball valves in sizes 6-inches and larger shall comply with ANSI/AWWA C507, with cast iron, ductile iron, or cast steel bodies, support legs or pads, flanged ends, and shall be designed for velocities up to 35 fps, temperatures up to 125 degrees F, and design pressures of 250 psi.
- 2. The balls shall be fabricated of cast iron, ductile iron, or cast steel, and designed for shaft- or trunnion-mounting, with tight shut-off, single or double seat, and full bore.

3. The valves shall be rubber- or metal-seated, with stainless steel or monel shafts, and shall include at least one thrust bearing.
4. Ferrous surfaces of valves 6-inches and larger, where contact with water is indicated, shall be epoxy-coated conforming to Section 04100.

B. Operators

1. Except as otherwise indicated, ball valves shall have manual operators with handwheel, position indicator, and 2-inch square operating nut.

2.2 BALL VALVES (4-INCH AND SMALLER)

- A. Except as otherwise indicated, ball valves in sizes 4-inch and smaller shall have manual operators with lever.
- B. Ferrous surfaces of valves where contact with water is indicated shall be epoxy-coated conforming to Section 04100.
- C. Ball valves up to 1-1/2-inches in size shall have bronze or forged brass 2 or 3 piece bodies with ends threaded and shall be designed for a pressure rating of not less than 300 psi.
- D. Valves 2-inch to 4-inch in size shall have bronze forged brass or steel 2 or 3 piece bodies with flanged ends and shall be designed for pressure rating of 150 psi.
- E. The balls shall be fabricated of solid brass, chrome plated bronze, or Type 316 stainless steel, with full openings.
- F. The valve stems shall be of the blow-out proof design, and fabricated of bronze or Type 316 stainless. Seats shall be of Teflon or Buna-N.

2.3 PLASTIC BALL VALVES

- A. Plastic ball valves designed for use with corrosive fluids shall be fabricated of polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), or polyvinylidene flouride (PVDF), as recommended by the manufacturer for use in the service indicated.
- B. Valves shall have manual operators except as otherwise indicated.
- C. Plastic ball valves shall have union ends or flanged ends conforming to ANSI B16.5, Class 150, except as otherwise indicated.
- D. Ball valves shall have full size ports and Teflon seats.
- E. Body seals, union O-ring seals, and stem seals shall be Viton.
- F. Valves shall be suitable for a maximum working pressure of 150 psi at 73 degrees F for PVC.

2.4. SWING CHECK VALVES (3-INCH AND LARGER)

- A. Except as otherwise indicated, swing check valves designed for water, sewage, sludge, and general service shall be of the outside lever and spring or weight type, complying with AWWA C508, and full-opening; valves shall be designed for a water working pressure of 150 psi and shall have a flanged cover piece designed to provide access to the disc.
- B. Corrosive surfaces of valves, 4-inch and larger, intended to be in contact with water, shall be epoxy-coated complying with Section 04100.
- C. The valve body and cover shall be fabricated of cast iron conforming to ASTM A126, with flanged ends conforming to ANSI F16.1, or mechanical joint ends, as indicated.
- D. The valve disc shall be fabricated of cast iron, ductile iron, or bronze conforming to ASTM B62.
- E. The valve seat and rings shall be fabricated of bronze conforming to ASTM B62 or B148, or of Buna-N.
- F. The hinge pin shall be fabricated of bronze or stainless steel.
- G. A proximity switch shall be provided to indicate when the disc is closed.

2.5. SWING CHECK VALVES (2-1/2-INCH AND SMALLER)

- A. Swing check valve intended for steam, water, oil, or gas in sizes 2-1/2-inch and smaller shall be designed for a stem pressure of 150 psi and a cold water pressure of 300 psi. They shall have threaded ends and caps.
- B. The valve body and cap shall be fabricated of bronze conforming to ASTM B61 and with threaded ends complying with ANSI/ASME B1.20.1.
- C. Valves designed for steam service shall have bronze discs, and valves designed for cold water, oil, and gas service shall have replaceable composition discs.
- D. The hinge pins shall be fabricated with bronze or stainless steel.

2.6. INTERNAL SPRING-LOADED CHECK VALVES (GLOBE STYLE)

- A. Internal spring-loaded check valves designed for water pumps, compressors, gas, air, and steam shall be of the full-flow internal spring-loaded poppet type. The valves shall be designed for a water-working pressure of not less than 150 psi unless otherwise indicated.
- B. Corrosive ferrous surfaces of valves 4-inch and larger shall be epoxy-coated complying with Section 04100.

- C. Bodies of valves in sizes 3-inch and larger shall be fabricated of cast iron with 125-lb flanged ends conforming to ANSI B16.1 unless otherwise indicated.
- D. Valves shall include positive, watertight seal between the removable seat and valve body and the stem guide shall be integrally cast with the body or screwed into the body.
- E. Valves smaller than 3 inches shall have bronze bodies suitable for the intended use with threaded ends conforming to ANSI/ASME B1.20.1 suitable for a minimum working pressure of 200 psi, and temperature of 250 degrees F, unless otherwise indicated.
- F. The disc and stem of valves in sizes 3-inch and larger shall be fabricated of bronze or stainless steel. The stem shall have two-point bearings with the downstream bearing fabricated of bronze or other suitable bushings designed to provide smooth operation.
- G. Valves smaller than 3 inches shall have discs and retaining rings of Teflon, Nylon, or other suitable material, and stems of bronze, brass, or stainless steel suitable for the intended service.
- H. Valves for general service at temperatures up to 250 degrees F shall have bubble-tight-shut-off with resilient seats of Buna-N, Teflon, or other suitable material.
- I. Valves for steam service and temperatures over 250 degrees F shall have metal-to-metal seating service condition.
- J. Resilient seats shall be firmly attached to the seating ring by compression-molding or other acceptable method.
- K. Valves in sizes 3-inch and larger shall have stainless steel springs, and valves smaller than 3-inch shall have stainless steel or beryllium copper springs and be suitable for the service. The spring tension of the valves shall be designed for the individual pressure condition indicated for each valve.

2.7 DOUBLE-LEAF CHECK VALVES

- A. Double-leaf check valves intended for air and gas service and where indicated shall be of wafer-type designed to fit between ANSI B16.1 flanges rated at 125 lb.
- B. The check valve leaves shall be spring-loaded.
- C. Flow from one direction shall cause the valve to open, and upon valve shutoff, the spring shall shut the valve leaves before reverse flow starts and at a point of zero velocity, with non-slam closure.
- D. The spring-tension of each valve shall be designed for the individual operating conditions.

- E. The valve body shall be fabricated of cast iron with integrally-cast seat, rated for minimum 150 lb. working pressure at up to 250 degrees F.
- F. The leaves shall be bronze, aluminum bronze, or ductile iron, revolving on stainless steel or monel hinge pins with retainers.
- G. The valves shall have resilient seats designed for bubble-tight shut-off suitable for temperatures up to 250 degrees F without sticking. The seats shall be Buna-N, Viton, or other material suitable for the intended purpose. The seat rings shall be firmly attached to the body or disc by compression-molding or proper method.
- H. The spring shall be of Type 316 stainless steel, or Monel and recommended by the manufacturer for use in the service indicated.

2.8 SLANTING DISC CHECK VALVES

- A. Slanting disc check valves intended for water service shall have a seating angle of approximately 55 degrees.
- B. Valves shall have replaceable seat rings and disc rings.
- C. The water pressure passage cross-sectional area shall be equal to the full pipe area.
- D. Valves shall have sufficient clearance around the pivot pins to permit free seating of the disc without binding and shall not stick in the closed position.
- E. Slanting disc check valves shall have position indicators with electrical signal switches for indication of disc position and two flanged connections for attachment of dashpots or hydraulic snubbers.
- F. The valves shall be designed for a water working pressure of 150 psi, except as otherwise indicated.
- G. The valve body shall be fabricated of cast iron conforming to ASTM A48 or A126, Class B, with flanged ends conforming to ANSI B16.1, Class 125 unless otherwise indicated.
- H. The valve disc shall be designed with an "aerofoil" configuration of cast iron or ductile iron, with bronze seating face, except that valves 10 inches or smaller shall have solid bronze or aluminum bronze discs.
- I. Discs shall be partially balanced with a short travel, designed to resist slamming.
- J. The seat ring shall be fabricated of centrifugally cast bronze, aluminum bronze, or stainless steel, with beveled edges, and be firmly clamped or screwed into the valve body.

- K. The pivot pins and bushings shall be fabricated of stainless steel, bronze, or aluminum bronze, designed to allow free movement of the disc without binding.
- L. A top mounted hydraulic dashpot shall be provided to control the opening and closing cycle of the valve to prevent surge and water hammer. The dashpot shall have two control flow rates: (1) 90 percent rapid rate and (2) 10 percent slow rate during shutdown and startup. Each rate shall be independently adjustable.
- M. The dashpot shall be a self contained oil system separate and independent from the water line media.
- N. The oil reservoir for the closing cycle shall be stainless steel and open to the atmosphere with an air breather cap to prevent oil spillage.
- O. The oil reservoir for the opening cycle shall be stainless and hermetically sealed to contain pressure (air over oil) and be equipped with a 3-inch diameter pressure gauge and pneumatic fill valve.

2.9 PLASTIC BALL CHECK VALVE

- A. Plastic ball check valves designed for corrosive fluids, in sizes up to 4-inch, shall be used for vertical upflow conditions only, unless the valves include spring actions.
- B. The valve bodies and balls shall be fabricated with polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), polyvinylidene fluoride (PVDF), or polypropylene (PP) and recommended by the manufacturer for the service indicated.
- C. Valves shall include unions with socket connections, or flanged ends conforming to ANSI B16.5, Class 150.
- D. Seals shall have Viton O-rings and valve design shall minimize possibility of the balls sticking or chattering.
- E. Valves shall be suitable for a maximum working non-shock pressure of 150 psi at 73 degrees F.

2.10 PLASTIC SWING CHECK VALVES

- A. Plastic swing check valves intended for corrosive fluids, in sizes up to 8 inches, may be used for either horizontal or vertical upflow conditions.
- B. Valve bodies and discs shall be fabricated with PVC, PP, or PVDF and recommended by the manufacturer for use in the service indicated.
- C. Valves shall have flanged ends conforming to ANSI B16.5, Class 150, and flanged top access covers, and shall be designed for positive shut-off at no-flow conditions.

- D. Seats and seals shall be EPDM, Teflon, or Viton.
- E. PVC valves shall be rated for maximum non-shock working pressure of 150 psi at 73 degrees F for sizes 3-inch and smaller.
- F. For larger sizes and other materials and temperatures the pressure rating will be recommended by the manufacturer for use in the service indicated.

2.11 SILENT CHECK VALVES

- A. The Check Valve shall be of the silent operating type that begins to close as the forward flow diminishes and is fully closed at zero velocity preventing flow reversal and resultant water hammer or shock.
- B. Wafer style valves shall be provided in sizes 2-inch (50 mm) through 10-inch (250 mm) for installation between ANSI B16.1 Class 125 or Class 250 iron flanges or ANSI B16.5 Class 300 steel flanges.
- C. The valve design shall incorporate a center guided, spring loaded disc, guided at opposite ends and having a short linear stroke that generates a flow area equal to the pipe size.
- D. The operation of the valve shall not be affected by the position of installation. The valve shall be capable of operating in the horizontal or vertical positions with the flow up or down. Heavy duty springs for vertical flow down installations shall be provided when specified on 14-inch and larger valves.
- E. All component parts shall be field replaceable without the need of special tools. A replaceable guide bushing shall be provided and held in position by the spring. The spring shall be designed to withstand 100,000 cycles without failure and provide a cracking pressure of 0.5 psi and to fully open at a flow velocity of 4 ft/sec. (1.22 M/sec).
- F. The valve disc shall be concave to the flow direction providing for disc stabilization, maximum strength, and a minimum flow velocity to open the valve.
- G. The valve disc and seat shall have a sealing surface finish of 32 micro-inch or better to ensure positive seating at all pressures. The leakage rate shall not exceed one-half of the allowable rate for metal seated valves allowed by AWWA Standard C508 or 0.5 oz (15 ml) per hour per inch (mm) of valve diameter.
- H. The valve flow way shall be contoured and unrestricted to provide full flow areas at all locations within the valve. Cv flow coefficients shall be equal to or greater than specified below and verified by an independent testing laboratory.

<u>VALVE SIZE</u>		<u>Wafer Style Cv</u>	<u>Globe Style Cv</u>
2-inch	(50 mm)	66	N/A
2.5-inch	(65 mm)	88	110
3-inch	(80 mm)	130	155
4-inch	(100 mm)	228	278
5-inch	(125 mm)	N/A	435
6-inch	(150 mm)	520	525
8-inch	(200 mm)	900	1115
10-inch	(250 mm)	1450	1770
12-inch	(300 mm)	N/A	2500

- I. The valve body shall be constructed of ASTM A128 Class B cast iron for Class 250 valves. Class 150 and Class 300 steel valves shall constructed of ASTM A218 Grade WCB cast steel. Optional body material include ASTM A536 Grade 65-45-12 ductile iron.
- J. The seat and disc shall be ASTM B584 Allow C83600 cast bronze or ASTM B148 Alloy C95200 aluminum bronze. Optional trim material include ASTM A351 Grade CF8M stainless steel, as specified by the ENGINEER.
- K. The compression spring shall be ASTM A313 Type 302 stainless steel with ground ends.
- L. A Buna-N seal shall be provided on the seat when specified to provide zero leakage at both high and low pressures without overloading or damaging the seal. The seal design shall provide both a metal to metal and a metal to Buna-N seal.
- M. The valves shall be hydrostatically tested at 1.5 times their rated cold working pressure. Additional tests shall be conducted per AWWA, ANSI, MSS or API standards when specified. When requested, the manufacturer shall provide test certificates, dimensional drawings, parts list drawings, and operation and maintenance manuals.

PART 3 - EXECUTION

3.1 GENERAL

- A. Valves shall be installed in accordance with Section 05100.

END OF SECTION

SECTION 05200 - BACKFLOW PREVENTERS

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes providing materials, installation, and testing of backflow prevention assemblies.

1.2 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300.
 - 1. Shop Drawings
 - a. Manufacturer's catalog data.
 - b. Manufacturer's installation instructions.
 - c. Manufacturer's certification that products comply with the indicated requirements. The selected backflow prevention assembly shall be selected from the approved California Department of Health Services list on file with the DISTRICT.

PART 2 - PRODUCTS

2.1 GENERAL

- A. General
 - 1. Backflow preventers shall work on the reduced pressure principle.
 - 2. Backflow preventers shall consist of 2 spring-loaded check valves, automatic differential pressure relief valve, drain valves, shut-off valves as well as test ports at each pressure chamber.
 - 3. Body material shall be bronze or cast iron for a working pressure of not less than 150 psi, with bronze or stainless steel trim.
 - 4. Drain lines with air gaps shall be provided.
- B. The water service installed on all commercial, industrial, fire, construction and irrigation services shall be locked or kept closed until an approved backflow device is installed in compliance with Standard Drawings.
- C. Each backflow preventer must be inspected and certified by the DISTRICT prior to the water meter being placed into service.

- D. The DISTRICT shall be the final authority as to location, installation, and type of backflow prevention device required.
- E. Approved and certified backflow preventers shall be required when temporary connections are made to the potable water system for flushing and disinfection or where directed by the DISTRICT.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall comply with the latest edition of the Uniform Plumbing Code, applicable DISTRICT requirements.
- B. Plumbing from the meter to the downstream side of the backflow device will be installed per DISTRICT specifications.
- C. Backflow preventers shall be installed in potable water lines where required by applicable codes or regulations, or wherever there is any danger or contamination, and where indicated.
- D. The nominal size of the backflow device shall be equal to or greater than the size of the purchased meter.
- E. A Reduced Pressure Backflow Device (RP) shall be required on all fire service installations. These devices shall be Reduced Pressure Detector Assembly (RPDA) type, installed with a ½-inch bypass meter and ½-inch RP. The ½-inch bypass meter shall be supplied by the manufacturer of the larger RPDA device.
- F. When two (2) or more BFD's or RPDA's are installed to supply the same private water system, certification of the devices, through testing, will be required to determine the primary device that opens first and the secondary device that opens after the primary device and so forth.

1.2 TESTING

- A. Upon completion of the installation and inspection by the DISTRICT, an initial test shall be performed by the DISTRICT Personnel to certify the adequacy and operational compliance with DISTRICT Standards.
- B. The main line and by-pass Reduced Pressure Backflow Device will require initial and annual certification.
- C. The by-pass meter on RPDA's will be tested and repaired or replaced every 5 years or sooner, if not in compliance with AWWA Standards for meters.
- D. Annual certifications will be the responsibility of the Customer.

END OF SECTION

SECTION 05300 - FIRE HYDRANTS

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes providing installation of fire hydrants, complete and operable as indicated.

1.2 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300.
 - 1. Shop Drawings
 - a. Manufacturer's catalog data.
 - b. Manufacturer's installation instructions.
 - c. Manufacturer's certification that products comply with the indicated requirements.
 - 2. OWNER's Manual
 - a. Manufacturer's catalog data.
 - b. Manufacturer's installation and operations instructions.
 - c. Manufacturer's maintenance procedures.
 - d. List of special tools.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Fire hydrant assemblies shall be furnished and installed at the locations shown on the Plans in accordance with the DISTRICT's Standard Drawings and to the modifications and supplements herein.
- B. All hydrants shall conform with AWWA C503.
- C. Fire hydrants where required by the local fire department, or indicated, shall be of the wet-barrel type, in accordance with AWWA C503.
- D. Hydrant components made from brass or bronze shall be of a grade containing not more than 16 percent zinc and not more than 2 percent aluminum as specified in Section 2.3.4 of the AWWA Specification C503 for waters with specific conductance exceeding 350 Mho per cm.

- E. Wet-barrel fire hydrants shall have the buried section of ductile iron or steel and a break-away flange connected to the hydrant head.
- F. Hydrant bodies and caps shall be solid bronze.
- G. Each hydrant shall be isolated by an individual, buried gate valve.

2.2 CONNECTION

- A. The hydrant head shall have a minimum of one (1) 4-inch steamer connection and two (2) 1/2-inch hose connection, except where otherwise required by the local fire department.
- B. The hose and steamer connections shall be provided with solid bronze caps and metal chains.

2.3 OUTLETS

- A. Residential hydrants shall have one (1) 2-1/2-inch outlet and one (1) 4 inch outlet.
- B. Industrial or commercial hydrants shall have two (2) 2-1/2-inch outlets and one (1) 4 inch outlet
- C. All outlets shall have National Standard Fire-Hose Threads.
- D. Threads for pumper and hose nozzles shall conform to the American National Standard adopted by the American Insurance Association (formerly the National Board of Fire Underwriters) and the National Fire Protection Association published in pamphlet No. 194, Fire Hose Couplings, by N.F.P.A. in 1968.
- E. Outer end of all hose coupling threads shall be terminated by the blunt start or "Higbee Cut" on full thread (to avoid cross threading).
- F. Brass hose caps with brass chains shall be provided for all outlets.

2.4 VALVE SEAT AND STEMS

- A. Valve seats and stem guides may be threaded into or cast into the hydrant body or may be secured to the body by means of a lock nut.
- B. Valve stems shall have a pentagon end and shall have a short radius of 33/64 inch to center of flat sides.
- C. All hydrants shall be drilled with a six (6) hole flange pattern.
- D. Hydrant body base flange shall be drilled in 9-1/2-inch bolt circle with six bolt holes, 7/8 inch in diameter, oriented to the center of the pumper connection.

- E. All bolts, nuts, and washers shall be provided with cast iron caps and metal required for structural reasons.
- F. The hydrants shall be tested to 300 psig and they shall be suitable for working pressure of 150 psig.

2.5 COATINGS

- A. All interior and exterior surfaces shall be coated in accordance with AWWA C550 and Section 04000 and painted ANSI safety yellow in accordance with local codes.
- B. Exterior surfaces shall be painted with a zinc chromate primer, Color No. 13528, of Federal Specifications TT-C-595.
- C. All hydrants shall be field painted with two (2) coats of fire hydrant yellow alkyd enamel paint.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All fire hydrants shall be installed in strict accordance with the manufacturer's published recommendations, AWWA standards, and all applicable codes, and the applicable provisions. All installations shall be to the satisfaction of the local fire and building department.
- B. All hydrant isolating valves with slip joints, friction type, or caulked joint connections shall be harnessed to the main pipe by means of welded steel harness sets, or clamps and steel rods, designed for this purpose.
- C. All hydrants with other than flanged inlets shall be installed with a concrete thrust block, calculated for the maximum expected water pressure.
- D. All hydrant locations shall be marked with a "blue dot" road marker.

END OF SECTION

SECTION 06000 - CATHODIC PROTECTION SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes providing a description of materials, installation and testing of cathodic protection equipment including magnesium and zinc anodes, anode backfill, bond and test wires, test stations, reference electrodes, alumino-thermic welds, insulating flange kits, and marker posts used in the construction of pipelines and appurtenances.

1.2 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300.
1. Shop Drawings
 - a. CONTRACTOR shall submit shop drawings before ordering or supplying corrosion protection materials
 2. Manufacturer's catalog data and descriptive literature.
 - a. Show dimensions and materials of construction by specification reference and grade.

PART 2 - PRODUCTS

2.1 PREPACKAGED MAGNESIUM ANODES

- A. Magnesium Anodes: Anodes shall be a prepackaged magnesium alloy ingot of the following chemical composition:
- | | |
|--------------|--------------------------------|
| 1. Aluminum | 0.010% |
| 2. Manganese | 0.50% to 1.30% |
| 3. Copper | 0.02% Max. |
| 4. Nickel | 0.001% Max. |
| 5. Iron | 0.03% Max. |
| 6. Other | 0.05% Each or 0.30% Max. total |
| 7. Magnesium | Remainder |
- B. Anode Weight: Ingot weight of the prepackaged magnesium anode shall be 48 pounds.
- C. Anode Backfill: Each magnesium anode shall be prepackaged in a permeable cloth bag with a backfill of the following composition:
- | | |
|-----------------------------|-----|
| 1. Gypsum | 75% |
| 2. Powdered Bentonite | 20% |
| 3. Anhydrous Sodium Sulfate | 5% |

Backfill grains shall be capable of 100% passing through a 100 mesh screen. The backfill shall be firmly packed around the anode by mechanical vibration to a density which will maintain the magnesium ingot in the center of the cloth bag and surrounded by at least one inch of backfill. The packaged weight of the 48-pound (ingot weight) magnesium anode and backfill shall be approximately 96 pounds.

- D. Steel Core: Anode shall be cast with a perforated galvanized steel core and recessed at one end for lead wire connection.
- E. Anode Lead Wire: Anode lead wire shall be AWG No. 10 stranded copper wire with THWN insulation conforming to U.L. Standard 83. Wire shall be connected to the core with silver solder. The connection will then be insulated by filling the remainder of the recess with electrical potting compound. Anode lead wire shall be of sufficient length to extend from the anode to the designated termination point without a splice. Wires with cut or damaged insulation will not be accepted and replacement of the entire lead will be required at the CONTRACTOR's expense.

2.2 ZINC ANODES

- A. Zinc Anodes: Anodes shall conform to ASTM B 418, Type II and shall be a prepackaged zinc alloy ingot of the following chemical composition:

1. Aluminum	0.005% Max.
2. Cadmium	0.003% Max.
3. Iron	0.0014% Max.
4. Zinc	Remainder

- B. Anode Weight: Ingot weight of the prepackaged zinc anode shall be 30 pounds.
- C. Anode Size: Dimensions of the anode ingot shall be 2 inches square by 30 inches long.
- D. Anode Backfill: Each zinc anode shall be prepackaged in a permeable cloth bag with a backfill of the following composition:

1. Gypsum	75%
2. Powdered Bentonite	20%
3. Anhydrous Sodium Sulfate	5%

Backfill grains shall be capable of 100% passing through a 100 mesh screen. The backfill shall be firmly packed around the anode by mechanical vibration to a density which will maintain the zinc ingot in the center of the cloth bag and surrounded by at least one inch of backfill. The packaged weight of the 30-pound (ingot weight) zinc anode and backfill shall be approximately 70 pounds.

- E.. Steel Core: Anode shall be cast full length with an electro-galvanized 1/4-inch diameter steel core which shall be exposed at one end for connection of the anode lead wire.

- F. Anode Lead Wire: Anode lead wire shall be AWG No. 12 stranded copper wire with THWN insulation conforming to U.L. Standard 83. Wire shall be attached to the steel core with a copper crimp type mechanical connection and silver solder. The connection shall be encapsulated in multiple layers of electrical insulation putty, vinyl electrical tape and coated with an electrical sealing compound. Anode lead wire shall be of sufficient length to extend from the anode to the designated termination point without a splice. Wires with cut or damaged insulation will not be accepted and replacement of the entire lead will be required at the CONTRACTOR's expense.

2.3 REFERENCE ELECTRODES

- A. Reference electrode shall be permanent copper-copper sulfate prepackaged electrodes, sized 2" x 8" long, Schedule 80 PVC packaged in special backfill. Lead wire for reference electrode shall be AWG No. 14 stranded copper wire with THWN insulation.

2.4 PIPE LEADS

- A. Pipe leads shall be AWG No. 8 stranded copper wire with high molecular weight polyethylene (HMW/PE) insulation specifically designed for cathodic protection service and suitable for direct burial in corrosive soil or water. Polyethylene insulation shall conform to ASTM D 1248, Type 3, Class C, Grade 5. Each pipe lead shall be of sufficient length to extend from the attachment to the pipe to the test box or anode test box without a splice. Wires with cut or damaged insulation will not be accepted and replacement of the entire lead will be required at the CONTRACTOR's expense.

2.5 BOND WIRES

- A. Bond wires shall be AWG No. 4 stranded copper wire with high molecular weight polyethylene (HMW/PE) insulation specifically designed for cathodic protection service and suitable for direct burial in corrosive soil or water. Polyethylene insulation shall conform to ASTM D 1248, Type 3, Class C, Grade 5. Each bond wire shall not exceed 18 inches in length.

2.6 ANODE TEST BOXES

- A. Post Mounted Anode Test Boxes:
 1. Enclosure: The enclosure for a post mounted shunt box shall be approximately 10" x 8" x 6" and suitable for mounting on a post. Enclosure shall be constructed of 16-gauge cold rolled steel, free of loose scale, finished with one coat of epoxy red oxide primer, and two coats of baked-on enamel. Prior to painting, thoroughly clean and treat the enclosure with phosphate to form a corrosion-resistant conversion film at the surface and to improve paint bonding. The bottom of the enclosure shall have a knockout for a two-inch conduit for anode and pipe lead wires. The enclosure shall have a hinged, raintight cover.
 2. Components: The post mounted anode test box shall contain solderless, compression-type terminal connectors for AWG No. 10 stranded wire and panel mounted 0.01 ohm shunts. A total of five shunts can be

installed per box each rated at six amperes minimum and accurate to plus or minus 1%. One shunt is required for each anode lead wire. A bus bar with a terminal common to shunts is required for the AWG No. 8 pipe lead. Isolated terminals are required for the other test pipe lead and reference electrode lead. See Standard Drawings for wiring configuration.

3. Panel: The mounting panel shall be micarta or laminated phenolic sheet cross-laminated for resistance to warpage and weathering. Minimum panel thickness shall be 3/16-inch. Panel shall be mounted to the back of the enclosure without shorting the terminal connections.
- B. At-Grade Anode Test Boxes: The at-grade test box shall be a precast concrete traffic box measuring 12" x 13-3/4" with a cast iron lid. Cast on the lid the words "CP TEST." Precast box and cover shall be Brooks No. 4-TT, or DISTRICT approved equal. The at-grade anode test box shall contain an appropriately sized split bolt connector and shunt. See Standard Drawings for wiring configuration.

2.7 INSULATOR TEST BOXES

- A. Post Mounted Insulator Test Boxes:
1. Enclosure: The enclosure of the post mounted insulator test box shall be the same as specified for the post mounted anode test box.
 2. Components: The post mounted insulator test box shall contain separate solderless, compression-type terminal connectors for four AWG No. 8 stranded wire. See Standard Drawings for wiring configuration.
 3. Panel: The mounting panel for the post mounted insulator test box shall be the same as specified for the post mounted anode test box.
- B. At-Grade Insulator Test Box: The at-grade insulator test box shall be a 8-3/4 inch diameter precast concrete box with a cast iron lid designed for traffic loading. Cast on the lid the word "CP TEST." Precast box and cover shall be Brooks No. 1-RT, or DISTRICT approved equal.

2.8 CASING TEST BOXES

- A. Post Mounted Casing Test Boxes: The enclosure, components and mounting panel for the post mounted casing test boxes shall conform to the enclosure, components and mounting panels specified for the post mounted insulator test boxes.
- B. At-Grade Test Boxes: The at-grade casing test box shall conform to the at-grade insulator test box.

2.9 TWO WIRE TEST BOXES

- A. Post Mounted Two Wire Test Box: The enclosure for the post mounted two wire test box shall be a 6" x 6" x 4" box constructed of 16 gauge steel with a

hinged cover and a quick release hasp. The bottom of the enclosure shall have a knockout for a 1 inch conduit.

- B. At-Grade Two Wire Test Box: The at-grade two wire test box shall be a 8-3/4 inch diameter precast, concrete box with a cast iron lid designed for traffic loading. Cast on the lid the words "CP TEST." Precast box and cover shall be Brooks No. 1-RT, or DISTRICT approved equal.

2.10 ALUMINO-THERMIC WELD KITS

- A. Wire-to-pipe connections shall be made by the alumino-thermic welding process. Weld charges and mold size shall be as specified by the manufacturer for various pipe sizes and surface configurations. Weld charges for use on cast iron and ductile iron are different from those used on steel. Care should be taken during installation to be sure correct charges are used. Welding charges and molds shall be the product of a manufacturer regularly engaged in the production of such materials. Weld charges for steel pipelines have green caps. Weld charges for cast or ductile iron have orange caps.

2.11 WELD COATINGS

- A. Coating for all alumino-thermic welds shall be a cold applied, fast drying mastic consisting of 80 percent solids by volume and formulated from refined tar resins, synthetic resins and solvent coatings. The mastic shall be Protecto Wrap 160/160H mastic, or DISTRICT approved equal.

2.12 INSULATING FLANGE KITS

- A. Insulating flange kits shall contain fullface gaskets, full-length sleeves and double washers (steel and phenolic) on each end. Insulation gaskets shall be dielectric neoprene-faced phenolic. Insulation sleeves shall be phenolic and full length. Insulating washers shall be phenolic. Steel washers shall be the same material as the bolts and nuts and shall be either plain carbon steel or cadmium plated. All insulating material shall be of the type designated by the manufacturer as suitable for the operating temperature and pressure of the service.

2.13 BURIED INSULATING FLANGE COATING

- A. General: Buried insulating flange coating shall be a three part, cold-applied wax tape coating system as described by NACE RP0375.
- B. Primer: Primer shall be a blend of petrolatums, plasticizers and corrosion inhibitors having a paste-like consistency. The primer shall have the following properties:

1. Color	Brown
2. Pour Point	100-110E F
3. Flash Point	350
4. Coverage	One Gallon per each 100 feet

Primer shall be Trenton Wax-Tape Primer or DISTRICT approved equal.

- C. Wax-Tape: Wax tape shall consist of a synthetic-fiber felt, saturated with a blend of micro-crystalline wax, petrolatums, plasticizers, and corrosion inhibitors, forming a tape coating that is easily formable over irregular surfaces. The tape shall have the following properties:

1. Color	Brown
2. Saturant Pour Point	115-120E F
3. Thickness	50-70 mils
4. Tape Width	6 inches
5. Dielectric Strength	100 volts/mil

Wax-Tape shall be Trenton #1 Wax-Tape or DISTRICT approved equal.

- D. Plastic Wrapper: Wrapper shall be a polyvinylidene chloride plastic with three 50 gauge plies wound together as a single sheet. The wrapper shall have the following properties:

1. Color	Clear
2. Thickness	1.5 mils
3. Tape Width	6 inches
4. Water Absorption	Negligible

Plastic wrapper shall be Trenton Poly-Ply or DISTRICT approved equal.

2.14 ABOVE GROUND INSULATING FLANGE COATING

- A. The tape coating for all above grade and in-vault insulated pipe flanges shall be a minimum 14 mil thick general utility pipeline tape such as Polyken No. 900-12.

2.15 INTERNAL INSULATING FLANGE COATING

- A. Coating for the interior lining of the pipeline at the insulating flange shall be a two-part, smooth white, thixotropic liquid epoxy consisting of 100 percent solids. Coating shall be Aquatapoxy Coating System A-5 as manufactured by Raven Linings Corporation, or DISTRICT approved equal.

2.16 CONDUITS

- A. Conduit for the post mounted anode test box and the post mounted insulator test box shall be a 2-inch diameter galvanized steel conduit approximately 4 feet long. Conduit for the post mounted two wire test box shall be a 1-inch diameter galvanized steel conduit approximately 4 feet long.

2.17 BRASS IDENTIFICATION TAGS

- A. Brass identification tags shall be 18 gauge brass and 1 inch in diameter. There shall be a small hole in the tag for attachment to the wires in the various test boxes.

2.18 PLASTIC WARNING TAPES

- A. Plastic warning tape to be run above each buried wire shall be 3 inches wide and shall have a printed warning, "CAUTION: CATHODIC PROTECTION CABLE BURIED BELOW."

2.19 SHUNTS

- A. Shunts used in the anode test boxes shall be 0.01 ohms resistance and rated at 6 amperes minimum capacity and accurate to plus or minus 1%.

2.20 MORTAR

- A. Mortar used to repair concrete coated pipe after attachment of the various bond or test wires shall be fast drying, non-shrinkable type.

2.21 REDWOOD POSTS

- A. Provide a post for each post-mounted test box. Use construction heart garden grade redwood per Standard Specifications for Grades of California Redwood Lumber issued by the Redwood Inspection Service. Provide seasoned redwood, 4" x 4", and surfaced on four sides.

2.22 PIPE CLAMPS

- B. Pipe clamp used to attach the zinc anode lead wire to the above ground riser portion of the copper water tubing shall be brass or copper and of a size to fit the tubing. The pipe clamp shall have a screw terminal suitable for AWG No. 12 stranded copper wire.

2.23 INSULATING BLANKET

- A. The insulating blanket shall be 1/8" thick neoprene or butyl rubber. The blanket shall be cut square and shall be 24 inches larger than the largest diameter pipeline to be isolated.

2.24 CASING INSULATORS

- A. The casing insulators to be used to isolate metallic carrier pipelines from steel casings shall be manufactured from plastic or phenolic and shall fully encircle the carrier pipe. The casing insulator shall be manufactured by PSI (Pipeline Seal & Insulator, Inc.) or DISTRICT approved equal.

2.25 CASING END SEAL

- A. The casing end seal shall be a heat shrinkable sleeve with a specially formulated sealant. There shall also be a non-conductive support member to help make the transition between the casing and the carrier pipe. End seals that utilize bands as fasteners are not acceptable. The casing end seal shall be CASEAL as manufactured by Raychem or DISTRICT approved equal.

SECTION 3 - EXECUTION

3.1 GENERAL

- A. Cathodic protection installation shall conform to NACE Publication RP0169 (Current Edition)--Recommended Practice, Control of External Corrosion on Underground and Submerged Metallic Piping Systems, including but not limited to Section 8.4 Galvanic Anodes; 8.4.2 Installing Anodes; 8.6 Corrosion Control Test Station, Connections and Bonds.

3.2 INSTALLING MAGNESIUM ANODES

- A. Each magnesium anode shall be installed horizontally or vertically in a hole a minimum of 3 inches larger than the prepackaged anode diameter. Anodes shall be installed at locations as shown on the Drawings. Care shall be taken to ensure that the cloth bag is not damaged and no backfill lost during installation. Each magnesium anode shall be centered in the cloth bag. It may be necessary to re-center the anode in the cloth bag by rolling it on the ground prior to installation. Each magnesium anode shall be placed vertically or horizontally in the bottom of the hole at a minimum depth of 10 feet as measured from the finish surface to the bottom of the anode. If the 10-foot depth cannot be obtained, the DISTRICT's Representative shall be notified for possible adjustment to the designed depth and position of anodes. There shall be a minimum of 10 feet of separation from the steel pipeline to the anodes and 15 feet of separation between adjacent anodes. Anode beds shall be located on the side of the pipe line as shown on the Drawings. At no time shall an anode be installed outside of the pipeline right-of-way. Each prepackaged anode shall be lowered into the hole using a sling or rope. Do not lower, transport, handle or lift the anode by the lead wire.

1. Backfilling: Once the prepackaged anode is in the hole, water shall be poured into the hole so that the anode is completely covered with water. Stone-free native soil shall then be used to backfill the anode hole. Do not use imported sand for backfilling. The anode hole shall be backfilled in stages and carefully tamped to ensure that no voids exist around the bag and that the bag and anode wire are not damaged. After backfill is level with the top of the anode, a minimum of 15 gallons of water shall be poured into the hole to completely saturate the soil backfill. More water shall be added if it is suspected that the backfill is not completely saturated. Care must be taken to avoid damage to the anode and anode lead wires.
2. Anode Lead Wire: Anode lead wires shall be long enough to reach from the anode to the anode test box without a splice. Anode wires shall be trenched a minimum of 36 inches deep and terminate individually in the appropriate anode test box.

3.3 INSTALLING ZINC ANODES

- A. Each prepackaged zinc anode shall be installed horizontally in a hole a minimum of 3 inches larger than the prepackaged anode diameter. The anode shall be installed under any new copper water tubing, this includes

service lines, blow-offs, air releases and sample points. The anode shall be positioned midway between the beginning of the copper water tubing and its termination point. There shall be a minimum separation of 2 feet between the copper water tubing and the zinc anode. Do not lower, transport, handle or lift the anode by the lead wire.

1. Backfilling: Backfilling shall be the same as specified for the magnesium anodes.
2. Anode Lead Wire: Anode lead wire shall run in the pipe trench to the end of the pipe run. At meter services, anode lead wire shall be coiled in the meter box and clamped to the pipe. At air releases and sample points, the anode lead wire shall run through the concrete pad in a 1/2-inch diameter PVC conduit and be clamped to the riser. At blow-offs and manual air releases, anode lead wire shall be coiled in the valve box and clamped to the riser. After attachment of the wire to the riser, the entire clamp and exposed wire shall be coated with a three part, cold applied wax tape system per Section 04300.

3.4 INSTALLING REFERENCE ELECTRODES

- A. The reference electrode shall be placed 6 inches below the pipe adjacent to each test box along the pipeline. The reference electrodes shall be saturated with water prior to backfilling.

3.5 INSTALLING PIPE LEAD WIRES

- A. Two AWG No. 8 wires with HMW/PE insulation shall be attached to the pipe and terminate in a test box without a splice as shown on the Standard Drawings. A minimum of 18 inches of slack wire from each lead shall remain in each test box.

1. Wire Connection: Connections of copper wire to the pipeline shall be made with the alumino-thermic welding charges or braze welding. Welding charges shall be the product of a manufacturer regularly engaged in the manufacture of the material. Manufacturer's recommended cartridge size and type shall be used. Only one wire may be connected with each weld. Each completed weld shall be coated with a bituminous compound. On mortar coated pipe, the bituminous compound shall be dry prior to repairing the mortar coating.
 - a. Preparation of Wire: Use a cutter to prevent deforming wire ends. Remove only enough insulation from the wire to allow the weld connection to be made. Do not use a hacksaw for cutting.
 - b. Preparation of Metal: Remove all coating, dirt, grime and grease from the metal pipe at weld location by wire brushing and/or use of suitable safe solvents. Clean the pipe to a bright, shiny surface free of all serious pits and flaws by use of mechanical grinder or a file. The area of the pipe where the attachment is to be made must be absolutely dry. Failure to provide a dry surface for welding will

result in a poor quality weld and could result in serious injury to the workman. Do not cut reinforcing rods when preparing metal surface for wire attachment.

- c. Attachment of Wire to Pipe: The attachment of copper wire shall be made using an alumino-thermic weld as shown on the Standard Drawings. The wire is to be held at a 30 degree to 45 degree angle to the surface when welding. One wire only is to be attached with each weld. Wires shall be attached a minimum of 6 inches apart.
 - d. Testing of All Completed Welds: As soon as the weld has cooled., the weldment shall be tested for strength by striking a sharp blow with a two-pound hammer while pulling firmly on the wire. All unsound welds are to be rewelded and retested. All weld slag shall be removed from the weldment with a wire brush.
 - e. Coating of All Completed Welds: Thoroughly clean by wire brushing the area to be coated. The area must be completely dry. Apply bituminous mastic coating material in accordance with the manufacturer's recommendations. Completely coat the weld, all bare pipe surfaces around the weld and any exposed copper wire. Allow sufficient time to dry prior to repair of the mortar coating on steel pipe.
2. Wire Trench Backfilling: All buried wiring shall be installed at a minimum depth of 36 inches. The bottom of the finished trench shall be sand or stone-free earth. The first three inches of backfill material shall be placed directly on the cable. The remainder of the trench shall be backfilled with stone-free earth and tamped to a compaction of 90% conforming to ASTM D 1557. Care shall be taken when installing wire and backfilling trench so that insulation is not broken, cut, nicked, or bruised. If wire insulation is damaged during installation, it shall be replaced completely at the CONTRACTOR's expense. Plastic warning tape shall be installed approximately 12 inches above the wire.

3.6 INSTALLING BOND WIRES

- A. Two bond wires shall be welded across each unwelded joint including valves, special fittings and flanges except insulating flanges, as shown on the Standard Drawings. Three bond wires are required for pipe diameters 18 inches and above. The same method of attachment and subsequent coating shall be used for bond wires as is used for pipe lead wires. Bond wires shall not be attached to valve bodies, but instead on the flange of the valve.

3.7 INSTALLING ANODE TEST BOXES

- A. Post Mounted Anode Test Box: Locate redwood post above the pipeline, if possible, but not in a roadway. The post and test box shall not be positioned over the buried anodes. Cut post to a 5 foot length. Paint post per Standard Specification Section 04000, System No. 60. Excavate a 2 foot deep hole, set post plumb and backfill with excavated material. Pour a concrete pad 6 inches thick by 2 feet square and center around the post. Concrete shall be Class 450-C-2000 per Section 03000. Connect 2 inch galvanized conduit to the

anode test box with a threaded screw connection. Attach test box to the redwood post using the mounting brackets and threaded fasteners. Attach the conduit to the post with two conduit clamps and threaded fasteners.

- B. At-Grade anode Test Box: The at-grade anode test box shall be installed over the pipeline or immediately adjacent to paved roadways behind the curb and out of traffic lanes if the pipeline is in the roadway. Pour a concrete pad 8 inches thick by 2 feet square around the test box. All wire shall be properly identified, with approximately 18 inches of slack wire above finish grade and coiled inside the test box. Keep the inside of the test box clear of all debris and other foreign material so that contact may be made with the native soil in the bottom of the box. Top of box shall be flush with finish grade.

3.8 INSTALLING INSULATOR TEST BOXES

- A. Post Mounted Insulator Test Box: Post mounted insulator test box shall be installed the same as specified for the Post Mounted Anode Test Box.
- B. At-Grade Insulator Test Box: At-grade insulator test box shall be installed the same as specified for the at-grade anode test box.

3.9 INSTALLING TWO WIRE TEST BOX

- A. Post Mounted Two Wire Test Box: Post mounted two wire test box shall be installed the same as specified for the Post Mounted Anode Test Box.
- B. At-Grade Two Wire Test Box: At-grade two wire test box shall be installed the same as specified for the at-grade anode test box.

3.10 INSTALLING INSULATING FLANGE KITS

- A. Insulating flange kit shall be installed as shown on the Standard Drawings, as recommended by the manufacturer, and by NACE RP0286. Care must be taken to prevent any moisture, soil or other foreign matter from contacting any portion of the insulating joint prior to its being sealed. If moisture, soil or other foreign matter contacts any portion of the insulating joint, the entire joint shall be disassembled, cleaned with a suitable solvent and dried prior to re-assembly. Special attention shall be paid to the manufacturer's recommendations regarding the torquing pattern of the bolts and the amount of torque to be used when installing the insulating flange kit.

3.11 BURIED INSULATING FLANGE COATING

- A. After testing, wrap the insulating flanges including all bolts, nuts, and washers, and adjacent surfaces of the pipe or valve with wax tape coating per Section 04300.

3.12 ABOVE GROUND INSULATING FLANGE COATING

- A. All above grade and in-vault insulating flanges shall be coated with two complete layers of half-lapped general utility pipeline tape. The tape coating shall be applied by the CONTRACTOR after all electrical effectiveness tests have been performed and approved by the DISTRICT or its Representative.

3.13 INTERNAL COATING AT INSULATING FLANGE

- A. The interior of the pipeline shall be coated with the two-part, smooth epoxy for a distance of two pipe diameters in each direction away from the insulating flange. At an insulating valve flange, interior of the pipeline shall be coated away from the valve for a distance of two pipe diameters.
 - 1. Surface Preparation: The surface preparation of the mortar lining shall consist of wire brushing to remove all loose mortar to provide a suitable surface for adhesion of the coating.
 - 2. Mixing: The two-part epoxy paint shall be mixed per the manufacturer's recommendations. The two-part epoxy shall be mixed thoroughly for at least two minutes by hand or with a mechanical mixer before being applied by brush. The epoxy for a two-gallon mixture has a pot-life of 30 minutes.
 - 3. Application: Application of undiluted coating shall be made by brushing until a minimum coating thickness of 20 mils is achieved. Each ensuing coat shall be applied before previous coat cures, usually within 3 to 6 hours after previous coat has been applied. Coating shall be at the rate of 140 square feet per gallon. This would ordinarily produce the required coating with a total of two coats. However, the 20 mil minimum thickness shall be satisfied regardless of the number of applications necessary to provide it.

3.14 MORTAR REPAIRS

- A. On mortar coated pipe, the mortar coating shall be repaired after the bituminous weld coating has dried, using fast-setting, non-shrinkable mortar to restore the original outside diameter of the pipe at each weld location.

3.15 INSTALLING IDENTIFICATION TAGS

- A. Identification tags shall be securely attached to each of the wires in the test box. Tags shall be stamped "P" for pipe, "A" for anode, and "E" for reference electrode to indicate to which structure each wire is attached. Tags on wires in the test box at insulating flanges shall be stamped "N", "S", "E", or "W" or North, South, East, or West and with the pipeline diameter to indicate on which side of the insulating joint and to which pipeline the wires are attached.

3.16 INSTALLING PLASTIC WARNINGS TAPES

- A. Plastic warning tape shall be placed 12 inches above each buried wire.

3.17 INSTALLING INSULATING BLANKETS

- A. An insulating blanket shall be installed whenever a metallic pipeline crosses or closely parallels another metallic pipeline when the distance between the two pipelines is 18 inches or less. If there is a cathodic protection system protecting one of the structures within 1500 feet of the crossing point, then an

insulating blanket shall be installed when the distance between the two structures is 36 inches or less.

3.18 INSTALLING CASING END SEALS

- A. The heat shrinkable casing seal shall be installed according to the manufacturer's recommendations. Care shall be taken that the annular space between the casing and the carrier pipe is free of contaminants prior to installation of the end seal. At no time shall organic materials be placed inside the casing. Also, care should be taken that no wrinkles or holes are present that could allow water to penetrate the end seal after installation.

3.19 CONTINUITY TESTS

- A. The CONTRACTOR shall notify the DISTRICT's representative when continuity bonding has been completed and all test boxes have been installed. A corrosion engineer designated by the DISTRICT will test and measure the electrical continuity of metallic pipelines at the CONTRACTORS expense, unless otherwise indicated in the Special Provisions of the Contract Documents. The pipeline shall be considered electrically continuous when the measured longitudinal resistance of the pipeline between each pair of adjacent test stations is no greater than 20 percent higher than the theoretical resistance of that section of pipeline.
- B. If tests indicate that adequate electrical continuity has not been achieved, the CONTRACTOR shall excavate to investigate and locate improperly bonded joints at his expense until electrical continuity is achieved to the satisfaction of the corrosion engineer.

3.20 CATHODIC PROTECTION TESTS

- A. The CONTRACTOR shall notify the DISTRICT's representative when the anode test boxes and other test boxes are ready for hookup. The wires shall remain disconnected to facilitate testing. A corrosion engineer designated by the DISTRICT will conduct tests before anode hookup to check that none of the anodes or wires were damaged or broken during the installation, at the CONTRACTORS expense, unless otherwise indicated in the Special Provisions of the Contract Documents. If tests indicate damage, the entire wire and/or anode shall be replaced and retested at the CONTRACTOR's expense.

END OF SECTION



APPROVED MATERIALS LIST
FOR USE ON NEW CONSTRUCTION OF POTABLE
WATER AND RECYCLED WATER FACILITIES

Submittal #: _____

VID Project #: _____

Project Name: _____

This form is part of the Approved Materials Checklist that follows. It is intended for use by developers or contractors constructing potable water or recycled water facilities within the Vista Irrigation District. An authorized representative of the developer shall check a single box per item for materials to be used in conjunction with the project, shall fill out this form in its entirety, shall sign the certification statement below and return to the District's Inspector or email. Contact the District if part numbers or models indicated within the Approved Materials Checklist are no longer available. District personnel will review this form and the Approved Materials Checklist and will separately attach review comments.

DEVELOPER INFORMATION

Company Name

Contact Person

Mailing Address

City , State, Zip

Cell/ Office/ FAX

Email

CONTRACTOR INFORMATION

Company Name

Contact Person

Mailing Address

City , State, Zip

Cell/ Office/ FAX

Email

SUPPLIER INFORMATION

Company Name

Contact Person

Mailing Address

City , State, Zip

Cell/ Office/ FAX

Email

I hereby certify that the specific products indicated within the attached Approved Materials Checklist represent a true list of materials to be used within the project indicated above, and I acknowledge understanding of the requirements that follow. Any and all specific requirements detailed within the Standard Specifications shall apply to all materials proposed for use on this project. When the notation "Full Submittal Required" or similar language appears within this Approved Materials List, or when required materials do not appear within this Approved Materials List, complete shop drawing submittals are required in accordance with the procedures detailed in the Standard Specifications. All materials supplied to the job site shall conform in all ways to the requirements of the Standard Specifications.

Signed By Developer or Contractor Representative

Printed Name of Developer or Contractor Representative

Date

Telephone

APPROVED MATERIALS LIST
FOR USE ON NEW CONSTRUCTION OF POTABLE WATER AND RECYCLED WATER FACILITIES

ITEM	DESCRIPTION	MANUFACTURER	SELECT	COMMENTS
ACTUATOR	Electric Valve Actuators used for Valve Control on Motor Operated Valves. Full Submittal Required.	Auma SG Series EIM Flo-Loc FloPak Pratt Rotork	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
ADAPTER, FLANGE COUPLING	(6") and Larger, MJ x Flg. Steel or Ductile-Iron Construction without Anchor Pins, Epoxy Coated, 304 Stainless Steel Bolts and Nuts.	Dresser 127 Dresser 227 Ford FFCA Style JCM 301 Powerseal 3521 Powerseal 3528 Romac FCA501 Romac FC400 Smith-Blair 912 Smith-Blair 913	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
AIR/VACUUM VALVE, ENCLOSURE, PLASTIC	(3/16") Wall Polyethylene with UV Stabilizer. (color selection subject to District Engineer approval)	Pipeline Products, Advantage Series VCAS 1830 & 2436	<input type="checkbox"/> <input type="checkbox"/>	
AIR/VACUUM VALVE SUCTION SCREEN	For use on (1") and (2") Air/Vacuum Installations. FIP Nylon Nut Style with 20 Mesh Stainless Steel Screen.	McMaster-Carr 9877K52 McMaster-Carr 9877K65 Northtown Hytech T. Christy's VC Series	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
ANODE, MAGNESIUM	High or Standard Potential Anode with a Galvanized Steel Core Encased in a Square Magnesium Alloy Ingot Pre-packaged in a Permeable Cotton Cloth Bag Filled with a 75% Gypsum, 20% Bentonite, 5% Sodium Sulfate Mixture. Provide Ingot Weight as Specified on the Approved Plans. See Standard Drawing 8-1. Full Submittal Required.	T. Christy's Corrpro Galvatec Alloy	<input type="checkbox"/>	
ANODE, ZINC	Pre-Packaged 6.8 Kg (30lbs) Min. Sacrificial Anode, #12 THHN Lead Wire, for the Protection of Copper Tubing. See Standard Drawings 8-14.	Hytech Pipeline Products CP-Z15 T. Christy's	<input type="checkbox"/> <input type="checkbox"/>	
ANTI-SEIZE COMPOUND	For use on Stainless Steel Bolts and Nuts.	Loctite Nevr Seize	<input type="checkbox"/> <input type="checkbox"/>	
BACKFLOW PREVENTER	Reduced Pressure Principal Type Assemblies as Approved by the USC List of approved Backflow Devices.	As Shown on List of Approved Backflow Prevention Assemblies	<input type="checkbox"/>	
BALL JOINTS FLEXIBLE/ EXPANSION	ANSI/ AWWA C153/ A21.53	EBAA Iron	<input type="checkbox"/>	

APPROVED MATERIALS LIST
FOR USE ON NEW CONSTRUCTION OF POTABLE WATER AND RECYCLED WATER FACILITIES

ITEM	DESCRIPTION	MANUFACTURER	SELECT	COMMENTS
BOLTS AND NUTS, A307	Hex-Head Machine, Cadmium/Zinc Plated, ASTM A307, Grade A Bolts and A307 Hex Nuts. Full Submittal Required.		<input type="checkbox"/>	
BOLTS AND NUTS, A307	Hex-Head Machine, Fluoropolymer Coated, ASTM A307, Grade A Bolts and A307 Hex Nuts. Full Submittal Required.	Tripac 2000 Blue	<input type="checkbox"/>	
BOLTS AND NUTS, A307 BREAK AWAY, 5/8" FOR 4" AUTO AIR VACS.	Auto Air Vac Flange Bolts, Hex Head Machine, Break Away Bolts, (5/8" x 3") and Nuts. Bolts Shall Incorporate a (23/64" x 1-7/8") Hole Drilled in the Bolt Shaft and Filled with Silicone Sealant. Bolts and Nuts Shall be Zinc Plated ASTM A307 Carbon Steel. Full Submittal Required.		<input type="checkbox"/>	
BOLTS AND NUTS, A307 BREAK AWAY, 3/4" FOR 6" AUTO AIR VACS.	Auto Air Vac Flange Bolts, Hex Head Machine, Break Away Bolts, (3/4" x 3-1/4") and Nuts. Bolts Shall Incorporate a (31/64" x 1-7/8") Hole Drilled in the Bolt Shaft and Filled with Silicone Sealant. Bolts and Nuts Shall be Zinc Plated ASTM A307 Carbon Steel. Full Submittal Required.		<input type="checkbox"/>	
BOLTS, EXPANSION, DROP-IN ANCHOR	(1/2") x (3") Stainless Steel Heavy Duty Anchor System with Anchor, Drop-in Sleeve and Epoxy Resin Adhesive Assembly with Hex Head Threaded Rod and Washer Capsule. For use on Air Valve and Water Test Station Enclosures.	Hilti HSLG-R Series U.S. Anchor W Series	<input type="checkbox"/> <input type="checkbox"/>	
BONDING AGENT, EPOXY	Epoxy Resin Based Bonding Agent for Bonding New Mortar or Concrete to Existing Concrete.	Sika Sikadur 32 Hi-Mod	<input type="checkbox"/>	No Known Equal
CASING END SEAL	(1/4") Thick Styrene Butadiene Rubber Sheet End Seal. Use (1") Wide Stainless Steel Bands. Zippered End Seals with Stainless Steel Bands May Also be Used.	Advance Products & Systems Cascade Calpico Pipeline Seal & Insulator Powerseal Raychem	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
CASING SPACER	Stainless Steel Casing Spacer, Center Restrained, Position Type with PVC Liner and Non-metallic Anti-friction Runners. Full Submittal Required.	Advance Products & Systems Cascade BWM Co. SS-8 & SS-12 Calpico Cascade Pipeline Seal & Insulator Powerseal Raychem	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	

APPROVED MATERIALS LIST
FOR USE ON NEW CONSTRUCTION OF POTABLE WATER AND RECYCLED WATER FACILITIES

ITEM	DESCRIPTION	MANUFACTURER	SELECT	COMMENTS
CATHODIC TEST STATION BOX	25.4 Kg (54 lbs) Concrete Body with 5.4 Kg (12 lbs) Ductile Iron Lid and Lid Ring. "CP TEST" Shall Be Cast into the Lid in (1") Letters. For Cathodic Protection Test Stations, Anode Ground Beds and Insulated Flange Test Stations.	Brooks 1-RT series Farwest Type 1-RT J & R Model V6-R T. Christy's	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
CATHODIC WELDING	For Welding Cathodic Bond Wires to Steel Pipelines.	Cadweld	<input type="checkbox"/>	
CHLORINE	Liquid (Gas) or Sodium Hypochlorite Solution. Chlorination Plan Submittal Required		<input type="checkbox"/>	
CLAMP, REPAIR	Stainless Steel, Full circle, For ACP, PVC, DI or CI Pipe, Sizes (4") Through (20"). Full Submittal Required.	Adams 220 Cascade CR-2 Cascade CRT-2 Ford FS2 Powerseal 3122AS Romac SS2	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
COATING, INTERNAL PIPE	For Coating the Internal Pipe Lining for an Insulated Flange.	Aquatapoxy CCI Carboline Phenoline 341 Devoe 223H Hydro-Pox Sherwin-Williams Macro Pox 646	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Wet Application NSF 61 Dry Application Dry Application NSF 61 Wet Application Dry Application
COATING, MASTIC	Cold-Applied Coal Tar- or Epoxy-Based Single Component, Self-Priming, Heavy Duty Protective Exterior Coating for Buried Concrete.	Carboline Bitumastic 50WB Devoe Devtar 5AHS Polykem 938 Sherwin-Williams Tar Guard Coal Tar Epoxy T. Christy's Coal Tar Mastic	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
COATING, WATERPROOF	Epoxy Resin-Based Cementitious Trowel Grade Protective Waterproofing for Concrete.	Sika Top Seal 107 Sto CR 241	<input type="checkbox"/> <input type="checkbox"/>	
COPPER DISC, SOLID	For Plugging Corporation Stops When a Service is to be Abandoned.	A.Y. McDonald 76125 Ford Copper Disc Mueller H-15535-N	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
CORPORATION STOP, BALLCORP	Bronze MIP x FLARE Thread Ball Valve (T-Head only) (3/4") & (1") Full Opening.	A.Y. McDonald 4704B Ford FB 700 - NL Jones - E1929 Mueller B-25025 N	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
CORPORATION STOP, BALLCORP	Bronze MIP x FIP Thread Ball Valve (T-Head only), (1-1/2") & (2") Full Opening	A.Y. McDonald 3149B Ford FB 1700 - NL Jones - E1931 Mueller B-20046 N	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	

APPROVED MATERIALS LIST
FOR USE ON NEW CONSTRUCTION OF POTABLE WATER AND RECYCLED WATER FACILITIES

ITEM	DESCRIPTION	MANUFACTURER	SELECT	COMMENTS
COUPLING, C900 PVC DEFLECTION	(4") through (12") Solid PVC for Obtaining Deflection Only. Provides 5 Degree Maximum Deflection.	North American Specialty Products	<input type="checkbox"/>	
COUPLING, C900 PVC CLOSURE OR REPAIR	(4") through (12") Solid PVC for Closure or Repair.	North American Specialty Products Specified Fittings	<input type="checkbox"/> <input type="checkbox"/>	
COUPLING, C905 PVC CLOSURE, DEFLECTION OR REPAIR	(14") through (36") Solid PVC for Closure, 3 Degree maximum Deflection or Repair.	Specified Fittings Sceptor IPEX NACO Industries	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
COUPLING, GROOVED	Use for Aboveground DI or Steel Pipe (4") or Larger.	Tyler 500 Victaulic Style 44 Victaulic Style 77	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
COUPLING, HALF, STEEL	Forged Steel Half Coupling, ASTM A105, 3000#, NPT Threads.	Bonney Forge	<input type="checkbox"/>	
COUPLING, STRAIGHT FLEXIBLE	(4") and Larger, Steel or Ductile-Iron Construction, Slip x Slip, Epoxy-Coated with 304 or 316 Stainless Steel Bolts and Nuts. For use on AC, PVC, DI, or Steel Pipe.	APAC 301 Dresser 253 Ford FC1 Powerseal 3501 Powerseal 3538 Romac 501 Smith-Blair 441 Viking Johnson MaxiFit	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
COUPLING, TRANSITION FLEXIBLE	(4") and Larger, Steel or Ductile-Iron Construction, Slip x Slip, Epoxy Coated with 304 or 316 Stainless Steel Bolts and Nuts. For use on AC, PVC, DI, or Steel Pipe.	APAC 311 APAC 313 Baker Dresser 253 Ford FC2A Powerseal 3501 Romac 4"-12" Macro HP Two Bolt Extended Range Coupling Powerseal 3538 Romac 501 Romac XR501 Smith-Blair 413 Viking Johnson MaxiFit	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
COUPLING, DI-ELECTRIC	Merchant Plated Steel Coupling- Mycarta Connector.	Calpico F.H. Mahoney	<input type="checkbox"/> <input type="checkbox"/>	

APPROVED MATERIALS LIST
FOR USE ON NEW CONSTRUCTION OF POTABLE WATER AND RECYCLED WATER FACILITIES

ITEM	DESCRIPTION	MANUFACTURER	SELECT	COMMENTS
CUSTOMER SIDE SHUT- OFF VALVE	(3/4") and (1") Bronze Customer Shut-off (Ball Valve), Inlet Swivel Meter Nut x Outlet FIP Thread, Lockable Tabs, with Lever Handle.	A.Y. McDonald 6101MWHB Cambridge ¾ 212-F3T3H Cambridge 1 212-F4T4H Ford B13-332W w/ HT34 Ford B13-444W w/ HT34 Jones J-1908W Mueller B-24351-1-N (W/HDL)	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
CUSTOMER SIDE SHUT- OFF VALVE	(1-1/2") and (2") Bronze Customer Shut-off (Ball Valve), Inlet Meter Flange x Outlet FIP Thread, Lockable Tabs, with Lever Handle.	A.Y. McDonald 6101MWHB Cambridge 1 ½ 212-F6MF6H Cambridge 2 212-F7MF7H Ford BF13-666W w/HB-67S Ford BF13-777W w/HB-67S Jones E-1913W Mueller B-24337-N	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
DISMANTLING JOINT	Telescoping, Adjustable, Double-Flanged Fitting, with High Tensile Strength Zinc-Plated Tie Bars. NSF-61 Epoxy or Nylon Interior and Exterior Coating.	Dresser 131 Romac DJ400 Viking Johnson	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
DUST CAP, CAM & GROOVE FITTING, LOCKING	316 Stainless Steel Cam and Groove Fitting Dust Cap, (2") (4") or (6").	Dixon "Andrews" Type DC OPW Kamlock 700 Type DC-SS	<input type="checkbox"/> <input type="checkbox"/>	
ELL, BURY, DUCTILE IRON	(6") x (16") Ductile Iron Bury Ells, Long Radius, FLGxPO	Clow Sigma South Bay Foundry	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
EPOXY ADHESIVE	High-Modulus, Low-Viscosity, Epoxy Resin-Based Adhesive Suitable for Grouting Bolts or Dowels.	Sika Sikadur 31 Sika Sikadur 35 Simpson Strong Tie	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	NSF Products
EXPANSION JOINT	For Water Pipeline Bridge Crossings.	APAC 703 Dresser 63 Onyx Valve 99 Powerseal 3563 Smith-Blair 611 Smith-Blair 612	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	

APPROVED MATERIALS LIST
FOR USE ON NEW CONSTRUCTION OF POTABLE WATER AND RECYCLED WATER FACILITIES

ITEM	DESCRIPTION	MANUFACTURER	SELECT	COMMENTS
EXPANSION JOINT, RUBBER	Expansion Joints at Reservoir and Pump Station Inlet/Outlet Piping to Allow Lateral Movement and Isolate Vibration.	General Rubber 1050 General Rubber 1075 Holz CSM Holz CR Holz C11R Mercer 500-700 Metraflex Metra Red Valve Redflex	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
FITTING, DUCTILE IRON	Flanged, Mechanical Joint or Push-on Tees, Bends, Crosses, Reducers, Adapters, etc., for Waterlines (4") and Larger. Manufactured per AWWA C110, C111 and C153.	Bachman Griffin Nappco/Sigma Pipeline Components Star Tyler	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
FITTING, GROOVED	Grooved Ductile-Iron Fittings for Grooved End Pipes, (4") through (24").	G-B Victaulic Grinnell Tyler	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
FITTINGS, BRASS & COPPER	Various sizes & types of ell bends, tee, adaptors, cap bushings, unions, plug, couplings, nipples	Eckhart Lee Mueller Nibco	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
FIRE HYDRANT BREAK-OFF CHECK VALVE	Break-off valves for Fire Hydrants Full Submittal Required.	Clow LBI 400A	<input type="checkbox"/>	
FIRE HYDRANT BREAK-OFF CHECK VALVE	Water loss & cross contamination reduction valve . Only when Required by District. Full Submittal Required.	AVK 24/88X FlowGuard II	<input type="checkbox"/>	
FIRE HYDRANT CAP	Screwed Brass or Ductile-Iron Cap for Fire Hydrant Hose Ports, (2-1/2") and (4").	AVK Jones Long Beach Iron US Pipe	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
FIRE HYDRANT, (150 PSI)	(6") Standard (150 PSI) Wet Barrel Bronze Fire Hydrants with Six-Hole Bolt Pattern. Color shall be Safety Yellow.	AVK 2462X/64X/68X Clow 2050 Clow 2060 Clow 2065 Jones J3775 - San Marcos Reqm't Jones J3700 - San Marcos Reqm't Jones J3765	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	

APPROVED MATERIALS LIST
FOR USE ON NEW CONSTRUCTION OF POTABLE WATER AND RECYCLED WATER FACILITIES

ITEM	DESCRIPTION	MANUFACTURER	SELECT	COMMENTS
FLANGE RING GASKETS	ANSI C111 Drop-in (1/16") thick	Calpico J-M Mfg. Co. or Equal	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
FLANGE RING GASKETS	ANSI B16.5 (1/8") thick (CML&C Piping)	Calpico J-M Mfg. Co. or Equal	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
GASKET	(1/8") Thick Full Face Aramid Fiber Bound with Nitrile. No Asbestos Content.	Calpico Garlock/Tripac 3000 & 5000 JM Eagle Klinger 4401	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
GASKET, RUBBER, GASOLINE - RESISTANT	Gasoline-Resistant Pipe Gaskets for Water Mains.	Newby	<input type="checkbox"/>	
GATE WELL LID- (8")	Ductile- or Cast-Iron Lid used for Valve Access, (8") Nominal Diameter Lid with a (6") Long Skirt and Lifting Slot. Well Installations. See Standard Drawing 5-3.	South Bay Foundry SBF (single lid) B6187 / 17lbs.	<input type="checkbox"/>	
GATE WELL LID- (10")	Ductile- or Cast-Iron Lid used for Valve Access, (10") Nominal Diameter Lid with a (4-1/2") Long Skirt and Lifting Slot. Well Installations. See Standard Drawing 5-3.	South Bay Foundry SBF (single lid) B6310 26lbs.	<input type="checkbox"/>	
GATE WELL LID- (12")	Ductile- or Cast-Iron Lid used for Valve Access, (12") Nominal Diameter Lid with a (6-3/8") Long Skirt and Lifting Slot. Well Installations. See Standard Drawing 5-3.	South Bay Foundry SBF (single lid) B6352 40lbs.	<input type="checkbox"/>	
GATE WELL LID AND CAN ASSEMBLY	Ductile- or Cast-Iron, Machined Frame with Ductile- or Cast-Iron Lid. Used for Valve Access. (8") Nominal Diameter Lid with a (6") Long Skirt and Lifting Slot. Full Submittal Required.	South Bay Foundry SBF1208N Cap and Can (2-piece) Assembly	<input type="checkbox"/>	
GREASE	For Bolt Corrosion Protection on Buried Bolts.	Dearborn Chemical Sanchem NO-OX-ID	<input type="checkbox"/> <input type="checkbox"/>	
GROUT	Non-Shrink Cementitious Construction Grout for Crack Repair, Flooring Mortar, Dowel Grouting, Crack Sealing and General Binding.	Sika SikagROUT 212 Sto Epoxy Binder CR633 Sto Epoxy Gel CR635 Sto N-S Grout CR732	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
HUMIDISTAT	120 Volt, 6.0 AMP, Single Phase with Adjustable Low and High Lockable Limit Stops. Adjustable Range of 20% to 70% Humidity and Suitable for Wet Locations. Full Submittal Required.		<input type="checkbox"/>	
INSULATING BLANKET	Insulating Blanket for Corrosion Interference Mitigation.	McMaster-Carr	<input type="checkbox"/>	

APPROVED MATERIALS LIST
FOR USE ON NEW CONSTRUCTION OF POTABLE WATER AND RECYCLED WATER FACILITIES

ITEM	DESCRIPTION	MANUFACTURER	SELECT	COMMENTS
INSULATING COUPLINGS	Insulating Couplings for Corrosion Protection of Pipelines.	Lochinvar Romac IC400 Romac IC501	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
INSULATING GASKET KIT	Insulating Gasket Kits for Corrosion Protection of Pipelines.	Advance Products & Systems Calpico Farwest Pipeline Seal & Insulator GasketSeal Pipeline Seal & Insulator LineBacker	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
ISOLATOR, VIBRATION	Wire Rope Seismic Support for Pipelines for Isolating Vibrations and Shocks.	Enidine Steelpaw	<input type="checkbox"/>	
JOINT RESTRAINT ASSEMBLY	360-Degree Wedge-Type Restraint System for Ductile-Iron, PVC, Pipe, Sizes (4") Through (30") Prior Approval of District Engineer is Required. Full Submittal Required.	Ford Uni-Flange 1300 & 1350 Series Sigma PV-Lok PVM Smith Blair Series 115 & 165 Star Series 1000C & 1100C Romac 611 & 612	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
JOINT SEALING COMPOUND	For use on Precast Vault and Manhole in Grooved Joints Between Sections.	A-Loc Butyl Lok Quickset Joint Sealing Compound	<input type="checkbox"/> <input type="checkbox"/>	
LUBRICANT, PIPE GASKET	Rubber gasket pipe lubricant for Use on PVC or Ductile-Iron Pipe Joints. ANSI/NSF-61 certified. Water soluble. Does not support bacteriological growth. Non toxic. Does not leave residue after assembly and flushing. Odorless, non-staining:adheres to wet and dry surfaces. Spreads	T. Christy's Pro-Lube Proselect Pipe Joint Lubricant Seacord Ease-On Whitlam Blue Lube Duck Butter	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
MARKER, UTILITY	Flexible Reinforced Polymer Glass Fiber Composite Strip Identification Marker. Branded or Customized Identification Markings for Pipelines and Appurtenances May Be Required.	Carsonite CUM-375 T. Christy's	<input type="checkbox"/> <input type="checkbox"/>	
METER ADAPTER	For Replacing Large Meters with Smaller Meters.	A.Y. McDonald 10J Series Cambridge 440 Series Ford A Series Jones E128H Mueller H10889-N	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
METER BOX, POLYMER	(17" x 30") Polymer Meter box with 1-Piece Lid for (2") & (1-1/2") Water Services. Gray for Potable Water use, Purple for Recycled Water use.	Armorcast A6001640PCX12 Box with 1 -Piece 20K Lid # A6001947T	<input type="checkbox"/>	
METER BOX, POLYMER	(13"x 24"x 12") Polymer Meter box Base rated 20K and 1-Piece Lid For (1") water services. Gray for Potable Water use.	Armorcast A6001946PCX12 Box with 1 -Piece 20K Lid # A6001969	<input type="checkbox"/>	

APPROVED MATERIALS LIST
FOR USE ON NEW CONSTRUCTION OF POTABLE WATER AND RECYCLED WATER FACILITIES

ITEM	DESCRIPTION	MANUFACTURER	SELECT	COMMENTS
METER BOX, POLYMER	(13" x 24"x 12") Gray Polymer Box w/Solid Grey Polymer Lid w/ Pickhole, No Lid Hook & VID Engraving. For all meter sizes (1") or smaller with a (1") Services Lateral.	DFW1324CH4-12-BODY DFW1324C-4P<>VID-LID	<input type="checkbox"/> <input type="checkbox"/>	
METER BOX, PLASTIC	(33" x 21" x 12") Gray Polymer Box w/Solid Grey Polymer Lid w/ Pickhole, No Lid Hook & VID Engraving. For all meter sizes (2") or smaller with a (1 1/2" or 2") Service Lateral.	DFWPW6C4-12-BODY DFWPW6C-4P<>VID-LID	<input type="checkbox"/> <input type="checkbox"/>	
METER FLANGE	Bronze Meter Flanges for (1-1/2") and (2") Meters with Slotted Holes.	A.Y. McDonald 7610F Cambridge 1 1/2" 5030295 NL Cambridge 2" 5030390 NL Ford CF Series Jones E129	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
METER FLANGE GASKET	(1/8") Rubber Drop-in (1-1/2") & (2")	Romac Ford	<input type="checkbox"/> <input type="checkbox"/>	
MORTAR, REPAIR	Two-Component, Low Shrinkage, Cementitious Mortar with High Compressive and Bonding Strength.	Sika Sika Top 122 Sika Sika Top 123 Sto CR 735 Sto CR 740	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
NOZZLE, WELD-ON	Weld-on Nozzle with Reinforcing Pad or Collar for Connection to CML&C Steel Pipe. ASTM A-53B (1/4") Minimum Thickness Seamless Pipe, Mortar Lined and Coated with AWWA C207 Flange. Full Submittal Required.		<input type="checkbox"/>	
PAINT, POLYESTER POWDER	TGIC Polyester Powder For Air Valve and Water Test Station Enclosures.	Tiger Dylac Series 49	<input type="checkbox"/>	
PAINT, SILICONE ALKYD ENAMEL	One-Component, Minimum 46% Solids (by Volume), 30 % Silicone Content (by Volume), High Gloss, VOC Compliant Industrial Grade Paint.	Amteco SA-3 Silicone Poly Plus Carboline Carbocoat 30 Devoe Devshield 475 Dunn-Edwards 42-53 Pittsburgh Paints 97-480 Porter Paint Porter Guard 2200 Sherwin-Williams Steel Master 9500	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
PENETRATION SEALS, INTERLOCKING	Mechanical Link Type Interlocking Vault, Casing and Building Penetration Seals.	Advance Products & Systems Interlynx Link Seal	<input type="checkbox"/> <input type="checkbox"/>	
PIPE, COPPER TUBING	(1") Type K Soft Seamless Rolled Tubing, (2") Type K Soft Seamless Straight	Cerro Halstead Lee Mueller Phelps-Dodge	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	

APPROVED MATERIALS LIST
FOR USE ON NEW CONSTRUCTION OF POTABLE WATER AND RECYCLED WATER FACILITIES

ITEM	DESCRIPTION	MANUFACTURER	SELECT	COMMENTS
PIPE, DUCTILE IRON	For Waterlines (4") and Larger Manufactured per AWWA C111, C115, C150, and C151.	American Pipe Griffin Pacific States U.S. Pipe	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
PIPE, PVC C900/909	For Waterlines (4") through (12") and (8") Gate Wells. Manufactured per AWWA C900/C909. Class (305) DR14 Only.	Certainteed Diamond Plastics Extrusion Technologies IPEX JM Eagle North American Pipe Corp. North American Specialty Products Pacific Western VinylTech	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
PIPE, PVC C905	For Waterlines (14") through (48"). Manufactured per AWWA C905, DR 18.	Certainteed Diamond Plastics North American Specialty Products Extrusion Technologies IPEX JM Eagle North American Pipe Corp. Pacific Western Vinyltech	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
PIPE, STEEL, CEMENT-MORTAR LINED AND COATED (CML&C)	Steel Cylinder (CML&C), per AWWA M11. (1/4") Minimum Wall Thickness. Steel Pipes Used for Recycled Water Installation are to be Identified Per District Requirements. Full Submittal Required.		<input type="checkbox"/>	
PLASTIC ENCASEMENT	12-mil Thick Polyethylene Encasement Sleeve for Ductile Iron Pipe (DIP) per AWWA C105 and Recycled PVC, CMC/L, or DIP Non-Purple Water Pipe. Clear Sleeve for Potable Water, Purple Sleeve for Recycled Water.	Northtown Co. T. Christy's	<input type="checkbox"/> <input type="checkbox"/>	
PLASTIC WRAP	8-mil Thick Polyethylene Encasement for Buried Fittings and Valves. Clear Sleeve for Potable Water, Purple Sleeve for Recycled Water.	Northtown Co.	<input type="checkbox"/> <input type="checkbox"/>	
PRIMER, WAX TAPE	Surface Primer for Underground Application of Petrolatum Wax Tape.	Carboline Denso Paste Trenton Tem-Coat	<input type="checkbox"/> <input type="checkbox"/>	
PROTECTOR POST, STEEL	(4") Diameter (0.250") Wall Galvanized A-120 Steel Pipe, Concrete Filled with (4") Galvanized Fence Post Cap.		<input type="checkbox"/>	

APPROVED MATERIALS LIST
FOR USE ON NEW CONSTRUCTION OF POTABLE WATER AND RECYCLED WATER FACILITIES

ITEM	DESCRIPTION	MANUFACTURER	SELECT	COMMENTS
REFERENCE ELECTRODE, COPPER SULFATE	High or Standard Potential Electrode with PVC Pipe Housing Pre-Packaged in a Permeable Cotton Cloth Bag Filled with a 50% Gypsum/50% Powered Bentonite Mixture. Electrode Shall have a Design Life of 15 Years with a Stability of +/- 5 Millivolts under a 3.0 Microampere Load. Provide Electrode with Integrally Attached #10 AWG HMW/PE Insulated Wire. Full Submittal Required.	Staperm Reference Electrode Model # 1 CU-1-UG	<input type="checkbox"/>	
ROCK, CRUSHED	Washed (3/8") and (3/4") Crushed Rock. (3/8") for Use in Meter Boxes Only. Full Submittal Required.		<input type="checkbox"/>	
SEALANT	Chemical Grout for Joint Sealing.	3M Scotch Seal	<input type="checkbox"/>	
SEISMIC COUPLING	Flexible Expansion Joints for Pipelines, Reservoirs and Pump Stations. Full Submittal Required.	EBAA Iron Flex-Tend Romac FlexiJoint Star Pipe Starflex 5000	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
SEISMIC SENSOR DEVICE	Seismic Sensors for Reservoirs and Pipelines. Full Submittal Required.		<input type="checkbox"/>	
SERVICE SADDLE FOR ACP AND CI PIPE	Cast Brass ASTM B62 Body with Silicone Bronze Double Straps, IP Outlet Sizes (1") and (2").	A.Y. McDonald 3826 Cambridge 810 Series Ford 202B Jones J-979 Mueller BR2B Series Romac 202B Smith-Blair 323	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
SERVICE SADDLE FOR PVC C900 PIPE	Bronze or Brass Saddle with Stainless Steel Four Bolt Strap(s), IP Thread Outlet for Saddle Sizes (1") and (2") Installed on Pipe Sizes (4") through (12").	A.Y. McDonald 3846 Cambridge 812 Series Ford 202BS Jones J-969 Mueller BR2S Series Romac 202BS Smith-Blair 393	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
SERVICE SADDLE FOR PVC C905 PIPE	Bronze or Brass Saddle with Stainless Steel Four Bolt Strap(s), IPT Thread Outlet for Sizes (1") and (2") Installed on Pipe Sizes (14") and Larger Full Submittal Required.	Ford 202BS Jones J-969 A.Y.McDonald 3846	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
TAG, BRASS IDENTIFICATION	(1") Diameter, 18 Gauge Brass with (3/16") Die-Stamped Letters and Numbers, Suitable for Attachment to Cathodic Protection Wires using a Nylon Zip Tie.		<input type="checkbox"/>	
TAPE, OUTER WRAP	Adhesive Plastic Outer Wrap for Wax Petrolatum Tape in Underground Applications.	Polyken 960 Trenton Polyply	<input type="checkbox"/> <input type="checkbox"/>	

APPROVED MATERIALS LIST
FOR USE ON NEW CONSTRUCTION OF POTABLE WATER AND RECYCLED WATER FACILITIES

ITEM	DESCRIPTION	MANUFACTURER	SELECT	COMMENTS
TAPE, UTILITY	10 to 50 Mil x (2") Wide General Utility Tape for Corrosion Protection of Aboveground and Underground Pipes and Fittings.	3M Scotchwrap 50 3M Scotchwrap 51 Calpico Northtown Polyken 900 T. Christy's	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
TAPE, WARNING/ IDENTIFICATION	(6") wide, Warning/Identification (Non-Metallic) Marking Tape for Buried Facilities.	Calpico Type 1 Line-Tec Type B Northtown T. Christy's Type 1 Terra Tape Standard 250 Thor Elast Tec	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
TAPE, WARNING/ IDENTIFICATION FOR RECYCLED IRRIGATION	(3") wide, Warning/Identification (Non-Metallic) Marking Tape for Buried Irrigation Pipelines, Purple Color with continuous warning "CAUTION RECLAIMED WATER MAIN BURIED BELOW."	Calpico Type 1 . Line-Tec Type B Northtown T. Christy's Type 1 Terra Tape Standard 250 Thor Elast Tec	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
TAPE, WAX ABOVEGROUND	Petrolatum-Saturated Synthetic Fabric Tape for use on Aboveground Couplings, Flanges, Fittings, etc.	Trenton #2 Wax-Tape	<input type="checkbox"/>	
TAPE, WAX UNDERGROUND	Petrolatum-Saturated Synthetic Fabric Tape for use on Underground Couplings, Flanges, Fittings, etc. Primer and Outer Wrap Required.	Carboline Densyl Tape Trenton #1 Wax-Tape	<input type="checkbox"/> <input type="checkbox"/>	
TAPPING SLEEVE FOR AC, CI, DI, & PVC PIPE	Fabricated Steel Tapping Sleeve for (4") Through (12") Wet Taps. Epoxy Coated with Stainless Steel Bolts and Nuts.	APAC 502 APAC 512 Baker 428 Series Clow F-5205 Clow F-5207 Dresser 610 Ford FTSC JCM 412 Mueller 615 Mueller 619 Powerseal 3460 Romac FTS-420 Smith-Blair 622	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
TAPPING SLEEVE FOR AC, CI, DI, & PVC PIPE	Fabricated Steel Tapping Sleeve for (14") & above Wet Taps. Epoxy Coated with Stainless Steel Bolts and Nuts Full Submittal Required.		<input type="checkbox"/>	

APPROVED MATERIALS LIST
FOR USE ON NEW CONSTRUCTION OF POTABLE WATER AND RECYCLED WATER FACILITIES

ITEM	DESCRIPTION	MANUFACTURER	SELECT	COMMENTS
VALVE, AIR RELEASE, (300 PSI)	Pressure Air Release Valve, Cast-Iron Body with Stainless Steel Internal Parts. Suction Screens Required (1") through (3") NPT, (4") Flanged. Full Submittal Required.	APCO 50 APCO 200 APCO 200A Crispin PL10H Crispin PL20H Crispin PL30H Crispin PL42H Val-Matic #45 Val-Matic #88	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
VALVE, ANGLE BALL	(1") Bronze Angle Ball Meter Valves. (1") flared with swivel meter nut and lock wing	A.Y. McDonald 4602B Ford BA23 Jones -E 1964W Mueller B24255 N	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
VALVE, ANGLE BALL FLANGE	(1-1/2") & (2") Bronze Angle Ball Meter Valves with meter flange x FIP double drilled and lock wing.	A.Y. McDonald 4604B Ford BFA13 Jones -E 1974W Mueller B-24286 N	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
VALVE, ANGLE BALL	2" FIP x MIP used for 2" Air Vent & Blow Off Assemblies. Vertical inlet and outlet with easy access to the tee-head. 300PSI working Pressure and a Full 360 Degree tee-head Rotation.	Ford - BLA18-777-TA-NL	<input type="checkbox"/>	
VALVE, BALL, (150 PSI)	(1/4") through (2"), FIP Threads with Handle.	Apollo 70-100 Series Milwaukee BA-1005 Nibco 560 Series Stockham S-214 Watts WBV-3 Watts WEBS-3	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
VALVE, BALL, (150 PSI)	(4") and Larger, Rubber Seated, AWWA C507. Fusion-Bonded Epoxy Lined and Coated Interior/Exterior, Holiday Free. Full Submittal Required.	Pratt	<input type="checkbox"/>	
VALVE, BUTTERFLY (150 PSI)	(14") and Larger, AWWA C504, Class 150B with Ductile Iron Body. Fusion-Bonded Epoxy Lined and Coated Interior/Exterior, Holiday Free. Class D or E Flange x Flange Ends. Full Submittal Required.	Dezurik AWWA M & H 1450 M & H 4500 Mueller Linesal III Pratt Groundhog Val-Matic Series 2000	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	

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ITEM	DESCRIPTION	MANUFACTURER	SELECT	COMMENTS
VALVE, BUTTERFLY (150 PSI)	(4") through (12"), AWWA C504, Class 150B with Ductile Iron Body. Fusion-Bonded Epoxy Lined and Coated Interior/Exterior, Holiday Free . Class D or E Flange x Flange Ends. Full Submittal Required.	Dezurik AWWA Keystone 504 M & H 4500 Mueller Lineseal III Val-Matic Series 2000	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
VALVE, BUTTERFLY, WAFER (150 PSI)	(14") and Larger, Thermosetting or Fusion Bonded Epoxy Coated and Lined. District Approval and Full Submittal Required.	Pratt MKII	<input type="checkbox"/>	
VALVE, BUTTERFLY (250 PSI)	(14") and Larger, AWWA C504, Class 250B with Ductile Iron Body. Fusion-Bonded Epoxy Lined and Coated Interior/Exterior, Holiday Free. Class F Flange x Flange Ends. Full Submittal Required.	Dezurik BAW 250 M & H 1450 M & H 4500 Mueller Lineseal XP 250 Val-Matic Series 2000	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
VALVE, BUTTERFLY (250 PSI)	(4") through (12"), AWWA C504, Class 250B with Ductile Iron Body. Fusion-Bonded Epoxy Lined and Coated Interior/Exterior, Holiday Free. Class F Flange x Flange Ends. Full Submittal Required.	Dezurik AWWA Keystone 507 M & H 1450 M & H 4500 Mueller Lineseal XP 250 Val-Matic Series 2000	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
VALVE, CHECK	(150 & 300 PSI), Slanting Disc Check Valve (4") and Larger. Full Submittal Required.	APCO Series 800 Crispin TD Series Val-Matic Series 9000	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
VALVE, COMBINATION AIR RELEASE AND AIR/VACUUM, (2")	Single Body Style Combination Air Release and Air/Vacuum Valve. Stainless Steel Internal Parts, BUNA-N seats per AWWA C512, and Epoxy Coated Interior per AWWA C550. N.P.T. Threaded Inlet and Outlet. Suction Screen Required, (300 PSI) Rated Body and Internals. Full Submittal Required.	APCO 145C Cla-Val 33A Crispin UL20 Val-Matic 202C.2 Vent-O-Mat RBX Series	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
VALVE, COMBINATION AIR RELEASE AND AIR/VACUUM, (4") AND LARGER	Single-Body Style Combination Air Release and Air/Vacuum Valve. Stainless Steel Internal Parts, BUNA-N seats per AWWA C512, with Protection Hood, Suction Screen Required, and Epoxy Coated Interior per AWWA C550. Flanged 125# or 250# Inlet. (300 PSI) Rated Body and Internals. Full Submittal Required.	APCO 150 Series Cla-Val Series 35 Crispin UL Series (for (4") size) Crispin C Series (for (6") and larger) Val-Matic 200 Series Vent-O-Mat RBX Series	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	

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ITEM	DESCRIPTION	MANUFACTURER	SELECT	COMMENTS
VALVE, DOUBLE DISK GATE	Valve Double Disk Gate.	American Clow Kennedy Mueller	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
VALVE, GATE, RESILIENT WEDGE (RWGV)	(4") Through (12"), Non-Rising Low Zinc Bronze or Stainless Steel Stem, Ductile-Iron Body and Bonnet, Stainless Steel Trim Bolts, Encapsulated Wedge per AWWA C509 or C515 with 8-mil or greater, Fusion-Bonded Epoxy Lined and Coated Interior/Exterior, Holiday Free. Manufactured to AWWA C509 or C515, with (250 PSI) Rating.	American FC, Series 2500 American R/D AVK 45 Clow 2639 F6100 Series Kennedy KSRW-8000 Series Mueller 2362 M&H 4067 & 7000 Series	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
VALVE, GATE, RESILIENT WEDGE, (14") AND LARGER	(14") Through (24"), per AWWA C509, Ductile Iron Body, Stainless Steel Trim Bolts, Encapsulated Wedge, Non-Rising Stem, 8-mil or greater, Fusion-Bonded Epoxy Lined and Coated Interior/Exterior, Holiday Free. Minimum (200 PSI) Rating. District Approval and Full Submittal Required.	Clow Model 2368 Series F-6100 Kennedy KSRW-7000 Series M&H 7000 Series Mueller A-2361 AVK series 55	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
VALVE, PRESSURE REDUCING	For Water Main Pressure Reducing, (4") through (16"). Full Submittal Required.	Ames 910/610 Series Cla-Val 90G-01 Watts ACV 115E Series	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
VALVE, PRESSURE REGULATING to (150 TO 249 PSI)	(3/4") through (2").	Watts 223, 25AUB	<input type="checkbox"/>	
VALVE, PRESSURE REGULATING to (250 TO 400 PSI)	(3/4") through (2").	Watts N35B Series	<input type="checkbox"/>	
VALVE, PRESSURE RELIEF AND SUSTAINING	For Water Main Pressure Reducing and Sustaining, (4") through (16"). Full Submittal Required.	Ames 920/620 Series Cla-Val 50-01 Cla-Val 650-01 Watts ACV 116E Series	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
VALVE STEM EXTENSION, STEEL	Round or Square (1-1/2") Diameter Steel Rod, Welded Construction, Hot Dipped Galvanized with Top Centering Ring and AWWA (2") Operating Nuts Top and Bottom. Use for Extensions Longer Than (8').	Pipeline Products SX-900 South Bay Foundry E4160 T. Christy's	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	

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ITEM	DESCRIPTION	MANUFACTURER	SELECT	COMMENTS
VAULT ACCESS DOOR, ALUMINUM	Aluminum Vault Access Door, Dual Door Configuration, Spring Loaded and Counter Balanced, with Inset for Padlock. H-10 Parkway or H-20 Street Loading Required. Full Submittal Required.	Bilco Type JD-AL USF Fabrication THS, THD	<input type="checkbox"/> <input type="checkbox"/>	
VAULT EXHAUST FAN	Electric, 110 Volt, Single Phase, Squirrel Cage Type, Suitable for Wet Locations. Size for 6 Volume Changes per Hour. Full Submittal Required.		<input type="checkbox"/>	
VAULT GROUND FAULT RECEPTACLE	125 Volt, 20 AMP, Duplex, with Gasketed, Self-Closing Aluminum Cover. Full Submittal Required.		<input type="checkbox"/>	
VAULT LADDER EXTENSION	Vault Ladder Extension, Retractable, (48") Extension. Full Submittal Required.	Bilco Ladder-Up Pipeline Products VL-100	<input type="checkbox"/> <input type="checkbox"/>	
VAULT LADDER, ALUMINUM	High Strength 6061-T6 Aluminum Alloy (1") Diameter Solid Rungs and (18") Between Side Rails. Ladder to Exceed Requirements of CAL/OSHA Standards.	Alaco Model 560	<input type="checkbox"/>	
VAULT LADDER, FIBERGLASS	Fiberglass Reinforced Plastic, (1") Solid Square Rungs with Grit Safety Surface, Ultraviolet Inhibitors. (30,000 PSI) Tensile Strength with a 3 to 1 Safety Factor per OSHA Requirements. Full Submittal Required.		<input type="checkbox"/>	
VAULT LIGHT SWITCH	120 Volt, 20 AMP, Single Pole, Spring Loaded with Clear Waterproof Cover. Full Submittal Required.		<input type="checkbox"/>	
VAULT LIGHTS	Non-Metallic Incandescent Vaportite, 120 Volt, 6.0 AMP, Wall or Ceiling Mounted, with 100 Watt Bulb with Cage and Glass Protector for Bulb. Suitable for Wet Locations. Two Light Fixtures Per Vault. Full Submittal Required.		<input type="checkbox"/>	
VAULT LOAD CENTER	100 AMP, Double Pole, 1 Phase, 3 Wire, Solid Neutral 120/240 VAC with Plug-In GFI Breaker. Full Submittal Required.		<input type="checkbox"/>	
VAULT SUMP PUMP	Automatic Submersible, Minimum 1/2 HP, 115 Volt, 60 Hz, 1 Phase, Ball Bearing Motor with Thermal Overload Protection. Either bronze or Epoxy Coated Cast Iron Body. Full Submittal Required.		<input type="checkbox"/>	
VENT VAULT	6 inch PVC Schedule 40 pipe with Schedule 40 socket weld fitting. 304 stainless steel insect screen.	Certaiteed Johns-Mansville Pacific Western	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	

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ITEM	DESCRIPTION	MANUFACTURER	SELECT	COMMENTS
METER VAULT, 3" THRU 10" METERS	(3' x 6') Sections - (24") high Lid-Bilco full opening Aluminum w/hinged meter reading lid, H-10 loading	Carson/Brooks Quickset 7100 Utility	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
VAULT, PRECAST CONCRETE	For Pressure Reducing Stations, Reservoir Altitude Valves, etc. Various Sizes. Precast Base, Sections and Top with Aluminum Two Leaf Access Door. See Section 03462. Full Submittal Required.	Brooks J & R San Diego Precast Utility Vault	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
WATER TEST STATION ENCLOSURE	Aluminum Housing	Pipeline Products WTS858 Koraleen	<input type="checkbox"/> <input type="checkbox"/>	
WIRE, TRACER	#10 AWG Solid Copper UF Type Wire, with Cross Linked Polyethylene Insulation. White	Baron Cosberg Industries Paige Regency Wire	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
WIRE, TRACER CONNECTOR	Direct Bury Silicone-Filled Capsule Tube with Standard Wire Nut or Silicone-Filled Wire Nut Connectors for Tracer Wire Connections.	3M DBR-6 King 4 King 5 King 6	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	

APPENDIX A

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