OLIVENHAIN
Municipal Water District

Standard Specifications and Drawings

For the Construction of Water, Recycled Water, and Sewer Facilities

Pure Excellence

OLIVENHAIN MUNICIPAL WATER DISTRICT
1966 Olivenhain Road
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STANDARD SPECIFICATIONS AND DRAWINGS

FOR THE CONSTRUCTION OF

WATER, RECYCLED WATER AND SEWER FACILITIES

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OLIVENHAIN MUNICIPAL WATER DISTRICT

STANDARD SPECIFICATIONS AND DRAWINGS

FOR THE CONSTRUCTION OF

WATER, RECYCLED WATER AND SEWER FACILITIES

June 2008

This document presents general guidelines and standard specifications and drawings that have been adopted by the Olivenhian Municpal Water District (District) for the design and construction of potable water, recycled water, and sewer system facilities within its service boundaries. The specifications are effective immediately.

Copies of this document are available for purchase at the District offices at 1966 Olivenhain Road, Encinitas, CA 92024, telephone 760-753-6466. The document can also be accessed on the internet at www.olivenhain.com where the standard specifications and standard drawings can be downloaded as .pdf files.

Please note that the District is not responsible for the use of all or any portion of this document on projects built or administered by any other agency or public entity. No representation or warranty of any kind is made concerning the accuracy, completeness, suitability, or utility of any information or product discussed in this document, and the District assumes no liability arising from such use.

Periodically, the District may make revisions to the document. Revisions will posted on the District web site. These revisions will be effective per the posting.

The District would welcome any comments or suggestions on how the document could be improved, or regarding the design and / or construction procedures. Please forward these in writing to George Briest, PE, the District's Engineering Manager.

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STANDARD SPECIFICATION

SECTION 01300 RECORD DRAWINGS AND SUBMITTALS

1.01 RECORD DRAWINGS

Provide and maintain on the jobsite one complete set of prints of all Drawings which form a part of the project. Immediately after each portion of the work is installed, indicate all deviations from the original design shown on the Drawings either by additional sketches or marked in red thereon. Upon completion of the job, deliver this record set to the Engineer of Work. The Engineer of Work will make the changes to the original Drawings indicating record conditions. Appropriate prints of the originals will then be delivered. Then print four blueline sets of the record drawings and deliver them to the District's Consulting Engineer.

1.02 SHOP DRAWINGS

A. Submittals are drawings, illustrations, schedules, performance charts, brochures, and other data which are prepared by the Contractor or any subcontractor, manufacturer, supplier, or distributor and which illustrates some portion of the work. Submit shop drawings where indicated in these Standard Specifications. Place all required shop drawings in one complete package that illustrates the full scope of the project. The intent of this requirement is to have one submittal package with all components of the project detailed in a single booklet.

B. Submit four copies of submittals. The District's Representative will keep one copy and return three copies. Clearly indicate the name of the project, specification section and drawing number to which each shop drawing is referenced.

C. The submittals shall be reviewed first by the Contractor and then by the Engineer of Work. Each copy of the submittal package shall be marked with an approval stamp, signed and dated by both the Contractor and the Engineer of Work. After these reviews, submit the submittal packages to the District's Representative for review.

D. Submittals shall be complete in all respects. If the submittals show any deviations from the requirements of the Drawings and Standard Specifications because of standard shop practices or other reasons, the deviations and the reasons therefore shall be set forth in the letter of transmittal. By submitting submittals, the Contractor represents that material, equipment, and other work shown thereon conforms to the Drawings and Standard Specifications, except for any deviations set forth in the letter of transmittal.

E. Within 30 calendar days after receipt of submittal package, the District's Representative will return the submittal packages to the Engineer of Work with comments noted thereon. If resubmittal is not required, the District's Representative will return three submittal packages. If resubmittal is required, the District's Representative will return all six submittal packages and the Contractor shall correct the submittals. Resubmit the corrected submittal packages in the same manner as specified for the original submittal. The Contractor in the letter of transmittal accompanying resubmitted packages shall direct specific attention to revisions other than the corrections requested by the District's Representative on previous submittals.

F. The review by the District's Representative is only of general conformance with the design concept of the project and general compliance with the Drawings and Standard

Specifications and shall not be construed as relieving the Contractor of the full responsibility for: providing materials, equipment, and work required by the project; the proper fitting and construction of the work; the accuracy and completeness of the shop drawings; selecting fabrication processes and techniques of construction; and performing the work in a safe manner.

G. No portion of the work requiring a submittal shall be commenced until the submittal has been reviewed by the District's Representative and returned with a notation indicating that resubmittal is not required.

H. If the Contractor would like to use products other than those listed in the Approved Materials List, he shall submit to the District's Representative a completed New Product Submittal Form. The purpose of the submittal form is to provide adequate information to determine if a product meets District criteria. If the District determines the product is not

END OF SECTION

STANDARD SPECIFICATION
SECTION 02110 CLEARING, GRUBBING, AND STRIPPING

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes the work included in clearing, grubbing, stripping, and preparing the project site for construction operations.

1.02 CLEARING

Remove and dispose of trees, snags, stumps, shrubs, brush, limbs, and other vegetative growth. Remove all evidence of their presence from the surface including sticks and branches greater than 1-inch in diameter or thickness. Remove and dispose of trash piles and rubbish. Protect trees, shrubs, other vegetative growth and fencing which are not designated for removal.

1.03 GRUBBING

After clearing, remove and dispose of wood or root matter including stumps, trunks, roots, or root systems greater than 1-inch in diameter or thickness to a depth of 12 inches below the ground surface.

1.04 STRIPPING

Remove and dispose of all organic sod, topsoil, grass and grass roots, and other objectionable material remaining after clearing and grubbing from the areas designated to be stripped.

PART 2 - MATERIALS

2.01 EXISTING TREES, SHRUBS, AND OTHER VEGETATIVE GROWTH

Existing trees, shrubs, and other vegetative growth may not be shown on the Drawings. Inspect the site as to the nature, location, size, and extent of vegetative growth to be removed or preserved, as specified herein. Preserve in place trees that are specifically shown on the Drawings and designated to be preserved.

2.02 PRESERVATION OF TREES, SHRUBS, AND OTHER VEGETATIVE GROWTH

A. Save and protect all trees, shrubs, and other vegetative growth beyond the limits of clearing and grubbing from damage resulting from the work. No filling, excavating, trenching, or stockpiling of materials will be permitted within the drip line of these plant materials. The drip line is defined as a circle drawn by extending a line vertically to the ground from the outermost branches of a plant or group of plants. To prevent soil compaction within the drip line area, no equipment will be permitted within this area.

B. When trees are close together, restrict entry to area within drip line by fencing. In areas where no fence is erected, protect the trunks of all trees 2 inches or greater in diameter by encircling the trunk entirely with boards held securely by 12-gage wire and staples. This protection shall extend from ground level to a height of 6 feet. Cut and remove tree branches where necessary for construction. Remove branches other than those required to effect the work to provide a balanced appearance of any tree. Treat cuts with a tree sealant.

PART 3 - EXECUTION

3.01 CLEARING AND GRUBBING LIMITS

Clear and grub excavation and embankment areas associated with new structures, slabs, roadways, and pipelines.

3.02 DISPOSAL OF CLEARING AND GRUBBING DEBRIS

Do not burn combustible materials. Remove all cleared and grubbed material from the worksite and dispose of in accordance with all local laws, codes, and ordinances.

3.03 AREAS TO BE STRIPPED

Strip excavation and embankment areas associated with new structures, slabs, walks, and roadways. Strip all stockpile areas.

3.04 DISPOSAL OF STRIPPINGS

Remove all stripped material and dispose offsite.

END OF SECTION

STANDARD SPECIFICATION
SECTION 02200 EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation and testing of earthwork for excavations, fills and embankments for structures and sites.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Clearing, Grubbing, and Stripping: STD SPEC 02110.

D. Blasting: STD SPEC 02228.

E. General Concrete Construction: STD SPEC 03000.

1.03 EARTHWORK AND REPAIRS IN CITY, COUNTY, AND STATE RIGHTS OF WAY

Conform to the requirements and provisions of the permits issued by those agencies in addition to the requirements of these Standard Specifications. If a permit is not required, earthwork and repairs shall conform to the standards of the agency in whose right of way the work is done in addition to the requirements of these Standard Specifications.

1.04 SAFETY PRECAUTIONS

Observe safety precautions in all phases of the work. Included shall be trench shoring, bracing, lighting, and barricades as dictated by reason and by the Safety Orders of the Division of Industrial Safety, State of California (CAL/OSHA). Acquire an exemption letter or trenching permit from the California Division of Industrial Safety (CAL/OSHA) and comply with Labor Code Section 6705, Excavation Plans For Worker Protection. Submit a copy of the exemption letter or trenching permit with excavation drawings to the District prior to excavation work.

1.05 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit a report from a testing laboratory verifying that imported material is asbestos-free and conforms to the specified gradations or characteristics.

1.06 TESTING FOR COMPACTION

A. The District or the agency having jurisdiction over the area of the work will require the Contractor to test for compaction as described below.

B. Determine the density of soil in place by the sand cone method, ASTM D 1556, or by nuclear methods, ASTM D 2922 and D 3017.

C. Determine laboratory moisture-density relations of soils by ASTM D 1557.

D. Determine the relative density of cohesionless soils by ASTM D 4253 and D 4254.

E. Sample backfill materials by ASTM D 75.

F. "Relative compaction" is the ratio, expressed as a percentage, of the inplace dry density to the laboratory maximum dry density.

G. Make excavation for compaction tests at the locations and to the depths designated by the District's Representative. Backfill and recompact the excavations at completion of testing. When tests indicate that the compaction is less than the specified relative compaction, rework and retest those areas until the specified relative compaction has been obtained.

1.07 WATER FOR CONSTRUCTION

Water supplied by the District, for whatever needs and uses, shall be paid for in accordance with the rates and rules of the District. The only exception is by written agreement with the District.

PART 2 - MATERIALS

2.01 NATIVE EARTH BACKFILL

Native earth backfill shall be excavated fine grained materials or loose soil free of asbestos, from organic matter, roots, debris, rocks larger than 6 inches in diameter, clods, clay balls, broken pavement, and other deleterious materials.

2.02 IMPORTED FILL MATERIAL

Imported fill material for embankment construction shall be free of asbestos, organic matter, and other deleterious substances and shall not contain rocks or lumps larger than 6 inches in the greatest dimension. The District's Representative and his authorized agent will evaluate the proposed imported fill material prior to placement.

2.03 GRANULAR MATERIAL FOR STRUCTURAL BACKFILL

A. Granular material for structural backfill shall be free of asbestos, organic materials, clay balls, and shall have the following gradation:

Sieve Size	Percent Passing By Weight
3/4-inch	100
1/2- inch	95 - 100
3/8-inch	50 - 100
No. 4	20 - 65
No. 8	10 - 40
No. 40	0 - 20
No. 200	0 - 5

B. Whenever the phrase "structural backfill material" is used in these Standard Specifications, it shall mean granular material for structural backfill as described above.

C. Excavated material may be used for structural backfill provided it conforms to the Standard Specifications for structural backfill material.

2.04 WATER FOR COMPACTION

Water used in compaction shall have a maximum chloride concentration of 500 mg/l, a maximum sulfate concentration of 500 mg/l, and shall have a pH of 7.0 to 9.0. Water shall be free of acid, alkali, or organic materials. Salt water will not be allowed.

PART 3 - EXECUTION

3.01 COMPACTION REQUIREMENTS

Unless otherwise shown on the Drawings, otherwise described in the Specifications or required by an agency having jurisdiction over the area of the work, compaction of fill areas and embankments shall be a minimum of 90% relative compaction.

3.02 BLASTING

Perform blasting operations in accordance with Standard Specification Section 02228.

3.03 SITE PREPARATION

Clearing, grubbing, and stripping shall conform to Standard Specification Section 02110. Prior to excavation, clear the existing ground surface at the work site.

3.04 SITE PROTECTION

A. Protection of the site during the period of grading shall be the responsibility of the Contractor. Protect the work site from flooding, ponding, or inundation during site clearing, excavation, and grading. Make temporary provisions during the rainy season to adequately direct surface drainage away from and off the work site. Dispose of the water in a manner to prevent damage to adjacent property and in accordance with regulatory agency requirements.

B. Use plastic sheeting to prevent unprotected slopes from becoming saturated. Install checkdams, desilting basins, riprap, sand bags, or other devices or methods necessary to control erosion.

C. Following periods of rainfall, the District's Representative and his authorized agent will visually assess rain related damage. At the request of the District's Representative, the Contractor shall make excavations in order to evaluate the extent of rain related damage.

D. Rain related damage will be considered to include, but may not be limited to, erosion, silting, saturation, swelling, structural distress and other adverse conditions identified by the District's Representative and his authorized agent.

E. Where soil has been adversely affected by rain related damage, it shall be overexcavated and replaced with compacted fill or other remedial grading as directed by the District's Representative.

3.05 DEWATERING

Provide and maintain means and devices to remove and dispose of all water entering the excavation during the period when concrete is being deposited and during the hydration process, when pipe is being laid, and during the placing of backfill. Avoid settlement or damage to adjacent property. Dispose of water in a manner that will not damage adjacent property. When dewatering open excavations, dewater from outside the structural limits and from a point below the bottom of the excavation. Obtain and comply with discharge permit from cognizant regulatory authority.

3.06 EXCAVATION

A. Perform all excavation regardless of the type, nature, or condition of the material encountered to accomplish the construction. Do not operate excavation equipment within 5 feet of existing structures or newly completed construction. Excavate with hand tools in these areas.

B. After the required excavation has been completed, the District's Representative will inspect the exposed subgrade to determine the need for any additional excavation. It is the intent that additional excavation be conducted in all areas within the influence of the structure where unacceptable materials such as soft, spongy or deleterious materials exist at the exposed subgrade. Overexcavation shall include the removal of all such unacceptable material that exists directly beneath the structure or within a zone outside and below the structure defined by a line sloping at 1 horizontal to 1 vertical from the outside edge of the footing. Refill the overexcavated areas with structural backfill material.

3.07 LIMITS OF EXCAVATION FOR FOUNDATIONS, VAULTS, AND STRUCTURES

Excavate to the depths and widths needed to accomplish the construction. Allow for forms, working space, structural backfill and site grading. Do not carry excavation for footings, slabs or conduits deeper than the elevations shown, unless unacceptable material is encountered. Backfill overexcavations, below the elevations shown to the proper elevation, with structural backfill material compacted as specified for structural backfills around structures. Correct cuts below grade by similarly cutting adjoining areas and creating a smooth transition.

3.08 PREPARED SUBGRADE FOR FOUNDATIONS, VAULTS, AND STRUCTURES

Excavate and shape subgrade to line, grade, and cross section. Compact exposed subgrade until the top 12 inches are compacted to 95% relative compaction. Remove soft or fractured material encountered and replace with structural backfill material. Fill holes, open joints, rock fractures, and depressions created by the excavation to the required line, grade, and cross sections with structural backfill material. Place a 6-inch minimum thickness of structural backfill material over the full width of the foundations, vaults, and structures and compact to 95% relative compaction. Extend the structural backfill material and compaction 12 inches beyond the edge of the foundations, vaults, and structures. The finished subgrade shall be within a tolerance of +/-0.08 of a foot of the grade and cross section shown, shall be smooth and free from irregularities, and shall be at the specified relative compaction.

3.09 PLACING STRUCTURAL BACKFILL MATERIAL

A. Remove form materials and trash from the excavation before placing any fill material. Obtain the specified compressive strength and finish of concrete work per Standard Specifications Section 03000 before backfilling.

B. Do not operate earthmoving equipment within 5 feet of walls of concrete structures. Place and compact backfill adjacent to concrete walls with hand-operated tampers or other equipment that will not damage the structure.

C. Place structural backfill material around piping, structures, and other areas, including authorized overexcavation areas, to the lines and grades shown or specified. Do not exceed loose lifts of 8 inches. Compact each lift to a minimum of 90% relative compaction, unless otherwise shown. Stop backfill at least 6 inches below finished grade in all areas where topsoil is to be replaced.

D. Place native earth backfill to the lines and grades shown in the areas that are not required to receive structural backfill material. Place native earth backfill in maximum 8-inch loose lifts and compact each lift to a minimum of 90% relative compaction, unless otherwise shown.

3.10 PLACING FILL MATERIAL IN EMBANKMENTS

A. Existing surfaces to receive fill material shall be keyed and benched. Excavate horizontal keys and vertical benches into the slope area to receive fill material. Keying and benching shall provide at least 10-foot wide benches and a minimum of 4 feet of vertical bench height within the firm subgrade.

B. Native earth backfill and imported fill material shall be used for embankment construction. Remove all deleterious materials. Highly organic topsoils and deleterious vegetative materials shall be segregated and not incorporated into the fill soils.

C. Place fill at optimum moisture content.

D. Place fill in maximum 8-inch lifts and compact each lift to 90% relative compaction.

E. Compact fill slopes by sheepsfoot rollers, by trackwalking with a dozer, or by other suitable equipment. Compact slopes until in-place density tests indicate a relative compaction of at least 90% at a horizontal distance of 2 feet from the slope face.

3.11 MOISTURE CONTROL OF EARTH FOR BACKFILLS AND EMBANKMENTS

During the compacting operations, maintain optimum practicable moisture content required for compaction purposes in each lift of the backfill material. Maintain moisture content uniform throughout the lift. Insofar as practicable, add water to the material at the site of excavation. Supplement by sprinkling the backfill material. At the time of compaction, the water content of the material shall be at optimum water content or within 2 percentage points above optimum. Aerate material containing excessive moisture by blading, discing, or harrowing to hasten the drying process.

3.12 FINISH GRADING

Perform earthwork to the lines and grades shown on the Drawings. Remove exposed roots and loose rocks exceeding 3 inches in diameter. Round tops of banks to circular curves to not less than a 6-foot radius. Neatly and smoothly trim rounded surfaces.

3.13 DISPOSAL OF EXCESS EXCAVATED MATERIAL

Dispose of excess excavated material offsite. Contractor shall make his own arrangements for the disposal of the excess material and bear all costs incidental to such disposal.

3.14 FINAL CLEAN-UP

After finish grading, make surfaces free of all cleared vegetation, rubbish and other construction wastes. Dispose of all exposed roots and excavated or surface rocks. Do not dispose of rocks within the work site by burying.

END OF SECTION

STANDARD SPECIFICATION
SECTION 02222 PROTECTING EXISTING UNDERGROUND UTILITIES

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and procedures for protecting existing underground utilities.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Trenching, Backfilling, and Compacting: STD SPEC 02223.

PART 2 - MATERIALS

2.01 REPLACEMENT IN KIND

Except as indicated or as specifically authorized by the District's Representative, reconstruct utilities with new material of the same size, type, and quality as that removed.

2.02 CONTRACTOR SUPPLIED TEMPORARY MATERIALS

Contractor shall supply all materials, including but not limited to, steel beams and bracing, support straps, sheeting and shoring, timbers, and all other items necessary to protect existing underground utilities.

PART 3 - EXECUTION

3.01 GENERAL

A. Replace in kind street improvements, such as curbs and gutters; fences; signs; paved surfaces; etcetera, that are cut, removed, damaged, or otherwise disturbed by the construction.

B. Where utilities are parallel to or cross the pipeline trench but do not conflict with the permanent work to be constructed, follow the procedures given below and as indicated on the Drawings. Notify the utility owner 48 hours in advance of the crossing construction and coordinate the construction schedule with the utility owner's requirements. For utility crossings not shown on the Drawings, refer to the instructions of the District's Representative for guidance.

C. Determine the true location and depth of utilities and service connections which may be affected by or affect the work. Determine the type, material, and condition of these utilities. In order to provide sufficient lead time to resolve unforeseen conflicts, order materials and take appropriate measures to ensure that there is no delay in work. Expose utilities in advance of the pipeline construction by potholing a minimum of 250 feet ahead of pipe laying.

3.02 PROCEDURES

A. Protect in Place: Protect utilities in place, unless abandoned, and maintain the utility in service, unless otherwise specified.

B. Cut and Plug Ends: Cut abandoned utility lines and plug the ends with concrete plug. Pour a concrete lug completely around the plugged end of the abandoned utility line such that the line is encapsulated with a minimum of 6 inches of concrete on all sides. Dispose of the cut pipe as unsuitable material.

C. Remove and Reconstruct: Where necessary or as required by the District's Representative, remove the utility and, after passage, reconstruct it with new materials. Provide temporary service for the disconnected utility.

3.03 COMPACTION

A. Utilities Protected in Place: Backfill and compact under and around the utility so that no voids are left. Where utilities are concrete encased, use the alternative construction method (sand slurry) for backfill around the utility.

B. Alternative Construction - Sand Slurry: Sand slurry consisting of one sack (94 pounds) of portland cement per cubic yard of sand and sufficient moisture for workability may be required for backfill to aid in reducing compaction difficulties. Submit specific methods and procedures for the review of the District's Representative prior to construction.

3.04 ADJACENT PARALLEL UTILITIES

Protect existing parallel utilities from any disturbances and repair the lines and associated appurtenances if they are damaged in any way. All costs incurred for protection of utilities or any costs incurred due to the presence of the lines, whether or not they lie within the new construction, shall be borne in full by the Contractor.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of trench excavation, backfilling, and compacting.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Clearing, Grubbing, and Stripping: STD SPEC 02110.

D. Earthwork: STD SPEC 02200.

E. Protecting Existing Underground Utilities: STD SPEC 02222.

F. Blasting: STD SPEC 02228.

G. General Concrete Construction: STD SPEC 03000.

1.03 EARTHWORK AND REPAIRS IN CITY, COUNTY, AND STATE RIGHTS OF WAY

Conform to the requirements and provisions of the permits issued by those agencies in addition to the requirements of these Standard Specifications. If a permit is not required, earthwork and repairs shall conform to the standards of the agency in whose right of way the work is done in addition to the requirements of these Standard Specifications.

1.04 SAFETY PRECAUTIONS

Observe safety precautions in all phases of the work. Included shall be trench shoring, bracing, lighting, and barricades as dictated by reason and by the Safety Orders of the Division of Industrial Safety, State of California (CAL/OSHA). Acquire an exemption letter or trenching permit from the California Division of Industrial Safety (CAL/OSHA) and comply with Labor Code Section 6705, Excavation Plans For Worker Protection. Submit a copy of the exemption letter or trenching permit with excavation drawings to the District prior to excavation work.

1.05 REGIONAL NOTIFICATION CENTER CONTACT

A. The Contractor, except in emergency, shall contact the appropriate regional notification center prior to commencing any excavation work. Notify the center at least two working days in advance or up to a maximum of 14 calendar days in advance of any excavation work. The Contractor shall delineate the proposed excavation site with white paint on paved surfacesor with marking such as flags or stakes in unpaved areas. The Contractor shall provide the regional notification center with all job site location information. The reginal notification center will assign to the Contractor a Dig Alert Number which validatesthe Contractor’s excavation permit and will notify all of its members having subsurface installations in the area. No excavation shall be commenced and carried out by the Contractor until all existing subsurface installations have been field marked and the District has been given the Dig Alert Number by the Contractor.

B. Emergency shall be defined as a sudden, unexpected occurrence, involving a clear and imminent danger, demanding immediate action to prevent or mitigate loss of, or damage to, life, health, property, or essential public services. Emergency includes such occurrences as fire, flood, earthquake, or other soil or geologic movements, as well as such occurrences as riot, accident, or sabotage (Government Code Section 4216).

C. Subsurface installation means any underground pipeline, conduit, duct, wire, or other structure operated or maintained in or across a public street or public right-of-way (Government Code Section 4216).

1.06 OBSTRUCTIONS

The Contractor's attention is directed to the possible existence of pipe and other underground improvements which may or may not be shown on the Drawings. Preserve and protect any such improvements whether shown on the Drawings or not. Expose such improvements in advance of the pipeline construction to allow for changes in the alignment as necessary. Where it is necessary to remove and replace or to relocate such improvements in order to prosecute the work, they shall be removed, maintained, and permanently replaced by the Contractor at his expense. Protect existing underground utilities in accordance with Standard Specification Section 02222.

1.07 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit a report from a testing laboratory verifying that imported material is asbestos-free and conforms to the specified gradations or characteristics.

1.08 TESTING FOR COMPACTION

A. The District or the agency having jurisdiction over the area of the work will require the Contractor to test for compaction as described below.

B. Determine the density of soil in place by the sand cone method, ASTM D 1556, or by nuclear methods, ASTM D 2922 and D 3017.

C. Determine laboratory moisture-density relations of soils by ASTM D 1557.

D. Determine the relative density of cohesionless soils by ASTM D 4253 and D 4254.

E. Sample backfill materials by ASTM D 75.

F. "Relative compaction" is the ratio, expressed as a percentage, of the inplace dry density to the laboratory maximum dry density.

G. Make excavation for compaction tests at the locations and to the depths designated by the District's Representative. Backfill and recompact the excavations at completion of testing. When tests indicate that the compaction is less than the specified relative compaction, rework and retest those areas until the specified relative compaction has been obtained.

1.09 PIPE BASE

The pipe base shall be defined as a layer of material immediately below the bottom of the pipe and extending over the full trench width in which the pipe is bedded. Thickness of pipe base shall be a minimum of 6 inches.

1.10 PIPE ZONE

The pipe zone shall include the full width of trench from the bottom of the pipe to a horizontal level 12 inches above the top of the pipe. Where multiple pipes are placed in the same trench, the pipe zone shall extend from the bottom of the lowest pipe to a horizontal level above the top of the highest or topmost pipe. Thickness of pipe zone above the highest top of pipe shall be a minimum of 12 inches.

1.11 TRENCH ZONE

The trench zone includes the portion of the trench from the top of the pipe zone to the bottom of the pavement zone or to the existing surface in unpaved areas.

1.12 PAVEMENT ZONE

The pavement zone includes the asphalt concrete and aggregate base pavement section placed over the trench backfill.

1.13 WATER FOR CONSTRUCTION

Water supplied by the District, for whatever needs and uses, shall be paid for in accordance with the rates and rules of the District. The only exception is by written agreement with the District.

PART 2 - MATERIALS

2.01 NATIVE EARTH BACKFILL--TRENCH ZONE

Native earth backfill used above the pipe zone shall be excavated fine grained materials or loose soil free of asbestos, organic matter, roots, debris, rocks larger than 6 inches in diameter, clods, clay balls, broken pavement, and other deleterious materials. Backfill material shall be so graded that at least 40% of the material passes a No. 4 sieve. The coarser materials shall be well distributed throughout the finer material. Backfill materials that are obtained from trench excavated materials to the extent such material is available, shall be either screened directly into the trench or screened during the trenching operation. If screened during trenching, the material shall be maintained free of unscreened material during the handling and backfilling process. Hand selecting of rocks from earth as it is placed into the trench will not be permitted in lieu of the specified screening. Under no circumstances will native earth backfill be allowed or used in the pipe base or pipe zone areas.

2.02 IMPORTED MATERIAL FOR BACKFILL--TRENCH ZONE

Imported material shall conform to that specified for native earth backfill or imported sand.

2.03 IMPORTED SAND--PIPE BASE AND PIPE ZONE

A. Imported sand used in the pipe base and pipe zone shall consist of natural or manufactured granular material, or a combination thereof, free of deleterious amounts of organic material, mica, loam, clay, and other substances. Under no circumstances will decomposed granite, rock dust, or native earth backfill be allowed or used in the pipe base or pipe zone areas. Imported sand shall have the following gradation or similar:

Sieve Size	Percent Passing By Weight
3/8-inch	100
No. 4	75 - 100
No. 30	12 - 50
No. 100	5 - 20
No. 200	0 - 15

B. Imported sand shall have a coefficient of permeability greater than 0.014 measured in accordance with ASTM D2434 or a minimum sand equivalent of 30 per ASTM D2419. Imported sand shall have a saturated resistivity greater than 1,000 ohm-cm, a neutral pH, and chlorides less than 100 ppm.

2.04 CRUSHED ROCK FOR BELOW GROUND INSTALLATIONS

A. Gravel or crushed rock material shall contain less than 1% asbestos by weight or volume and conform to the Standard Specifications for Public Works Construction, Section 200-1.2 and shall meet the following gradation:

	Designated Rock Size			
	1-1/2-Inch	**1-Inch**	**3/4-Inch**	**3/8-Inch**
Sieve Sizes	**Percent Passing**	**Percent Passing**	**Percent Passing**	**Percent Passing**
2 inches	100	-	-	-
1-1/2 inches	90 to 100	100	-	-
1 inch	20 to 55	90 to 100	100	-
3/4 inch	0 to 15	30 to 60	90 to 100	-
1/2 inch	-	0 to 20	30 to 60	100
3/8 inch	0 to 5	-	0 to 20	90 to 100
No. 4	-	0 to 5	0 to 5	30 to 60
No. 8	-	-	-	0 to 10

B. Use 3/4-inch size unless indicated otherwise in the Drawings.

2.05 ROCK REFILL FOR FOUNDATION STABILIZATION

Rock refill shall be crushed or natural rock having the following gradation:

Sieve Size	Percent Passing By Weight
3 inches	100
1-1/2 inches	70 - 100
3/4-inch	60 - 100
No. 4	25 - 55
No. 30	10 - 30
No. 200	0 - 15

2.06 GRANULAR MATERIAL FOR STRUCTURAL BACKFILL

A. Granular material for structural backfill shall be free of asbestos, organic materials, clay balls, and shall have the following gradation:

Sieve Size	Percent Passing By Weight
3/4-inch	100
1/2-inch	95 - 100
3/8-inch	50 - 100
No. 4	20 - 65
No. 8	10 - 40
No. 40	0 - 20
No. 200	0 - 5

B. Whenever the phrase “structural backfill material” is used in these Standard Specifications, it shall mean granular material for structural backfill as described above.

C. Excavated material may be used for structural backfill provided it conforms to the Standard Specifications for structural backfill material.

2.07 CONCRETE FOR BELOW GROUND INSTALLATIONS

A. Concrete for anchors, collars, cradles, encasements, supports, and thrust blocks shall be Class A for reinforced items and Class C for unreinforced items per Standard Specification Section 03000, except use rapid set concrete mix where indicated.

B. Provide anchor blocks at valves in pipe having rubber gasket bell and spigot or unrestrained mechanical joints.

C. Provide support blocks at valves in ductile iron pipe or steel pipe.

D. Provide thrust blocks at fittings in pipe having rubber gasket bell and spigot or unrestrained mechanical joints. Do not provide thrust blocks for ductile iron pipe with restrained joints or steel pipe having welded, flanged, or butt strap joints unless detailed on the Drawings or otherwise required.

2.08 TRENCH CUT-OFF WALLS

A. Provide ASTM C 90, Grade N-I, hollow load-bearing concrete masonry units, medium weight, moisture controlled, average compressive strength over gross area of 1,000 psi. Nominal face dimensions: 8 inches by 8 inches by 16 inches.

B. Provide ladder steel conforming to ASTM A 82.

C. Mortar and grout shall be a mixture of cement, sand, and water. Mortar shall consist of not more than one part cement to two and one-half parts sand by damp loose volume. The quantity of mixing water shall be not more than necessary for handling and placing.

2.09 REDWOOD BAFFLES

Use merchantable heart garden grade redwood per Standard Specifications for Grades of California Redwood Lumber issued by the Redwood Inspection Service. Provide seasoned or unseasoned redwood and surfaced on four sides.

2.10 WATER FOR COMPACTION

Water used in compaction shall have a maximum chloride concentration of 500 mg/l, a maximum sulfate concentration of 500 mg/l, and shall have a pH of 7.0 to 9.0. Water shall be free of acid, alkali, or organic materials injurious to the pipe or coatings. Salt water will not be allowed.

PART 3 - EXECUTION

3.01 COMPACTION REQUIREMENTS

Unless otherwise shown on the Drawings, otherwise described in the Specifications or required by the agency having jurisdiction over the area of the work, relative compaction in pipe trenches shall be a minimum as follows:

A. Pipe base--90% relative compaction.

B. Pipe zone--90% relative compaction.

C. Backfill above pipe zone not beneath paving--90% relative compaction.

D. Backfill above pipe zone in existing or new paved areas--95% relative compaction.

E. Rock refill for foundation stabilization--80% relative density.

F. Imported sand refill for overexcavation--90% relative compaction.

3.02 SHEETING, SHORING, AND BRACING OF TRENCHES

Trenches shall have sheeting, shoring, and bracing conforming with 29CFR1926, Subpart P- -Excavations, CAL/OSHA requirements, and the District's requirements.

3.03 SIDEWALK, PAVEMENT, AND CURB REMOVAL

Cut and remove bituminous and concrete pavements regardless of the thickness, and curbs and sidewalks prior to excavation of the trenches with a pavement saw, hydrohammer, or pneumatic pavement cutter. Width of the pavement cut shall be at least equal to the required width of the trench at ground surface. Haul pavement and concrete materials from the site. Do not use for trench backfill.

3.04 BLASTING

Perform blasting operations in accordance with Standard Specification Section 02228.

3.05 DEWATERING

Provide and maintain means and devices to remove and dispose of all water entering the trench excavation during the time the trench is being prepared for the pipelaying, during the laying of the pipe, until cement mortar of exterior joints has set hard, when concrete is being deposited and during the hydration process, and until the backfill at the pipe zone and trench zone has been completed. These provisions shall apply during the noon hour as well as overnight. Dispose of the water in a manner to prevent damage to adjacent property and in accordance with regulatory agency requirements. Do not drain trench water through the pipeline under construction.

3.06 MATERIAL REPLACEMENT

Remove and replace any trenching and backfilling material which does not meet the Specifications, at the Contractor's expense.

3.07 TRENCH WIDTHS

A. Pipe trench widths in the pipe zone for water pipelines will be limited as follows:

Pipe Diameter	Minimum Trench Width	Maximum Trench Width
1" through 8"	O.D. + 12"	O.D. + 18"
10" through 16"	O.D. + 16"	O.D. + 24"
18" through 24"	O.D. + 20"	O.D. + 36"
27" through 36"	O.D. + 24"	O.D. + 48"

B. Trench width at the top of the trench will not be limited except where width of excavation would undercut adjacent structures and footings. In such case, width of trench shall be such that there is at least 2 feet between the top edge of the trench and the structure or footing. Where shoring or encasement is required, trench widths shall be increased accordingly.

C. Pipe trench widths for sewer pipelines shall be the sewer pipe outside diameter plus 12 inches minimum and 16 inches maximum.

3.08 TRENCH EXCAVATION

A. Perform all excavation regardless of the type, nature, or condition of the material encountered to accomplish the construction. Do not operate excavation equipment within 5 feet of existing structures or newly completed construction. Excavate with hand tools in these areas.

B. Excavate the trench to the lines and grades shown on the Drawings with allowance for pipe thickness, sheeting and shoring if used, and for pipe base. If the trench is excavated below the required subgrade, refill any part of the trench excavated below the subgrade at no additional cost to the District with imported sand. Place the refilling material over the full width of trench in compacted layers not exceeding 6 inches deep to the established grade with allowance for the pipe base.

C. Trench depth shall accommodate the pipe and the pipe base at the elevations shown in the profile on the Drawings. In the absence of such profile, the top of pipe shall be located 4 feet below the surface elevation of the centerline of the street or 3 feet below existing ground at the pipe location, whichever is lower.

D. Construct trenches in rock by removing rock to a minimum of 6 inches below bottom of pipe and backfilling with imported sand.

3.09 TRENCH EXCAVATION IN BACKFILL OR EMBANKMENT AREAS

Construct trench excavation for pipe or pipes in backfill or embankment areas in accordance with one of the following procedures:

A. Construct and compact the embankment to an elevation of 1-foot minimum over the top of the largest pipe to be installed. Excavate trench in the compacted embankment. Place pipe base material, install pipe, and backfill with pipe zone material. Construct embankment as specified in the Standard Specification Section 02200.

B. Excavate trench in the completed backfill or embankment. Place pipe base material, install pipe, and backfill with pipe zone material. Place and compact backfill above the pipe zone to the same relative compaction as the adjacent embankment as specified in the Standard Specification Section 02200.

3.10 LOCATION OF EXCAVATED MATERIAL

During trench excavation, place the excavated material only within the working area or within the areas shown on the Drawings. Do not obstruct any roadways or streets. Conform to federal, state, and local codes governing the safe loading of trenches with excavated material.

3.11 LENGTH OF OPEN TRENCH

A. Limit the length of open trench to 300 feet in advance of pipelaying or amount of pipe installed in one working day.

B. Complete backfilling and temporary or first layer paving not more than 120 feet in the rear of pipelaying.

C. Where pipelines are located beneath or adjacent to existing paved roads, backfill all trenches at the end of each workday and place temporary or first layer of paving. Clean all new and adjacent existing paved surfaces of residual excavated and backfill materials. Perform dust control operations in these areas with a self-loading motor street sweeper with operational spray nozzles at least once each working day for the purpose of keeping paved areas clean.

D. Where open trenches are not required to be backfilled at the end of the day per these Standard Specifications but in the opinion of the District's Representative pose a hazard to the public, the trench shall be surrounded with temporary chain link fence panels or be backfilled.

E. Provide ingress and egress to buildings and property at all times. Provide steel covering for vehicular access.

3.12 TEMPORARY STEEL PLATE BRIDGING

A. When backfilling operations of an excavation in the traveled way, whether transverse or longitudinal, cannot be properly completed within a workday, provide steel plate bridging with a nonskid surface and shoring to preserve unobstructed traffic flow. In such cases, the following conditions shall apply:

1. Shore the trench to support the bridging and traffic loads.

2. Steel plates used for bridging shall extend a minimum of 12 inches beyond the edges of the trench.

3. The pavement shall be cold planed to a depth equal to the thickness of the plateand to a width and length equal to the dimensions of the plate.

4. Install steel plate bridging to operate with minimum noise.

B. Maintain the steel plates and shoring.

C. Unless specified, use of steel plate bridging at any given location shall not exceed four consecutive days in any given week.

D. The following table shows the required minimal thickness of steel plate bridging required for a given trench width:

Trench Width (feet)	**Minimum Plate Thickness (inches)**
1	1/2
1-1/2	3/4
2	7/8
3	1
4	1-1/4

E. For spans greater than 4 feet, prepare a structural design by a registered civil engineer and submit to the District's Representative for review.

F. Design steel plate bridging for HS20-44 truck loading per Caltrans Bridge Design Specifications Manual. Maintain on the steel plate a nonskid surface having a minimum coefficient of friction equivalent to 0.35 as determined by California Test Method 342. The Contractor may use standard steel plate with known coefficient of friction equal or exceeding 0.35.

G. Use a Rough Road sign (W33) with black lettering on an orange background in advance of steel plate bridging. This is to be used along with any other required construction signing.l

3.13 FOUNDATION STABILIZATION

After the required excavation has been completed, the District's Representative will inspect the exposed subgrade to determine the need for any additional excavation. It is the intent that additional excavation be conducted in all areas within the influence of the pipeline where unacceptable materials such as soft, spongy or deleterious materials exist at the exposed grade. Overexcavation shall include the removal of all such unacceptable material that exists directly beneath the pipeline to a minimum width equal to the maximum trench width and to a depth determined by the District's Representative. Backfill the trench to the established subgrade of the pipe base with rock refill material for foundation stabilization. Place the foundation stabilization material over the full width of the trench and compact in layers not exceeding 6 inches deep to the required grade. Place imported sand on the compacted foundation stabilization and apply water to wash the sand into the voids of the rock refill material. Continue this procedure until the voids of the rock refill have been filled with imported sand. Do not apply water in such quantities that it will damage the integrity of the foundation stabilization. Rock refill material and imported sand may be placed and compacted at the same time.

3.14 CONCRETE FOR BELOW GROUND INSTALLATIONS

A. Encase pipe with concrete to the line and dimensions indicated or place concrete between the undisturbed ground and the pipe or fittings to be restrained or supported. Quantity or bearing area of the concrete against undisturbed ground shall be as shown on the Standard Drawings, Drawings, or as directed by the District's Representative. Provide temporary support on the pipe, fittings, or valves until the concrete has obtained a 3-day cure. Place concrete such that the pipe joints, fittings, or valves are accessible for repairs. Spade or rod the concrete during placement to eliminate honeycombing. Prior to backfilling of the trench adjacent to the concrete, remove all formwork from the trench including sandbags used in the work. Backfilling of the trench adjacent to the concrete will not be allowed until the concrete has cured for at least 3 days. Allow concrete to cure for at least 7 days prior to subjecting the concrete to pipeline pressure. Where rapid set concrete mix has been used, the 3-day and 7-day cure time is not required. Backfill the rapid set concrete mix as soon as the concrete is hard (approximately one to two hours) and place pipeline into service.

B. The bearing area of a thrust block shall be calculated as follows:

Height of concrete block = $\sqrt{\dfrac{Bearing\ \ Area}{2}}$

Width of concrete block = 2 x height

The height and width of the concrete block shall be centered on the pipe and bear against undisturbed ground.

3.15 TRENCH CUT-OFF WALLS

Install trench cut-off walls at the locations shown on the Drawings, and at 25 feet on center on slopes 35-percent and steeper. Hand cut trench walls to form a neat slot into which the concrete blocks can be laid as tight as possible to the downhill side. Place concrete blocks in horizontal layers and reinforce with ladder steel as the wall is laid. Lay blocks full-bedded in mortar to prevent leakage of grout. All head joints shall be solidly filled with mortar. Cut blocks to fit around the pipe and mortar in place. Provide weep holes in the wall to relieve hydrostatic pressure. Provide one 1/2-inch diameter weep hole for each 1.5 square foot of wall in the trench pipe zone. Grout solid all cells of the wall. Place backfill in layers being evenly brought up on each side of the cut-off wall. Compact by hand tamping. Give special attention to placing backfill in slot in trench walls.

3.16 TRENCH BACKFILLING

A. Place the specified thickness of pipe base material (imported sand) over the full width of trench and compact to the specified relative compaction. Grade the top of the pipe base ahead of the pipelaying to provide firm, continuous, uniform support along the full length of the trench for the pipe, fittings, and valves.

B. Excavate bell holes at each joint to permit proper assembly and inspection of the entire joint. Fill and compact the area excavated for the joints with the pipe base material.

C. After the pipeline has been bedded and the cement mortar used in the exterior joints has set hard, place pipe zone material (imported sand) simultaneously on both sides of the pipe, fittings, and valves, keeping the level of backfill the same on each side. Carefully place the material around the pipe so that the pipe barrel is completely supported and that no voids or uncompacted areas are left beneath the pipe. Use particular care in placing material on the underside of the pipe to prevent lateral movement during subsequent backfilling. Do not drop sharp, heavy pieces of material directly onto the pipe or the tamped material around the pipe.

D. Compact imported sand in the pipe zone by hand tamping only. Care shall be exercised in backfilling to avoid damage to pipe coatings and polyethylene encasement.

E. Push the native earth backfill or imported material for backfill carefully onto the imported sand previously placed in the pipe zone. Do not permit free fall of the material until at least 2 feet of cover is provided over the top of the pipe. Compact backfill material in the trench zone to the specified relative compaction by mechanical compaction or hand tamping.

F. Place and compact imported sand in the pipe zone in layers not exceeding 12 inches of compacted thickness. Place and compact native earth or imported material for backfill in the trench zone in layers not exceeding 6 inches of compacted thickness.

3.17 MECHANICAL COMPACTION OR HAND TAMPING

Place imported sand and backfill materials in uniform layers of the indicated thickness. Compact each layer to the required minimum relative compaction at the optimum moisture content. Do not use heavy duty compaction equipment with an overall weight in excess of 125 pounds until backfill has been completed to a depth of 2 feet over the top of pipe. Do not use high impact hammer type equipment except where the pipe manufacturer warrants in writing that such use will not damage the pipe.

3.18 DISPOSAL OF EXCESS EXCAVATED MATERIAL

Dispose of excess excavated material offsite. Contractor shall make his own arrangements for the disposal of the excess material and bear all costs incidental to such disposal. In open terrain, excess material may be disposed of within the right of way by spreading, provided that rocks or lumps which cannot be readily covered by spreading are removed.

3.19 FINAL CLEAN-UP AND REDWOOD BAFFLES

A. After backfilling, grade the right-of-way to the contours of the original ground and match the adjacent undisturbed ground. Make surfaces free of all cleared vegetation, rubbish and other construction wastes. Dispose of all excavated or surface rocks and lumps which cannot be readily covered by spreading. On slopes 35-percent and steeper or where rainfall would create an erosion problem as determined by the District's Representative, provide redwood baffles across the backfilled trench at the locations shown on the Standard Drawings, Drawings, or as directed by the District's Representative. Place baffles in a vertical position across the backfilled trench and level with the contours of the slope.

B. Replace in kind street improvements, such as curbs and gutters, barricades, traffic islands, signalization, fences, signs, mail boxes, etcetera that are cut, removed, damaged, or otherwise disturbed by the construction.

3.20 SLOPE PROTECTION

A. Prepare and seed all open ground within the easement or working area disturbed by the construction, not otherwise protected from erosion, or as determined by the District's Representative. After final clean-up, cultivate areas to be seeded to break up any compaction resulting from grading operations.

B. The seed mix shall be specifically developed for the area of application and shall be as shown on the Drawings. The intent of this instruction is to provide a seed mix design that is environmentally compatible with the surrounding habitat.

END OF SECTION

STANDARD SPECIFICATION
SECTION 02228 BLASTING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section includes procedures for blasting for excavation. The use of explosives during construction shall be as specified herein. However, no blasting will be permitted which, in the blasting supervisor's judgment or the judgment of the District's Representative, may be detrimental to existing facilities or pipelines.

B. The Contractor shall be liable for all injuries to, or death of, persons, or damage to property caused by a blast or explosive, and he agrees by submission of a bid to indemnify and hold the District, its officers, agents, employees, volunteers and project consultants harmless from any and all liability claims, costs, expenses including expenses of investigation and defending against the same in regard thereto.

C. Blasting may be proposed by the Contractor as a means of excavating rock, but may not be allowed by the District. At least 28 calendar days in advance of any proposed blasting, Contractor shall submit to the District a request for permission to blast that includes a general description of the proposed blasting activities, and the approximate location(s) and volume(s) of rock to be removed by blasting. The request shall be submitted in accordance with Standard Specification Section 01300 for approval by the District. If the request for blasting is not approved by the District, then rock must be removed by means other than blasting. If the request for blasting is approved by the District, then the procedures for blasting shall conform to the requirements described herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Record Drawings and Submittals: STD SPEC 01300.

B. Earthwork: STD SPEC 02200.

C. Trenching, Backfilling, and Compacting: STD SPEC 02223.

1.03 REFERENCES

Comply with the applicable rules, regulations and standards established by the Regulatory Agencies, codes and professional societies listed herein, including rules and regulations for storage, transportation, and use of explosives.

A. Whenever blasting operations are in progress, explosives shall be stored, handled and used as provided in: the Federal Occupational Safety and Health Act of 1970 and the Construction Safety Act of 1969, as amended; Safe Explosives Act, Title XI, Subtitle C of Public Law 107-296, Interim Final Rule; and Organized Crime Control Act of 1970, Title XI, Public Law 91-452, Approved October 15, 1970, as amended; and California Occupational Safety and Health Administration (Cal OSHA) – Division of Mining and Tunneling rules.

B. Ensure that all explosive deliveries to work sites are done in compliance with recent rules and regulations issued by the Department of Transportation (DOT) and the Transportation Security Administration (TSA) on commercial transportation of explosives pursuant to the mandates of the USA PATRIOT ACT of 2001. Under TSA rules, commercial drivers with hazardous materials endorsement shall undergo a personal background records check, training and testing.

C. Comply with all the applicable provisions of OSHA of 1970, 29 U.S.C., Section 651 et seq., including safety and health regulations for construction.

D. U.S. Code of Federal Regulations (CFR)

1. CFR 27, U.S. Department of Justice, Alcohol, Tobacco, Firearms and Explosives Division (ATF). 27 CFR Part 555, Implementation of the Safe Explosives Act, Title XI, Subtitle C of Public Law 107-296; Interim Final Rule.

2. Organized Crime Control Act of 1970, Title XI, Public Law 91-452, Approved October 15, 1970, as amended.

3. CFR 49, Parts 100-177 (DOT RSPA); 301-399 (DOT FHA).

4. Federal Occupational Safety and Health Act of 1970, as amended.

5. Construction Safety Act of 1969, as amended.

E. State Agencies:

1. California Code of Regulations (CCR)

a. Title 8, Chapter 4, Subchapter 20, Tunnel Safety Orders.

b. Title 8, General Industry Safety Orders, Subchapter 7, Group 18. Explosives and Pyrotechnics.

F. Non-regulating Industry Support Organizations:

1. Vibration Subcommittee of the International Society of Explosive Engineers (ISEE), blast monitoring equipment operation standards (1999).

2. IME (Institute of Makers of Explosives) Safety Library Publications (SLPs).

1.04 DEFINITIONS

A. Peak Particle Velocity (PPV): The maximum of the three ground vibration velocities measured in the vertical, longitudinal and transverse directions. Velocity units are expressed in inches per second (ips).

B. Air-Overpressure: Temporary changes in ambient air pressure caused by blasting. Air-overpressure is expressed in units of psi or dB or dBL (linear decidel scale). Measurements for blasting are made with microphones having a flat frequency response for over-pressure in the 2 to 200 Hz range. A- weight or C-weight microphones shall not be used for these measurements.

C. Occupied Building: Structure on or off construction limits that is occupied by humans or livestock.

D. Residential Building: Includes single and multiple family dwellings, hotels, motels and any other structure containing sleeping quarters.

E. Scaled Distance: A factor describing relative vibration energy based on distance and charge-per-delay. For ground vibration control and prediction purposes, Scaled Distance (Ds) is obtained by dividing the distance of concern (D) by the square root of the charge-per-delay (W), Ds = D/(W)0.5. Minimum scaled distance limits are used to establish charge weights and the units of scaled distance (Ds) are ft-lb-0.5.

F. Charge-per-Delay: For vibration control, any charges firing within any 8-millisecond time period are considered to have a cumulative effect on vibration and air-overpressure effects. Therefore, the maximum charge-per-delay (W) is the sum of the weight of all charges firing within any 8-millisecond time period. For example, if two 10-lb. Charges fire at 100 ms and one 15-lb charge fires at 105 ms, the maximum charge per delay would be 35 lbs.

G. Production Holes: Blast holes in the main body of the rock mass being removed by drilling and blasting.

H. Stemming: Crushed stone, tamped clay or other inert earth material placed in the unloaded collar area of blastholes for the purpose of confining explosive charges and limiting rock movement and air-overpressure (airblast).

I. Primary Initiation: The method whereby the blaster initiates the blast(s) from a remote and safe location. Primary initiation systems use pneumatic tubing or shock-tubes to convey firing energy from blasters to blast locations.

J. Sub-drilling: The portion of the blasthole that is drilled below or beyond the desired excavation depth or limit. Subdrilling is generally required to prevent the occurrence of high or tight areas of unfractured rock between blastholes.

K. Prohibited Persons: Persons prohibited from handling or possessing explosive materials as defined by the seven categories described in Section 555.11 of 27 CFR (ATF Rules).

L. Delay: A distinct pause of pre-determined time between detonations of single charges or groups of charges.

M. Blaster-in-Charge or Blasting Supervisor: The single designated and licensed person with complete responsibility and total authority over all decisions involving safe handling, use and site storage of explosives.

1.05 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit Safety Plan for the Use of Explosives that meets all requirements of paragraph 1.06, E.

C. Submit Blasting Control Plan meeting requirements of paragraph 1.06, J.

D. Submit after blast reports meeting all requirements of paragraph 1.06, R.

E. Submit copies of all required blasting permits.

1.06 PERMITS, SAFETY ORDERS AND RECORDS

A. No drilling or blasting work shall be performed until the Contractor's Safety Plan and Blasting Control Plan for such operations has been submitted and approved by the District's Representative.

B. Prior to any blasting by the Contractor for the work, obtain the blasting permits required by San Diego County, the State of California, and any applicable agency having jurisdiction. Notify the fire district, local fire department, and utilities in the general blast area. The San Diego Sheriff's Department requires prior notification of any blasting work. The assigned USA Dig Alert construction project notification number, date and blast area location are required on the permit application from the Sheriff's Department. A copy of all permits required shall be submitted to the District's Representative prior to drilling for blasting.

C. The transporting, handling, storage, and use of explosives shall conform to the requirements specified in the General Industry Safety Orders of the California Division of Industrial Safety; provided, that if the amount of explosives to be transported exceeds 1,000 pounds, a permit to transport shall be secured from the California Highway Patrol; and further provided, that the locations, access, and construction of all explosive storage magazines shall be in accordance with the American Table of Distances for Storage of Explosives and approved by the District's Representative.

D. Comply with the requirements specified in the General Industry Safety Orders of the California Division of Industrial Safety.

E. At a minimum of 14 days prior to the commencement of any work involving explosives, including drilling, submit a complete Safety Plan For The Use Of Explosives. A Blasting Safety Plan simply stating: “all regulations will be followed” will not be acceptable. Blasting Safety Plan shall include:

1. A complete list of all authorities having jurisdiction over operations involving the transportation, storage, handling and use of explosives.

2. A printed copy of all applicable federal, state and local regulations governing the use and storage of explosives for this work shall be attached to the Blasting Safety Plan.

3. Copies of all required blasting permits regarding explosive use and storage.

4. Copies of California Blasting Licenses, including proper initiation system and construction blasting endorsements, for all blasters overseeing blasting operations.

5. A list of at least three previous projects of similar character, successfully completed. List shall include contact names and phone numbers of the owner’s responsible project manager or engineer.

6. A complete description of the clearing and guarding procedures that will be employed to ensure personnel, staff, visitors, and all other persons are at safe locations during blasting. This information shall include details regarding visible warning signs or flags, audible warning signals, method of determining blast areas (all areas affected by any potentially harmful blast effects), access blocking methods, guard placement and guard release procedures, primary initiation method, and the system by which the blaster-in-charge will communicate with site security guards.

7. A detailed description of how explosives will be: 1) kept in day-storage-boxes when on site, and 2) transported and used at the various project work areas. Plans shall explain how day-storage magazines and explosive transport vehicles will satisfy all applicable ATF, OSHA, federal, CalOSHA, and San Diego County regulations. This plan shall also indicate how explosives will be inventoried, secured and guarded to prevent theft or unauthorized use.

8. Include Material Safety Data Sheets (MSDS) and specific details about hazard communication programs for employees.

9. Equipment that will be used to monitor the approach of lightning storms and in the event of such, evacuation and site security plans.

10. Detailed contingency plans for handling of misfires caused by cutoffs or other causes.

F. A minimum of 14 days prior to commencement of any blasting operations, the Contractor shall be responsible for all notification required by his permits, but shall at a minimum notify all residences within 600 feet of any blast at least 24 hours prior to the blast. Contractor shall be responsible for inspection of structures as required by his permits prior to the blast.

G. A blasting supervisor licensed by the State of California, Division of Industrial Safety, and acceptable to the District's Representative shall be on the site, and in immediate charge of the blasting operations. The license of the supervising blaster(s) shall contain endorsements for construction blasting and use of non-electric initiation systems. Such supervisor shall have no less then three years of continuous experience in controlled blasting on projects of similar character. A written description of the education and experience of this supervisor shall be submitted to the District's Representative. The description shall be specific and include references who are able to verify the details.

H. The Contractor shall retain the services of an outside Consultant regarding the prediction and control of ground vibration and air-overpressure. Such Consultant shall not be in the employ of the Contractor and shall be subject to the approval of the District's Representative. Consultant's qualifications shall be submitted to the District's Representative in writing as part of the Blasting Control Plan.

I. Proper criteria and blast effects limitations for any given location and any given structures, residences, utilities, and any other facilities shall be evaluated and determined by the Contractor and by the approved Blasting Consultant.

J. Submit a Blasting Control Plan to the District's Representative. No blasting operation, including drilling, shall start until the District has reviewed and approved the Blasting Control Plan. Allow not less than two weeks for District review of the Plan. In the event that additional or revised Blasting Control Plans are required, provide at least two weeks for the review of each additional plan. Approval of the Contractor's Blasting Control Plan or blasting procedures shall not relieve the Contractor of any of his responsibility for assuring the complete safety of his operations or for the successful completion of the work in conformity with the requirements of the Drawings and Standard Specifications. The Blasting Control Plan shall include:

1. Details of controlled blasting techniques. Include plan and vertical section drawings showing hole locations, spacing, diameter and loading details for typical blastholes charges.

2. All blast plan drawings shall indicate explosive types, amounts, priming method, initiator types, delay periods, and locations, charge firing times, stemming type and quantities, and typical charge weights.

3. Plans for preventing overbreak or ground shifting that could threaten adjacent buried utilities. Plan shall include calculations showing predicted levels of vibration not exceeding 5.0 in/s at the nearest buried pipe.

4. Methods of drilling, including equipment descriptions, and hole placement and alignment techniques.

5. Hole Charging Methods: Primer make-up, placement of charges and inert stemming and method of securing detonators until tie-in.

6. Initiation system hook-up methods and method of primary initiation.

7. Methods for preventing spills or losses of explosives, drilling fluids, oil, or any other pollutants to ground during all handling and hole charging operations. Include details of all containment and contingency plans for quickly and effectively cleaning up any spilled materials.

8. Method of safe and approved disposal of all explosive packaging materials.

9. Copies of: 1) blasting permits, 2) blasters' licenses, and 3) explosive transporters' commercial driver’s licenses with Hazmat endorsements.

10. The Blasting Control Plan shall indicate the type and method of instrumentation proposed to determine the ground motion particle velocity and air blast overpressure. The description shall include the manufacturer and model of the instrumentation, the source of the instrumentation (rented or owned and by whom). Include copies of calibration certificates issued by the equipment maker that confirm the instruments and transducers have been calibrated within the last 12 months.

K. A minimum of two portable seismographs shall be available for use on the project at all times. The seismographs shall be capable of producing a permanent record and shall meet the following technical standards.

1. Equipment for on-site and off-site particle velocity and air overpressure monitoring shall be 4-channel (1 overpressure and 3 seismic channels) units capable of digitally storing collected data. Equipment shall be capable of printing ground motion time histories and summaries of peak motion intensities and frequencies. Printed report

records shall also include date, time of recording, operator name, instrument-number and date of last calibration.

2. Instruments shall have a flat frequency response between 2 and 250 Hz for particle velocity and from 2 to 200 Hz for air overpressure.

3. The digitizing sampling rate for peak particle velocity and air overpressure measurements shall be least 1,024 samples per second.

4. Seismographs used for off-site compliance monitoring shall be capable of recording overpressure from 88 to 148 dBL, and particle velocity from 0.05 to 5.0 in/sec.

5. Systems shall be capable of providing printed event reports that include all peak measurements, frequencies and complete waveform plots.

6. Seismographs shall have adequate memory to digitally record events of the blast-induced motion lasting up to five seconds.

7. All seismograph software systems shall be capable of saving back-up copies of all event files on floppy or Zip disks in file formats supported by software that can open and interpret stored data. Upon request of the District's Representative the Contractor shall provide a licensed copy of the appropriate software, and all monitoring data files, to the District.

8. Seismographs shall be provided by:

   a. White Industrial Seismology Inc. (303) 324-4116,

   b. Nomis Seismographs. (205) 592-2466,

   c. GeoSonics/Vibr-Tech. (724) 934-2900, or

   d. Instantel. (425) 888-5425.

L. All vibration and air-overpressure measuring equipment shall be used in accordance with the standards established by the Vibration Section of The International Society of Explosives Engineers (ISEE). The following standards shall be applied when measuring blast-induced vibration and air-overpressure.

1. General Guidelines for Vibration and Air-Overpressure Measuring Equipment:

   a. Only personnel who have successfully completed a proper training course shall operate monitoring equipment.

   b. The recording units and sensor instruments shall be calibrated. Documenting certificates shall be kept on file and copies shall be provided to District's Representative upon request.

   c. When employing instruments to operate in auto-trigger-mode, trigger levels shall be set low enough to record blast effects. If expected levels of blast noise or vibration do not exceed minimum trigger levels, the instrument shall be attended by an operator and turned on manually.

d. The horizontal distance from the seismograph to the blast shall be known to at least two significant digits. For example, a blast within 1000 feet would be nearest tens of feet and a blast within 10,000 feet would be measured to the nearest hundreds of feet. Where the vertical-to-horizontal ground slope ratio exceeds 2.5 to1, slant distances or true distance shall be used and recorded in the monitoring records.

e. When instruments are used in auto-trigger and continuous-recording mode to record the effects of multiple blasts, the time between successive blasts shall be at least one (1) minute and seismographs shall be set to NOT automatically print out event records. These procedures shall ensure that instruments have adequate time to save event data for each blast and reset to monitoring mode before subsequent blasts occur.

f. The memory or record capacity of the seismograph shall be sufficient to store the event data from the blast(s) planned during that operating day.

g. Instruments shall be set to save full waveform data for all monitored blast and digitally saved event files shall contain this data for use in further analyses if needed.

h. In order to prevent false triggering, suspended or freely moving cables shall be secured from movement by the wind or other extraneous sources.

2. Ground Vibration Monitoring:

a. Sensor Placement

1) Place the sensor on or in the ground on the side of the structure towards the blast. A structure can be a house, pipeline, telephone pole, etc. Measurements on driveways, walkways, and slabs are to be avoided where possible.

2) Place the sensor within 10 feet of the structure or less than 10% of the distance from the blast, whichever is less.

3) Avoid placing velocity transducers in loose or low-density soils. The density of the ground shall be greater than or equal to the sensor density.

4) Place transducers so they are level or nearly level.

5) Orient sensor blocks so the arrow indicating the longitudinal direction is aimed at the blast location.

6) Where access to a structure is not available, place the transducers at the accessible location closest to the structure of concern and in line with the blast.

b. Sensor Coupling

1) Based on expected acceleration as determined from ISEE Standards (see Table 1 below), use the following methods to couple vibration transducers to the ground or structure to avoid decoupling errors:

   a) Less than 0.2 g: No burial or attachment is necessary.

   b) Between 0.2 and 1.0 g: Transducer shall be attached to the ground with a spike or covered with a sand bag.

   c) Greater than 1.0 g: Transducer shall be buried, bonded to the ground or structure with stiff clay or putty, or some other method that shall achieve firm attachment.

Table 1: Acceleration Intensity (g's) Based on Estimated Particle Velocities and Frequencies

	Maximum Frequency (Hz or cycles-per-second)										
	4	10	15	20	25	30	40	50	100	150	200
PPV (in/s) at Acc. (g) ≥ **0.2**	3.08	1.23	0.82	0.62	0.49	0.41	0.31	0.25	0.12	0.08	0.06
PPV (in/s) at Acc. (g) ≥ **1.0**	15.38	6.15	4.10	3.08	2.46	2.05	1.54	1.23	0.62	0.41	0.31

2) Employ the following methods for sensor burial:

   a) Excavate a hole that is no less than three times the height of the sensor (ANSI S2.47-1990, R1997).

   b) If possible, spike the sensor to the bottom of the hole.

   c) Firmly compact soil around and over the sensor.

3) Employ the following methods for attaching sensors to bedrock or hard structural surfaces:

   a) Bolt, clamp or use epoxy or putty to firmly couple the sensor to the hard surface.

   b) The sensor may be attached to the foundation of the structure if it is located within +/- 1-foot of ground level (USBM RI 8969). This method shall only be used if burial, spiking or and bagging is not practical.

4) If disturbance of the ground is not possible, cover transducers with sand bags loosely filled with about 10 pounds of sand. When placed over the sensor, the sandbag profile shall be as low and wide as possible with a maximum amount of firm contact with the ground. If possible also spike the sensor to the ground.

c. Programming Considerations for Ground Vibration Monitoring:

1) The PPV ground motion trigger-level shall be programmed low enough to trigger the unit from blast vibrations and high enough to minimize the occurrence of false events. The level shall be slightly above the expected background vibrations for the area.

2) If PPV is expected to exceed 10 in/s or frequency is expected to exceed 250 Hz, special sensors shall be used to measure blast effects. A digital sampling rate shall be used that provides accurate recordings. The approach shall be described in the Blasting Plan.

3) Set the record time for 2 seconds longer than the blast duration plus 1 second for each 1100 feet from the blast.

3. Air-Overpressure Monitoring:

a. Microphone Placement:

1) Place the microphone along the side of the structure nearest the blast.

2) Cover the microphone with a windscreen and mount it near the velocity transducers.

3) The preferred microphone height is 3 feet above the ground or within 1.2 inches of the ground. If other heights are to be used, describe them in the Blasting Plan. (ANSI S12.18-1994, ANSI S12.9-1992/Part2) (USBM RI 8508)

4) If possible, the microphone shall not be shielded from the blast by nearby buildings, vehicles or other large barriers. If such shielding cannot be avoided, the horizontal distance between the microphone and shielding object shall be greater than the height of the shielding object above the microphone.

5) If microphones are placed too close to a structure, the airblast may reflect from the house surface and record higher amplitudes. Structure response noise may also be recorded. Place the microphone near a corner of the structure in order to minimize reflection of over-pressure energy. (USBM RI 8508).

b. Programming Considerations for Air-Overpressure Monitoring:

1) When only an airblast measurement is desired, set the trigger level low enough to trigger the unit from the airblast and high enough to minimize the occurrence of false events. The level shall be slightly above the expected background noise for the area.

2) When only recording airblast, set the recording time for at least 2 seconds more than the blast duration. When ground vibrations and air-overpressure measurements are desired on the same record, set the record time for 2 seconds longer than the blast duration plus 1 second for each 1100 feet from the blast.

M. Design of drilling and blasting patterns, explosive types, and quantities shall be at the Contractor's choice; provided, that non-electric initiation devices shall be used and the ground motion limitations as specified herein are met with respect to explosive detonated per delay period; and provided further, that non-nitroglycerin explosive types are used in wet ground conditions, unless the dynamite is phlegmatized (i.e. PowerDitch 1000).

N. Approval of the Contractor's Blasting Control Plan shall not relieve the Contractor of any of his responsibility under the Contract for assuring the complete safety of his operation with respect to adjacent improvements so as to not aggravate the existing structural conditions or cause damage, or for the successful completion of the work in conformity with the requirements of the Drawings and Standard Specifications. Such approval shall not operate to waive any of the requirements of the Standard Specifications nor relieve the Contractor of any regulation or permit obligation thereunder.

O. As production blasting operations progress, the drilling and blasting procedures shall be determined only by satisfactory results achieved. If a drilling and blasting program results in unacceptable results, devise and employ methods which will improve results. The revision may include special methods such as, but not limited to, zone blasting, shorter holes, different delay patterns, reduction in size of individual blasts, smaller diameter blast holes, closer spacing of blast holes, or reduction of explosives as necessary to improve results.

P. Regardless of the ground motion and air-overpressure limits set forth herein, controlled blasting shall be conducted in a manner which will produce relatively smooth and sound rock faces at the final excavation lines. The type, distribution and quantity of explosive detonated per delay period shall be such that existing rock fractures will neither be opened nor new fractures created outside of the minimum excavation limits. Whenever, in the opinion of the District's Representative or independent Inspector, further blasting is liable to reduce rock stability or damage pipelines or other structures, the Contractor shall cease blasting and continue to excavate the rock by approved mechanical means. Excessive blasting or "overshooting" will not be permitted, and any material outside the authorized cross-section which may be shattered or loosened by blasting shall be removed and replaced with acceptable materials at the Contractor's expense.

Q. Blasting shall be done only by properly trained workers under the direct supervision of a State-licensed Blasting Supervisor. Blasting shall be done only when proper precautions are taken for the protection of persons, the work, and existing structures. Any damage done to persons, private property, the work, or existing structures shall be the responsibility of the Contractor.

R. Keep accurate records of each blast. Blasting records shall be available to the District's Representative at all times and shall contain the following data as a minimum:

   1. Blast identification by numerical and chronological sequence.

   2. Location (referenced to pipeline stationing), date and time of blast.

   3. Type of material blasted.

   4. Number of holes, burden and spacing.

   5. Diameter and depth of holes.

6. Height or length of stemming.
7. Types of explosives used.
8. Types of caps and delay periods used.
9. Total amount of explosives used.
10. Maximum amount of explosives per delay period of 9 milliseconds or greater.
11. Powder factor (pounds of explosive per cubic yard of material blasted).
12. Method of firing and type of circuit.
13. Weather conditions (including wind direction).
14. Direction and distance to nearest structure or position of concern.
15. Type and method of instrumentation.
16. Location and placement of instruments by plotting numbered locations on scaled maps to within +/- 1 foot where the equipment was placed.
17. Instrumentation records and calculations for determination of ground motion particle velocity or for charge size based on scaled distance.
18. An ongoing log-log plot of both vibration and air blast data. The Contractor or his consultant shall maintain an ongoing log-log plot of both ground vibration and air blast overpressures, and shall submit an updated plot to the District's Representative after each blast, highlighting the newest data.
19. Measures taken to limit air overpressure and fly rock.
20. Any unusual circumstances or occurrences during blast.
21. Name of Contractor.
22. Name, license number and signature of responsible Blasting Supervisor.
23. Summary report of all complaints including complaints regarding blasting-related damage.
24. Method to notify other contractors, personnel on-site of a scheduled blast.
25. Provide a summary report of all complaints, including complaints regarding blast-related damage.
26. Within 24 hours after each blast, Contractor shall submit to the District's Representative a summary report addressing items 1 through 25 above for compilation in a three-ring binder and have the Contractor's current blast reports so compiled and available for immediate review by authorities having jurisdiction, including the District and the District's Representative.

PART 2 - MATERIALS

Furnish materials and equipment required for blasting operations and monitoring. Material usage, including transportation and storage, shall conform to all applicable regulatory agency and permit requirements.

PART 3 - EXECUTION

3.01 BLASTING HOURS

Blast only between the hours of 7 a.m. and 5 p.m. during any workday, Monday through Friday, unless special circumstances warrant another time or day and special approval is granted in writing by the District and the agency having jurisdiction. For any blasting within 1,200 feet of a residence or commercial structure, blast only between the hours of 9:00 a.m. and 5:00 p.m.

3.02 BLASTING PROCEDURES

A. Control fly rock and debris to prevent damage to persons, structures, existing improvements, or vegetation. Clean the blasting site of debris associated with the blasting operation at the end of each working day. Use blasting mats in developed areas. Equipment used for drilling of holes shall have a positive means of dust control.

B. Do not perform blasting closer than 8 feet to existing water, gas, sewer, or other buried utilities.

C. Use controlled blasting techniques to keep the air blast overpressure, vibrations, and noise within the limits herein specified. Use controlled blasting techniques to minimize overbreak or fracturing of rock beyond the designated excavation boundaries. Excessive blasting will not be permitted. Material outside the authorized cross-section, which may be shattered or loosened because of blasting, shall be removed at the Contractor's expense and the area repaired to the satisfaction of the District's Representative. Discontinue any method of blasting which leads to overshooting, is hazardous in any way to persons, or destructive to property or habitat.

D. Notify the District’s Representative at least seven workdays before all blasting and if blasting will occur within 1200 feet of a residence or commercial structure or utility.

E. Fifteen minutes prior to each blast, sound an audible siren or horn capable of being heard within one-half mile of the blasting site.

F. Blasting operations may be suspended by the District’s Representative for any one or more of the following:

1. Safety precautions are inadequate.

2. Ground motion vibration levels exceed specified limits of particle velocity or frequency.

3. Existing structural conditions are aggravated or adjacent improvements are damaged as a result of blasting.

4. Blasting methods adversely impact the stability of intact rock outside the prescribed limits of excavation.

5. Skilled operators and/or licensed foreman are not present.

Blasting operations shall not resume until modifications have been made to correct the conditions that resulted in the suspension.

G. Repair or replace any damage caused by blasting. Repair or replace any damage resulting from possession or use of explosives for the Work.

3.03 MAXIMUM PARTICLE VELOCITIES

Monitor vibrations by measuring the peak particle velocity in the vicinity of work. Peak particle velocity is defined as a maximum of the three velocity components, measured in three mutually perpendicular directions at any point by an instrument. The peak particle velocity of any individual components as measured on or at the locations as specified in the submitted vibration and frequency's monitoring plan, for all blasting, or other vibration-inducing operations, shall not exceed the following levels:

Point of Concern	**Maximum Allowable Peak Particle Velocity, PPV (in/sec)**	**Frequency Range (Hz)**
Surface Structures	0.5	2-250
Buried Pipes or Utility Cables	5.0	2-250

3.04 AIR-OVERPRESSURE

Blast induced air-overpressure at the property or right of way lines or structures within 300 feet of the blast area shall not exceed 0.03 psi (140 dBL). Air-overpressure at residential or other occupied structures shall not exceed 0.012 psi (133 dBL).

3.05 CONSEQUENCES OF BLASTING SPECIFICATION VIOLATIONS

Any violations of Section 3.03 Maximum Particle Velocities or Section 3.04 Air-Overpressure shall obligate the Contractor to pay for all costs to the District caused by the violation, including by not limited to: District staff and consultant's time and expenses that are required, as solely determined by the District's Representative, to investigate such violations. This includes, but is not limited to, reviews of resubmittals by the Contractor, analyses of subsequent Blasting Control Plans submitted by the Contractor, meetings with the Contractor and his Blasting Consultant, and investigations into the condition of existing pipeline, wells, structures, etc. These costs shall be actual cost to the District without additional mark-up, and the District's decision to charge the contractor shall be final.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, testing, and installation of aggregate base course, prime coat, tack coat, asphalt concrete pavement, seal coat, striping and markers.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Record Drawings and Submittals: STD SPEC 01300.

B. Trenching, Backfilling, and Compacting: STD SPEC 02223.

1.03 DEFINITIONS

Whenever the term "Public Works Specifications" is used in this Section, the meaning shall be interpreted as Standard Specifications for Public Works Construction by APWA/AGC the "GREENBOOK" latest edition with Regional Supplement Amendments.

1.04 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit report from a testing laboratory verifying that aggregate material is asbestos-free and conforms to the specified gradations or characteristics.

1.05 TESTING FOR COMPACTION

A. The District or the agency having jurisdiction over the area of the work will require the Contractor to test for compaction as described below.

B. Determine the density of soil in place by the sand cone method, ASTM D 1556, or by nuclear methods, ASTM D 2922 and D 3017.

C. Determine laboratory moisture-density relations of soils by ASTM D 1557.

D. Determine the relative density of cohesionless soils by ASTM D 4253 and D 4254.

E. Sample backfill materials by ASTM D 75.

F. "Relative compaction" is the ratio, expressed as a percentage, of the inplace dry density to the laboratory maximum dry density.

G. Compaction shall be deemed to comply with the Specifications when no more than one test of any three consecutive tests falls below the specified relative compaction. The one test shall be no more than three percentage points below the specified compaction. The Contractor shall pay the costs of any retesting of work not conforming to the Specifications.

PART 2 - MATERIALS

2.01 ASPHALT CONCRETE PAVING

Asphalt concrete paving shall conform to III-C2-AR-4000 as listed in Section 400-4 of the Public Works Specifications “GREENBOOK.”

2.02 ASPHALT

Asphalt shall be viscosity grade AR 4000 or AR 8000. Asphalt content in the pavement shall be 5.5% to 6.0%.

2.03 AGGREGATE FOR ASPHALT CONCRETE

Aggregate shall be in accordance with Sections 400-1.1 and 400-1.2 of the Public Works Specifications “GREENBOOK.” Aggregate shall be asbestos-free.

2.04 AGGREGATE BASE COURSE

Aggregate base shall be crushed aggregate base as specified in Section 400-2 of the Public Works Specifications “GREENBOOK.” Aggregate shall be asbestos-free.

2.05 PRIME COAT

All areas to be paved shall receive prime coat. Prime coat shall be slow curing (SC-70) in accordance with Section 203-2 of the Public Works Specifications “GREENBOOK.”

2.06 TACK COAT

Tack coat shall be slow setting (SS-1h) in accordance with Section 203-3 of the Public Works Specifications “GREENBOOK.”

2.07 SEAL COAT

Seal coat shall conform with Section 302-5.10 in the Regional Supplement Amendments of the Public Works Specifications “GREENBOOK.”

2.08 PAINT FOR TRAFFIC STRIPING AND MARKINGS

Provide rapid dry or fast dry paint per Section 210-1.6 of the Public Works Specifications “GREENBOOK.” Provide a color to match the existing traffic striping and markings.

2.09 REFLECTIVE PAVEMENT MARKERS

Markers shall be of the reflective type and colored to match the existing pavement markers. Markers shall conform to Section 85 of the State Standard Specifications, State of California, Department of Transportation, Caltrans, latest editions.

PART 3 - EXECUTION

3.01 PERMIT REQUIREMENTS

Comply with the ordinances, directives, and regulations of the respective agencies having jurisdiction over the area of the work. Pavement removal and replacement shall be in accordance with these Specifications and the issued permit.

3.02 PAVEMENT REMOVAL

A. Initially cut asphalt concrete pavement with a pavement saw, hydrohammer, or pneumatic pavement cutter at the limits of the excavation and remove the pavement regardless of the thickness. After backfilling the excavation, saw cut asphalt concrete pavement to a minimum depth of 2 inches at a point not less than 9 inches outside the limits of the excavation or the previous pavement cut, whichever is greater, and remove the additional pavement.

B. Saw cut concrete pavement, including cross gutters, curbs and gutters, sidewalks, and driveways, to a minimum depth of 1-1/2 inches at a point 1-foot beyond the edge of the excavation and remove the pavement. The concrete pavement may initially be cut at the limits of the excavation by other methods prior to removal and then saw cut after backfilling the excavation. If the saw cut falls within 3 feet of a concrete joint or pavement edge, remove the concrete to the joint or edge.

C. Make arrangements for and dispose of the removed pavement.

D. Final pavement saw cuts shall be straight along both sides of trenches, parallel to the pipeline alignment, and provide clean, solid, vertical faces free from loose material. Saw cut and remove damaged or disturbed adjoining pavement. Saw cuts shall be parallel to the pipeline alignment or the roadway centerline or perpendicular to same.

3.03 PAVEMENT REPLACEMENT

Backfill, compaction, and the permanent paving, except for the final asphalt surface course, shall be complete at all times to a point not to exceed 420 feet behind pipelaying. The final asphalt surface course shall be 1-inch thick. Do not place final surface course until all pipelines and appurtenances have been installed within the roadway or as directed by the District's Representative to maintain traffic safety. After the base course of asphalt concrete pavement has been completed, place temporary striping in the same configuration as the existing permanent striping so that traffic can be returned to normal patterns. This striping shall be considered temporary and is the Contractor's responsibility to place and maintain.

3.04 INSTALLATION

Producing, hauling, placing, compacting, and finishing of asphalt concrete shall conform to Section 302-5 of the Public Works Specifications “GREENBOOK.” Apply seal coat to all paving.

3.05 PREPARATION OF SUBGRADE

Compact the top 6 inches of subgrade to 95% relative compaction. Remove all soft material disclosed by the compacting and replace with suitable material and recompact. The finished subgrade shall be within a tolerance of +/-0.08 of a foot and shall be smooth and free from irregularities and at the specified relative compaction. The subgrade shall be considered to extend over the full width of the base course.

3.06 PLACING AGGREGATE BASE COURSE

Place aggregate base course to a thickness of 6 inches or to the standards of the agency having jurisdiction over the area of the work. Compact to 95% relative compaction. Install in accordance with Section 301-2 of the Public Works Specifications “GREENBOOK.”

3.07 COMPACTION OF AGGREGATE BASE AND LEVELING COURSES

Compaction and rolling shall begin at the outer edges of the surfacing and continue toward the center. Apply water uniformly throughout the material to provide moisture for obtaining the specified compaction. Compact each layer to the specified relative compaction before placing the next layer.

3.08 PLACING PRIME COAT

Apply prime coat to the surface of the leveling course of aggregate base at the rate of 0.25 gallon per square yard per Section 302-5.2 of the Public Works Specifications “GREENBOOK.”

3.09 PLACING TACK COAT

Apply tack coat on both horizontal and vertical surfaces to receive finish pavement per Section 302-5.3 of the Public Works Specifications “GREENBOOK.” Apply tack coat to concrete surfaces that will be in contact with the asphalt concrete paving.

3.10 PLACING ASPHALT PAVING

Place asphalt paving to a total thickness of 4 inches or 1-inch thicker than adjacent pavement section, whichever is greater or to the standards of the agency having jurisdiction over the area of the work. Install in accordance with Section 302-5 of the Public Works Specifications “GREENBOOK.”

3.11 COMPACTION OF ASPHALT CONCRETE PAVING

Compact until roller marks are eliminated and a minimum density of 92% has been attained per ASTM D 2041.

3.12 SURFACE TOLERANCE

Finished grade shall not deviate more than 0.02 of a foot in elevation from the existing surface.

3.13 APPLYING SEAL COAT

Apply seal coat at the rate of 0.10 to 0.15 gallon per square yard and spread a cover coat of sand at the rate of 6 to 12 pounds per square yard. Remove excess sand after 5 days. Apply per Section 302-5.10 in the Regional Supplement Amendments of the Public Works Specifications “GREENBOOK.”

3.14 APPLYING PAVEMENT STRIPING AND MARKINGS

Apply traffic striping, markings, and all other directional information to new paved surfaces and existing surfaces that were damaged by the construction. Use traffic paint that matches the color of the existing traffic striping and markings. Apply per Section 310-5.6 of the Public Works Specifications “GREENBOOK.” Wait a minimum of 10 days between the seal coat application and permanent traffic striping and markings. Apply a second coat of paint to all areas where the first coat of paint bled, curled, or discolored.

3.15 INSTALLING REFLECTIVE PAVEMENT MARKERS

After the application of all pavement striping and markings, install markers on new paved surfaces and existing surfaces that were damaged by the construction. Use markers that are reflective and match the color or combination of colors of the existing markers within the area of work. Install markers along the alignment and match spacing of the existing, as directed by the District's Representative, and in accordance with Section 85 of the State Standard Specifications.

3.16 INSTALLING FIRE HYDRANT MARKERS

Install a blue reflective marker opposite each new or relocated fire hydrant. Place the marker on the pavement and locate 6 inches off the centerline of the traffic striping or reflective pavement markers towards the hydrant. Install markers in accordance with Section 85 of the State Standard Specifications. Where existing fire hydrants have been relocated or removed from service, dislodge the existing blue marker from the pavement and dispose.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of chain link fences and gates having top and bottom tension wires, anticlimb extension arms, and barbed wire.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Record Drawings and Submittals: STD SPEC 01300.

B. General Concrete Construction: STD SPEC 03000.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit manufacturer's descriptive literature and standard drawings of fence and gate installation.

C. Submit manufacturer's certificate or original shipping tags showing compliance with cited U.S. Federal and ASTM specifications.

PART 2 - MATERIALS

2.01 GALVANIZED CHAIN LINK FABRIC

A. Use fabric conforming to ASTM A 392, Class I; or U.S. Federal Specification RR-F-00191/1C, Type I; 1.2 ounces per square foot zinc coating, hot-dip galvanized after weaving, 2-inch diamond mesh, 9-gage steel wire. Fabric height shall be 72 inches unless otherwise shown on the Drawings.

B. Top and bottom selvage twisted and barbed.

C. Tie wire shall be same material and gage as the chain link fabric.

2.02 GALVANIZED POSTS, BRACES AND RAILS

A. Use steel pipe conforming to ASTM F 1083, 1.8 ounces per square foot zinc coating, hot-dip galvanized.

B. Provide posts and braces in compliance with ASTM F 669 for heavy industrial fence, Group IA pipe or Group II rolled shapes, as follows:

1. End, Corner, and Pull Posts: 2.875-inch O.D. steel pipe, 5.79 pounds per linear foot.

2. Line Posts: 2.375-inch O.D. steel pipe, 3.65 pounds per linear foot.

3. Braces: 1.660-inch O.D. steel pipe, 2.27 pounds per linear foot.

4. Gate Posts for up to 6-Foot Leaf Width Gate: 2.875-inch O.D. steel pipe, 5.79 pounds per linear foot.

5. Gate Posts for over 6-Foot and to 13-Foot Leaf Width Gate: 4.000-inch O.D. steel pipe, 9.11 pounds per linear foot.

6. Gate Posts for over 13-Foot and to 18-Foot Leaf Width Gate: 6.625-inch O.D. steel pipe, 18.97 pounds per linear foot.

7. Gate Posts for over 18-Foot and to 36-Foot Leaf Width Gate: 8.625-inch O.D. steel pipe, 24.70 pounds per linear foot.

8. Gate Frames: 1.900-inch O.D. steel pipe, 2.72 pounds per linear foot.

9. Gate Stiffeners: 1.660-inch O.D. steel pipe, 2.27 pounds per linear foot.

C. Post Brace Assembly: At gate posts, end posts, and at each side of corner and pull posts, place a horizontal compression brace to the next post at midheight of fabric. Truss the two posts together with a diagonal tension rod. Use steel pipe for the horizontal brace and 3/8-inch diameter adjustable diagonal truss rod.

D. Length of Posts Into Footing: At line posts for fabric height of 72 inches and more, provide 36 inches. At end, corner, and pull posts, provide 6 inches more than at line posts. At gate posts, provide 12 inches more than at line posts. In solid rock, the portion of the depth of footing that is in solid rock may be reduced to one half of the above lengths.

2.03 GALVANIZED HARDWARE

Comply with U.S. Federal Specification RR-F-00191/4C and the following:

A. Caps: Weathertight caps on all exposed ends of tubular members.

B. Tension Wires: 7-gage galvanized coil spring steel.

C. Tension or Stretcher Bars: One piece, 2 inches less than fabric height, 1/4- by 3/4-inch size. One bar for each end and gate post, and two for each corner and pull post.

2.04 BARBED WIRE

A. Barbed Wire: ASTM A 121, Class 3, two twisted 12-1/2-gage steel wires, 0.80 ounce per square foot zinc coating, 4-point round shape barbs 5 inches apart.

B. Extension Arms: Post cap and anticlimb 45-degree single extension arm for three barbed wires. Top wire to be 12 inches above fabric. Provide way for top tension wire.

2.05 GALVANIZED GATES

A. Frame and Stiffeners: Use steel pipe for gate frame and stiffeners. Provide intermediate vertical stiffener for width over 8 feet and intermediate horizontal stiffeners for width over 10 feet. Assemble frame with malleable or pressed steel corner fittings, riveted for rigid connection. Welding will not be permitted. Provide fabric and barbed wire as for fence. Use stretcher bars at vertical edges and optional at top and bottom edges. Diagonal cross bracing of 3/8-inch diameter adjustable truss rods. Form anticlimb extension by extending vertical members 12 inches above fabric. Provide hinged gates to swing through 180 degrees from closed to open.

B. Gate Hardware:

1. Hinges: Provide pressed or forged steel or malleable iron, nonlift-off type, offset for 180-degree opening, one and one-half pairs for each leaf over 6 feet wide.

2. Latch: Provide forked type or plunger bar type for operation from either side, with padlock eye as integral part.

2.06 CONCRETE

Concrete for post holes and plunger bar block shall be Class C per Standard Specification Section 03000.

PART 3 - EXECUTION

3.01 PREPARATION FOR INSTALLATION

Clear the line of the fence and dispose of resulting material. Grade between post centers and excavate high spots so bottom of fabric will be between 1 and 2 inches above finished grade.

3.02 INSTALLATION

Install in accordance with ASTM F 567, except as modified herein.

3.03 SETTING POSTS

A. Space line posts uniformly at maximum intervals of 10 feet between end, corner, and gate posts.

B. Excavate post holes so concrete will be 3 inches below and around metal posts, except that minimum diameter of concrete footing for end, corner, pull, and gate posts is 12 inches or post O.D. plus 6 inches whichever is greater. In solid rock, diameters may be reduced to post O.D. plus 3 inches, and posts emplaced with a grout of one part portland cement to three parts sand.

C. Set posts plumb to within 1/4-inch of the post vertical centerline, perpendicular to the ground.

D. Fill post holes with concrete to 2 inches above finish grade and crown to slope away from post.

3.04 INSTALLING FABRIC

A. Place fabric on security side of fence. Place tension bands on side opposite fabric side and peen bolts ends or score threads.

B. Tie fabric to line posts and clip tension bar to end, corner, pull and gate posts at 15-inch intervals. Tie fabric to tension wires or weave tension wires through fabric at 24-inch intervals. Gage of tie wire to equal gage of fabric. Tie tension wires to line posts with 6-gage wire. Twist tie wires two full turns and bend back edges to reduce hazard.

C. Join rolls of fabric by weaving a single strand into ends of the rolls to form a continuous mesh.

3.05 INSTALLING PLUNGER BAR BLOCK

Excavate a 12-inch diameter by 24-inch deep hole for the plunger bar block. Locate hole under the plunger bar with the double gate in the closed position. Place a 24-inch long steel pipe sleeve in the hole and align to receive the plunger bar. Set pipe sleeve 1/2-inch above finish grade and fill hole with concrete. Slope concrete away from pipe sleeve end to finish grade.

END OF SECTION

STANDARD SPECIFICATION
SECTION 03000 GENERAL CONCRETE CONSTRUCTION

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of formwork, reinforcing steel, joints, concrete, and finishing and curing for general concrete construction.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Painting and Coating: STD SPEC 09900.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit manufacturer's catalog data and descriptive literature for form ties, spreaders, corner formers, form coatings and curing compound, bond breakers, joint sealant, backing rod, joint filler, control joints, expansion joint dowels, epoxy bonding compound, floor hardener, color additive, and rapid set cement.

C. Submit mill test certificates identifying chemical and physical analyses of each load of reinforcing steel delivered. If mill test reports are unavailable and the quantity of steel for a structure exceeds 5 tons, provide a laboratory test to prove conformance with the specified ASTM standard.

D. Submit reinforcing bending lists and placing drawings for all reinforcing. Placing drawings shall indicate all openings (mechanical, electrical, equipment, and architectural) including additional reinforcing at openings and corner bar arrangements at intersecting beams, walls, and footings indicated in the typical detail and structural drawings. Placing drawings shall be coordinated with the concrete placing schedule. Each bending list and placing drawing submitted shall be complete for each major element of a structure (grade slabs, footings, walls, deck, floor, or roof slabs) including dowels and corner bars. Furnishing such lists shall not be construed that the lists will be reviewed for accuracy. The Contractor shall be wholly and completely responsible for the accuracy of the lists and for furnishing and placing reinforcing steel in accordance with the details shown on the plans and as specified.

E. Submit concrete mix design at least 15 days before placing concrete.

F. Submit six copies of a report from a testing laboratory verifying that aggregate material contains less than 1% asbestos by weight or volume and conforms to the specified gradations or characteristics.

PART 2 - MATERIALS

2.01 FORMWORK

A. Design forms according to ACI 347.

B. Class I Forms: Use steel forms, ply form, or smooth-surface plywood 3/4-inch minimum thickness for straight surfaces and 1/2-inch minimum thickness for curved surfaces.

C. Class II Forms: Use plywood in good condition, metal, or smooth-planed boards free from large or loose knots with tongue and groove or ship lap joints. Forms shall be oiled.

D. Class II forms may be used for exterior concrete surfaces which are 1 foot or more below finished grade. Use Class I forms for all other surfaces.

2.02 BOND BREAKER

Bond breaker shall be a nonstaining type which will provide a positive bond prevention, such as Williams Tilt-Up Compound, as manufactured by Williams Distributors, Inc., Seattle, Washington; Silcoseal 77, as manufactured by SCA Construction Supply Division, Superior Concrete Accessories, Franklin Park, Illinois; or District approved equal.

2.03 FORM RELEASE AGENT

A. Form release agent shall effectively prevent absorption of moisture and prevent bond with the concrete. Agent shall be nonstaining and nontoxic after 30 days.

B. For steel forms, release agent shall prevent discoloration of the concrete due to rust.

2.04 REINFORCING STEEL

A. Reinforcement shall conform to ASTM A 615, Grade 60.

B. Fabricate reinforcing in accordance with the current edition of the Manual of Standard Practice, published by the Concrete Reinforcing Steel Institute. Bend reinforcing steel cold.

C. Deliver reinforcing steel to the site bundled and tagged with identifying tags.

2.05 WELDED WIRE FABRIC

Welded wire fabric shall conform to ASTM A 185.

2.06 TIE WIRE

Tie wire shall be 16 gauge minimum, black, soft annealed.

2.07 BAR SUPPORTS

Bar supports in beams and slabs exposed to view after form stripping shall be galvanized and plastic coated. Use concrete supports for reinforcing in concrete placed on grade.

2.08 BAR COUPLERS

Reinforcing steel bar splicing couplers shall be a mechanical type as manufactured by Dayton Barsplice Inc. or District approved equal. Use couplers which do not reduce tensile or ultimate strength of bars.

2.09 JOINT SEALANT

Joint sealant shall be a multipart, gray, nonstaining, nonsagging, polyurethane sealant, which cures at ambient temperature to a firm, flexible, resilient, tear-resistant rubber. Sealant shall be RC 270 of Products Research and Chemical Corporation, Mameco International Vulkem 227, Multi-Chem MC287, or District approved equal.

Technical Requirements	
Consistency	Gun grade
Tack free time	24 hours at 75°F and 50% R.H.
Pot life	1 to 3 hours
Hardness	35 Shore A, ±5
Elongation	700%
Tensile strength, ASTM D 412	300 psi
Peel strength on concrete	No loss of bond after 24 hours at 150% elongation
Temperature service range	-40°F to +175°F
Immersion in water	Continuous

2.10 BACKING ROD FOR EXPANSION JOINTS

Backing rod shall be an extruded closed-cell polyethylene foam rod, such as Minicel backer rod, manufactured by Industrial Systems Department, Plastic Products Group of Hercules, Inc., Middletown, Delaware; Ethafoam SB, as manufactured by Dow Chemical Company, Midland, Michigan; or District approved equal. The rod shall be 1/4-inch larger in diameter than the joint width. Where possible, provide full length sections for the joint; minimize splices. Apply backup rod and bond breaker tape in expansion joints.

2.11 BOND BREAKER TAPE

Bond breaker tape shall be an adhesive-backed glazed butyl or polyethylene tape which will adhere to the premolded joint material or concrete surface. The tape shall be the same width as the joint. The tape shall be compatible with the sealant.

2.12 PREFORMED CONTROL JOINT

Preformed control joint shall be a one-piece, flexible, PVC joint former, such as Kold-Seal Zip-Per Strip KSF-150-50-50, manufactured by Vinylex Corp., Knoxville, Tennessee, or a one-piece steel strip with preformed groove, such as Keyed Kold Retained Kap, manufactured by Burke Concrete Accessories, Inc., San Mateo, California, or District approved equal. Provide the preformed control joint material in full length unspliced pieces.

2.13 PREMOLDED JOINT FILLER

Joint filler shall be preformed, nonextruded type constructed of closed-cell neoprene conforming to ASTM D 1752, Type I, as manufactured by W. R. Grace Company of Cambridge, Massachusetts; W. R. Meadows, Inc., Elgin, Illinois; or District approved equal.

2.14 STEEL EXPANSION JOINT DOWELS

A. Steel expansion joint dowels shall conform to one of the following:

B. Epoxy coated steel bar dowels with a 12-mil coating thickness. Steel bar dowels shall conform to ASTM A 36 or ASTM 615, plain rounds, Grade 40. Epoxy coating shall be in conformance with ASTM A 775; or

C. Stainless steel bar dowels conforming to ASTM A 276, Type 302.

D. Exposed portion of expansion joint dowels shall be thoroughly greased prior to casting of adjoining wall or slab.

2.15 CEMENT

Cement shall conform to ASTM C 150, Type II, with maximum tricalcium aluminate not to exceed 8%. The maximum percent alkalies shall not exceed 0.6%.

2.16 RAPID SET CEMENT

Rapid set cement is a unique dry blend of hydraulic cement and other ingredients that provide fast sets and high strengths within an hour. Cement shall be free of calcium chloride. Use 400 pounds of rapid set cement per cubic yard of mix and combine with the sand and aggregate as specified for Class A concrete. Rapid set cement shall be as manufactured by CTS Cement Manufacturing Company or District approved equal. Deliver the rapid set cement, sand, and aggregate to the job site in a dry and uncombined condition. Use a mobile mixer truck to combine the components with water at the point of use.

2.17 AGGREGATES

Aggregates shall comply with ASTM C 33 and shall contain less than 1% asbestos by weight or volume and be free from any substances that will react with the cement alkalies.

2.18 COLOR ADDITIVE FOR EXTERIOR ELECTRICAL DUCT ENCASEMENT

For exterior electrical duct concrete encasements, use a color additive for identification purposes: brick red "Colorfull," as manufactured by Owl Manufacturing Company, Arcadia, California; coral red "Chromix C-22," as manufactured by L. M. Scofield Company, Los Angeles, California; or District approved equal. Add the color additive while the concrete is being mixed using the quantity per cubic yard of concrete recommended by the manufacturer for the class of concrete indicated.

2.19 CONCRETE ADMIXTURES

A. Concrete shall contain an air-entraining admixture. Admixture shall conform to ASTM C 260, except it shall be nontoxic after 30 days and shall contain no chlorides. Admixtures shall be Master Builders MB-AE 10, Sika AER (Sikamix 104), or District approved equal.

B. Concrete shall contain a water-reducing admixture. The admixture shall conform to ASTM C 494, Type A or D, except it shall contain no chlorides, shall be nontoxic after 30 days, and shall be compatible with the air-entraining admixtures. The amount of admixture added to the concrete shall be in accordance with the manufacturer's recommendations. Admixtures shall be Master Builders Pozzolith polymer-type normal setting; Plastocrete (Sikamix 160) Normal Set, Sika Chemical Corporation; or District approved equal.

C. Do not use any admixture that contains chlorides or other corrosive elements in any concrete.

2.20 GROUT

A. Nonshrink grout shall conform to the Corps of Engineers Specification for Nonshrink Grout, CRD-C621-83, and to these Standard Specifications. Use a nongas-liberating type, cement base, premixed product requiring only the addition of water for the required consistency. Grout shall be UPCON High Flow, Master Flow 713, or District approved equal. Components shall be inorganic.

B. Ordinary type grout (dry pack) shall consist of one part portland cement to two parts sand (100% passing a No. 8 sieve). Add sufficient water to form a damp formable consistency.

C. Expansive Grout: Premixed, cementitious mixture with a minimum 28-day strength of 3,500 psi. Provide air-entraining content as recommended by the manufacturer.

D. Epoxy Grout:

1. Mix the two components of epoxy bonding compound in compliance with the manufacturer's instructions.

2. Use sand that is oven dry and meets the following gradation requirements for epoxy grout:

Sieve Size:	No. 8	No. 50	No. 100
% Passing:	100	30 ±15	5 ±5

2.21 MORTAR

A. Mortar or grout placed on horizontal construction joints shall be a mixture of cement, sand, and water in the same proportions used in the concrete but with coarse aggregate omitted.

B. Mortar used for repair of concrete shall be made of the same materials as used for concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than one part cement to two and one-half parts sand by damp loose volume. The quantity of mixing water shall be no more than necessary for handling and placing.

2.22 BONDING COMPOUND

A. Epoxy bonding compound shall be Concresive 1001 LPL, Adhesive Engineering Company, San Carlos, California; Sikadur Hi-Mod (Sikastix 370), Sika Chemical Corporation, Lyndhurst, New Jersey; Epoxtile 2391 by W. R. Grace and Company; Euco Epoxy 463 by Euclid Chemical Company; or District approved equal.

B. Nonepoxy bonding compound shall be Weldcrete by Larsen Products Corp., Link by Sta-Dry Manufacturing Corp., Euco Weld by Euclid Chemical Co., or District approved equal. The compound shall be rewettable for up to two weeks.

2.23 CONCRETE MIX DESIGN

A. Conform to ASTM C 94, except as modified by these Standard Specifications.

B. Air content as determined by ASTM C 231 shall be 4% ±1%.

C. Maximum water-cement ratio for Class A concrete = 0.45 by weight.

D. Use classes of concrete as described in the following table:

Class	Type of Work	28-Day Compressive Strength (in psi)	Minimum Cement Content (in lbs per C.Y.)
A	Concrete for all structures and concrete not otherwise specified. Concrete fill at structure foundations, cradle, supports across pipe trenches.	4,000	564
B	Pavement.	3,000	500
C	Floor grout, miscellaneous unreinforced concrete.	2,000	376

E. Measure slump in accordance with ASTM C 143. Slump shall be as follows:

Slab on grade or heavy sections wider (in plan view) than 3 feet	3 inches max.
Footings, walls, suspended slabs, beams, and columns	4 inches max.
Pavement	2 inches max.
Floor grout, miscellaneous unreinforced concrete	4 inches max.

Proportion and produce the concrete to have a maximum slump as shown. A tolerance of up to 1-inch above the indicated maximum shall be allowed for individual batches provided the average for all batches or the most recent 10 batches tested, whichever is fewer, does not exceed the maximum limit. Concrete of lower than usual slump may be used provided it is properly placed and consolidated.

F. Aggregate size shall be 3/4-inch maximum for slabs and sections 8 inches thick and less. Aggregate size shall be 1-inch maximum for slabs and sections greater than 8 inches and smaller than 17 inches. Aggregate size shall be 1-1/2 inches maximum for all larger slabs and sections. Aggregate size for floor grout shall be maximum 3/8-inch.

G. Combined aggregate grading shall be as shown in the following table:

	Maximum Aggregate Size			
	1-1/2-inch	1-inch	3/4-inch	3/8-inch
Aggregate Grade per ASTM C 33	467	57	67	8

H. Mix design for pumped concrete shall produce a plastic and workable mix. The percentage of sand in the mix shall be based on the void content of the coarse aggregate.

2.24 CONCRETE TESTS

A. The District will require the Contractor to test for concrete quality as described below.

1. Frequency of Sampling: Cast four concrete test cylinders from each 50 cubic yards, or fraction thereof, of each class of concrete placed in any one day. Sampling and curing of cylinders shall conform to ASTM C 31.

2. Strength Testing: Test cylinders in accordance with ASTM C 39. Test one cylinder at 7 days for information; test two cylinders at 28 days for acceptance; and hold one cylinder for verification. Strength acceptance will be based on the average of the strengths of the two cylinders tested at 28 days. If one cylinder of a 28-day test manifests evidence of improper sampling, molding, or testing, other than low strength, discard it and use the fourth cylinder for the test result.

3. Determine concrete slump by ASTM C 143 with each strength test sampling and as required to establish consistency.

4. Determine air content of the concrete using ASTM C 231 to verify the percentage of air in the concrete immediately prior to depositing in forms.

5. The average value of concrete strength tests shall be equal to or greater than the specified 28-day strength. No test shall be less than 90% of the specified 28-day strength.

6. If the 28-day strength tests fail to meet the specified minimum compressive strength, the concrete will be assumed to be defective and one set of three cores from each area may be taken as selected by the District's Representative and in accordance with ASTM C 42. If the average compressive strength of the set of three concrete cores fails to equal 90% of the specified minimum compressive strength or if any single core is less than 75% of the minimum compressive strength, the concrete will be considered defective. The District may require additional coring, nondestructive load testing, or repair of defective concrete. Costs of coring, testing of cores, load testing, and required repairing pertaining thereto shall be paid by the Contractor at no extra cost to the District.

B. To facilitate concrete sampling and testing, the Contractor shall:

1. Furnish labor, equipment, and materials to assist the District's Representative in obtaining and handling samples at the project site.

2. Advise the District's Representative in advance of concrete placing operations to allow for scheduling and completion of quality testing.

3. Provide and maintain facilities for safe storage and proper curing of concrete test specimens on the project site, as required by ASTM C 31.

2.25 CURING COMPOUND

A. Curing compound shall conform to ASTM C 309.

B. Curing compound shall be compatible with required finishes and coatings and shall meet the State of California Clean Air Quality Standards which limit the quantity of volatile organic compounds to 250 grams per liter.

2.26 CLEAR FLOOR HARDENER (SURFACE APPLIED)

Floor hardener shall be a colorless, aqueous solution of zinc and/or magnesium fluosilicate. Each gallon of the fluosilicate solution shall contain not less than 2 pounds of crystals. Hardener shall be Saniseal, a product of Master Builders Company, Cleveland, Ohio; Hornolith, a product of Grace Construction Materials, Cambridge, Massachusetts; Lapidolith, a product of Sonneborn, Minneapolis, Minnesota; or District approved equal. The solution shall be delivered ready for use in the manufacturer's original sealed containers.

2.27 MATS, PAPER, AND SHEETING FOR CURING

A. Burlap mats shall conform to AASHTO Specification M182.

B. Sisal-kraft paper and polyethylene sheets shall conform to ASTM C 171.

PART 3 - EXECUTION

3.01 FORM TOLERANCES

A. Failure of the forms to produce the specified concrete surface and surface tolerance shall be grounds for rejection of the concrete work. Rejected work shall be repaired or replaced at no additional cost to the District.

B. The following table indicates tolerances or allowable variations from dimensions or positions of structural concrete work:

	Maximum Tolerance
Sleeves and inserts	+1/4" - 1/4”
Projected ends of anchors	+1/4" -0.0"
Anchor bolt setting	+1/4" -1/4"
Finished concrete, all locations	+1/4" -1/4" in 10 feet Max ±1" in total length

C. The planes or axes from which the above tolerances are to be measured shall be as follows:

Sleeves and inserts:	Centerline of sleeve or insert.
Projected ends of anchors:	Plane perpendicular to the end of the anchor as located on the Drawings.
Anchor bolt setting:	Centerline of anchor bolt.
Finish concrete:	The concrete surface as located on the Drawings.

D. Where equipment is to be installed, comply with manufacturer’s tolerances if more restrictive than above.

3.02 FORM SURFACE PREPARATION

A. Clean form surfaces to be in contact with concrete of foreign material prior to installation.

B. Coat form surfaces in contact with concrete with a release agent prior to form installation.

3.03 FORM REUSE

Reuse only forms which provide a uniform surface texture on exposed concrete surfaces. Apply light sanding or other surface treatment between uses for uniform texture. Plug unused tie rod holes with corks, shave flush, and sand the concrete surface side. Do not patch forms other than filling tie rod holes, except in the case of Class II forms. Do not use metal patching discs on Class I forms.

3.04 REMOVAL OF FORMS

A. Forms and shoring for elevated structural slabs or beams shall remain in place until the concrete has reached a compressive strength equal to the specified 28-day compressive strength as determined by test cylinders. Do not remove supports and reshore. The following table indicates the minimum allowable time after the last cast concrete is placed before forms, shoring, or wall bracing may be removed:

Sides of footings and encasements	24 hours
Walls, vertical sides of beams, girders, columns, and similar members not supporting loads	48 hours
Slabs, beams, and girders	10 days (forms only)
Shoring for slabs, beams, and girders	Until concrete strength reaches specified 28-day strength
Wall bracing	Until top or roof slab concrete reaches specified 28-day strength

B. Do not remove forms from concrete which has been placed with outside air temperature below 50°F without first determining if the concrete has properly set without regard for time. Do not apply heavy loading on green concrete. Immediately after forms are removed, the surface of the concrete shall be carefully examined and any irregularities in the surface shall be repaired and finished as specified.

3.05 FORMED OPENINGS

Openings shall be of sufficient size to permit final alignment of pipes or other items without deflection or offsets of any kind. Allow space for packing where items pass through the wall to ensure watertightness. Provide openings with continuous keyways and waterstops. Provide a slight flare to facilitate grouting and the escape of entrained air during grouting. Provide formed openings with reinforcement as indicated in the typical structural details. Reinforcing shall be at least 2 inches clear from the opening surfaces and encased items.

3.06 EMBEDDED ITEMS

Set anchor bolts and other embedded items accurately and hold securely in position until the concrete is placed and set. Check all special castings, channels, or other metal parts that are to be embedded in the concrete prior to and again after concreting. Check all nailing blocks, plugs, and strips necessary for the attachment of trim, finish, and similar work prior to concreting.

3.07 PIPES AND WALL SPOOLS CAST IN CONCRETE

A. Install pipes, wall spools, and wall anchors before placing concrete. Do not weld, tie or otherwise connect the pipes, spools or anchors to the reinforcing steel.

B. Support pipe and fabricated fittings, to be encased in concrete, on concrete piers or pedestals.

3.08 BEVELED EDGES (CHAMFER)

Form 3/4-inch beveled edges on exposed concrete edges and corners, beam soffit corners, and where indicated on the Drawings. Reentrant corners in concrete members shall not have fillets, unless otherwise shown in the Drawings. The top edges of slabs, walkways, beams, and walls may be beveled with an edging trowel in lieu of using chamfer strips.

3.09 CONSTRUCTION JOINTS

A. Layout of construction joints shall be as shown in the Drawings and according to the following guidelines:

1. Provide horizontal construction joints at top of foundation members and slabs-on-grade and at the soffit of supported slabs and beams.

2. Space the construction joints at a maximum horizontal distance of 25 feet and a maximum vertical distance of 16 feet.

3. Space the corner vertical construction joints between 4 and 8 feet from the corner of walls or wall intersections.

4. Space horizontal construction joints at least 8 inches below bottom of slabs.

B. For slabs-on-grade that are not subject to hydraulic loading, use formed construction joints. Maximum size of pour shall be 30 feet each way for slabs with wire mesh reinforcement and 75 feet each way for slabs with bar reinforcement. Allow 24 hours between pours of adjacent slabs. Provide joints as specified or shown. Set continuous expansion joint strips between slabs and abutting vertical surfaces as indicated in the Drawings.

C. Place expansion joint fillers every 30 feet in straight runs of walks, at right-angle turns, and wherever concrete walks butt into vertical surfaces.

D. For control joints of nonstructural slabs, provide partial depth plastic strips set flush with finished surface or 1/8-inch-wide joints cut with a diamond saw. Use control joints one-quarter to one-third the depth of the slab unless otherwise indicated.

E. Construction joints shall be keyed, unless otherwise detailed. Form keyways by beveled strips or boards placed at right angles to the direction of shear. Except where otherwise shown on the Drawings or specified, keyways shall be at least 1-1/2 inches in depth over at least 25% of the area of the section.

F. When it is necessary to make a joint because of an emergency, furnish and place reinforcing dowels across the joint. Embed dowels 48 bar diameters each side of the joint. Size and number of dowels shall match reinforcing in the member. Furnishing and placing such reinforcing steel shall be at the Contractor's expense.

G. After the pour has been completed to the construction joint and the concrete has hardened, thoroughly clean the entire surface of the joint of surface laitance, loose or defective concrete, and foreign material, and expose clean aggregate by sandblasting the surface of construction joints before placing the new concrete. Cover horizontal construction joints with mortar. Spread uniformly and work thoroughly into all irregularities of the surface. The water-cement ratio of the mortar in place shall not exceed that of the concrete to be placed, and the consistency of the mortar shall be suitable for placing and working.

H. In case of emergency, place additional construction joints. (An interval of 45 minutes constitutes cause for an emergency construction joint.)

3.10 EXPANSION JOINTS

Provide expansion joints with continuous edge reservoirs, which shall be filled with a joint sealant. Leave the material used for forming the reservoirs in place until immediately before the grooves are cleaned and filled with joint sealant. After removing edge forms from the reservoir, remove grout, loose concrete, and fins; then sandblast the slots. Allow the reservoirs to become thoroughly dry; then blow out the reservoirs and immediately prime and fill with the expansion joint sealant and backup materials. The primer used shall be supplied by the same manufacturer supplying the joint sealant.

3.11 TIME BETWEEN POURS

At least two hours shall elapse after depositing concrete in the columns or walls before depositing in beams, girders, or slabs supported thereon. Place beams, girders, brackets, column capitals, and haunches monolithically as part of the floor or roof system, unless otherwise indicated on the Drawings.

3.12 INSTALLATION OF PREMOLDED JOINT FILLER

Install in joint accurately as shown. Attach to concrete with a bonding agent recommended by the joint sealant and joint filler manufacturer for compatibility.

3.13 INSTALLATION OF JOINT SEALANTS

A. Immediately before installing the joint sealant, clean the joint cavity by sandblasting or power wire brushing. Install bond breaker tape per manufacturer's instructions.

B. After the joints have been prepared as described above, apply the joint sealant. Apply the primer, if required, and joint sealant only with the equipment and methods recommended by the joint sealant manufacturer. Application criteria for the sealant materials, such as temperature and moisture requirements and primer cure time, shall be in accordance with the recommendations of the sealant manufacturer.

C. Apply masking tape along the edges of the exposed surface of the exposed joints. Trowel the joints smooth with a tuck pointing tool wiped with a solvent recommended by the sealant manufacturer.

D. After the sealant has been applied, remove the masking tape and any sealant spillage.

3.14 INSTALLATION OF STEEL EXPANSION JOINT DOWELS

Install parallel to wall or slab face, perpendicular to the joint face, and in true horizontal position. Secure tightly in forms with rigid ties. Orient dowels to permit joint movement.

3.15 PLACING REINFORCEMENT

A. Place reinforcing steel in accordance with the current edition of Recommended Practice for Placing Reinforcing Bars, published by the Concrete Reinforcing Steel Institute.

B. Place reinforcing in accordance with the following, unless otherwise indicated:

1. Reinforcement indicated on the drawings is continuous through the structure to the farthest extent possible. Terminate bars 2 inches clear from faces of concrete.

2. Splices may be used to provide continuity due to bar length limitations. Minimum length of bars spliced for this reason is 40 feet. Splicing of reinforcement which is detailed to be continuous on the Drawings is not permitted.

C. Reinforcing steel, before being positioned and just prior to placing concrete, shall be free from loose mill and rust scale and from any coatings that may destroy or reduce the bond. Clean reinforcing steel by sandblasting or wire brushing and remove mortar, oil, or dirt to remove materials that may reduce the bond.

D. Do not straighten or rebend reinforcing steel in the field. Do not use reinforcing with bends not shown in the Drawings.

E. Position reinforcing steel in accordance with the Drawings and secure by using annealed wire ties or clips at intersections and support by concrete or metal supports, spacers, or metal hangers. Do not place metal clips or supports in contact with the forms. Bend tie wires away from the forms to provide the specified concrete coverage. Bars additional to those shown on the Drawings, which may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position, shall be provided by the Contractor at his own expense.

F. Place reinforcement a minimum of 2 inches clear of any metal pipe or fittings.

G. Secure reinforcing dowels in place prior to placing concrete. Do not press dowels into the concrete after the concrete has been placed.

H. Roll welded wire fabric used for reinforcement flat before placing concrete. Extend fabric to within two inches of the slab edges and lap splices at least 1-1/2 courses of the fabric and a minimum of 6 inches. Tie laps and splices at ends and at 24 inches on center. Pull the fabric into position as the concrete is placed by means of hooks, and work concrete under the fabric to ensure that it is placed at the proper distance above the bottom of the slab.

I. Position dowels for masonry walls to occur at reinforced block cells.

3.16 SITE-MIXED CONCRETE

Conform to ACI 304.

3.17 READY-MIXED CONCRETE

Conform to ASTM C 94.

3.18 PLACING CONCRETE

A. Conform to ACI 304.

B. Place ready-mixed concrete within the specified delivery time after initial batching based on the outside temperature. Ready-mixed concrete exceeding the delivery time will be rejected by the District’s Representative.

Outside Temperature	Delivery Time
Below 40 degrees F (4 degree C)	See Cold Weather Placing
40 to 85 degrees F (4 to 29 degrees C)	90 Minutes
86 to 90 degrees F (30 to 32 degrees C)	75 Minutes
Above 90 degree F (32 degree C)	60 Minutes

3.19 PUMPING CONCRETE

Conform to ACI 304.2R-71.

3.20 WEATHER REQUIREMENTS

A. Conform to ACI 305 for placing during hot weather.

B. Conform to ACI 306 for placing during cold weather.

C. Do not place ready-mixed concrete in the rain or at times when rain is expected or forecasted. The District’s Representative in his sole judgement may reject any concrete work that is affected by rain.

3.21 BONDING TO OLD CONCRETE

Coat the contact surfaces with epoxy bonding compound. The method of preparation and application of the bonding compound shall conform to the manufacturer's printed instructions and recommendations for specific application for this project.

3.22 BACKFILL AGAINST WALLS

Do not place backfill against walls until the concrete has obtained a compressive strength equal to the specified 28-day compressive strength. Where backfill is to be placed on both sides of the wall, place the backfill uniformly on both sides.

Do not backfill the walls of structures that are laterally restrained or supported by suspended slabs or slabs on grade until the slab is poured and the concrete has reached the specified compressive strength.

3.23 CONCRETE FINISHES

Complete concrete surfaces in accordance with the following schedule:

Finish Designation	Area Applied
F-1	Beams, columns, and exterior walls not exposed to view.
F-3	Beams, columns, and walls of structures or buildings exposed to view. Underside of formed floors or slabs.
F-4	Exterior and interior surfaces to be coated.
S-1	Slabs and floors to be covered with concrete or grout.
S-4	Slabs and floors of structures or buildings exposed to view.
S-5	Slabs and floors at slopes greater than 10% and stairs.
E-1	Exposed edges. EXCEPTION: edges normally covered with earth.
E-2	Top of walls, beams, and similar unformed surfaces.

A. Finish F-1: Repair defective concrete, fill Depressions deeper than 1/2-inch, and fill tie holes.

B. Finish F-3: In addition to Finish F-1, remove fins, fill depressions 1/4-inch or deeper, fill depressions and airholes with mortar. Dampen surfaces and then spread a slurry consisting of one part cement and one and one-half parts sand by damp loose volume, over the surface with clean burlap pads or sponge rubber floats. Remove any surplus by scraping and then rubbing with clean burlap.

C. Finish F-4: Repair defective concrete, remove fins, fill depressions 1/16-inch or deeper, fill tie holes, remove mortar spatter, and remove bulges higher than 1/16-inch.

D. Finish S-1: Screed to grade without special finish.

E. Finish S-4: Steel trowel finish without local depressions or high points and apply a light hair-broom finish. Do not use stiff bristle brooms or brushes. Leave hair-broom lines parallel to the direction of slab drainage.

F. Finish S-5: Steel trowel finish without local depressions or high points. Apply a stiff bristle broom finish. Leave broom lines parallel to the direction of slope drainage.

G. Finish E-1: Provide chamfer or beveled edges.

H. Finish E-2: Strike smooth and float to an F-3 or F-4 finish.

3.24 CURING CONCRETE

A. Conform to ACI 308.

B. Water cure with burlap mats unless optional curing methods are permitted.

C. Do not use curing compound on surfaces which are to be coated with clear floor hardener.

D. It is the responsibility of the Contractor to select the appropriate curing method in response to climatical and/or site conditions occurring at the time of concrete placement. Take appropriate measures as described in ACI 305 and 306 for protecting and curing concrete during hot and cold weather.

3.25 REPAIR OF DEFECTS

A. Do not repair defects until concrete has been reviewed by the District's Representative.

B. Surface Defects: Repair surface defects that are smaller than 1-foot across in any direction and are less than 1/2-inch in depth.

Repair by removing the honeycombed and other defective concrete down to sound concrete, make the edges perpendicular to the surface and at least 3/8-inch deep, thoroughly dampen the surface, work into the surface a bonding grout (one part cement to one part fine sand), fill the hole with mortar, match the finish on the adjacent concrete, and cure as specified.

C. Severe Defects: Repair severe defects that are larger than surface defects but do not appear to affect the structural integrity of the structure.

Repair by removing the honeycombed and other defective concrete down to sound concrete, make the edges of the hole perpendicular to the surface, sandblast the surface, coat the sandblasted surface with epoxy bonding compound, place nonshrink grout, match the finish on the adjacent concrete, and cure as specified.

D. Major Defects: If the defects are serious or affect the structural integrity of the structure or if patching does not satisfactorily restore the quality and appearance to the surface, the District may require the concrete to be removed and replaced, complete, in accordance with the provisions of this section.

3.26 REPAIR OF CRACKS

A. Repair cracks in concrete structures that are wider than 1/10-inch in width by cutting out a square edged and uniformly aligned joint 3/8-inch wide by 3/4-inch deep, preparing exposed surfaces of the joint, priming the joint, and applying polyurethane joint sealant.

B. If the cracks are serious or affect the structural integrity or function of the element, the District's Representative may require the concrete to be removed and replaced, complete, in accordance with the provisions of this section.

3.27 CLEAR HARDENER APPLICATION (SURFACE APPLIED)

A. Cure, clean, and keep floors dry to receive hardener. Complete work immediately above floors prior to applying hardener. Apply hardener evenly, using three coats, allowing 24 hours between coats. The first coat shall be one-third strength, second coat one-half strength, and third coat two-thirds strength. Apply each coat so as to remain wet on the concrete surface for 15 minutes. Apply proprietary hardeners in conformance with the manufacturer's instructions. After the final coat is completed and dry, remove surplus hardener from the surface by scrubbing and mopping with water.

B. Apply hardener to the surfaces designated in the Drawings.

C. Apply hardener to risers and treads of concrete stairs as described above.

3.28 ALUMINUM SURFACES IN CONTACT WITH CONCRETE

Coat aluminum surfaces in contact with concrete per Standard Specification Section 09900, System No. 51.

END OF SECTION

STANDARD SPECIFICATION
SECTION 03461 PRECAST CONCRETE MANHOLES

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of precast circular concrete manholes for sewers.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Earthwork: STD SPEC 02200.

D. Trenching, Backfilling, and Compacting: STD SPEC 02233.

E. General Concrete Construction: STD SPEC 03000.

F. Plastic Sheet Liner: STD SPEC 09850.

1.03 SUSBMITTALS

A. Submit submittal packages in accordance with Standard Specifications Section 01300.

B. Submit manufacturer’s catalog data on precast concrete manholes, frames, and covers. Show dimensions and materials of construction by ASTM reference and grade. Show lettering on manhole covers.

1.04 SEWER MANHOLES

A. Use 48-inch diameter manholes for sewer pipe 15 inches in diameter and smaller.

B. Use 60-inch diameter manholes for sewer pipe 18 inches in diameter and larger.

1.05 DROP MANHOLES

Use 60-inch diameter drop manholes for sewer applications and construct only at locations shown on the Drawings.

1.06 CORROSION PROTECTION

Use corrosion protection lining and/or coating on the interior of manholes for sewer mains 18-inches or larger, and on all drop manholes regardless of sewer pipe size.

1.07 WATERPROOFING

Use waterproofing on the exterior portions of manholes when located at or below the water table, when moisture or seepage occurs, or as directed by the District's Representative.

1.08 JOINT SEALING

Use joint sealant to form a continuous watertight seal on the concrete base and between successive precast concrete manhole sections.

1.09 SAFETY GRATING

Use safety grating above the drain channels in manholes and drop manholes for sewer mains 18-inches and larger. Safety grating shall be installed only in locations shown on the Drawings or as directed by the District's Representative.

1.10 VACUUM TESTING OF MANHOLES

Use vacuum testing of manholes to demonstrate the integrity of the installed materials and construction procedures.

PART 2 - MATERIALS

2.01 PRECAST CONCRETE MANHOLES

A. Precast components and other appurtenant materials shall be selected from the Approved Materials List.

B. Precast circular concrete manholes shall comply with ASTM C478 except that the wall thickness shall be 6 inches minimum.

C. Manhole components shall be designed for H-20 highway wheel loading, specific site conditions, and the Standard Drawings..

D. Manhole bases may be either precast or cast-in-place, as appropriate for the application, with a formed recess shaped to match the first precast shaft section. The manhole base shall extend a minimum of 10 inches below the bottom of the lowest pipe and a minimum of 6 inches above the top of the largest pipe. Manhole bases for mains 18-inch or larger shall incorporate a 4-inch wide grating-support ledge, cast integrally with the drain channels, at the top of the base.

E. Manhole shafts shall be fabricated only from precast shaft sections, eccentric cone sections and grade rings.

F. Pipe penetrations for sewer applications shall incorporate a watertight flexible pipe connector or ring-type seal according to the method of manhole construction as shown in the Standard Drawings. Precast manholes shall utilize either an integrally cast embedded pipe connector, or a boot-type connector installed in a circular block out opening in accordance with ASTM C923. Connections to existing manholes shall utilize a boot type connector per ASTM C923 installed in a cored opening. Cast-in-place bases shall incorporate a ring-type seal on the pipe to be embedded in the concrete.

G. Manholes on sewer mains 18 inches or larger, and all drop manholes regardless of the size of the sewer main, shall be polyvinyl chloride (PVC) lined and polyurethane coated. Precast shaft sections, cone sections and grade rings on PVC lined manholes shall have an integrally-cast PVC T-shaped liner of 0.065-inch minimum thickness per Standard Specifications Section 09850. A 100% solids elastomeric polyurethane coating shall be applied to exposed concrete at the interior of precast and cast-in-place bases.

2.02 CRUSHED ROCK BASE AND BACKFILL MATERIALS

Crushed rock base and backfill materials shall be in accordance with Standard Specification Section 02223.

2.03 MANHOLE FRAMES AND COVERS

A. Manhole frames shall be either 24 inches in diameter with single cover or 36 inches in diameter with two concentric covers, made of cast iron in accordance with ASTM A48, Class 30, the Standard Drawings and the Approved Materials List. Locking frames and covers may be required as determined by the District's Representative and shall be done in accordance with the Standard Drawings.

B. Frames and covers shall be designed for H-20 highway wheel loading.

C. Covers shall have the words "OMWD" "SEWER'" cast into the cover. No other lettering will be permitted on the top portion of the cover.

D. Castings shall be smooth, clean, and free from blisters, blowholes, and shrinkage. Mating surfaces of the frame and cover shall be machined to prevent movement of the lid. Frames and covers shall be match marked in sets before shipping to the site.

E. All castings shall be dipped twice in a preparation of asphalt or coal tar and oil and in such a manner as to form a firm and tenacious coating.

2.04 CONCRETE

Concrete used for manholes and appurtenances shall be in accordance with Standard Specifications Section 03000.

2.05 JOINT SEALING COMPOUND

Joint sealing compound shall be a mastic-type material in a flexible rope or rolled form with removable wrapper sized to fit into the key of manhole or sections.

2.06 REPAIR MORTAR AND EPOXY BONDING AGENT

Repair mortar and an epoxy bonding agent shall be used to repair minor surface damage to precast sections or cast-in-place manhole bases at the discretion of the District's Representative. Repair products shall be in accordance with Standard Specifications Section 03000.

2.07 MORTAR

Mortar for use on joints between precast sections and for setting manhole cover frames shall be in accordance with Standard Specifications Section 03000.

2.08 WATERPROOFING

Waterproofing material shall be in accordance with Standard Specifications Section 03462.

PART 3 - EXECUTION

3.01 WORK WITHIN EXISTING MANHOLES

Contractor shall comply with all Federal and State regulations for confined space entry. Work inside confined spaces, as defined by the applicable regulations, shall not be undertaken until all the tests and safety provisions of the Code of Federal Regulations 1910.146, and the General Industry Safety Orders of the California Code of Regulations, Title 8, Section 5159, for confined space entry have been performed and the area is verified as safe to enter. District policy prohibits entry into any confined space with Immediately Dangerous to Life and Health (IDLH) conditions except by trained emergency rescue personnel.

3.02 EARTHWORK

Manhole excavation, foundation stabilization (if necessary), placement of base material, backfill and compaction shall be performed in accordance with Standard Specifications Sections 02200 and 02223.

3.03 MANHOLE BASE

A. The invert of precast and cast-in-place bases shall be hand-worked to provide channels conforming in size to the inside diameter of the piping as indicated on the Drawings. The channels shall vary uniformly in size and shape from inlet to outlet. The concrete base shall be shaped with a wood float and shall receive a hard steel trowel finish before the concrete sets. A template shall be used to accurately form the level surface that will receive the first precast section.

B. During construction of cast-in-place bases, all sewer mains and stub piping shall be in place, including ring-type seals, before concrete placement. Pipe grade and alignment shall be verified immediately upon placement of concrete to assure that the pipelines are in proper position prior to the concrete taking an initial set. The invert elevation and flow line of piping shall be as shown on the Approved Plans and Standard Drawings. The manhole base shall extend a minimum of 10-inch below the bottom of the lowest pipe and a minimum of 6-inch above the top of the largest pipe.

C. Cast-in-place bases shall set a minimum of 24 hours before the manhole construction is continued. In certain critical situations, the setting time may be reduced upon approval of the District's Representative.

3.04 INSTALLING MANHOLE SECTIONS

A. The concrete manhole base and successive precast sections will receive a mastic joint sealing compound prior to setting the precast sections in place as shown on the Standard Drawings. Following the vacuum testing as described in this section, the joints will be mortared and tooled to a smooth finish, free of voids. Note that sewer manholes are to be vacuum tested following assembly of the concrete sections, but prior to mortaring the joints, or backfilling.

B. Manhole components incorporating a PVC liner and polyurethane coating shall be installed and tested in accordance with these specifications, the manufacturer's recommendations, and the Standard Drawings. Upon assembly of the precast sections and vacuum testing as described in this section, the mortaring and finishing of joints shall be performed. The PVC liner seams at the joints shall then be welded. The PVC liner shall be secured by insertion between the uppermost grade ring and the manhole cover frame. Note that PVC lined sewer manholes are to be vacuum tested following assembly of the concrete sections, but prior to mortaring the joints, welding the seams of the PVC liner, or backfilling. The polyurethane coating of all exposed concrete on the manhole base shall follow completion of the entire installation and all construction activity within the manhole.

C. Assemble the precast sections to the elevation required by the location of the manhole as follows:

1. Paved Areas: Top of cover shall be flush with the finished paving surface.

2. Traveled Way: Top of cover shall be flush with the existing surface where it is in a traveled way.

3. Shoulder Areas: Top of cover shall be 1-inch above the existing surface where outside the limits of a traveled way. Manholes shall not be placed in roadside ditches without the prior approval of the District.

4. Unpaved Easements: Top of cover shall be 12 inches above the ground surface. Guard posts around the manhole may be required in this area as directed by the District’s Representative.

D. Secure the manhole frame to the grade ring with mortar.

E. After the frame is securely set the cover shall be installed. All necessary cleaning of foreign materials from the frames and covers shall be accomplished to ensure a satisfactory fit.

F. Where manholes are to be given a protective coating, they shall be free of seepage and surface moisture.

G. Piping installation adjacent to the manhole and connection to the base or shaft sections shall be performed as shown on the Drawings and Standard Drawings. Piping installation into flexible pipe connectors shall be in accordance with the manufacturer's recommendations for assembly, lubricants and limits of deflection.

H. In order to prevent accidental use of the new sewer before completion and acceptance, the new inlet to existing tie-in manhole(s) and the outlet of the first new upstream manhole(s) shall be sealed with expandable plugs. The District shall approve the specific location of these plugs. Plugs shall be removed at the time of final inspection or as directed by the District's Representative. Removal of all construction debris and water shall be completed prior to removal of plugs.

I. Brick or mortar bulkheads shall be installed at the manhole end of all unused stub channels over 36 inches beyond manhole base. The bulkheads are intended to prevent ponding of sewage and debris in the unused channels until such time as the manhole stub is connected and normal sewage flow can occur.

J. New connections to existing manholes, where stubs have not been provided, shall be made by core drilling through the walls or base as directed by the District's Representative. Flexible seals selected from the Approved Materials List and installed in accordance with the Standard Drawings shall be used for the pipe penetration. Apply a protective epoxy coating to the cored concrete and the ends of any exposed reinforcing steel. The coating shall be an epoxy resin product exhibiting a high bond strength to steel and concrete. It shall conform to ASTM C881.

K. A concrete collar shall be poured around manhole frames in accordance with the Standard Drawings.

L. Replacement of asphalt or concrete pavement shall be in accordance with the requirements of the agency having jurisdiction.

3.05 WATERPROOFING

At the discretion of the District's Representative, waterproofing material shall be applied to the exterior surfaces of manholes in accordance with the manufacturer's recommendations and Standard Specification Section 03462. Field apply two coats at a rate of 65 square feet per gallon per coat. The material shall be applied to all exterior surfaces at or below the water table or indications of seepage or moisture as directed by the District's Representative.

3.06 VACUUM TESTING OF MANHOLES

A. Vacuum testing of manholes is required and shall be performed as directed in the presence of the District's Representative.

B. Vacuum testing shall be done in accordance with ASTM C1244.

C. Vacuum testing equipment shall be as manufactured by P.A. Glazier, Inc. or District approved equal.

D. Manholes shall be tested after assembly and prior to mortaring the joints or backfilling. In the case of manholes incorporating a PVC liner and polyurethane coating, the testing is to take place prior to mortaring the joints, welding the liner seams between sections, applying the coating, or backfilling.

E. All lift holes shall be plugged with an approved grout prior to testing.

F. All pipes entering the manhole shall be plugged, and bracing installed, to prevent the plug from being drawn into the manhole.

G. The test head shall be placed inside the top of the cone section and the seal inflated in accordance with the manufacturer's recommendations.

H. A vacuum of 10 inches of mercury shall be drawn. The time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass the test if the time taken for the drop is greater than 60 seconds for a 48-inch manhole and 75 seconds for a 60-inch manhole.

I. If the manhole fails the test, necessary repairs shall be made and the test repeated until acceptable results are obtained. The leak(s) shall be located and repaired according to their nature with material-in-kind.

3.07 PULL TESTING OF PVC LINED MANHOLES

PVC lined manholes shall have field-welded joints pull tested. Field welds shall withstand a pull test of at least 100 lbs per liner inch, applied perpendicularly to the concrete surface for a period of one minute, without evidence of cracks or separations. This test shall be conducted at a temperature of 70°F to 80°F inclusive.

3.08 HOLIDAY TESTING OF PVC LINED MANHOLES

PVC lined and Polyurethane coated surfaces shall be holiday tested with an electrical holiday detector as manufactured by Tinker and Rasor (Model # AP-W with power pack) with the instrument set at 20,000 volts and used as directed by the District's Representative. All imperfections identified on the PVC lining and polyurethane coating shall be repaired with materials-in-kind and the test shall be repeated until no holidays are evident.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, design, and installation of precast concrete vaults with factory applied waterproofing.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Record Drawings Submittals: STD SPEC 01300.

B. Earthwork: STD SPEC 02200.

C. General Concrete Construction: STD SPEC 03000.

D. Miscellaneous Metalwork: STD SPEC 05120.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit manufacturer's catalog data on precast concrete items. Show dimensions of vault and location of openings including thicknesses of walls, floor and top slab. Show reinforcing wire and steel. Show materials of construction by ASTM reference and grade.

C. Submit manufacturer's design calculations and certification signed and sealed by a professional civil or structural engineer registered in the State of California that vault design and construction comply with the specified design load conditions and the referenced ASTM specification (e.g., ASTM C 857 and C 858).

D. Submit manufacturer's catalog data, descriptive literature, and installation instructions for the waterproofing material.

1.04 INSPECTION

A. The District's Representative or his authorized representative will conduct an inspection of the vault fabrication process at the manufacturer's plant prior to the placement of the concrete into the formwork. The inspection will review the quality of materials, the formwork, placement of reinforcing steel, location of openings in the vault, and other construction details as shown in the approved fabrication drawings in the submittal package. If the concrete is placed into the formwork without this prior inspection, the vault will be rejected.

B. The District's Represenative or his authorized representative will conduct a second inspection of the vault upon its arrival at the jobsite. The inspection will review the quality of the concrete surfaces, defects that indicate any imperfect concrete mixing and molding, surface deflects indicated by honey-combed or open texture and damaged areas, any exposed or bare reinforcing steel, and waterproofing that is missing from indicated surfaces or poorly applied. If any of these items are present or exist, the vault will be rejected.

PART 2 - MATERIALS

2.01 MANUFACTURERS

Precast concrete vaults shall be manufactured by Brooks Products Inc., Utility Vault, or District approved equal.

2.02 PRECAST CONCRETE VAULTS

A. Precast concrete vaults shall comply with ASTM C 858 except as modified herein.

B. Design live and dead loads shall be in accordance with ASTM C 857. Design precast concrete vaults to withstand site soil conditions and traffic loading of A-16 per Table 1 of ASTM C 857 with a 30% increase due to impact. Soil lateral loads shall be as determined by ASTM C 857. Alternate design by the strength design method shall include a load factor of 1.7 times the lateral earth or hydrostatic pressures. Design shall evaluate earthquake (Zone 4).

C. Design shall also comply with the following restrictions:

1. The maximum reinforcement ratio allowed is one-half the reinforcement ratio that would produce a balanced strain condition.
2. Earth pressure shall be converted to a horizontal pressure using a coefficient of earth pressure at rest of 0.5 and not a coefficient of active earth pressure.
3. Include a live load surcharge of 2 feet of soil in the design of the walls.

D. Precast vault construction shall be in the form of monolithic walls or horizontal wall sections; do not use panel walls.

E. Minimum wall thickness shall be 6 inches. Design knockout wall panels to accommodate loading pressures defined above.

F. Design and construct vaults to be watertight when subjected to groundwater over the entire height of the vault.

G. Provide openings in precast vaults for piping and access. Provide cast in place inserts in the roof slab and end walls at the locations as shown on the Drawings. No field coring of openings is allowed.

2.03 PRECAST CONCRETE RISERS

Precast concrete grade rings and cones shall comply with ASTM C 478, except that the wall thickness shall be 6 inches minimum. Provide interlocking keyways on rings and cones. Provide cones with cast in place inserts for the manhole frame.

2.04 SEALANTS AND MORTAR

Fill joints between precast sections with a double layer of plastic sealing compound and make watertight. Plastic sealing compound shall comply with Federal Specification SS-S-00210. Fill with mortar all recesses, lifting inserts, or other cavities not filled with plastic sealing compound. Mortar shall comply with ASTM C 387, Type S.

2.05 CEMENT

Cement shall be ASTM C 150, Type II.

2.06 ADMIXTURES

Provide concrete admixtures as specified in Standard Specification Section 03000.

2.07 WATERPROOFING

The waterproofing material shall be Horn Dehydratine 4, Select Shield 301-A, or District approved equal. The material is a black bituminous compound of brush or spray consistency for application on below grade concrete surfaces.

2.08 VAULT APPURTENANCES

Provide ladders, covers and frames, vents, supports, inserts, eyebolts, and other miscellaneous metalwork. See Standard Specification Section 05120 for a description of the vault appurtenances.

PART 3 - EXECUTION

3.01 EXCAVATING AND BACKFILLING FOR VAULTS

Perform earthwork as specified in Standard Specification Section 02200. Provide 6-inch minimum thickness 3/4-inch crushed rock over the full width of the vault base and extend 12 inches beyond the edges of the vault. After repairing the waterproofing, backfill and compact around the vault with structural backfill material. Excavated material may be used for structural backfill provided it conforms to the Standard Specifications for structural backfill material.

3.02 INSTALLING VAULTS AND RISERS

Set each precast concrete vault section or riser plumb on a double layer bed of sealant at least 1/2-inch thick to make a watertight joint with the preceding unit. Point the inside joint and wipe off the excess sealant.

3.03 WATERPROOFING

Waterproofing shall be factory applied to all exterior surfaces of vaults and risers. This includes the bottom of the vault to be coated as an exterior surface. Apply two coats at a rate of 65 square feet per gallon per coat. Prior to backfilling, field apply waterproofing material on joints and damaged surfaces. Protect coating from damage during backfilling and compacting.

END OF SECTION

STANDARD SPECIFICATION
SECTION 05121 MISCELLANEOUS METALWORK

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, fabrication, and installation of structural steel, connecting bolts, pipes, galvanizing, welding electrodes, guard posts, ladders, covers and frames, vents, air valve enclosures, supports, eyebolts, anchors, and other miscellaneous metalwork.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Painting and Coating: STD SPEC 09900.

D. Thermally Sprayed Metallic Coating (Flame Spray): STD SPEC 09965.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit drawings of fabricated items, such as pipe supports, vents, and air valve enclosures. Show dimensions and reference materials of construction by ASTM designation and grade.

C. Submit manufacturer's catalog data and dimensional drawings for lifting eyebolts and inserts; ladders with safety post; manhole covers and frames; and anchor bolts.

PART 2 - MATERIALS

2.01 STRUCTURAL STEEL

Material for bolted or welded construction shall conform to ASTM A 36.

2.02 BOLTS

Steel anchor and connection bolts shall conform to ASTM A 307, unless noted otherwise. Provide galvanized bolts. Provide with galvanized self-locking nuts or lockwashers and plain nuts.

2.03 STEEL PIPE

Pipe for guard posts and vault vents shall be standard weight (Schedule 40) conforming to ASTM A 53 or A 120, and hot dipped galvanized.

2.04 GALVANIZING

Zinc coating for plates, bolts, anchor bolts, and threaded parts shall be in accordance with ASTM A 153. Structural steel shall be zinc coated in accordance with ASTM A 123.

2.05 WELDING ELECTRODES

Welding electrodes for structural steel shall conform to AWS A5.5. Use electrodes in the E-70 series.

2.06 GUARD POSTS

Use standard weight (Schedule 40) steel pipe, hot dipped galvanized, and 6 feet long. Coat aboveground surfaces per Standard Specification Section 09900, System No. 20. Finish color to be OSHA Yellow.

2.07 VAULT LADDERS

A. Ladders shall be 16 inches wide between rails, welded steel construction, and galvanized after fabrication. Minimum diameter of rungs shall be 3/4-inch. The distance between rungs shall not exceed 12 inches and shall be uniform throughout the length of the ladder. Provide galvanized steel supports at the top and bottom of the ladder and anchor to the precast concrete vault with adhesive anchor bolts. Ladders and supports shall be Alhambra Foundry Company No. A-3885, or District approved equal.

B. Mount on the ladder rungs below the manhole cover a telescoping safety post. The post shall be fabricated of steel with telescoping tubular section that locks automatically when fully extended. The upward and downward movement shall be controlled by a stainless steel spring balancing mechanism. The unit shall be galvanized with special alloy spring and be complete with fasteners for securing to the ladder rungs. The telescoping safety posts shall be a Model LU-2 Bilco Ladder UP, or District approved equal.

2.08 COVERS AND FRAMES

Manhole covers and frames shall be cast iron and designed for traffic loading. Castings shall be smooth, clean and free from blisters, blowholes, and shrinkage. Covers shall seat firmly into the frames without rocking. Frames shall be provided with anchor bolts and neoprene gasket. Covers shall be provided with stainless steel cap screws and lifting holes. Dip castings in a preparation of asphalt or coal tar and oil to form a firm and tenacious coating. Covers and frames shall be Alhambra Foundry Company No. A-1106, or District approved equal.

2.09 VAULT VENTS

A. Fabricate vault vents as shown on the Drawings. Vault vents shall be of welded steel construction and hot dipped galvanized after fabrication. Coat vault vents per Standard Specification Section 09900, System No. 20. Finish color to be OSHA Blue.

B. Use standard weight (Schedule 40) steel pipe with one threaded end for the riser section. At the plain pipe end, cut three 5-inch long by 3-inch high window openings evenly spaced along the circumference of the pipe. Locate top of window 1-inch from end of pipe. Place

10 x 10 steel wire cloth over the window openings on the inside surface of the pipe and tack weld.

C. Use 10-gauge steel pipe for the hood. Center a circular cut 1/4-inch thick plate on the plain pipe end of the riser section. Attach the plate to the riser with a full circle fillet weld.

2.10 PIPE SUPPORTS

Fabricate pipe supports as shown on the Drawings. Pipe supports shall be of welded steel construction and flame spray coated after fabrication per Standard Specification Section 09965. Coat supports per Standard Specification Section 09900, System No. 10. Color shall match adjacent piping.

2.11 LIFTING EYEBOLTS

A. Locate eyebolts and inserts over the centerline of the piping at the locations shown on the Drawings. Eyebolts and inserts shall have a minimum safety factor of 3:1 and be rated for a working load of 3,000 pounds.

B. Provide drop forged steel eyebolts with shoulder pattern and hot dipped galvanized. Provide eyebolts with 1-inch diameter by 2-1/2-inch long shank and fully threaded. Provide a 4-inch square by 3/8-inch thick galvanized steel plate washer for each eyebolt.

C. Provide inserts of the ferrule wing nut design with National Course threads to match the eyebolts. Cast the inserts in the roof slab of the vault at the locations identified in the Drawings.

2.12 THREADED INSERTS

Threaded inserts to be cast into the precast concrete vaults shall be of ductile iron construction with Standard N.C. threads. Provide 5/8-inch diameter inserts for the end walls. Inserts shall be Burke Hi-Tensile Threaded Inserts, or District approved equal. Inserts shall be cast in place at the locations identified in the Drawings.

2.13 ADHESIVE ANCHORS

Adhesive anchors shall be a two component system consisting of an all threaded anchor rod with nut and washer, and the adhesive capsule. Anchor rods shall be Type 304 stainless steel conforming to ASTM F 593 with nuts conforming to ASTM F 594. The adhesive capsules shall contain a vinylester resin and hardener within a sealed glass capsule. Adhesive anchors shall be Hilti HVA Adhesive Anchor System, or District approved equal.

2.14 WEDGE ANCHOR BOLTS

Anchor bolts for use in concrete shall be a stud type expansion anchor with a single piece wedge that performs as three independent wedges. Stud and wedge shall be Type 304 stainless steel conforming to ASTM A 276. Nut shall be Type 304 stainless steel conforming to ASTM F 594 with washer of similar material. Wedge anchor bolts shall be Hilti Kwik Bolt II, or District approved equal.

PART 3 - EXECUTION

3.01 STORAGE OF MATERIALS

Store structural material, either plain or fabricated, above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

3.02 FABRICATION AND ERECTION

A. Fabricate miscellaneous metal items to straight lines and true curves. Drilling and punching shall not leave burrs or deformations. Continuously weld permanent connections along the entire area of contact. Exposed work shall have a smooth finish with welds ground smooth. Joints shall have a close fit with corner joints coped or mitered and shall be in true alignment. Unless specifically indicated on the Drawings, there shall be no bends, twists, or open joints in any finished member nor any projecting edges or corners at intersections. Conceal fastenings wherever possible. Built-up parts shall be free of warp. Exposed ends and edges of metal shall be slightly rounded. All boltholes shall be 1/16-inch in diameter larger than bolt size.

B. Clean the surfaces of metalwork to be in contact with concrete of rust, dirt, grease, and other foreign substances before placing concrete.

C. Set embedded metalwork accurately in position when concrete is placed and support it rigidly to prevent displacement or undue vibration during or after the placement of concrete.

D. Repair or replace metal items with damaged galvanized surfaces. Accomplish repairs with a field applied, cold galvanizing repair compound. Apply in accordance with the manufacturer's instructions.

3.03 WELDING

A. Perform welding on steel by the Shielded Metal Arc Welding (SMAW) process. Welding procedures shall comply with AWS B3.0.

B. Provide one pass for metal of 3/16-inch thickness plus one additional pass for each additional 1/8-inch in metal thickness.

C. Produce weld uniform in width and size throughout its length with each layer of weldment smooth; free of slag, cracks, pinholes, and undercuttings; and completely fused to the adjacent weld beads and base metal. Avoid irregular surface, nonuniform bead pattern, and high crown. Form fillet welds of the indicated size of uniform height and fully penetrating. Accomplish repair, chipping, and grinding of welds in manner that will not gouge, groove, or reduce the base metal thickness.

3.04 BOLTING

A. Use steel bolts to connect structural steel members.

B. Drive bolts accurately into the holes without damaging the thread. Protect boltheads from damage during driving. Boltheads and nuts shall rest squarely against the metal. Where self-locking nuts are not furnished, bolt threads shall be upset to prevent the nuts from backing off.

C. Bolts shall be of the length that will extend entirely through but not more than 1/4-inch beyond the nuts. Draw boltheads and nuts tight against the work. Tap boltheads with a hammer while the nut is being tightened. After final tightening, lock the nuts.

3.05 ADHESIVE ANCHORS

Drill hole in concrete by means of a percussion hammer drill. Blow compressed air in resulting hole and remove dust. Insert adhesive capsule into hole. Screw stud halfway into nut, screw drive unit into nut/stud assembly, and secure drive unit into chuck of rotary percussion hammer drill. Break capsule with chamfered end of stud. Using a rotary hammer drill, drive stud to bottom of hole. Release friction lock and remove drill. Allow resin to cure for the time recommended by the capsule anchor manufacturer before loading stud.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

This section covers premolded PVC plastic sheet liner for use as the concrete protective liner at all exposed interior areas indicated on the drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. General Concrete Construction: STD SPEC 03000.

D. Precast Concrete Manholes: STD SPEC 03461.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit catalog data, descriptive literature and assembly drawings. Show dimensions, materials of construction by specification reference and grade.

C. Show dimensions and materials of construction.

D. Drawings shall be submitted showing a complete layout indicating the limits of work and details of materials of construction and installation. The manufacturer shall provide site-specific detailed drawings of all areas of special construction including, but not necessarily limited to, corners, pipe penetrations, slide gates, concrete benching, termination strips, construction joints, and any other miscellaneous penetrations. The drawings shall show the limits and locations of all these special construction areas.

1.04 SAMPLES

Contractor shall also submit the following samples:

1. Two 12 inch x 12 inch pieces of liner sheet including the locking extensions.

2. Two outside and inside corner strips.

3. Two tie rod patching strips.

4. Two joint strips.

5. All weld strips.

6. Two termination strips.

7. Two angle strips.

PART 2 - MATERIALS

2.01 ACCEPTABLE PRODUCTS

The plastic liner shall be as manufactured by Ameron “T-Lock Amer-Plate”, Poly-Tee Incorporated “Poly-Tee PVC Liner”, or Serrot Corporation “SERROTLOCK”. No other manufacturers are acceptable.

2.02 MATERIALS

A. Plastic Lining: Flexible PVC sheet, capable of withstanding a back pressure of 40 psi applied to the under surface of the lining without causing anchorage failure and without sheet rupture. The liner shall be white in color. At least 0.065 inch thick with internally molded rib on one side of the sheet.

B. Joint corner, strips, angles, and sheets: As recommended by the lining manufacturer and designed for joining sheets of membrane at joints, corners, and penetrations, respectively.

C. Welding strips: As recommended by the lining manufacturer and designed to join sections of lining by means of hot air welding for PVC. Solvent welding or adhesive bonding will not be allowed.

D. Adhesive, primer, and tape: As recommended by the lining manufacturer.

2.03 SHOP HOLIDAY TESTING

Prior to preparing the sheets for shipment, the sheets shall be tested for pinholes using an electrical spark tester set at 20,000 volts minimum. Any holes shall be repaired and retested.

2.04 DELIVERY, STORAGE, AND HANDLING

A. The contractor shall take all reasonable precautions during the receipt, handling, and storage of the liner to prevent scratching, denting, or puncturing the liner surface or damaging the anchorage system. Sheets shall be stored in a flat position. During cold weather, special precautions shall be made for handling.

B. Any damage to the liner shall be repaired by the Contractor in accordance with the liner manufacturer’s instructions and recommendations.

PART 3 - EXECUTION

3.01 QUALITY ASSURANCE

A. Applicators: The installation of the specified liner shall be considered as highly specialized work, and personnel performing this type of work shall be trained in methods of installation and shall demonstrate their ability to the satisfaction of the Engineer.

B. Qualification of Welders: Each welder shall prequalify by successfully passing a welding test before doing any welding. Requalification may be required at any time deemed necessary by the District. All test welds shall be made in the presence of the District's Representative and shall consist of the following:

Two pieces of liner, at least 15 inches long and 9 inches wide, shall be lapped 1-1/2 inches and held in a vertical position. A welding strip shall be positioned over the edge of the lap and welded to both pieces of liner plate. Each end of the welding strip shall extend at least 2 inches beyond the liner plate to provide tabs.

C. The weld specimen will be tested by the District's Representative as follows:

1. Each welding strip tab, tested separately, shall be subjected to a 10-pound pull normal to the face of the liner with the liner being held firmly in place. There shall be no separation between the welding strip and liner when the welding tabs are submitted to the test pulls. The edges of the weld shall be probed with a putty knife to check for separation at the edge.

2. The test specimens shall be cut from the welded sample and tested in tension across the welds. If none of these specimens fail when tested, the weld will be considered as satisfactory in tension.

3. If one of the specimens fails to pass the tension test, a retest will be permitted. The retest shall consist of testing 3 additional specimens cut from the original welded sample. If all 3 of the retest specimens pass the test, the weld will be considered satisfactory.

D. A disqualified welder may submit a new welding sample when, in the opinion of the Engineer, he has had sufficient off-the-job training or experience to warrant re-examination.

3.02 INSTALLATION

A. Preparation of concrete forms and liner shall be done in accordance with the manufacturer's recommendations. Plastic liner shall be installed in accordance with the manufacturer's recommendations and the requirements set forth herein. All work for and in connection with the installation of plastic sheet liner, the preparation of surfaces, and the sealing and welding of joints shall be performed by the manufacturer of the liner or by a firm or individual who is authorized by and recommended to the Owner and the Engineer in writing by the manufacturer.

B. Walls

1. Liner sheets for wall linings shall be set and properly secured to the concrete contact faces of the forms which form the surfaces to be lined. The sheets shall be placed with the smooth face next to the form and the line of tees or anchoring devices on the back side of the sheets vertical in the walls. The sheet shall be overlapped or butt jointed without more than 1/8 inch opening in any joint between adjacent sheets and the sheets held in place with small-headed finishing nails placed within ¼ inch of the edge of the sheets. After all sheets are in place on the form being lined, the joints between sheets shall be sealed on the back side with a 1-inch wide welding strip or other means

acceptable to the Engineer shall be used to prevent concrete from flowing around edges. A termination strip shall be provided at the intersection of the walls and slab.

2. Where possible, the form to be lined shall be set in place, the lining attached, and all lining joints covered before the reinforcing steel is installed. The outer form shall then be set in place and the form ties installed through the liner in the normal manner. The number of form ties used shall be held to the minimum.

3. The lining installation and sealing shall provide a continuous plastic lining and prevent entrance of concrete or mortar between the lining and the form.

4. Forms shall be removed in a careful manner after the concrete has attained sufficient strength and has been properly cured. Finishing nails used to hold the liners in place on the forms may pull out with the forms but if not, shall be removed afterwards.

5. After the forms have been removed, the exposed butt joints in the liner, including nail and form tie holes, shall be sealed with welding strip heat-welded over the areas involved. Sealing shall provide a continuous plastic lining.

C. Ceilings: Liner sheets for ceiling surfaces shall be set, properly secured, and joints sealed in accordance with the requirements specified for wall surfaces. Care shall be taken to form and securely seal the corners formed between the wall and ceiling sheets.

D. Wrapping: Underneath slabs or along walls where an opening, such as an access opening, is indicated on the drawings, the liner shall be wrapped or placed along the opening ledge or exposed vertical section of concrete.

E. Connection to Existing PVC Liner: Existing PVC liner shall be neatly trimmed prior to being welded to new PVC liner. All joint interfaces between old and new liner shall be connected as though they were new weld splices.

3.03 FIELD QUALITY CONTROL

A. The surface of the liner shall be cleaned as required to permit visual inspection and spark testing.

B. After liners are installed, all surfaces covered with lining, including welds, shall be tested at the expense of the Contractor, with an acceptable electrical spark tester with the instrument set at 20,000 volts minimum.

C. All welds shall be physically tested by a nondestructive probing method. All patches over holes, or repairs to the liner wherever damage ahs occurred, shall be made as specified herein.

D. At least 25 percent of the transverse welding strips which extend to a lower edge of the liner shall be tested. The welding strips shall extend 2 inches below the liner to provide a tab. A 10-pound pull shall be applied to each tab. The force shall be applied normal to the face of the structure by means of a spring balance. Liner adjoining the welding strip shall be held against the concrete during application of the force. The 10-pound pull shall be maintained if a weld failure develops, until no further separation occurs. Defective welds shall be retested after repairs have been made. Tabs shall be neatly trimmed away after the welding strip has passed inspection. Inspection shall be made within 2 days after joint has been completed in order to prevent tearing the projecting weld strip and consequent damage to the liner from equipment and materials used in or taken through the Work.

3.04 PROTECTION

A. All necessary measures and precautions shall be taken to prevent damage to liner plate from equipment and materials used in, or taken through the Work. Any damage to the installed liner shall be repaired by the Contractor in accordance with the liner manufacturer's instructions and recommendations.

B. All holes and all cut, torn, and seriously abraded areas in the lining shall be patched. Patches made entirely with welding strip shall be fused to the liner over the entire patch. The use of this method is limited to patches which can be made with a single welding strip. The use of parallel, overlapping, or adjoining welding strips will not be permitted. Patches over grout holes and larger areas may consist of smooth liner over the damaged area with edges covered with welding strips fused to the patch and to the liner adjoining the damaged area. The size of a single patch of the latter type shall be limited to its width, which shall not exceed 4 inches.

C. Wherever the liner is not properly anchored to concrete, or wherever patches larger than those permitted above are necessary, the repair of the liner and the restoration of anchorage shall be as recommended by the manufacturer and shall be acceptable to the Engineer.

END OF SECTION

STANDARD SPECIFICATION

SECTION 09860 POLYURETHANE COATING SYSTEM FOR MANHOLES AND WET WELLS

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes the installation of an epoxy/urethane lining system to be applied to the interior concrete surface of new manholes and wet wells.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Painting and Coating: STD SPEC 09900.

D. Precast Concrete Manholes: STD SPEC 03461.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit installation schedule.

C. Submit manufacture's catalog data and descriptive literature.

D. Submit testing procedures and acceptance criteria.

PART 2 - MATERIALS

2.01 LINING MATERIAL

A. The lining material shall be a two-component, 100% solid, non-solvent hybrid polyurethane coating, with a shore “D” hardness of 57 at 77 degrees Fahrenheit, such as Sancon 100 as manufactured by Sancon Engineering, Huntington Beach, California or District approved equal.

B. Materials specified are those which have been evaluated for the specific service. Elastomeric urethane products of Sancon Engineering, Inc., or equal, are listed to establish a standard of quality. Standard products of manufacturers other than those specified may be accepted when it is proved to the satisfaction of the Engineer they meet Standard Specifications requirements, are equal in composition, durability, usefulness, and convenience for the purpose intended. Substitution will be considered provided when the following minimum conditions are met:

1. The proposed lining system shall have a dry film thickness equal to or greater than that of the specified system.

2. The proposed lining system shall employ an equal number of coats.

3. The proposed lining system shall employ coating of the same generic type.

4. The proposed lining system shall have been successfully used in 10 similar projects, and at least three years old, where lining has been applied to similar exposure and application.

5. All requests for substitution shall carry full descriptive literature and directions for application, along with complete information, generic type and non-volatile content by volume. Proof of meeting SSPWC Section 500- 2 requirements shall also be submitted to the District's Representative for review.

6. Submit certified laboratory data sheets showing the proposed substitute. Testing shall have been performed by an independent testing laboratory satisfactory to the District's Representative and all costs incurred in the testing program shall be borne by the Contractor. The District's Representative shall be sole and final judge of the acceptability of any proposed substitution. Requests for substitution must be approved in writing.

7. Both manufacturer and installer of the elastomeric polyurethane shall warrant its lining for five years against any type of failure due to defects in material and application.

8. The material shall be the high-build type capable of application thickness, as specified, without runs or sags, and shall be capable of passing ASTM D-1737 for flexibility, using cylinder mandrel of 0.5 inch (12.7 millimeter). The flash point of the fluid mixture shall be 450 degrees Fahrenheit open Zahn cup.

9. Lining material shall meet or exceed the requirements of 210-2.3.3 and 500-2.4.10 of the Standard Specifications for Public Works Construction pertaining to Chemical Resistance and Physical Properties. Proof of meeting these requirements shall be provided as part of the bid submittal and shall be confirmed by the District's Representative 15 days prior to commencement of work.

C. The color shall be white or cream. The complete coating shall be impermeable to sewer gases and liquids and non-conductive to bacterial or fungus growth. The lining shall be capable of repair at any time during its lifespan.

PART 3 - INSTALLATION

3.01 SURFACE PREPARATION

A. No surface preparation is required on clean concrete surfaces free from oils, curing Compounds or other foreign materials. Surface cleaning, if required, shall be accomplished by grit blasting.

B. Grit blasting is required where the coating is subject to immersion service.

C. Newly placed concrete or mortar may be coated as soon as initial set. Three to seven days of curing time for the newly placed concrete is required prior to coating.

3.02 LINER APPLICATION

A. Only workmen trained and experienced with the specified material shall perform the lining application.

B. The lining shall be applied through plural component equipment specifically designed and approved by the manufacturer of the lining material. The equipment shall be in good working order to insure correct proportioning and mixing of the components.

C. A recommended thickness of 1 to 3 mils of epoxy shall be applied as the primer coat.

D. A recommended minimum thickness of 80 mils of polyurethane shall be applied prior to the epoxy becoming tack free. The lining shall be applied over dry concrete to all interior surfaces as designated in the plans in one continuous coat, without seams, bubbles or pinholes.

E. The finished lining shall be uniform in color and free from any holes or defects. Any areas in question shall be removed, reworked and patched.

F. During lining application, the Contractor shall take wet gauge thickness readings as required to insure correct lining thickness.

G. Application of the lining shall not take place when exposed to rain, or high winds. It is the Contractor's responsibility to insure protection of the work from these conditions.

3.03 QUALITY ASSURANCE

A. Spark testing will be performed upon completion of lining installation and visual inspection. Spark testing voltage will be set at 100 volts per mil of coating thickness specified. Spark testing equipment shall be Tinker and Rasor APW or District approved equal.

B. Spark Testing shall be witnessed by the District's Representative.

END OF SECTION

STANDARD SPECIFICATION

SECTION 09870 GLASS LININGS AND COATINGS

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes the installation of specially formulated internal porcelain linings for handling sewage, grease, scum and sludge. Glass linings shall be Vitco Corp. type SG-14, or District approved equal.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Painting and Coating: STD SPEC 09900.

D. Disinfection of Piping: STD SPEC 15141.

E. Pressure Testing of Piping: STD SPEC 15144.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit installation schedule.

C. Submit manufacture's catalog data and descriptive literature.

D. Submit testing procedures and acceptance criteria.

1.04 SAMPLES

Submit a sample of the approved lining to the District's Representative for use as a comparison guide at the jobsite.

PART 2 - MATERIALS

2.01 GLASS MATERIAL

A. The glass lining material shall consist of special glasses and inorganic materials applied to internal surfaces.

B. A minimum of two linings shall be applied and each shall be separately fired to a maturing temperature exceeding 1300 degrees Fahrenheit. The firings shall form an integral molecular chemical/mechanical bond with the base metal.

C. Subsequent coatings will form an integral molecular bond with the previous coat. The resulting bond shall be sufficient to with stand a metal yield of 0.001 inch/inch without damage to the glass.

2.02 MATERIAL PROPERTIES

A. The entire lining system shall be 0.008 to 0.12 inches thick as tested with magnetic coating thickness test equipment.

B. It shall have a hardness exceeding 5 on the MOHS scale and a density from 2.5 to 3 grams per cubic centimeter.

C. The lining shall be capable of with standing an instantaneous thermal shock of 350 degrees Fahrenheit without crazing, blistering or spalling. It shall be resistant to corrosion by solutions with a pH between 3 and 10 at 125 degrees F.

D. It shall show a weight loss of not more than 3 milligrams per square inch when tested in accordance with ASTM C283-54.

E. There shall me no visible loss of surface gloss after immersion of a normal production run sample in an 8% sulfuric acid solution at 148 degrees F for a period of 10 minutes.

F. Pin holes, crazing or fish scales which expose the metal substrate shall be limited to 0.01% of the total glass surface. The visual appearance of the glass lining should be similar to bright and clean opaque window glass.

PART 3 - INSTALLATION

3.01 FIELD CUTTING

Field cutting of the glass lined pipe shall be limited to only one piece per production run. This cut is for closure purposes only, unless otherwise specified or shown on the Drawings.

3.02 CUTS

Cuts shall be made using a high-speed abrasive wheel type cut off saw. Cut edges should be repaired using Glidden “Glid Guard” high solids epoxy, Series 5430 or District approved equal.

END OF SECTION

STANDARD SPECIFICATION
SECTION 09900 PAINTING AND COATING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section includes materials and application of painting and coating systems for the following surfaces:

1. Submerged Metal

2. Exposed Metal

3. PVC, CPVC and FRP

4. Metal in Contact with Concrete

5. Plaster, Wood, Masonry and Drywall

B. This section does not include coating steel tanks and reservoirs.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit coating manufacturer's data sheets for the products to be applied. Data sheets shall show the following information:

1. Percent solids by volume.

2. Minimum and maximum recommended dry-film thickness per coat for prime, intermediate, and finish coats.

3. Recommended surface preparation.

4. Recommended thinners.

5. Statement verifying that the specified prime coat is recommended by the manufacturer for use with the specified intermediate and finish coats.

6. Application instructions including recommended equipment and temperature limitations.

7. Curing requirements and instructions.

C. Submit color swatches.

D. Submit certificate identifying the type and gradation of abrasives used for surface preparation.

E. Submit material safety data sheets for each coating.

PART 2 - MATERIALS

2.01 PAINTING AND COATING SYSTEMS

A. Coating products shall conform to San Diego Air Pollution Control District Rule 67.0, where products cannot contain more than 250 grams per liter of volatile organic compound (VOC) per gallon of coating product as applied. The following index lists the various painting and coating systems by service and generic type.

PAINT COATINGS SYSTEM INDEX

No.	Title	Generic Coating
	Submerged Metal Coating System	
5.	Submerged or Intermittently Submerged Metal, Potable or Recycled Water	Epoxy
	Exposed Metal Coating Systems	
10.	Exposed Metal, Corrosive Environment	High Build Epoxy (2 Coat System) with Polyurethane Topcoat
15.	Exposed Metal, Atmospheric Weathering Environment	Acrylic
20.	Exposed Metal, Exterior	Epoxy with Urethane Topcoat
	PVC, CPVC and FRP Coating System	
41.	PVC, CPVC and FRP, Ultraviolet Exposure	Polyurethane
	Metal in Contact with Concrete Coating System	
51.	Aluminum and Concrete	Epoxy
	Plaster, Wood, Masonry and Drywall Coating System	
60.	Plaster, Wood, Masonry and Drywall	Acrylic Latex

B. These systems are specified in detail in the following paragraphs. For each coating, the required surface preparation, prime coat, intermediate coat (if required), topcoat, and coating thicknesses are described. Mil thicknesses shown are minimum dry-film thicknesses.

2.02 SUBMERGED METAL COATING SYSTEM

System No. 5 -- Submerged Metal, Potable or Recycled Water:

Type: Epoxy

Service Conditions: For use with steel structures, piping, valves, or equipment in potable or recycled water.

Surface Preparation: SSPC SP-10.

Coating System: Apply the manufacturer's recommended number of coats to attain the specified minimum coating thickness. Products: Devoe Bar-Rust 233H, Tnemec N140 or 100, Sherwin-Williams Tank Clad HS B62-80, PPG AQUAPON® LT NSF Low Temperature Epoxy Coatings 95-172, or District approved equal; 12 mils total. Color of topcoat: white. Each coat shall be different color than the one preceding it.

2.03 EXPOSED METAL COATING SYSTEMS

A. System No. 10 -- Exposed Metal, Corrosive Environment:

Type: High-build epoxy finish coat having a minimum volume solids of 60%, with an inorganic zinc prime coat and a pigmented polyurethane finish coat having a minimum volume solids of 52%.

Service Conditions: For use with metal structures, pipes, or valves subjected to water condensation; chemical fumes; and chemical contact.

Surface Preparation: SSPC SP-10.

Prime Coat: Self-curing, two-component inorganic zinc-rich coating recommended by the manufacturer for overcoating with a high-build epoxy finish coat. Minimum zinc content shall be 12 pounds per gallon. Apply to a thickness of 3 mils. Products: Tnemec 90E-92, Devoe Catha-Coat 304 or 304V, International Interzinc 22HS, Ameron 9HS, Sherwin-Williams Zinc-Clad II Plus, PPG METALHIDE® 28 Inorganic Zinc-Rich Primer 97-672, or District approved equal.

Intermediate Coat: Tnemec 104, ICI Devoe Devran 224HS or 231, International Interseal 670HS, Ameron 385, Sherwin-Williams Macropoxy 646 B58-600, PPG PITT-GUARD® Direct-to-Rust Epoxy Mastic Coating 97-145 series, or District approved equal; 5 mils.

Finish Coat: Two-component pigmented acrylic or aliphatic polyurethane recommended by the manufacturer for overcoating a high-build epoxy coating. Apply to a thickness of at least 2 mils. Products: Tnemec Series 1075, ICI Devoe Devthane 379, International Interline 990HS, Ameron 450HS, Sherwin-Williams Hi-Solids Polyurethane B65-300, PPG PITTHANE® Ultra Gloss Urethane Enamel 95-812 series, or District approved equal.

B. System No. 15 -- Exposed Metal, Atmospheric Weathering Environment:

Type: One component acrylic enamel having a minimum volume solids content of 35% with an acrylic inorganic zinc primer.

Service Conditions: For use on interior and exterior metal and piping subject to sunlight, weathering, and water condensation.

Surface Preparation: SSPC SP-10.

Prime Coat: Sherwin-Williams Zinc Clad II Plus primer, ICI Devoe Inorganic Zinc 304V, Tnemec 90E-92, or District approved equal applied to a minimum dry-film thickness of 3 mils.

Finish Coats: Two or more coats of Sherwin-Williams Sher-Cryl B66–300, ICI Devoe Devflex 659, Tnemec Series 28 or 29, or District approved equal. Apply sufficient coats to provide a total minimum dry-film thickness of 8 mils. Thickness of any individual coat shall not exceed 4 mils.

C. System No. 20 -- Exposed Metal, Exterior:

Type: High-build epoxy prime coat with a pigmented high-build aliphatic or acrylic polyurethane finish coat.

Service Conditions: For use on exterior metal piping appurtenances, such as valve box lids, hydrant heads, and guard posts.

Surface Preparation: SSPC SP-10.

Prime Coat: Two-component high-build epoxy. Apply to a thickness of 8 mils. Products: Ameron 400, ICI Devoe 235, Tnemec 104, International Interseal 670HS, Sherwin-Williams Macropoxy 646 B58-600, PPG PITT-GUARD® Direct-to-Rust Epoxy Mastic Coating 97-145 series, or District approved equal.

Finish Coat: Two-component pigmented high-build polyurethane. Apply one or more coats to a total thickness of 5 mils. Products: Ameron “Amershield,” ICI Devoe Devthane 359, Tnemec Series 1075, International Interthane 990HS, Sherwin-Williams Hi-Solids Polyurethane B65-300 series, PPG PITTHANE® Ultra Gloss Urethane Enamel 95-812 series, or District approved equal.

2.04 PVC, CPVC AND FRP COATING SYSTEM

System No. 41 -- PVC, CPVC and FRP, Ultraviolet Exposure:

Type: Epoxy primer with a minimum volume solids of 54% and a pigmented Polyurethane enamel having a minimum volume solids of 52%.

Service Conditions: PVC or CPVC piping and FRP exposed to sunlight.

Surface Preparation: SSPC SP-1. Then lightly abrade the surface with medium-grain garnet paper.

Prime Coat: One coat of Tnemec Series N69 Epoxoline, International 7510, Ameron 385, ICI Devoe Devran 224HS, Sherwin-Williams Macropoxy 646 B58 series, PG PITT-GUARD® Direct-to-Rust Epoxy Mastic Coating 97-145 series, or District approved equal. Apply to a minimum dry-film thickness of 4 mils.

Finish Coat: One coat of Tnemec Series 1075, International Interthane 990HS, Ameron 450HS, ICI Devoe Devran 379, Sherwin-Williams Hi-Solids Polyurethane B65-300 series, PPG PITTHANE® Ultra Gloss Urethane Enamel 95-812 series, or District approved equal. Apply to a minimum dry-film thickness of 3 mils

2.05 METAL IN CONTACT WITH CONCRETE, COATING SYSTEM

System No. 51 -- Aluminum insulation from Concrete and Carbon Steel:

Type: High solids epoxy or phenolic epoxy having a minimum volume solids of 80% (ASTM D2697).

Service Conditions: Coat areas of aluminum grating, stairs, framing, structural members, or aluminum fabrications in contact with concrete or carbon steel with this system.

Surface Preparation: Preparation: Solvent or steam cleaning per SSPC SP-1; do not use alkali cleaning. Then dust blast.

Coating System: Apply three or more coats of Ameron 400, Tnemec Series 135, ICI Devoe Bar-Rust 233H, Sherwin-Williams Macropoxy B58-600, PPG PITT-GUARD® Direct-to-Rust Epoxy Mastic Coating 97-145 series, or District approved equal; 30 mils total. Maximum thickness of an individual coating shall not exceed the manufacturer's recommendation.

2.06 PLASTER, WOOD, MASONRY AND DRYWALL COATING SYSTEM

System No. 60 -- Plaster, Wood, Masonry and Drywall, Normal Exposure:

Type: Acrylic latex coating having a minimum volume solids of 40%.

Service Conditions: For use in coating weather-exposed or enclosed concrete masonry, drywall, wood, and plaster.

Surface Preparation: Surfaces shall be dry, clean, and free of contaminants.

Prime Coat: Self-priming.

Finish Coats: Two coats of Tnemec Series 6, Tneme-cryl, 2 mils each; two coats of ICI Dulux Professional, 2 mils each; two coats of Sherwin-Williams Metalatex B42 series, 2 mils each; two coats of PPG PITT-TECH® Int/Ext Satin DTM Industrial Enamel 90-474 series, 2 to 3 mils each, or District approved equal.

2.07 ABRASIVES FOR SURFACE PREPARATION

A. 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 or steel grit.

B. Abrasives used for preparation of copper and aluminum surfaces shall be one of the following:

1. Crushed slag, 80 to 100 mesh.

2. Very fine silica sand, 80 to 100 mesh.

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

3.01 WEATHER CONDITIONS

A. Do not paint 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. Do not apply paint when the relative humidity is above 85% or the temperature is above 90 degrees F.

C. Do not paint when temperature of metal to be painted is above 120 degrees F.

D. Do not apply paints if air or surface temperature is below 40 degrees F or expected to be below 40 degrees F within 24 hours.

E. Do not apply epoxy, acrylic latex, and polyurethane paints 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.

3.02 SURFACE PREPARATION

A. Remove oil and grease from metal surfaces in accordance with SSPC-SP 1. Use clean cloths and cleaning solvents and wipe dry with clean cloths. Do not leave a film or greasy residue on the cleaned surfaces before sandblasting.

B. Remove weld spatter and weld slag from metal surfaces and grind smoothly rough welds, beads, peaked corners, and sharp edges in accordance with SSPC SP-2 and SSPC SP- 3. Grind 0.02 inch (minimum) off the weld caps on pipe weld seams. Grind outside sharp corners, such as the outside edges of flanges, to a minimum radius of ¼ inch.

C. Neutralize welds with a chemical solvent that is compatible with the specified coating materials. Use clean cloths and chemical solvent. Wipe dry with clean cloths. Do not leave a residue on the cleaned surfaces.

D. Do not abrasive blast or prepare more surface area than can be coated in one day. Remove all sharp edges, burrs, and weld spatter. Do not abrasive blast PVC, CPVC, or FRP piping or equipment. Do not abrasive blast epoxy, enamel coated, or fusion-bonded epoxy pipe that has already been factory coated, except to repair scratched or damaged coatings.

E. Surface preparation shall conform with the SSPC specifications as follows:

Solvent Cleaning	SP-1
Hand Tool Cleaning	SP-2
Power Tool Cleaning	SP-3
White Metal Blast Cleaning	SP-5
Commercial Blast Cleaning	SP-6
Brush-Off-Blast Cleaning	SP-7
Pickling	SP-8
Near-White Blast Cleaning	SP-10

F. Wherever the words "solvent cleaning," "hand tool cleaning," "wire brushing," or "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 (Society for Protective Coatings), surface preparation specifications listed above.

G. Dust blasting is defined as cleaning the surface through the use of very fine abrasives, such as siliceous or mineral abrasives, 80 to 100 mesh. Apply a fine etch to the metal surface to clean the surface of any contamination or oxide and to provide a surface profile for the coating.

3.03 ABRASIVE BLAST CLEANING

A. Use dry abrasive blast cleaning for metal surfaces. Do not use abrasives in automatic equipment that have become contaminated. When shop or field blast cleaning with handheld nozzles, do not recycle or reuse blast particles.

B. After abrasive blast cleaning and prior to application of coating, dry clean surfaces to be coated by dusting, sweeping, and vacuuming to remove residue from blasting. Apply the specified primer or touch-up coating within the period of an eight-hour working day. Do not apply coating over damp or moist surfaces. Reclean prior to application of primer or touch-up coating any blast cleaned surface not coated within said eight-hour period.

C. Keep the area of the work in a clean condition and do not permit blasting particles to accumulate and constitute a nuisance or hazard.

D. During abrasive blast cleaning, prevent damage to adjacent coatings. Schedule blast cleaning and coating such that dust, dirt, blast particles, old coatings, rust, mill scale, etc., will not damage or fall upon wet or newly coated surfaces.

3.04 PROCEDURES FOR ITEMS HAVING SHOP-APPLIED PRIME COATS

Handle shop-primed items with care during unloading, installation, and erection operations to minimize damage. Do not place or store shop-primed items on the ground or on top of other work unless ground or work is covered with a protective covering or tarpaulin. Place shop-primed items above the ground upon platforms, skids, or other supports.

3.05 FIELD TOUCH-UP OF SHOP-APPLIED PRIME COATS

A. Remove oil and grease surface contaminants on metal surfaces in accordance with SSPC SP-1. Use clean rags wetted with a degreasing solution, rinse with clean water, and wipe dry.

B. Remove dust, dirt, salts, moisture, chalking primers, or other surface contaminants that will affect the adhesion or durability of the coating system. Use a high-pressure water blaster or scrub surfaces with a broom or brush wetted with a solution of trisolium phosphate, detergent, and water. Before applying intermediate or finish coats to inorganic zinc primers, remove any soluble zinc salts that have formed by means of scrubbing with a stiff bristle brush. Rinse scrubbed surfaces with clean water.

C. Remove loose or peeling primer and other surface contaminants not easily removed by the previous cleaning methods in accordance with SSPC SP-7. Take care that remaining primers are not damaged by the blast cleaning operation. Remaining primers shall be firmly bonded to the steel surfaces with blast cleaned edges feathered.

D. Remove rust, scaling, or primer damaged by welding or during shipment, storage, and erection in accordance with SSPC SP-10. Take care that remaining primers are not damaged by the blast cleaning operation. Remaining primers shall be firmly bonded to the steel surfaces with blast cleaned edges feathered.

E. Use repair procedures on damaged primer which protects adjacent primer. Blast cleaning may require the use of lower air pressure, smaller nozzles, and abrasive particle sizes, short blast nozzle distance from surface, shielding, and/or masking.

F. After abrasive blast cleaning of damaged and deflective areas, remove dust, blast particles, and other debris by dusting, sweeping, and vacuuming; then apply the specified touch-up coating.

G. Surfaces that are shop primed with inorganic zinc primers shall receive a field touch-up of organic zinc primer to cover all scratches or abraded areas.

H. Other surfaces that are shop primed shall receive a field touch-up of the same primer used in the original prime coat.

3.06 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. Deliver paints to the jobsite in the original, unopened containers.

3.07 PAINT MIXING

Prepare multiple-component coatings using all of the contents of the container for each component as packaged by the paint manufacturer. Do not use partial batches. Do not use multiple-component coatings that have been mixed beyond their pot life. Provide small quantity kits for touchup painting and for painting other small areas. Mix only the components specified and furnished by the paint manufacturer. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

3.08 PROCEDURES FOR THE APPLICATION OF COATINGS

A. Conform to the requirements of SSPC PA-1. Follow 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.

B. Stir, strain, and keep coating materials at a uniform consistency during application. Apply each coating evenly, free of brush marks, sags, runs, holidays, and other evidence of poor workmanship. Use a different shade or tint on succeeding coating applications to indicate coverage where possible. Finished surfaces shall be free from defects or blemishes.

C. Do not use thinners unless recommended by the coating manufacturer. If thinning is allowed, do not exceed the maximum allowable amount of thinner per gallon of coating material. Stir coating materials at all times when adding thinner. Do not flood the coating material surface with thinner prior to mixing. Do not reduce coating materials more than is absolutely necessary to obtain the proper application characteristics and to obtain the specified dry-film thicknesses.

D. Remove dust, blast particles, and other debris from blast cleaned surfaces by dusting, sweeping, and vacuuming. Allow ventilator fans to clean airborne dust to provide good visibility of working area prior to coating applications. Remove dust from coated surfaces by dusting, sweeping, and vacuuming prior to applying succeeding coats.

E. Apply coating systems to the specified minimum dry-film thicknesses as measured from above the peaks of the surface profile.

F. Apply primer immediately after blast cleaning and before any surface rusting occurs, or any dust, dirt, or any foreign matter has accumulated. Reclean surfaces by blast cleaning that have surface colored or become moist prior to coating application.

G. Apply a brush coat of primer on welds, sharp edges, nuts, bolts, and irregular surfaces 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. Apply the spray coat over the brush coat.

3.09 SURFACES NOT TO BE COATED

Do not paint the following surfaces unless otherwise noted on the Drawings or in other Standard Specification sections. Protect during the painting of adjacent areas:

A. Cement mortar coated pipe and fittings.

B. Stainless steel.

C. Metal plates/nameplates or letters.

D. Concrete surfaces.

E. Fencing.

F. 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.

G. Electrical fixtures except for factory coatings.

H. Grease fittings.

I. Buried pipe unless specifically required in the piping specifications.

J. Fiberglass items.

K. Aluminum handrails, stairs and grating, unless in contact with concrete.

3.10 PROTECTION OF SURFACES NOT TO BE PAINTED

Remove, mask, or otherwise protect hardware, lighting fixtures, switchplates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process. Mask openings in motors to prevent paint and other materials from entering the motors.

3.11 SURFACES TO BE COATED

Coat surfaces as described below:

A. Coat mechanical equipment as described in the various mechanical equipment specifications. Color shall match the color of the connecting piping.

B. Coat aboveground and exposed piping or piping in vaults and structures as described in the various piping specifications. Color shall be as indicated or as selected by the District's Representative.

C. Coat valves as described in the various valve specifications. Aboveground valves or valves in vaults and structures shall match the color of the connecting piping.

D. Coat aluminum surfaces in contact with concrete per System No. 51.

E. Coat exposed surfaces of enclosures, guard posts, marker posts, fire hydrants, valve boxes, and test boxes as described in the particular specifications for the above items.

3.12 DRY FILM THICKNESS TESTING

A. Measure coating thickness specified for metal surfaces with a magnetic-type dry-film thickness gage. Test the finish coat (except zinc primer and galvanizing) for holidays and discontinuities with an electrical holiday detector, low-voltage, wet-sponge type. Provide measuring equipment. Provide detector as manufactured by Tinker and Rasor or K-D Bird Dog. Provide dry-film thickness gage as manufactured by Mikrotest or Elcometer. Check each coat for the correct dry-film thickness. Do not measure 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

STANDARD SPECIFICATION
SECTION 09952 COLD APPLIED WAX TAPE COATING

PART 1 - GENERAL

1.01 DESCRIPTION

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.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit manufacturer's catalog data sheets and application instructions.

PART 2 - MATERIALS

2.01 PRIMER

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

Color	Brown
Pour Point	100°F to 110°F
Flash Point	350°F
Coverage	1 gallon/100 square feet

B. Primer shall be Trenton Wax Tape Primer, Denso Paste Primer, or District approved equal.

2.02 WAX TAPE

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

Color	Brown
Saturant Pour Point	115°F to 120°F
Thickness	50 to 70 mils
Tape Width	6 inches
Dielectric Strength	100 volts/mil

B. Wax tape shall be Trenton No. 1 Wax Tape, Denso "Densyl Tape," or District approved equal.

2.03 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:

Color	Clear
Thickness	1.5 mils
Tape Width	6 inches

B. Plastic wrapper shall be Trenton Poly-Ply, Denso Tape PVC Self-Adhesive, or District approved equal.

2.04 PLASTIC ADHESIVE TAPE

Use 2-inch wide plastic adhesive tape such as Calpico Vinyl Tape, Polyken 900, Scotchwrap 50, or District approved equal.

PART 3 - EXECUTION

3.01 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. Apply primer by hand or brush to all surfaces of the pipe, fitting, flanges, and bolts to be wrapped by wax tape. Work the primer into all crevices, around bolts and nuts, into the threads, and completely cover all exposed metal surfaces. Extend the primer beyond the indicated limits of application a minimum of 6 inches onto adjacent surfaces of the piping.

C. Apply the wax tape immediately after the primer application. Work the tape into the crevices around the fitting or flanges. Cut short lengths of tape, place over each bolt head and nut, and work the tape into the crevices. Wrap the wax tape spirally around the pipe and across the fitting or flanges. Use a minimum overlap of 55 percent of the tape width. Extend the wax tape a minimum of 6 inches beyond each side of the application limits.

D. Work the tape into the crevices and contours of irregularly shaped surfaces and smooth out so that there is a continuous protective layer with no voids or spaces under the tape. Tape must be in contact with the surfaces to be protected.

E. Overlap the completed wax tape coating installation with the plastic wrapper 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 the plastic wrapper material.

F. Overlap the completed plastic wrapper material with the plastic adhesive tape. Wrap spirally around the pipe and across the fitting or flanges. Use a minimum overlap of 55 percent of the tape width and completely cover the wrapper material.

END OF SECTION

STANDARD SPECIFICATION
SECTION 09954 POLYETHYLENE SHEET OR TUBE ENCASEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, application, and inspection of polyethylene sheet or tube encasement for buried steel and iron pipe, fittings, couplings, valves, and appurtenances.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit manufacturer's catalog literature and product data sheets describing the physical, chemical and electrical properties of the encasement material.

PART 2 - MATERIALS

2.01 POLYETHYLENE MATERIAL

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

2.02 PLASTIC ADHESIVE TAPE

Use 2-inch wide plastic adhesive tape such as Calpico Vinyl Tape, Polyken 900, Scotchwrap 50, or District approved equal.

PART 3 - EXECUTION

3.01 APPLYING TUBE ENCASEMENT TO BURIED PIPE AND FITTINGS

A. Cut polyethylene tube 2 feet longer than the length of pipe to receive the encasement. Prior to placing the length of pipe into the trench, raise the pipe section and slip the polyethylene tube over the spigot end of the pipe. Bunch up the tube in accordion fashion between the spigot end and the supporting sling.

B. Lower the pipe section into the trench and seat the spigot end into the bell of the previously installed pipe. Provide a shallow hole at the bell to facilitate the joint overlap.

C. Remove the sling from the pipe. Raise the pipe from the bell end about 3 or 4 inches and slip the bunched up polyethylene tube along the full length of pipe. Leave 1-foot of bunched up polyethylene tube at each end of the pipe for joint overlap.

D. To make the joint overlap, pull the polyethylene tube from the bell end over the pipe joint to the spigot end. Fold the tube around the pipe and secure with three circumferential wraps of 2-inch wide plastic adhesive tape or a plastic tie strap. Then pull the bunched up polyethylene tube on the spigot end over the wrapped pipe joint to the bell end. Fold tube and secure with tape as previously described or a plastic tie strap.

E. Pull the loose polyethylene tube on the pipe snugly around the pipe barrel. Fold the excess material over at the top of pipe and secure the fold with 6-inch long strips of 2-inch wide plastic adhesive tape at 3 feet on center.

F. Polyethylene sheet will not be allowed as a substitute for tube when required for installation on buried pipe.

3.02 APPLYING SHEET ENCASEMENT TO BURIED VALVES

Wrap valves by pulling the bunched up polyethylene tube (where installed) from the adjacent pipe over the bells or flanges of the valve. Secure the tube to the valve body with 2-inch wide plastic adhesive strips wrapped around the valve body. Then wrap the valve with a flat sheet of polyethylene. Place the sheet under the valve and fold in half. Extend the sheet to the valve stem and secure the sheet in place with 2-inch wide plastic adhesive tape. Apply the second layer and secure with tape. Secure the sheets with tape around the valve stem below the operating nut and around the barrel of the connecting pipe to prevent the entrance of soil. Pour concrete anchor and support blocks after the wrap has been properly placed.

3.03 APPLYING SHEET ENCASEMENT TO BURIED FITTINGS, COUPLINGS, AND APPURTENANCES

A. Wrap buried ferrous metal pipe fittings, couplings, adapters, and appurtenances with polyethylene sheet. Overlap the adjoining pipe or fitting a minimum of one-foot and secure in place with 2-inch wide plastic adhesive tape. Apply a second layer and secure with tape around the barrel of the connecting pipe to prevent the entrance of soil. Pour concrete anchor and thrust blocks after the wrap has been properly placed.

B. Wrap base elbows and risers of hydrants and backflow prevention assemblies with 2 layers of polyethylene sheet and secure in place with 2-inch wide plastic adhesive tape. Extend the wrap to the finish ground level of the assembly. Secure the sheets with tape around the ends to prevent the entrance of soil. Pour concrete anchor and support blocks after the wrap has been properly placed.

3.04 REPAIR OF POLYETHYLENE MATERIAL

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

END OF SECTION

STANDARD SPECIFICATION
SECTION 09957 POLYETHYLENE TAPE PIPE COATING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section includes materials, application, and testing of a polyethylene tape pipe coating complying with AWWA C209 and AWWA C214 with a 3/4-inch-thick reinforced cement-mortar armor coat in accordance with AWWA C205 for steel pipe sizes 4 inches and larger.

B. Supervisors of tape coating and cement-mortar coating operations shall have at least two years' continuous recent experience in the application of tape and cement-mortar coating systems for steel pipe. The manufacturer of the tape coatings shall demonstrate a minimum of five years' successful application of this product on large diameter steel water pipelines.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Steel Transmission Pipe: STD SPEC 15061.

D. Steel Pipe for Minor Applications: STD SPEC 15253.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit certificates of tests of physical and performance characteristics of each batch of primer and tape wraps.

C. Submit method approved by tape manufacturer to minimize voids at weld seams. Submit method approved by tape manufacturer to minimize disbondment of free ends of tape during shipping and storage.

D. Submit application procedure approved by tape manufacturer, including the pattern of distribution and method of application of the weld seam tape system.

E. Submit an affidavit of compliance with AWWA C209 and AWWA C214.

F. Submit schedule for application of tape coating. Schedule coating to be accomplished during normal working hours. Provide a minimum two weeks notice to the District's Representative prior to commencing or rescheduling work.

G. Submit 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.

H. Submit material description and certificates of tests of physical and performance characteristics of heat shrinkable pipe joint sleeves.

1.04 INSPECTION

The District's Representative or his authorized representative will inspect the entire procedure of applying the protective coating material as herein described from surface preparation to completion of coating. Such inspection shall not relieve the Contractor of responsibility to furnish material and perform work in accordance with this specification. All coating work shall be done in the presence of the District's Representative. All coating work done in the absence of the District's Representative will be subject to rejection.

PART 2 - MATERIALS

2.01 POLYETHYLENE TAPE COATING

A. Provide polyethylene tape coating in accordance with AWWA C209, AWWA C214, and as specified herein. Furnish plant and field applied primer and polyethylene tape, and plant and field applied repair tape by a single manufacturer. 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."

B. The exterior tape coating system shall consist of a primer on the blast cleaned bare metal surface of steel pipe, a multiple-layer cold-applied polyethylene tape coating system and a protective cement-mortar coating applied over the tape system. Tape width shall not exceed 12 inches regardless of pipe diameter. This system shall be applicable to:

1. Plant applications on straight run of pipe.

2. Plant applications on special sections, connections and fittings, and plant repairs of cold-applied tape.

3. Field applications to pipe joints, field coated fittings and repair of field cold-applied tape.

2.02 PRIMER

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 No. 1039 or District approved equal.

2.03 STORAGE PRIMER

Storage primer on the exposed steel at the tape cutbacks shall be Polyken No. 924 or District approved equal. Color to be black.

2.04 PLANT COLD-APPLIED POLYETHYLENE TAPE COATING SYSTEM FOR STRAIGHT RUN PIPE

A. Anti-corrosion inner layer tape shall be Polyken No. 989 or District approved equal with the following properties.

Tape Color:	Black.
Backing:	Consists of a 98% blend of high and low density polyethylene with the remaining portion a blend of colorants and stabilizers.
Adhesive:	Consists of a 100% Butyl based elastomers with resins for adhesion, cathodic disbonding, and long-term in-ground performance.
Thickness:	Total thickness 20 mils: Backing, 9 mils; Adhesive, 11 mils. Tolerance: -5%, + 10%.

B. First mechanical outer layer shall be Polyken No. 955 or District approved equal, with the following properties:

Color:	Black.
Thickness:	Total thickness 30 mils: Backing, 25 mils; Adhesive, 5 mils. Tolerance: -5%, + 10%.

C. Second mechanical outer layer shall be Polyken No. 956 UV1 or District approved equal, having ultraviolet radiation protection properties as follows:

Color:	White.
Thickness:	Total thickness 30 mils: Backing, 25 mils; Adhesive, 5 mils. Tolerance: -5%, + 10%.

D. Total system shall be Polyken YGIII or District approved equal.

2.05 PLANT COLD-APPLIED POLYETHYLENE TAPE COATINGS FOR SPECIALS, FITTINGS, AND PLANT REPAIR OF COLD-APPLIED TAPE

A. Anti-corrosion inner layer shall be Polyken No. 932-35 (Black) or District approved equal. Total thickness 35 mils.

B. Mechanical layer outer tape shall be Polyken No. 932-50 (White) or District approved equal. Total thickness 50 mils.

2.06 FIELD JOINT, FIELD COATED FITTINGS, AND FIELD REPAIR OF COLD-APPLIED TAPE

A. Joint filler tape to be Polyken No. 939 or District approved equal. Color to be black. Thickness 125 mils.

B. Field joint, field coated fitting and field repair outer layer shall be Polyken No. 932-50 or District approved equal. Total thickness 50 mils.

2.07 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.

2.08 MORTAR OVERCOAT

A. Cement shall be Type II, low alkali conforming to ASTM C 150. Mortar overcoat thickness shall be 3/4 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- by 4-inch mesh, ungalvanized conforming to ASTM A 185 or spiral ribbon wire per AWWA C205 Section 4.5.5.. Wire with excessive rusting shall not be used.

PART 3 - EXECUTION

3.01 GENERAL

A. Apply plastic tape coating in accordance with AWWA C209, AWWA C214, and as modified herein.

B. Certificate of Compliance: Prior to shipment of pipe, provide a certificate of compliance stating that tape materials and work for all pipe delivered complies with the requirements of these Specifications and AWWA C209 and AWWA C214. This certification shall be submitted by the pipe manufacturer and endorsed by the tape manufacturer.

C. The pipe manufacturer shall retain the services of a representative of the tape manufacturer to ensure proper installation of all tape materials in the pipe manufacturer's shop.

D. The Contractor shall retain the services of a representative of the tape manufacturer to ensure that the application of tape to field joints and the coating repairs made in the field are done properly and in accordance with the manufacturer's recommendations.

E. Training Certification: The tape manufacturer shall submit certification that the Contractor has been properly trained to apply tape coatings in the field and that the procedures used by the Contractor in the field meet the tape manufacture's requirements. This certification shall be received by the District's Representative within two weeks of the beginning of pipe laying operations.

3.02 STRAIGHT RUN PIPE APPLICATION

A. Cold-applied polyethylene tape coating applied in the plant on straight run pipe shall be a four-layer system consisting of: (1) primer; (2) anti-corrosion inner layer tape; (3) mechanical protective tape (first outer layer); and (4) mechanical protective tape (second outer layer).

B. Large Diameter Pipe (Greater than 36 in.):The entire coating operation on each pipe section shall be performed as a one-station operation where the pipe is supported at the ends in a manner which will permit the application of the specified coatings. No additional handling following the initial setup of the pipe section, from application of primer, tape coating, and cement-mortar coating, will be allowed. No application involving rollers to support the pipe during the primer application, tape coating, or cement-mortar coating will be permitted. The pipe shall be of sufficient stiffness or have sufficient internal bracing to keep pipe cylindrical during taping. Maintain the axis of pipe during application without rocking, pitching, or yawing.

C. Small Diameter Pipe (less than 36 in.): Small diameter pipe may be coated in a two station process either at one facility or at a different facility provided tape damage due to handling is repaired by approved tape vendor procedures with complete encirclement of the repair by the repair tape and retested by the approved holiday detection method. The roller-supported process shall be subject to the review and approval of the District's Representative prior to the process inception. There must be sufficient support and uniform drive to smoothly apply the tape without creating folds, creases, or air entrapment and to not scar the tape with drive rollers during the application process. The interim storage of tape coated pipe must be on protected berms prohibiting any tape indentation or penetration by foreign objects. At the inception of the cement mortar coating process, the tape coated pipe must be retested by an approved holiday detection procedure and any repair must be performed as above.

D. The pipe shall be of sufficient stiffness or have sufficient internal bracing to keep pipe cylindrical during taping. Maintain the axis of pipe during application without rocking, pitching, or yawing.

E. Perform the coating operation in an environmentally controlled area such that it is protected from direct sunlight, wind, rain, snow, mist, fog, dust, and hail.

F. 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.

G. Surface preparation shall conform to AWWA C214 and the following:

1. Bare pipe shall be clean of all foreign matter such as mud, mill scale, dirt, organic matter, weld slag and splatter, wax, coal tar, asphalt, oil, grease, or any contaminants. Wash pipe with hot water and allow the surface to dry.

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.

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

1. Prior to primer and coating application, blast 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 pipe exterior surfaces after the initial curing of the spun mortar lining. Perform the exterior blast cleaning in such a manner as not to damage 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 to 60 percent grit. The shot grit mixture is to be determined prior to 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's Representative.

4. Achieve from abrasive blasting an anchor pattern profile a minimum of 1.0 mil, but not exceeding 2.0 mils. Use NACE No. 3 Surface Profile Standard per NACE TM-01-75 as a visual comparison to define the acceptable anchor pattern profile during blast cleaning operations.

5. Inspect the blast cleaned exterior of each pipe section for adequate surface preparation prior to application of the primer. Surface comparitor tapes are to be used by the pipe manufacturer in three (3) random areas along any given 40-foot length of pipe. The results of the surface comparitor tapes are to be included in the quality control records.

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.

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

1. Apply the primer in a uniform thin film at the coverage rate and thickness recommended by the manufacturer. Apply the inner layer of tape only after the primer is dried as specified by the tape manufacturer.

2. Apply primer only to those sections of pipe that can be taped within the same workday. Pipe coated with primer which was not taped within the same workday may be rejected at the discretion of the District's Representative. The primer shall be removed from rejected pipe sections and the surface shall be re-primed.

3. Protect primer-coated pipe sections from moisture, dirt, sand, and other potentially contaminating materials. Suspend primer application operations or provide full protection for the pipe during high wind periods. Pipe sections not adequately protected shall be rejected by the District's Representative. If rejection occurs due to contamination of the primer, completely remove the primer from the exterior of the pipe section and re-application of the primer will be required.

4. Store, mix and apply primer in strict compliance with the manufacturer's recommendations.

J. Inner layer tape application:

1. Apply the inner layer of tape directly onto the primed surface using mechanical dispensing equipment recommended and approved by the tape manufacturer. Rollers shall be used to apply pressure on the tape as it comes in contact with the pipe. Tape shall be applied with uniform tension such that the surface is tight, smooth and wrinkle-free. The tape shall be overlapped a nominal 1-inch with a 3/4-inch minimum overlap.

2. 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. Provide instrumentation to measure and record tape tension throughout the tape application operation. Documentation of tape tension data shall be suitable to the District's Representative.

3. Apply inner layer tape at a minimum roll temperature of 70°F. Continuously monitor and record the temperature of the tape within 12 inches of the point of contact with the pipe surface. Document the temperature of the tape during application suitable to the District's Representative. Pipe sections where the tape application tension and temperature is not maintained within manufacturer's recommendations shall be rejected and the tape removed from the entire pipe section and re-applied.

4. Provide continuous electronic holiday testing of the inner tape layer at 6000 volts. The holiday test equipment shall be permanently mounted to the tape application station such that the tape is tested immediately after the tape is applied. The test equipment shall be equipped with an indicator light and audio buzzer suitable to the District's Representative to alert the workmen of the presence of holidays in the coating system. Holidays shall be marked as found and repaired after the inner tape layer is completely applied to the pipe section but before the mechanical protection tape layers are applied.

5. Splice each new roll with an overlap of at least 6 inches over the end of the previous roll. 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 ensure a uniform, straight cutback.

K. Mechanical outer layer tape application:

1. The first mechanical outer layer of tape shall be applied using the same mechanical equipment used in the application of the inner layer tape. Longitudinal tape splices shall be at least 6 inches away from a longitudinal tape splice on the inner tape layer. Apply two mechanical outer layers of tape. The inner layer tape shall be electrically tested, inspected, and approved prior to the application of the first mechanical outer layer. Visually inspect the first mechanical outer layer prior to the application of the second mechanical outer tape layer. Both mechanical outer tape layers shall be smooth, tight, and wrinkle-free.

2. Apply the outer layer mechanical protection tapes in a similar manner to the inner protective tape except that the minimum tape roll application temperature shall be 90°F. Monitor tension and temperature during the application of the mechanical outer layer tapes. The use of rollers to apply pressure on the outer tape layers is not required during application. Holiday testing of the mechanical outer layer tapes in not required.

L. Storage primer application shall conform to AWWA C214 as modified herein:

1. Clean the pipe surface free from foreign matter such as sand, grease, oil, grit, rust particles, and dirt prior to storage primer application.

2. Store, mix and apply storage primer in strict accordance with the primer manufacturer's recommendations.

3. Apply storage primer to the exposed steel pipe at tape cutbacks to prevent oxidation of the cleaned metal surface. Spray apply a 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.

M. Mortar Overcoat:

1. Apply cement-mortar overcoating in accordance with AWWA C205 immediately after the application of the tape coating layers. Allow 3-1/2-inch cutback 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 or timbers.

3.03 FITTINGS COATED AT THE PLANT

A. Coat fittings which cannot be machine coated in accordance with AWWA C209 using materials as specified herein. Weld bead preparation, surface preparation, blast cleaning, primer and tape application shall be as specified for straight run pipe. Apply an inner layer tape of Polyken No. 932-50 or District approved equal, with a 1-inch nominal, 3/4-inch minimum, tape overlap on all plant coated fittings. Apply an outer layer of cold-applied polyethylene tape as specified herein with a 55 percent overlap on all plant coated fittings.

Provide a minimum thickness of 110 mils for the total tape coat system for plant coated fittings.

B. Test all completed tape coated fittings in the presence of the District's Representative with an electrical holiday detector prior to installation of cement-mortar coating. Applied voltage shall be in the range of 11,000 to 15,000 volts. Repair any holidays found.

C. Follow the procedure described herein for field tape coating repairs on fittings and for coating field joints.

D. Apply cement-mortar coating in accordance with AWWA C205 immediately after completion of tape coating, holiday testing indicating no holidays and inspections.

3.04 REPAIR DAMAGE TO PIPE COATING DURING IN-PLANT APPLICATION AND HANDLING

A. If there is any damage to the tape pipe coating that is larger than 36 square inches in any one area of a pipe section or special as determined by the District's Representative, of if there is damage to the tape pipe coating on a single pipe section or special at more than four separate locations of any size, the entire pipe section or special shall be subject to rejection.

B. If there is any damage to the tape pipe coating that is larger than 16 square inches, but less than 36 square inches, in any one area of a pipe section or special as determined by the District's Representative, the tape pipe coating shall be repaired per tape manufacturer's recommendations with a patch that wraps around the pipe circumferentially.

C. If there is any damage to the tape pipe coating that is smaller than 16 square inches in any one area of a pipe section or special as determined by the District's Representative, the tape pipe coating shall be repaired per tape manufacturer's recommendations with a local area patch.

3.05 COATING OF FIELD JOINTS USING POLYETHYLENE TAPE

A. Field cold-applied polyethylene tape pipe coating shall be in accordance with AWWA C209, 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 on each side of the joint prior to welding. Do not use the coated portion of the pipe for grounding.

C. For exterior welded lap joints, remove the storage primer and wire brush areas to be welded immediately prior to welding.

D. No field tape coating will be permitted until the welding has been completed and the pipe section has cooled sufficiently so as to not damage the integrity of the tape coating system.

E. Do not permit trapped air under the tape in the joint.

F. After joint welding, remove flash rusting by mechanical means, such as a wire brush. Wire brush the weld, storage primed steel and all exposed steel. Remove all burrs and weld slag to achieve a smooth surface.

G. Clean the pipe surface 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. The pipe surface shall be free of any moisture and all foreign matter prior to the application of primer.

H. Pack irregular surfaces in the joint with elastomeric joint filler.

I. Apply primer immediately after surface is cleaned by brush or roller (4 mils wet, 1 mil dry). Overlap primer onto plant applied tape coating.

J. After primer has dried, apply tape to the joint and extend a minimum of 3 inches onto the plant applied tape coat. End splices shall be a minimum of 6 inches and shall be staggered. Maintain 55 percent overlap on all field joint tape to produce a minimum thickness of 100 mils.

K. Apply tape with sufficient tension to conform with the surface irregularities. The finished tape wrap shall be smooth and wrinkle-free.

L. Test the final applied joint tape coating in the presence of the District's Representative with an electrical holiday detector. Repair all holidays and physical damage to the final applied tape coating prior to application of the mortar coating.

M. Apply mortar joint coating and reinforcement over tape coating using fabric diapers to retain the mortar. Apply the mortar coating 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 shall be 1-inch minimum.

3.06 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.

3.07 INSPECTION OF TAPE PIPE COATING

A. Inspection: The District's Representative shall have access to witness the application of coatings on all pipe sections at his or her discretion.

1. Provide the District's Representative with reasonable facilities and space at the pipe fabrication plant for the inspection and testing of the tape pipe coating. Assist the District's Representative in obtaining any information required to determine the characteristics of the material to be used. Furnish to the District's Representative 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 pipe coating.

2. Provide free access to the District's Representative to plants of the manufacturer furnishing the materials and to mill or the worksite.

B. Holiday detection for tape coating:

1. Prior to the application of the mechanical outer layer tapes, electrically test the inner layer tape for any flaws in the coating with a suitable holiday detector as approved by the District's Representative. The detector shall impress a voltage conforming to NACE Standard RP-02. The voltage to be used to electrically test the tape shall be fully documented.

2. Clearly mark all holidays electrically or otherwise detected and immediately repair. Do not start wrapping the first mechanical outer layer tape until all detected holidays have been repaired. Perform repairs per tape manufacturer's recommendations. 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.

3.08 PROTECTING COATED PIPE

A. The mortar overcoat provides mechanical protection for the underlying tape pipe coating; however, normal precautions are required to protect the mortar from damage and additional care must be taken to protect the exposed tape at the ends of each pipe section. At the fabrication plant, handle the coated pipe sections only after application of the cement-mortar coating using minimum 12-inch-wide belt slings with spreader bars or padded forklifts.

B. Apply a storage wrap to the exposed tape ends to protect against ultraviolet exposure. Remove the storage wrap prior to completing the field joint. Tape exposed to ultraviolet light for more than 90 days without protection is subject to being rejected by the District's Representative.

END OF SECTION

STANDARD SPECIFICATION
SECTION 09961 FUSION-BONDED EPOXY LINING AND COATING

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, application, and testing of one part, fusion-bonded, heat cured, thermosetting, 100% solids epoxy lining and coating on steel, cast iron, and ductile iron equipment, such as valves, flexible pipe couplings, fittings, structural steel, and steel pipe. Do not apply fusion-bonded epoxy to aluminum, brass, bronze, copper, plastic, rubber, or stainless steel surfaces.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

1.03 SUBMITTALS

A. Submit submitall packages in accordance with Standard Specification Section 01300.

B. Submit manufacturer's catalog literature and product data sheets, describing the physical and chemical properties of the epoxy coating. Describe application and curing procedure.

C. Submit coating application test records for measuring coating thickness and holiday detection for each item or pipe section and fitting. Describe repair procedures used.

PART 2 - MATERIALS

2.01 PIPING AND EQUIPMENT SURFACES

The Contractor shall require the suppliers to provide bare pipe and equipment that is free of salts, oil, and grease to the coating applicator.

2.02 SHOP APPLIED EPOXY LINING AND COATING

Lining and coating shall be a 100% solids, thermosetting, fusion-bonded, dry powder epoxy resin. Provide: Scotchkote 134 or 206N, Lilly Powder Coatings "Pipeclad 1500 Red," H.B. Fuller 1F-3003, or District approved 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 (Minimum)	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-inchsteel panel, 0.010 glue line	4,300 psi (ASTM D 1002)
Impact (Minimum Value)	100 inch-pounds (Gardner 5/8-inch diameter tup)

2.03 FIELD APPLIED EPOXY COATING FOR PATCHING

Use a two-component, 80% solids, liquid resin, such as Scotchkote 306 or District approved equal.

PART 3 - EXECUTION

3.01 SHOP APPLICATION OF FUSION-BONDED EPOXY - GENERAL

A. Grind surface irregularities, welds, and weld spatter smooth before applying the epoxy. The allowable grind area shall not exceed 0.25 square foot per location, and the maximum total grind area shall not exceed 1 square foot per item or piece of equipment. Do not use any item, pipe, or piece of equipment in which these requirements cannot be met.

B. Remove surface imperfections, such as slivers, scales, burrs, weld spatter, and gouges. Grind outside sharp corners, such as the outside edges of flanges, to a minimum radius of 1/4-inch.

C. Uniformly preheat the pipe, item, or piece of equipment 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.

D. Sandblast surfaces per SSPC SP-5. Protect beveled pipe ends from the abrasive blast cleaning.

E. Apply a phosphoric acid wash 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. The acid wash shall be 5% by weight phosphoric acid solution. 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, remove the acid with demineralized water having a maximum conductivity of 5 micromhos/cm at a minimum nozzle pressure of 2,500 psi.

F. Apply lining and coating by the electrostatic spray or fluidized bed process. Minimum thickness of lining or coating shall be 12 mils. Heat and cure per the epoxy manufacturer's recommendations. The heat source shall not leave a residue or contaminant on the metal surface. Do not allow oxidation of surfaces to occur prior to coating. Do not permit surfaces to flash rust before coating.

3.02 SHOP APPLICATION OF FUSION-BONDED EPOXY TO PIPE

A. In addition to the above requirements, apply lining and coating per AWWA C213 except as modified herein.

B. Grind 0.020-inch (minimum) off the weld caps on the pipe weld seams before beginning the surface preparation and heating of the pipe.

3.03 QUALITY OF LINING AND COATING APPLICATIONS

The 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.

3.04 SHOP TESTING OF LINING AND COATING - GENERAL

A. Test linings and coatings with a low-voltage wet sponge holiday detector in accordance with AWWA C213, Section 5.3.3. 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, 12 inches and smaller, is 5 or less per item, repair and retest. Repair the holidays and pinholes by applying the coating manufacturer's recommended patching compound to each holiday or pinhole and retest. If the number of holidays or pinholes exceeds these allowable quantities, remove the entire lining or coating and recoat the pipe or item and retest.

B. 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.

C. The District's Representative will conduct in the field an independent inspection of the lining and coating for compliance with the above criteria. Coated items failing his inspection will be cause for rejection.

3.05 SHOP TESTING OF LINING AND COATING OF PIPE

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.

3.06 FIELD REPAIRS

Patch scratches and damaged areas incurred while installing fusion bonded epoxy coated items with a two-component, 80% solids (minimum), liquid epoxy resin. Wire brush or sandblast the damaged areas 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. Apply a two-part epoxy coating 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, remove the entire lining and coating and recoat the entire item or piece of equipment and retest. Apply the liquid epoxy coating to a minimum dry-film thickness of 12 mils.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, application, and testing of thermally sprayed zinc coating (flame spray) for corrosion control on steel, cast iron, and ductile iron equipment, such as valves, pipe, pipe couplings, fittings, air valve enclosures, pipe supports, and structural steel. Do not apply flame spray coating to aluminum, brass, bronze, copper, plastic, rubber, stainless steel, fusion-bonded epoxy surfaces, or flange insulating sets.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Painting and Coating: STD SPEC 09900.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit manufacturer's catalog literature and product data sheets, describing the physical and chemical properties of the thermally sprayed coating. Describe surface preparation and application procedures.

C. Submit coating manufacturer's technical and material safety data sheets for the product to be applied.

PART 2 - MATERIALS

2.01 THERMALLY SPRAYED COATING PROCESS

The thermally sprayed coating shall use a metal process wherein an oxygen-fuel gas flame is utilized as the source of heat for melting the coating material or a thermal arc spray technique in which two wires arc, causing them to atomize or melt. Compressed air or gas may be used for atomizing and propelling the material to the work piece.

2.02 METAL SPRAY WIRE

Wire shall conform to ASTM B 833. Material shall be 99.9% zinc (Grade Z 15005 per ASTM B 833).

2.03 ABRASIVES FOR BLAST CLEANING

Abrasives shall conform to MIL-STD-2138A (SH) and shall be either aluminum oxide grit with 16-30 mesh size or angular chilled iron grit with 25-40 mesh size.

2.04 EQUIPMENT FOR THERMAL SPRAYING

A. Comply with AWS C2.18, Section 6.

B. Gases: Comply with AWS C2.18, paragraph 5.7.

PART 3 - EXECUTION

3.01 APPLICATORS

Applicators of thermally sprayed coatings shall have a minimum of 2 years of successful experience in the surface preparation and application technique of wire metal spraying. Experienced applicators shall be R.W. Little Co., San Diego, California; Flame-Spray Inc., San Diego, California; or District approved equal.

3.02 THERMAL SPRAY APPLICATION

Comply with AWS C2.18, Section 8, except as modified herein.

3.03 MASKING

Protect all areas not to be sprayed including fusion-bonded epoxy surfaces and flange insulating sets. Mask any aluminum, brass, bronze, copper, plastic, rubber, or stainless steel surfaces. Masking material shall be resistant to abrasive blast cleaning and thermally sprayed coating.

3.04 SURFACE PREPARATION

Start the metal spray operation within four hours after anchor-tooth surface preparation has been completed and finish within six hours. If the substrate temperature is not greater than 9°F above the dew point, do not conduct metal spraying. No more than four hours shall elapse between the surface preparation and the start of the metal spray process.

3.05 THERMAL SPRAYING OPERATION

A. Use clean dry air with not less than 60 psi air pressure at the compressor. Do not allow more than 35 feet of 3/8-inch inside diameter hose between the compressor and spray gun.

B. Apply wire spray coating with a minimum of two passes and at right angles to one another. Total coating thickness of zinc shall be 8 to 10 mils. The rate of gun movement and indexing shall achieve the proper thickness per pass. Apply coating to all ferrous surfaces including those areas made inaccessible by the pipe supports. Provide temporary supports during the coating operation and reinstall the pipe supports.

C. Any surface which shows visible moisture, rust, scale, or other contamination shall be reblasted before spraying. At least one layer of the coating must be applied within 4 hours of blasting, and the surface must be completely coated to the specified thickness within 8 hours of blasting.

D. After spraying, the coating shall be uniform and free of lumps; loosely adherent, spattered metal; and uncoated spots.

3.06 TESTING AND REPAIR

A. Test coating for thickness with a calibrated magnetic thickness gauge. If the coating thickness is less than that specified, repair and retest. Coating shall be free from blisters, chips and cracks.

B. Blast clean defective sections of all sprayed metal prior to re-spraying, except that where the rejection has been solely due to thin coatings, additional sprayed metal may be added if the surface is completely dry and free of visible contamination.

C. Repair defective coatings per AWS C2.18, Section 9.

3.07 PAINTING AND COATING

After thermal spray coating, paint above ground surfaces of piping, valves, and enclosures per Standard Specification Section 09900, System No. 20. Color of finish coat shall be OSHA Blue. Paint piping and valves located in vaults per Standard Specification Section 09900, System No. 10. Apply finish coat in field. Do not apply prime coat.

END OF SECTION

STANDARD SPECIFICATION
SECTION 13110 CORROSION CONTROL FOR BURIED PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

This section addresses the materials, installation and testing for basic corrosion control and monitoring facilities on buried metallic piping. Materials include herein are: test and bond stations, simple sacrificial anode installations, wire and cable, alumino-thermic welds, casing insulators and end seals, insulating flange kits, supplemental linings at insulators and marker posts. Specifications for large sacrificial anode installations and impressed current cathodic protection systems shall be specifically designed for the particular application.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings

B. Record Drawings and Submittals: STD SPEC 01300.

C. Trenching, Backfilling, and Compacting: STD SPEC 02223.

D. General Concrete Construction: STD SPEC 03000.

E. Cold Applied Wax Tape Coating: STD SPEC 09952.

F. Polyethylene Sheet or Tube Encasement: STD SPEC 09954

G. Painting and Coating: STD SPEC 09900.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specifications Section 01300.

B. Submit manufacturer’s catalog data on precast concrete manholes, frames, and covers. Show dimensions and materials of construction by ASTM reference and grade.

PART 2 - MATERIALS

2.01 TEST STATION

A. Post Mounted Test Boxes:

1. Enclosure: Post-mounted enclosures shall be constructed of one piece molded fiberglass and conform to NEMA 4X. The fiberglass-reinforced resins shall be chemically resistant to a wide range of corrosive atmospheres. It shall have a hinged cover with quick-release lockable latches and a seamless foam gasket. All hardware shall be stainless steel. Hinges shall be corrosion resistance polyester or stainless steel piano hinge. Size as follows unless specified differently in the project drawings:

No. of Wires	Size (inside)	Acceptable Product
2 or 3 wires	5.5x4.0x5.0”	Hoffman A-645JFGQRR
4 or 5 wires	7.5x6.0x5.28”	Hoffman A-865JFGQRR

2. Panel: The mounting panel shall be fiberglass, 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 off of the back of the enclosure to allow sufficient access to make up wire terminals.

3. Components: All terminal lugs shall be solid brass. Provide a properly sized terminal lug for all wires. See Standard Drawings or Drawings for wiring configuration and wire labels.

4. Post: Post shall be seasoned, construction heart garden grade redwood, 4 inches by 4 inches by 5 feet long, and surfaced on four sides. Cut a ¾-inch chamfer in all 4 top edges and paint per Standard Specification Section 09900 using System No. 60. Color shall be white and green as approved by the District.

5. Conduit: 2-inch diameter galvanized rigid steel conduit per UL 6 approximately 4-feet long with long radius sweeps. Fittings shall be galvanized rigid steel per UL 514.

6. Brass Tags: Wire identification tags shall be 1½-inch diameter, 18 Ga. brass discs with a 3/16-inch diameter hole and die stamped with ¼-inch characters. Tags shall be attached to test wires with un-insulated AWG No. 14 solid copper wire. Tag legend shall be as indicated in the Drawings or Standard Drawings.

7. Concrete Pad: ASTM C-94 ready mix concrete.

B. At-Grade Test Box:

1. Concrete Box: At-grade test boxes shall be round, pre-cast concrete with dimensions of 13-1/2-inch O.D. by 8-inch I.D. by 12-inches high, similar to Christy G5 Utility Box with a cast iron supporting ring and lid, and shall have sufficient strength to support occasional H-20 vehicular traffic. The lid shall be 10 inches O.D. and cast with the legend "CP Test" using letters not less than 1-1/2-inch high.

2. Concrete Pad: Test boxes mounted in un-paved areas shall be mounted in a reinforced 26 inches square by 4 inches thick concrete pad constructed of ASTM C94 Ready-Mix concrete. Rebar shall be No. 4. A concrete pad is not required where the test box is placed in pavement.

3. Brass Tags: See paragraph 2.01 A. 6.

2.02 PREPACKAGED MAGNESIUM ANODES

A. Magnesium Anode (High Potential): unless otherwise specified anodes shall be high potential prepackaged magnesium alloy ingot of the following chemical composition:

Aluminum	0.010%
Manganese	0.50 to 1.30%
Copper	0.02% MAX

Nickel	0.001% MAX
Iron	0.03% MAX
Other	0.05% Each or 0.3% MAX Total
Magnesium	Remainder

B. Magnesium Anode (Standard Potential): If the Drawings call out standard potential magnesium anodes, the ingot shall have the following chemical composition:

Aluminum	5.3 to 6.7%
Manganese	0.15 to 0.30%
Zinc	2.5 to 3.5%
Copper	0.02% MAX
Nickel	0.002% MAX
Iron	0.003% MAX
Silicon	0.10% MAX
Other	0.05% Each or 0.3% MAX Total
Magnesium	Remainder

C. Anode Weight: Unless otherwise specified the ingot weight of prepackaged magnesium anodes shall be 48 pounds. The anode ingot shall have a trapezoidal cross section and be approximately 32 inches long. Other anode ingot weights (with different cross sections and dimensions) may be specified in the Drawings.

D. Anode Backfill: Each magnesium anode shall be prepackaged in a permeable cloth bag with a backfill of the following composition:

Gypsum	75%
Powdered Bentonite	20%
Anhydrous Sodium Sulfate	5%

E. 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.

F. Prepackage Weight: The total packaged weight of 48-pound (ingot weight) magnesium anodes and backfill shall be approximately 105 pounds. The cloth bag diameter is 8 inches. The packaged weight and diameter of other anode sizes shall be as indicated in the Drawings.

G. Anode Lead Wire: Anode lead wire shall be AWG No. 12 stranded copper wire with THWN insulation conforming to UL Standard 83. Wire shall be connected to the strap core with silver solder. The connection shall be mechanically secured before soldering and shall have at least one and one-half turns of wire at the connection. The connection shall 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.

2.03 PREPACKAGED ZINC ANODES

A. Zinc Alloy: The anode alloy shall conform to ASTM B 418, Type II and shall be prepackaged with the following chemical composition unless otherwise specified:

Aluminum	0.005% Max
Cadmium	0.003% Max
Iron	0.0014% Max
Zinc	Remainder

B. Anode Weight: Unless otherwise specified the Ingot weight of the prepackaged zinc anode shall be 30 pounds.

C. Anode Backfill: Each zinc anode shall be prepackaged in a permeable cloth bag with a backfill of the following composition:

Gypsum	75%
Powdered Bentonite	20%
Anhydrous Sodium Sulfate	5%

D. 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. Prepackaged weights for other size zinc anodes shall be as indicated in the Drawings.

E. Anode Lead Wire: Anode lead wire shall be AWG No. 12 stranded copper wire with THWN insulation conforming to UL Standard 83. Wire shall be connected to the steel rod core with silver solder. The connection shall be mechanically secured before brazing or silver soldering and shall have at least one and one-half turns of wire at the connection. The connection shall then be insulated with a heat-shrinkable sleeve and coated with bituminous compound. The 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.

2.04 SHUNTS

Shunts used in the anode test boxes shall be 0.01 ohms - resistance and rated at 6 amperes capacity and accurate to plus or minus 1%. Use Holloway Type RS shunt unless otherwise specified.

2.05 WIRE AND CABLE

A. General: All DC wires shall be stranded copper with high molecular weight polyethylene (HMWPE) or thermal plastic (THWN) insulation suitable for direct burial in corrosive soil and water conforming to UL 83 and ASTM Standards B3 or B8. HMWPE insulation shall conform to the requirements of ASTM D1248 Type 1, Class C. THWN insulation shall conform to the requirements of ASTM D-2220. Wires with cut or damaged insulation will not be accepted and replacement of the entire length of wire will be required at the Contractor’s expense.

B. Test Leads: Unless otherwise indicated, test wires shall be AWG No. 8 HMWPE wire. THWN wire shall be used only where specifically called out. Each test lead shall be of sufficient length to extend from the attachment to the pipe or structure to the test box without a splice.

C. Bond Wires: Bond wires shall be AWG No. 2, No. 4, or No. 6 HMWPE depending on the pipe diameter and as indicated in the detail drawings or directed by the District. Bond wires shall be as short as possible.

2.06 LEAD WIRE CONNECTORS

A. Terminal Lugs: Terminal lugs shall be solderless, UL 486 copper or brass and sized to accommodate the wire.

B. Split-bolt Connectors: Split bolt connectors shall be UL 486 copper or brass and sized to accommodate the lead wire and shunt being used.

2.07 INSULATING FLANGE KITS

A. General: Insulating flange kits shall consist of Type E, full-face gaskets, insulating sleeves and double washers (steel and dielectric) on each end. All insulating material shall be of the type designated by the manufacturer as suitable for the operating temperature and pressure of the service. If the insulating flange kit is not compatible with planned tapping valve, an additional flanged spool or a prefabricated insulating joint will be required.

B. Gaskets: Insulating gaskets shall be dielectric neoprene-faced phenolic.

1. Sleeves: Use full-length sleeves except for installation on threaded studs where half-length sleeves are required. For installation on threaded bolts, i.e., at butterfly valve flange bonnets and bases, the sleeves shall be half-length.

2. Flanges 12-inches or less: 1/32-inch thick phenolic tube.

C. Flanges greater than 12-inches: s 1/32-inch thick G10 epoxy glass tube material as per NEMA LI-1.

D. Washers: Insulating washers shall be 1/8-inch thick G10 epoxy glass sheet material.

1. Flanges 12-inches or less: Phenolic

2. Flanges greater than 12-inches: G10 epoxy glass

E. Steel Washers: Steel washers shall be 1/8-inch thick cadmium plated or zinc plated carbon steel.

2.08 WAX TAPE WRAP

A. Surfaces Requiring Wax Tape: All buried piping system surfaces not coated with the primary pipe coating such as flanges, valves, couplings, insulating flanges, adapters, uncoated pipe spools or specialty fittings.

B. Material and Application Standard: per Standard Specification Section 09952.

2.09 INTERNAL SUPPLEMENTAL LINING AT INSULATING FLANGES

A. Flanges Requiring Supplemental Lining: Supplemental lining is only required on insulating flanges greater than 20-inches and where specifically designated as requiring a supplemental lining in the Project Design Documents.

B. Lining: Supplemental lining shall be Aquatapoxy as manufactured by Raven Linings Corporation (Tulsa, OK), Hydro-Pox by Con-Tech of California (Stockton, CA), or District approved equal. All internal lining materials must be NSF approved for use in potable water.

2.10 PIPELINE CASING INSULATORS

A. Body: The casing insulator body shall be constructed of a 12-inch wide steel band with a heat-fused plastic (PVC) coating with a minimum thickness of 10 mils. The steel band shall be flanged with stainless steel tightening bolts and nuts. The body shall be provided with a ribbed PVC liner to protect the pipe coating and prevent slippage.

B. Runners: 2-inch wide reinforced plastic (18,000 psi compressive strength). Runners are attached with stainless steel nuts on 3/8-inch threaded studs that are welded to the steel band before coating. The bolt holes counterbored and filled with epoxy.

C. Acceptable Products: Use PSI Model A12G-2 or District's approved equal. Wooden skids or high-density polyethylene casing insulators are not acceptable.

2.11 CASING END SEALS

A. Type: End seals shall be either a heat shrinkable sleeve type or the mechanical link type. End seals shall provide full dielectric isolation and a watertight seal between the casing and the carrier pipes. Pre-molded casing seals held in place by an external band of metal or other material are not acceptable.

B. Heat Shrinkable Seal: Heat shrinkable sleeve shall have a minimum tensile strength of 2,500 psi and be resistant to abrasion, corrosive gases and be able to tolerate typical expansion and contraction of the casing and carrier pipes. Provide a separate non-conductive support skirt or transition padding that will allow a smooth transition of the heat shrink material from casing to carrier diameter. Watertight seals on both the casing and the carrier pipes are required. Use Raychem Caseal or Canusa CSK Casing Seal Kit.

C. Mechanical Link Seal: Articulated mechanical annular seal shall include EPDM rubber seal elements, non-metallic pressure plates and Type 316 stainless steel nuts and bolts for tightening. When compressed a full watertight seal is required. Use link-Seal Model "C" or District approved equivalent.

2.12 ALUMINO-THERMIC WELD KITS AND WELD COATING

A. Weld Kits: 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 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.

B. Weld Cap Primer: Weld cap primer shall be an elastomer-resin based corrosion resistant primer for underground services such as Royston Roybond Primer 747 or District approved equal.

C. Weld Caps: Alumino-thermic welds shall be sealed with a pre-fabricated plastic cap filled with formable mastic compound on a base of elastomeric tape. Weld caps shall be Royston Handy Cap 2 or District approved.

D. Weld Cap Overcoating: Weld caps and the surrounding area shall be overcoated with a cold-applied, black, thixotropic material containing plasticized coal tar pitch, solvents, and special fillers per MIL-C-18480A such as Protecto Wrap 160/160H, Carboline 330M, Tape-Coat TC Mastic or 3M Scotch Clad 244. Apply to at least 20 mils thickness.

2.13 PIPE ENCASEMENT

Unless otherwise specified all ductile iron pipe shall be fully encased in 8 mil (0.008 inches) polyethylene sheet material in accordance with AWWA C105 Method A and STD SPEC 09954. The plastic encasement shall be installed without pinholes or tears and shall be fully protected from damage during backfilling. All pipe sections shall be fully inspected by the District's Inspector before the pipe is backfilled.

2.14 PLASTIC WARNING TAPE

Plastic warning tape shall be run in the wire trench at a depth of 12-inches and above each buried wire. The warning tape shall be 3 inches wide and shall have a printed warning - “Caution - Cathodic Protection Cable Buried Below” or similar.

2.15 MORTAR

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

2.16 BARRIER POSTS

Where indicated protective barrier post shall be 6-inch Sch 40 steel pipe concrete filled. Pipe height, 4 feet, embedded depth 24-inches in a concrete footing. Paint OSHA safety orange epoxy or as indicated.

PART 3 - EXECUTION

3.01 GENERAL

Except as directed differently below, the installation of corrosion control and monitoring facilities shall conform to NACE Publication RP-0169 (Revised 1996) - Recommended Practice, Control of External Corrosion on Underground and Submerged Metallic Piping Systems and NACE RP0286 Electrical Isolation of Cathodically Protected Pipelines. The installation of impressed current cathodic protection facilities and large sacrificial anode systems is addressed in the Project Design Documents.

3.02 TEST BOXES

A. Post Mounted Test Boxes:

1. Location: locate redwood post directly above the pipeline, if possible, but not in a roadway or in a location that clearly obstructs existing access or is particularly susceptible to damage. The district shall approve test station locations.

2. Post: Use white paint for the finish coats and green paint for the top 4 inches of the chamfered end. Excavate a 16-inch diameter by 2-foot deep hole. Center the post and test box in the hole and fill the hole with concrete. The concrete shall be class C per Standard Spec Section 03000.

3. Test box and Conduit: Connect 2-inch galvanized conduit to the anode test box with a threaded flange and collar connection. Attach test box to the redwood post using mounting brackets and threaded fasteners or wood screws through the back of the test box. Attach conduit to the post with conduit clamps and wood screws if necessary. Insert all test leads in the galvanized conduit and run into test box prior to setting the post in concrete.

4. Wire Identification: Brass identification tags shall be securely attached to each of the wires in the test box. Tags shall be stamped with the size-material-service of the pipe to which the test leads are attached. For example 18"-STL-DW. Brass tags on wires in insulating flange test boxes shall be stamped with the additional identification of "N", "S", "E", or "W" for North, South, East or West to indicate on which side of the insulating flange the wires are attached. Attach tags with bare No. 14 copper wire.

5. Concrete Footing: Footing shall be 16-inch diameter by 24-inches deep. Dome concrete slightly to prevent ponding water next to wood post.

B. At-Grade Test Boxes:

1. Location: The at-grade test boxes 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. Test boxes can be embedded in the sidewalk just beyond the curb or placed in a concrete pad in the planter strip or just beyond the sidewalk. The District Representative shall approve test station location.

2. Installation: The test box shall be centered in a gravel leach field that extends 24 inches below the bottom of the test box. A 2-½ inch PVC reference cell tube shall extend into the test box 3 inches from the bottom and shall extend into the native soil below the test box by at least 3 inches. The reference cell tube shall be filled with native soil and not gravel. All wires shall be properly identified and cut off such that there is 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. Top of box shall be flush with finish grade in paved areas. In unpaved areas, the top of the box shall be 1 inch above grade with the concrete pad domed to make a smooth transition to grade at the perimeter of the pad.

3. Wire Identification: Brass identification tags shall be installed and marked per paragraph 3.02 A 4.

4. Concrete Pad: In unpaved areas the test box shall be mounted in a reinforced concrete pad 26-inches square by 4 inches deep constructed of ASTM C94 Ready-Mix concrete. Rebar shall be No. 4 steel placed as shown in the drawings.

5. Marker Posts: Redwood marker posts are required wherever at-grade anode test boxes are utilized in a remote area. Paint topside of test box cover per Standard Specification Section 09900, System No. 20. Color of finish coat shall be green and white. Locate marker post as directed by the District Representative. Cut, paint, and install the redwood post as described in 3.02 A.2. On the side facing the at-grade test box, stencil on the post in 2-inch high green letters the words "CP TEST" and the distance in feet from the marker post to the test box.

3.03 INSTALLING MAGNESIUM ANODES

A. General: Anodes shall be installed at locations as shown on the Drawings or as directed by the District. Care shall be taken to ensure that the cloth bag is not damaged and no backfill material 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 lowered into the hole using a sling or rope and placed vertically at the bottom of the hole. Do not lower, transport, handle or lift the anode by the lead wire.

B. Primary Excavation Method: Prepackaged magnesium anodes shall be installed in a vertical augured hole of 12-inches in diameter. The depth of the hole shall be 12 feet as measured from the finish surface to the bottom of the anode unless otherwise specified.

C. Alternate Excavation Method: If the 12-foot depth cannot be obtained or if vertical auguring cannot be accomplished due to heavy rock, the District's Representative shall be notified for possible adjustment to the designed depth, position, and orientation of the anodes. Backhoe excavations must be approved by the District.

D. Relative Position: Anode beds shall be offset from the steel pipe a minimum of 10 feet unless otherwise indicated on the Corrosion Protection Detail Drawings or directed by the District. At no time shall an anode be installed outside of the pipeline right-of-way or District's easement.

E. Anode Soaking (Augured Holes): Once the prepackaged anode is in the hole, water shall be poured into the hole so that the anode is completely covered with water. Allow to soak for at least 15 minutes. 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 lead wire is 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 wire.

F. Anode Soaking (Backhoe Installations): Prepackaged must be pre-soaked in water for at least 15 minutes before installing in the trench. After covering the anode with native, rock-free soil (approximately 3 inches over the anode) the anode and initial backfill shall be further soaked with 15 to 20 gallons of water and allowed to soak for 15 minutes. The remainder of the trench is backfilled with native soil.

G. Lead Wire: Anode lead wire shall be long enough to reach from the anode to the anode test box without a splice. Anode lead wires shall be trenched a minimum of 36-inches deep and terminate individually in the appropriate anode test box. Care shall be taken not to damage the lead wire thought the installation process.

H. Wire Tags: Anode wires are not tagged.

3.04 INSTALLING ANODE LEAD WIRES

A. Wire Trenching: All buried anode and test wires 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 sand backfill material shall be placed directly on the wires. The remainder of the trench shall be backfilled with stone-free earth. 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, the wire and anode shall be replaced unless wire splices or insulation repairs are approved by the District. Anode replacement shall be at the Contractor's expense. Plastic warning tape shall be installed approximately 12 inches below finished grade.

B. Wire Splicing and Insulation Repairs: See paragraph 3.07 for general wire splice and insulation repair requirements. Neither splices nor insulation repairs are allowed unless specifically approved by the District Representative.

3.05 INSTALLING ZINC ANODES

A. Facilities Requiring Zinc Anodes: Zinc anodes are required on all copper air-vacs, water sampling assemblies and water services. Zinc anodes may be required on other facilities as indicted on the Project or Corrosion Protection Detail Drawings.

B. Installation: Zinc anodes are typically installed in trench excavations below the buried copper tubing. Depths and locations with respect to the assembly shall be as shown in the Standard Drawings or as specified or shown in the Project Design Documents.

3.06 EARTHWORK

See Section 02200

3.07 WIRE AND CABLE

A. General: No less than two test wires shall be attached to the pipe at each designated test site. All test wires shall terminate in a test box without a splice. A minimum of 18 inches of slack wire shall be coiled at the wire-to-pipe connection and in at-grade test boxes for each test wire. At post-mounted test stations slack wire shall be provided inside the box to the extent possible and with one 8-inch diameter loop at the below-grade entrance to the conduit.

B. Connection to Pipe: Connections of copper wire to the pipeline shall be made with alumino-thermic weld charges or by brazing. Welding charges shall be the product of a manufacturer regularly engaged in the manufacture of the material. Manufacturer's recommend cartridge size and type shall be used. Each weld shall be installed, tested and coated as described below.

1. 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.

2. 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.

3. 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 30° to 45° angle to the surface when welding. Only one wire shall be attached with each weld.

4. 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 re-welded and re-tested. All weld slag shall be removed from the weldment.

5. Coating of All Completed Welds: Thoroughly clean by wire brushing the area to be coated. The area must be completely dry. Apply the weld cap primer and the weld cap. Overcoat the weld cap with a 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.

6. Mortar Repair: 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.

C. Plastic Lined Pipe: Do **not** weld test or bond wires directly to plastic lined pipe (sewer or reclaimed water). Wires must be attached to factory installed bonding pads per OMWD Standard Drawings.

D. Wire Trenching and Backfill:

1. Depth: All buried horizontal test lead runs shall be installed at a minimum depth of 36 inches.

2. Backfill: The bottom 2 inches of the finished trench shall be sand or stone-free earth. The first three inches of the backfill shall be sand or stone-free earth placed directly on the wires. The remainder of the trench shall be backfilled with native earth with a maximum stone size of 2 inches and compacted as specified in Standard Specification 02223.

3. Damaged Wire: 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.

4. Warning Tape: Plastic warning tape shall be installed over all wire runs 12 inches below grade.

E. Installing Identification Tags

1. Characters: Tags shall be stamped with OMWD, size, material and service. For example a 24-inch CML&C steel water line shall be stamped “OMWD, 24”CML&C, W”. An 8-inch ductile iron reclaimed water line would be tagged “OMWD, 8”DIP, RW”. Anode lead wires are not tagged. Tags on wires on insulating flanges shall be stamped with “N, E, S or W” indicating which side of the insulating joint to which the wires are attached. The character size shall be 1/4-inch high.

2. Attachment to Wire: Identification tags shall be securely attached to each test wire in the test box with a bare No. 14 copper wire. Do not use plastic or nylon ties.

F. Wire Splices or Repairs

1. Approval: No wire splices or insulation repairs shall be made unless approved by the District Representative.

2. Splices: The minimum amount of insulation shall be removed from each wire end. Brass crimp or split-bolt connectors shall be used. The splice shall be encased in a plastic mold filled with insulating resin such as 3M Scotchcast splice kits.

3. Insulating Repairs: Depending on the severity of the insulation damage repairs shall be made with electrical tape or with a splice kit as determined by the District Representative.

4. Inspection: All splices and insulation repairs shall be inspected by the District Representative before they are buried.

3.08 CONTINUITY BONDING:

A. General: All joints on buried metallic pipe shall be metallically continuous by welding or bonding. Joints to be bonded include all unwelded pipe joints and mechanical joints including flanges (except insulating flanges), valves, couplings, adapters and special fittings. All bonding shall be done with single conductor, stranded copper jumper wires with HMWPE insulation. Bond wires shall be as short as possible with only minimal slack. All pipe reaches with one or more unwelded joints (or one or more bonds) will be tested for continuity.

B. Pipe Joints: At least two wires are required for each steel or ductile iron pipe bond. Two wires shall be installed unless otherwise specified. Three wires may be required at valves, couplings, special fittings and across unwelded joints on pipe larger than 24-inches. Bond wire sizes may be No. 2, 4 or 6. Use No. 4 bond wires unless indicated otherwise in the project drawings.

C. Mechanical Joints and Fittings: All flanges and in-line fittings (valves, couplings, etc.) shall be completely bridged by at least two bond wires. Three wires may be required on fittings larger than 24-inches. One additional No. 6 HMWPE wire is required from the pipe (on either side) to the fitting. Bond wire sizes may be No. 2, 4 or 6. Use No. 4 bond wires unless indicated otherwise in the project drawings.

D. Wire Attachment Method: Bond wire attachment, testing and subsequent coating of the welds shall be as specified in paragraph 3.07, B.

E. Wire Attachment Location: Bond wires can either be attached to the pipe or pipe cylinder directly of to the outside edges of flanges that are welded to the pipe. Bond wires shall not be attached to valve bodies, but instead to the flange of the valve.

3.09 INSULATING FLANGE KITS

A. Flange Kits: Insulating kits shall be installed as shown on drawings and as recommended by the manufacturer. Moisture, soil, or other foreign matter must be carefully prevented from contacting any portion of the mating surfaces prior to installing insulator gasket. If moisture, soil, or other foreign matter contacts any portion of these surfaces, the entire joint shall be disassembled, cleaned with a suitable solvent and dried prior to reassembly.

B. Spool Assembly: All direct buried insulating kits, greater than 20-inches in diameter, shall be pre-installed and tested on the pipe spool prior to installing the spool in the ditch. If possible, all smaller size direct buried insulating kits shall be similarly pre-installed and tested.

C. Handling of Gasket: Care shall be taken to prevent any excessive bending or flexing of the gasket. Creased or damaged gaskets shall be rejected and removed from the job site.

D. Alignment: Alignment pins shall be used to properly align the flange and gasket.

E. Bolt Tightening: The manufacturer's recommended bolt-tightening sequence shall be followed. Bolt insulating sleeves shall be centered within the insulation washers so that the insulating sleeve is not compressed and damaged.

F. Testing: All insulating flanges must be tested by a qualified Corrosion Technician or Engineer and accepted by the District Representative. All buried insulating flanges must be tested prior to wax tape wrap coating and backfilling. The assembled flange shall be tested as described below.

G. Wax Tape Coating: After testing and the District’s acceptance, the insulating flange shall be fully wrapped with petrolatum wax tape, including individual wrapping of all bolts, nuts, and washers, and irregular surfaces, per Standard Specification Section 09952.

3.10 SUPPLEMENTARY INTERIOR LINING AT INSULATING FLANGES

A. General: Supplementary linings are required only where called out in the drawings or Project Design Documents. It is the contractor’s responsibility to determine and verify which insulating flanges require supplementary internal lining.

B. Extent of lining: the interior of the pipeline shall be lined with a supplementary epoxy lining for a distance of two pipe diameters in each direction away from an insulating flange. At an insulated flange on a valve, the supplementary lining shall be applied (for a distance of two pipe diameters) only to the pipe directly adjacent to the insulating flange.

C. Surface Preparation: The surface preparation of the mortar lining shall consist of wire brushing (hand or power) or water blasting to remove the latence and all loose mortar to provide a clean abraded surface for adhesion of the lining. The surface shall be clean and free of dust and standing water but not necessarily dry.

D. Mixing: The two-part epoxy paint shall be thoroughly mixed per the manufacturer's recommendations but at a minimum of two minutes by hand or with a mechanical mixer before being applied by brush.

E. Pot Life: A typical pot life is 30 minutes. The lining material shall not be applied after its useful pot life.

F. Application: Application of undiluted lining material shall be by spray, roller or brush until a maximum coating thickness of 20 mils is achieved. Each ensuing coat shall be applied before the previous coat fully cures, usually within 3 to 6 hours. Typically, this material is applied 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 achieve it.

G. Inspection: Each pipe spool to which the supplementary lining is applied must be inspected and accepted by the District Representative prior to assembly.

3.11 CASING INSTALLATIONS

A. Casing Insulators: The number and orientation of runners on each casing insulator shall be as recommended by the manufacturer depending on pipe size. The spacing between insulators shall be determined by the civil or structural engineer.

B. End Seals: Heat shrinkable or mechanical link seals shall be installed in accordance with the manufacturer's recommendations. Remove all contaminants and debris from the annulus. Seals must be watertight.

C. Casing Test Stations: Test stations (4-wire) shall be installed on all casings. Use 2 each No. 10 HMWPE wires on the casing and 2 each No. 8 HMWPE wires on the carrier pipe unless otherwise directed. Use post-mounted or at-grade test stations as indicted in the project drawings or as directed by the District Representative.

PART 4 - SYSTEM TESTING

4.01 TEST LEADS AND BOND WIRES

A. Responsibility: The Contractor shall be responsible for testing all test leads and bond wire welds.

B. Test Method: All completed wire connection welds shall be tested for strength by striking the weld with a sharp blow with a 2-pound hammer while pulling firmly on the wire. Welds failing this test shall be re-welded and re-tested. Wire welds shall be spot tested by the District Representative. After backfilling pipe, all test lead pairs shall be tested using a standard ohmmeter or resistance meter for broken welds. Bond wires shall be tested through continuity testing described below.

C. Acceptance: The resistance between each pair of test leads shall not exceed 150% of the total wire resistance as determined from calculations based on published wire resistance data and an estimate of test wire length.

4.02 ANODE INSTALLATION

A. Responsibility: The contractor must provide the proper rated potential anode, sufficient anode lead wire length and the proper anode hole depth. The District shall test each installed anode for wire connection integrity and for open-circuit potential.

B. Notification: The Contractor shall notify the District at least 5 days in advance of the start and completion of the anode installations, including anodes and test stations.

C. Cathodic Protection Performance Test Method: The performance of the cathodic protection system shall be tested by the District Representative. The testing shall include: measurement of all open-circuit anode potentials; pipe-to-soil potentials at each test station and other locations as necessary before the anodes are connected; initial anode currents after connecting anode leads to the pipe leads; and the pipe-to-soil potential at each previously tested site with all anodes connected. Pre- and post cathodic protection potentials at midpoints between anode beds are required as necessary to verify that the pipeline is fully protected. Adequate protection shall be as defined in NACE RP0169.

D. Field Report: All system deficiencies shall be listed and described in one or more field test reports and presented to the Contractor for repairs.

E. Acceptance: The system will be accepted if all anodes, test stations, and supporting facilities are installed properly. Cathodic protection performance, with the exception of materials and installation deficiencies, is not the Contractor's responsibility.

4.03 WIRE TRENCHING

A. Responsibility: The District Representative, at his or her discretion, shall inspect wire trenches and backfill material and methods.

B. Test Method: The depth, trench bottom padding and backfill material shall be visually inspected prior to backfilling.

C. Acceptance: Conformance with project specifications.

4.04 INSULATOR TESTING

A. Responsibility: Insulating flanges shall be inspected and tested by the District Corrosion Engineer or Corrosion Technician. Buried insulators must be tested and approved prior to application of wax tape and backfilling. Large diameter insulators shall be tested on the spool prior to installation in the ditch.

B. Test Method: The assembled flange shall be tested with an insulator testing device (i.e., Gas Electronics Model 601 Insulation Checker) specifically designed for this purpose. Additionally, the pipe-to-soil potential, using a high impedance voltmeter and suitable reference cell, shall be measured on each side of the insulator after installation in the trench but before backfilling. Potential testing can only be done on piping that has been installed in the ditch.

C. Acceptance: The installation shall be considered complete when the insulator testing device indicates that no shorts or partial shorts are present and when the potential tests indicate greater than 20-millivolt pipe-to-soil potential difference across the flange. (Note that this test may not be valid if the pipe on each side of the insulator is in contract through interconnection piping or through contacts to the electrical grounding system.) If shorts are detected the Contractor shall assist the District in finding partial shorts or shorted bolts. All disassembly and re-assembly necessary to gain the acceptance of the District shall be done at the Contractor's expense.

4.05 PIPELINE CONTINUITY

A. Responsibility: The District's Corrosion Engineer shall test the continuity of all sections of buried pipe that contains non-welded pipe joints or mechanical joints or fittings. All such joints are required to be bonded per this specification.

B. Test Method: Resistance shall be measured by the linear resistance method. A direct current shall be impressed from one end of the test section to the other (test station to test station) using DC power supply (battery). A voltage drop is measured for several current levels. The resistance (R) is calculated using the equation R = dV/I, where dV is the voltage drop and I is the current. The resistance shall be calculated for three or four different current levels.

C. Acceptance: Acceptance is reasonable comparison of the measured resistance with the calculated or theoretical resistance. The measured resistance shall not exceed the theoretical resistance by more than 130%. The Contractor shall submit calculations of the theoretical resistance and the measured resistance for each section of pipe tested.

D. Deficiencies: If discontinuity or high resistance is found between sections of pipe tested, it is the Contractor's responsibility to locate, excavate, and repair all bonds that are found to be discontinuous. Continuity tests shall be repeated after repairs are made. Note: Discontinuities may be difficult and expensive to locate and may require several excavations to expose pipe joints and attach temporary test leads for progressive continuity testing. Accordingly, the Contractor shall exercise due care in installing continuity bonds and should schedule continuity testing as early as possible so that discontinuity location and repairs, if necessary, do not conflict with road paving operations.

4.06 TEST STATIONS

A. Responsibility: The District Representative will inspect all test station installations for compliance with this specification. The District Representative or Corrosion Engineer will test all wires for continuity and proper connection.

B. Test Method: Test stations will be visually inspected. Wire continuity will be tested by potential and resistance measurements.

C. Acceptance: Installation in accordance with this specification and good workmanship and verification that all wires are properly connected.

4.07 COATING AND SUPPLEMENTARY LINING

A. Responsibility: The District Representative shall inspect all completed wax tape wrapping and supplementary linings at insulators for compliance with these specifications prior to backfilling.

B. Test Method: Inspection shall be visual.

C. Wax Tape Acceptance: Wax tape applications shall be accepted if: the application conforms with this specification; there are no voids or gaps under the wax tape; stud-ends, nuts, couplings rods and all irregular surfaces are individually wrapped such that there is complete coverage with the petrolatum material; the outer wrap is complete and tightly adhering to the wax tape; and the application is done in a good workman-like manner.

D. Supplementary Lining Acceptance: Internal supplementary linings must cover the specified length of pipe and must be well bonded to the substrate and free of voids or damage.

4.08 DEFICIENCIES

Deficiencies: Any deficiencies or omissions in materials or workmanship found by these tests shall be rectified by the Contractor at his expense. Deficiencies shall include but are not limited to: broken or missing test leads; improper or unclean wire trench backfill; inadequate pipeline continuity; shorted or partially shorted insulators; lack of 18-inch slack wire in at-grade test boxes; improperly mounted or located test boxes; improper wire identification; poorly applied wax tape or supplementary lining; and other deficiencies associated with the workmanship, installation and non-functioning equipment.

END OF SECTION

STANDARD SPECIFICATION
SECTION 13437 PRESSURE GAUGES

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of pressure gauges and accessories.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit manufacturer's catalog data and descriptive literature. Show materials of construction by specification reference and grade.

PART 2 - MATERIALS

2.01 MANUFACTURERS

Gauges and tools shall be as manufactured by Ashcroft, Crosby, Marshalltown, Marsh, or District approved equal.

2.02 GAUGE DESIGN

Gauges shall comply with ANSI B40.1, Grade A. Gauges shall incorporate the following features:

A. Side or rear blowout relief.

B. Pressure tight.

C. 270-degree arc with adjustable pointer.

D. 1/4-inch stem connection, unless otherwise indicated.

E. Dial size 3-1/2 inches, unless otherwise indicated.

F. Liquid filled silicone or glycerine.

G. Gauge range shall be approximately two times the normal operating pressure or 133% of the maximum pressure, whichever is higher.

2.03 MATERIALS OF CONSTRUCTION

Materials of construction shall be as follows:

Component	Material	Specification
CASE	Stainless Steel	AISI 316
Bourdon Tube	Stainless Steel	AISI 316
Window	Acrylic Plastic	——
Ring	Stainless Steel	AISI 316
Stem	Stainless Steel	AISI 316
Dial Face	Aluminum with clear baked on acrylic coating	ASTM B 209 6061-T6

2.04 PIPE NIPPLES AND FITTINGS

Nipples for connecting gauges to piping shall be brass, regular weight, per ASTM B 43. Threaded fittings shall be bronze, Class 125 or 250, per ANSI B16.15. Use Class 250 where the pressure exceeds 200 psi. Size of nipple shall match the gauge connection size.

2.05 TOOLS FOR GAUGES

Provide two gauge tool kits, each containing a hand jack set, screwdriver, five reamers (minimum), two pin vise holders, wiggler, tweezer and carrying case.

2.06 GAUGE COCKS

Gauge cocks shall be two way or as shown on the Drawings. Gauge cocks shall be brass or bronze, ASTM B 61 or B 62. End connections shall be NPT, female. Cocks shall be Lunkenheimer 1178, or District approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to threads before installing. Joints shall be watertight. Install gauges before conducting pressure tests.

END OF SECTION

STANDARD SPECIFICATION
SECTION 15050 GENERAL PIPING REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes the general requirements for selecting bolts, nuts, washers, and gaskets for flanges used in the various piping services in the Standard Specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Painting and Coating: STD SPEC 09900.

D. Cold Applied Wax Tape Coating: STD SPEC 09952.

E. Polyethylene Sheet or Tube Encasement: STD SPEC 09954

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit affidavit of compliance with referenced standards (e.g., AWWA, ANSI, ASTM, etc.).

C. Submit certified copies of mill test reports for bolts and nuts, including coatings if specified. Provide recertification by an independent domestic testing laboratory for materials originating outside of the United States.

D. Submit manufacturer's data sheet for gaskets supplied showing dimensions and bolting recommendations.

PART 2 - MATERIALS

2.01 THREAD FORMING FOR STAINLESS STEEL BOLTS

Form threads by means of rolling, not cutting or grinding.

2.02 BOLTS AND NUTS FOR STEEL OR DUCTILE IRON FLANGES

A. Bolts and nuts for Class 150 flanges (including AWWA C207, Class E) located indoors; outdoors above ground; in vaults and structures; or where buried and wrapped with polyethylene material shall be carbon steel, ASTM A 307, Grade B.

B. Bolts and nuts for AWWA C207 Class F flanges and ANSI B16.5 and B16.47 Class 300 flanges located indoors; outdoors above ground; in vaults and structures; or where buried and wrapped with polyethylene material shall conform to ASTM A 193, Grade B7, with nuts conforming to ASTM A 194, Grade 2H.

C. Bolts and nuts for Class 150 flanges and Class E flanges exposed to water or in direct contact with earth shall be Type 316 stainless steel conforming to ASTM A 193, Grade B8M, for bolts and ASTM A 194, Grade 8M, for nuts.

D. Bolts and nuts for Class 300 flanges and class F flanges exposed to water or in direct contact with earth shall be Type 316 stainless steel conforming to ASTM A 193, Grade B8M, Class 2, for bolts and ASTM A 194, Grade 8M, for nuts.

E. Bolts used in flange insulation kits shall conform to ASTM A 193, Grade B7. Nuts shall conform to ASTM A 194, Grade 2H.

F. Provide washers for each nut. Washers shall be of the same material as the nuts.

2.03 BOLTS AND NUTS FOR FLANGES USED IN COPPER PIPE OR TUBE

A. When both aboveground or buried adjoining flanges are bronze, use bronze bolts and nuts. Bolts shall conform to ASTM F 468, Grade C65100 or C63000. Nuts shall conform to ASTM F 467, Grade C65100 or C63000.

B. When only one of the aboveground adjoining flanges is bronze, use Type 316 stainless steel bolts and nuts conforming to ASTM A 193, Grade B8M for bolts and ASTM A 194, Grade 8M for nuts.

C. Connect to buried ferrous flanges with flange insulation kits. Bolts used in flange insulation kits shall conform to ASTM B 193, Grade B7. Nuts shall comply with ASTM A 194, Grade 2H. If the adjoining buried flange is bronze, use bronze bolts and nuts as described above, without a flange insulation kit.

D. Provide washers for each nut. Washers shall be of the same material as the nuts.

2.04 LUBRICANT FOR STAINLESS STEEL BOLTS AND NUTS

Lubricant shall be chloride free and shall be TRX-Synlube by Ramco, Anti-Seize by Ramco, Husk-It Husky Lube O'Seal, or District approved equal.

2.05 GASKETS FOR FLANGES USED IN STEEL PIPING FOR WATER SERVICE

Gaskets for flat face and raised face flanges shall be 1/8-inch thick and shall be one of the following nonasbestos materials:

A. Cloth-inserted rubber with a Shore "A" hardness of 75 to 85. Gaskets shall be suitable for a working pressure of 200 psi at a temperature of 180°F. Products: Garlock Style 19 or District approved equal.

B. Acrylic or aramid fiber bound with nitrile. Products: Garlock "Bluegard," Klinger "Klingersil C4400," or District approved equal. Gaskets shall be suitable for a pressure of 500 psi at a temperature of 400°F.

2.06 GASKETS FOR FLANGES USED IN STEEL PIPING FOR SEWAGE SERVICE

Gaskets shall be full face, 1/8-inch thick, and shall be one of the following nonasbestos materials:

A. Buna-N having a hardness of 55 to 65 durometer. Gaskets shall be suitable for a working pressure of 200 psi at a temperature of 180°F. Products: Garlock Style 9122 or District approved equal.

B. Acrylic or aramid fiber bound with nitrile. Products: Garlock "Bluegard," Klinger "Klingersil C4400," or District approved equal. Gaskets shall be suitable for a water pressure of 500 psi at a temperature of 400°F.

2.07 GASKETS FOR FLANGES USED IN DUCTILE-IRON PIPING AND FITTINGS FOR WATER SERVICE

Gaskets shall be full face, 1/8-inch thick, cloth-inserted rubber, with a Shore "A" hardness of 75 to 85. Gaskets shall be suitable for a working pressure of 200 psi at a temperature of 180°F. Gaskets shall have "nominal" pipe size inside diameters not the inside diameters per ANSI B16.21. Products: Garlock Style 19 or District approved equal.

2.08 GASKETS FOR FLANGES USED IN DUCTILE-IRON PIPING AND FITTINGS FOR SEWAGE SERVICE

Gaskets shall be full face, 1/8-inch thick, Buna-N having a hardness of 55 to 65 durometer. Gaskets shall be suitable for a working pressure of 200 psi at a temperature of 250°F. Gaskets shall have "nominal" pipe size inside diameters not the inside diameters per ANSI B16.21. Provide Garlock Style 9122 or District approved equal.

2.09 GASKETS FOR FLANGES USED IN COPPER PIPE OR TUBE

Gaskets shall be full face, 1/8-inch thick, and shall be one of the following nonasbestos materials:

A. Cloth-inserted rubber with a Shore "A" hardness of 75 to 85. Gaskets shall be suitable for a working pressure of 200 psi at a temperature of 180°F. Products: Garlock Style 19 or District approved equal.

B. Acrylic or aramid fiber bound with nitrile. Products: Garlock "Bluegard," Klinger "Klingersil C4400," or District approved equal. Gaskets shall be suitable for a pressure of 500 psi at a temperature of 400°F.

PART 3 - EXECUTION

3.01 RAISED FACE AND FLAT FACE FLANGES

Where a raised face flange connects to a flat-faced flange, remove the raised face of the flange.

3.02 INSTALLING ABOVEGROUND OR EXPOSED PIPING

A. Provide pipe hangers and supports as detailed in the Drawings and the Standard Specifications.

B. Install pipe without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment.

3.03 INSTALLING FLANGED PIPING

A. Set pipe with the flange bolt holes straddling the pipe horizontal and vertical centerline. Install pipe without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment. Before bolting up, align flange faces to the design plane within 1/16-inch per foot measured across any diameter. Align flange bolt holes within 1/8-inch maximum offset.

B. Clean bolts, nuts, washers and flange faces by wire brushing before installing gasket and adjoining flange. Inspect gasket seating surfaces, gasket, each bolt, nut, washer, and facing on which the nuts will rotate. Replace any damaged item.

C. Lubricate threads of carbon steel bolts and nuts with oil and graphite prior to installation. Assemble all bolts, nuts, and washers in the flange, then tighten nuts in a progressive diametrically opposite sequence, and torque with a calibrated torque wrench. All clamping torque shall be applied to the nuts only.

D. Bolt lengths shall extend completely through their nuts. Any which fail to do so shall not be considered acceptably engaged.

E. Do not use more than one gasket between contact faces in assembling a flanged joint.

F. Place washers under all nuts. Place washers under bolt heads where the flanges have been fusion bonded epoxy coated. Do not damage coated surfaces during installation.

G. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight. Replace galled, cracked, or distorted bolts and nuts.

H. After testing, coat exposed surfaces of bolts, nuts, and washers to be buried with primer for wax tape coating per Standard Specification Section 09952.

I. Wrap flanges which connect to buried valves or other buried equipment with polyethylene sheet per Standard Specification Section 09954. Extend the polyethylene material over the flanges and bolts, and secure it around the adjacent pipe circumference with plastic adhesive tape.

3.04 INSTALLING BLIND FLANGES

A. At outlets not indicated to be connected to valves or to other pipes and to complete the installed pipeline hydrostatic test, provide blind flanges with bolts, nuts, washers, and gaskets.

B. Coat the inside face of blind flanges per Standard Specification Section 09900, System No. 5.

3.05 INSTALLATION OF STAINLESS STEEL BOLTS AND NUTS

Prior to assembly, coat threaded portions of stainless steel bolts and nuts with lubricant.

END OF SECTION

STANDARD SPECIFICATION
SECTION 15061 STEEL TRANSMISSION PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, design, fabrication, and testing of cement mortar lined and di-electric coated and/or cement-mortar coated welded steel pipe with special pieces in accordance with AWWA C200, C205, C208 and the following options and restrictions. Size range is 6- to 36-inch nominal pipe size.

1.02 PIPE IDENTIFICATION SYMBOLS

Interpret pipe identification symbols used on the Drawings as follows: S-30"-150 or S-30"-0.1875" designates type of pipe (steel); nominal pipe size (30 inches); and working pressure rating (Class 150) or pipe wall thickness (0.1875 inches).

1.03 SPECIALS

A special is defined as any piece of pipe other than a normal full length of straight pipe. This includes but is not limited to elbows, manhole sections, short pieces, reducers, adapter sections with special ends, sections with outlets, etcetera.

1.04 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Painting and Coating: STD SPEC 09900.

D. Polyethylene Tape Pipe Coating: STD SPEC 09957.

E. Corrosion Control for Buried Piping: STD SPEC 13110.

F. General Piping Requirements: STD SPEC 15050.

G. Flexible Pipe Couplings: STD SPEC 15122.

H. Pressure Testing of Piping: STD SPEC 15144.

I. Installation of Steel Transmission Pipe: STD SPEC 15251.

1.05 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit an affidavit of compliance with AWWA C200 and C205.

C. Submit detailed shop drawings for the pipe and specials showing:

1. Order of installation and closures with designation by piece number for each steel pipe and fabricated special to be furnished and installed.

2. Pipe station and centerline elevation at each change of grade and horizontal alignment.

3. Elements of curves and bends, both in horizontal and vertical alignment including elements of the resultant true angular deflections in case of combined curvature.

4. Pipe outside diameter, wall thickness, location of welded seams, and working pressure rating.

5. Locations of bulkheads for field hydrostatic testing of pipeline.

6. Locations of closures for length adjustment and for construction convenience.

7. Locations of valves, manholes, and other mechanical equipment.

8. Limits of each reach of field-welded joints, rubber gasket joints, and of concrete encasement.

9. Call out weld sizes and dimensions of thrust ring collars, grooved end collars, flanges, reinforcing collars, wrapper plates, and crotch plates.

D. Submit joint details.

E. Submit details of lining and coating.

F. Submit drawings of butt straps, couplings, and flanges.

G. Submit details of bulkheads and of their method of attachment to the pipeline.

H. Submit certificate that cement complies with ASTM C 150, designating type.

I. Submit certified copies of mill test reports on each heat from which steel is rolled.

J. Submit test reports on physical properties of rubber used in gaskets.

K. Submit welding procedure specifications (WPS) and procedure qualification records (PQR) for each welding process and welder qualification records (WQR) for each welder and welding operator.

L. Submit drawings of all pipes and specials to the District's Representative for review. The Contractor and Engineer of Work shall both review and mark the review action taken, before submitting to District. Shop drawings shall be complete in all respects. If the shop drawings show any deviations from the requirements of the Drawings and Standard Specifications because of standard shop practices or other reasons, the deviations and the reasons therefore shall be set forth in the submittal packages.

M. Submit fabricator's quality control program results in one complete binder including all inspection reports, conducted tests, certified mill test reports, weld test coupon reports, welder qualification records, hydrostatic testing reports, shop testing reports, final fabrication checklist for each special, and affidavit of compliance. The quality control program results shall document all phases of the fabrication process.

1.06 INSPECTION AND FIELD VERIFICATION

A. The District's Representative or his authorized representative will inspect materials, fabrication, and testing of pipes and specials at the manufacturer's plant.

B. Where new pipelines are to be connected to existing waterlines of the District, the Contractor shall verify in the field the location, elevation, pipe material, pipe outside diameter, and any other characteristics of the existing waterline before proceeding with the pipe fabrication or installation. This field verification shall be performed in the presence of the District's Representative. Adjust and align the new pipeline as necessary to meet the field conditions and provide all required material, labor, and equipment to make the connection.

PART 2 - MATERIALS

2.01 DESIGN CRITERIA

A. Obtain the following information from the Drawings:

1. Elevation of the pipe centerline and the completed ground.

2. Alignment of the pipeline.

3. Working pressure rating (psi) or pipe wall thickness. Working pressure is the maximum high water level (HWL) or maximum static head (HGL) of the pressure zone minus the pipe centerline elevation in feet divided by 2.31 feet per psi.

4. Nominal pipe size.

5. Location of single or double lap welded joints.

B. Field hydrostatic test pressure shall be as indicated in Standard Specification Section 15144, unless noted otherwise on the Drawings.

C. Steel Cylinder.

1. The following formula shall be used to determine the stress in the steel cylinder:

$$S = \frac{PD}{2T}$$

Where S = Stress, PSI
P = Working pressure rating, PSI
D = Actual outside diameter of steel cylinder, inches (not bell)
T = Wall thickness of steel cylinder, inches

2. Stress in steel cylinders shall not exceed 15,000 psi at the working pressure rating with no allowance for tensile strength of cement mortar, except that the following minimum cylinder thicknesses shall prevail:

Nominal Pipe Size (inches)	Minimum Thickness (inches)
6 to 10	0.1046
12 to 18	0.1345
20 to 27	0.1875
30 to 36	0.2500

3. Steel cylinder outside diameters for pipe 12 inches and smaller in nominal pipe size shall conform to the following:

Nominal Pipe Size (inches)	Steel Cylinder Outside Diameter (inches)
6	6.625
8	8.625
10	10.750
12	12.750

4. For larger pipes, the steel cylinder outside diameter shall meet the following minimum outside diameters:

Nominal Pipe Size (inches)	Steel Cylinder Outside Diameter (inches)
14	15.375
16	17.375
18	19.375
20	21.375
21	22.375
24	25.750
27	28.875
30	31.875
33	34.875
36	37.875

2.02 SPECIALS

A. Fabricated steel fittings shall comply with AWWA C208. For elbows, fabricate to a minimum centerline radius of 2.5 pipe diameters and provide the number of pieces as tabulated below:

Deflection Angle	Number of Pieces
0 to 22.5 degrees	2
22.6 to 45.0 degrees	3
45.1 to 67.5 degrees	4
67.6 to 90.0 degrees	5

B. Maximum circumferential stress at the working pressure rating shall not exceed 40 percent of the minimum yield stress.

C. Material for fabricated specials shall be the same as the pipe and may be from previously tested pipe manufactured in accordance with these specifications. Minimum wall thickness shall be equal to the thickest adjacent straight pipe, except that the following minimum wall thicknesses shall prevail for a special:

Nominal Pipe Size (inches)	Minimum Thickness (inches)
6 to 18	0.1345
20 to 27	0.1875
30 to 36	0.2500

D. Select the type of reinforcement for specials with outlets from the following:

$$R = \frac{\text{ID outlet}}{\text{ID main run x sin B}}$$

Where B = Angle between the longitudinal axis of the main run and the outlet

R	Type of Reinforcement
Maximum of 0.5	Collar Plate
Maximum of 0.7	Wrapper Plate
No limit	Crotch Plate

When outlets are located opposite each other in a special (i.e., a cross), the limiting values of “R” shall be 0.25 and 0.35, respectively. Use wrapper plate when the pipe main run is 21 inches and smaller, and “R” is larger than 0.7. Use crotch plate when the pipe main run is 24 inches and larger, and “R” is larger than 0.7.

E. Collar Plate Reinforcement.

1. For collar plate reinforcement, select an effective shoulder width "W" of a collar from the inside surface of the steel outlet to the outside edge of the collar, measured on the surface of the cylinder of the main run, such that:

$$W = (1/3 \text{ to } 1/2) \times \frac{\text{ID outlet}}{\sin B}$$

2. For collar plate reinforcement of tangential outlets, use:

$$\sin B = \sqrt{\frac{\text{OD outlet}}{\text{OD main run}}}$$

3. The minimum thickness "T" of the collar is determined by:

$$T = \frac{P \times \text{ID main run} \times \text{ID outlet} \times (2 - \sin B)}{4 \times F \times W \times \sin B}$$

Where P = Working pressure, PSI
F = Allowable stress at working pressure (40% of minimum yield)
B = As in paragraph 2.02, D.

4. Collars may be oval in shape or rectangular with rounded corners.

F. For wrapper plate reinforcement, use the above collar formula except that the wrapper is of thickness "T," its total width is (2W + ID outlet/sin B), and it extends entirely around the main pipe diameter portion of the steel special.

G. Base crotch plate design on Swanson, H.S. et. al., DESIGN OF WYE BRANCHES FOR STEEL PIPES, summarized in AWWA Manual M11 (Current Edition), Chapter 13.

H. Steel pipe used for outlets, 12 inches and smaller, shall be standard weight conforming to ASTM A 53 (Type E or S), Grade B. For flanged outlets, use a slip on flange, double welded, and match the flange of the connecting component.

I. At flanged outlets not indicated to be connected to valves or to other pipes, provide blind flanges with bolts, nuts, washers, and solid face gaskets.

2.03 STEEL FOR PIPE AND SPECIALS

Use steel conforming to ASTM A 36; ASTM A 283 Grade D; ASTM A 572 Grade 42 or 50; ASTM A 1011 Grade 33; or ASTM A 1018 Grade 33 with carbon content of 0.25% maximum. Use steel plate and sheet having a thickness with a maximum allowable variation of not more than 0.01-inch less than the minimum thickness specified.

2.04 CEMENT FOR INTERIOR MORTAR LINING

Use cement conforming to ASTM C 150, Type II.

2.05 CEMENT FOR EXTERIOR MORTAR COATING

Use cement conforming to ASTM C 150, Type II.

2.06 POLYETHYLENE TAPE PIPE COATING (DI-ELECTRIC COATED)

See Standard Specification Section 09957.

2.07 FLANGES

Use flanges conforming to AWWA C207, Class E or Class F; or ANSI B16.5, Class 150 or Class 300.

2.08 BOLTS, NUTS AND GASKETS FOR FLANGES

See Standard Specification Section 15050.

2.09 INSULATING FLANGE KITS

See Standard Specification Section 13110.

2.10 OUTLETS

For threaded outlets 3 inches and smaller, use a thredolet type per AWWA Manual M11 (Current Edition), Chapter 13. Outlets shall be 3000 pound WOG forged steel per ASTM A 105 or ASTM A 216, Grade WCB. Threads shall comply with ANSI B1.20.1, NPT. Outlets shall be Bonney Forge Co. "Thredolet," Allied Piping Products Co. "Branchlet," or District approved equal. Do not use pipe couplings for outlets.

2.11 MECHANICAL CLAMP-TYPE COUPLINGS

A. Mechanical clamp-type couplings for grooved or shouldered end pipe shall be ductile iron, ASTM A 536 Grade 65-45-12. Bolts shall conform to ASTM A 183, 110,000 psi tensile strength. Gaskets shall be EPDM (ethylene propylene diene monomer) conforming to ASTM D 2000.

B. Couplings for pipe, 12-3/4 inches outside diameter and smaller, shall conform to AWWA C606 for flexible, square cut grooved joints in IPS steel pipe with weld-on grooved adapters. Couplings shall be Victaulic Style 77 or District approved equal.

C. Couplings for pipe, 15-3/8 inches outside diameter and larger, shall conform to AWWA C606 for shouldered end flexible joints with Type D special ends. Couplings shall be Victaulic Style 44 or District approved equal.

2.12 TYPE OF PIPE JOINTS

Joint ends of pipe sections shall be as indicated on the Drawings.

A. Rubber Gasket Joints: For pipes smaller than 24 inches, use a bell band or expanded bell and rolled groove spigot with rubber gasket. For pipes 24 inches and larger, use a carnegie shape spigot with matching bell. Attach spigot and bell with fillet weld on both the interior and exterior circumference of the pipe section.

B. Welded Joints: Use expanded bell with matching spigot to penetrate a minimum of 1-1/2 inches into the bell. The manufacturing tolerances stated in AWWA C200 do not apply and are hereby exceeded by the following. Joint tolerances shall not exceed a total of 1/8-inch on the diameter with the joint gap equalized around the perimeter.

C. Flanges: Use slip-on or ring type welded to the interior and exterior circumference of the pipe section. Use flanges for attaching pipe to valves, other appurtenances, or as shown on the Drawings.

D. Butt Strap Closures: Butt straps shall be the same thickness and material as the pipe wall but not less than 10 gage, at least 10 inches wide, rolled to fit the outside cylinder diameter in two half sections, and shall be centered over the plain ends of the pipe sections they are to join. Weld a 5-inch threaded, steel, standard half coupling or couplings to the interior and exterior of the top butt strap half section to provide access for mortar lining the inside of the joint. Provide two couplings for pipes 18 inches and larger. Provide a threaded steel plug for each half coupling.

E. Mechanical Clamp-Type Couplings: Use grooved or shouldered ends as determined by the outside diameter of the pipe and per AWWA C606. Prepare the pipe ends to properly engage with the specified dimensions of the coupling manufacturer for a correct fit.

F. Flexible Pipe Couplings: Use plain end pipe and provide joint harnesses where shown. Flexible pipe couplings and harnesses shall conform to Standard Specification Section 15122.

2.13 PAINTING AND COATING APPLIED IN SHOP

A. Wrap exterior surfaces of buried pipe with polyethylene tape pipe coating and apply cement mortar overcoat where shown on the Drawings as di-electric coated per Standard Specification Section 09957. Apply coating in shop.

B. Cement mortar coat buried pipe where shown on the Drawings. Apply coating in shop.

C. Coat the exposed bare steel surfaces of the spigot and bell ends of each pipe section per Standard Specification Section 09900, System No. 15 (prime coat only). Apply primer in shop to the interior and exterior surfaces to a 2-mil dry film thickness.

D. Coat inside surfaces of threaded outlets and blind flanges per Standard Specification Section 09900, System No. 5. Apply coating in shop.

E. Coat the grooved and shouldered ends of pipe to be in contact with mechanical clamp-type couplings per Standard Specification Section 09900, System No. 5. Apply coating in shop to the described surfaces to a maximum of 10 mils dry film thickness.

F. Coat the ends of plain end pipe where flexible pipe couplings are to be installed per Standard Specification Section 09900, System No. 5. Apply coating in shop.

PART 3 - EXECUTION

3.01 LENGTH OF PIPE SECTIONS

Provide pipe with a maximum length of 30 feet unless spreader beams are used in lifting the pipe sections at the third points, in which case lengths up to 40 feet can be used.

3.02 PIPE CYLINDER FABRICATION

A. Longitudinal and Girth Welds: Fabricate the pipe cylinder by full penetration butt welding with spiral seam or straight seam. Limit girth welds to two per pipe section with full penetration butt welds. Limit longitudinal welds to one seam for pipe diameters less than 30 inches and two seams for 30- to 36-inch diameters. Stagger longitudinal seams of adjacent shell courses. When using spiral seam, coil splices shall be a minimum of 2 feet away from the ends of the pipe cylinder.

B. Preparation on Edges: Machine or face the ends and edges of pipe sections for butt welds. Inspect sheared edges of plates or sheets over 1/4-inch in thickness for cracks. Do not use plates or sheets with edges containing cracks.

1. If the ends are faced with a cutting torch, removed irregularities and scale due to burning by grinding or chipping.

2. The dimensions and shape of the edges of the plates to be joined by welding and the gap between the plates shall be such as to allow thorough fusion and complete penetration, and the edges of plates shall be properly formed to accommodate the various welding conditions. Remove projecting burrs. Do not use hammering to shape the edges preparatory to welding.

3. Cut plates true to line so that the edges, when in position for welding, shall be straight, parallel, and in contact on longitudinal seams.

4. The maximum gap between the edges of plates prior to welding shall not be more than 1/16-inch.

C. Forming:

1. General:

a. Before rolling or forming longitudinal edges, plates shall be lap broken by a continuous rolling operation or be formed in a press having dies that are machined to the proper radius. The pressure exerted during the lap breaking operation shall be sufficient to secure a true and uniform curve at the edges of the plate. Roll or press form plates to the specified diameter.

b. Continually remove scale and other foreign matter accumulating on the plate during the rolling and forming operation by an air blast so that it will not be rolled or pressed into the surface of the plate. Keep the surfaces of breaker dies and rolls clear of bits of metal or other accumulated materials during forming operations.

c. Form each section of pipe to a true circle of the specified diameter throughout its entire length so as to produce a finished pipe truly round and free from dents, kinks, and abrupt changes in curvature. The outside circumference of the finished pipe shall not be less than its design value and shall not exceed its design value by more than 0.4%.

d. Complete rolling and forming prior to making butt welds.

e. Do not heat or hammer for the necessary forming of angles.

2. Minimum Radius: Do not use any forming process in which the plates are bent or otherwise formed during any stage of the process to a curvature of appreciably smaller radius than the radius of curvature corresponding to the specified diameter of the pipe.

3. Forming Bells:

a. Shape the bells to accommodate the spigot penetration. Form the bell on an expanding press or by being thrust axially over a die in such a manner as to stretch the steel plate beyond its elastic limit to a round bell of required diameter and shape, avoiding injurious reduction in plate thickness at any point, and avoiding impairment of the physical properties of any part of the plate.

b. Do not use any process in which the bell is formed by rolling.

c. Bells for mitered pipe shall be normal to the axis of the adjacent course of the adjoining pipe, and the axis of any such bell shall be parallel to the axis of such adjacent course.

D. Preparation for Welding:

1. Fit Up:

a. Take special care in the layout of joints in which fillet welds are to be used in order to ensure the fusion of the weld material at the bottom of the fillet. Prior to welding, fit the plates closely; and during welding, hold them firmly together.

b. Tack weld or clamp in place the edges of butt joints in proper alignment and hold throughout the welding process. Do not use dogs, clips, lugs, or equivalent devices welded to the steel plate for the purpose of forcing it into position.

2. Cleaning:

a. Prior to welding, clean the surfaces of plates and members to be welded by an automatic process of all scale and rust for a distance of not less than 1-inch and of all oil or grease for a distance of not less than 3 inches from the welding edge and on both sides of the plates in the case of butt joints.

b. Remove grease or oil with lye or other solvent. Do not use kerosene or any heavier petroleum solvent.

c. Blasting and other cleaning shall preferably be done prior to any tack welding of the plates. Should inspection indicate a greater amount of porosity at the tack welds than in the remainder of the welds, sandblast the tack welds prior to automatic welding.

d. When it is necessary to deposit metal over a previously welded surface, remove any scale, slag, or welding flux thereon by a roughing tool, chisel, air chipping hammer, or other means to prevent inclusion of impurities in the weld metal.

3. Aligning: Where butt-welded joints are used, take particular care in aligning the edges to be joined so that complete penetration and fusion at the bottom of the joint is accomplished. The offset in abutting edges shall not exceed 1/16-inch at circumferential and spiral seams and shall not exceed 1/32-inch at longitudinal seams.

E. Fabrication of Specials: Fabricate specials from previously hydrostatically tested straight pipe sections.

3.03 WELDING

A. Material and Objective:

1. Perform welding by skilled welders who have had experience in the method and materials to be used. Welding operators shall be qualified under the standard qualification procedures of the ASME Boiler and Pressure Vessel Code, Section IX, Welding Qualifications. Any welder or welding operator performing work shall have been qualified for the process involved within the past three years.

2. Perform welding by an unvarying arc-welding process, which excludes the atmosphere during the process of deposition and while the metal is in a molten state. The size and type of electrode used, the current and voltage required, and the type of wire and flux to be used for automatic processes shall be subject to review by the District's Representative.

3. Do not use rusted or damaged electrodes. Sift used flux from automatic welders free of fines and coarse pieces and remove mill scale before reusing.

4. Welds shall be of uniform composition, neat, smooth, full strength, and ductile. Make welds with a technique which will ensure uniform distribution of load throughout the welded section with a minimum tendency to produce eccentric stress or distortion in the weld or in the adjacent metal.

5. Make all welds in such manner and on such time schedule as to avoid residual internal stresses in the welded joints and stresses due to temperature changes in the completed pipe sections. Weld longitudinal seams before girth seams.

B. Quality of Welds:

1. There shall be no greater evidence of oxidation in the metal of the weld than in the metal of the unwelded plate. Welded joints shall be of a type that will produce complete fusion of the plates and shall be free from unsound metal, pinholes, and cracks.

2. The finish of welded joints shall be reasonably smooth and free from grooves, depressions, burrs, and other irregularities. There shall be no valley or undercut in the center or edges of any weld.

3. Any pipe section which shows irregularities in shape after welding may be rerolled to make it cylindrical, but in no case shall it be reformed by hammering, and in no event shall reforming be permitted of pipe sections which after welding are found to have abrupt changes in curvature at longitudinal seams, unless such welds are subsequently removed and rewelded following the reforming operation.

4. Back chipping on both automatic and hand welding, whether for repairs or preparation of the groove for the original weld, are subject to inspection by the District's Representative before being filled with weld metal. Do not make butt welds prior to the completion of the rolling and forming. Grind butt welds for both hand and automatic welding to sound metal before welding the reverse side.

C. Longitudinal Joints:

1. Longitudinal joints shall be double butt welded by a fully automatic welding process, using welding heads which permit visual investigation of the deepest point of penetration of the first pass and which permit backfilling of extensive repair cuts by the automatic process. Use starter and runoff plates for longitudinal weld. The first pass on longitudinal welds shall be on the inside of the pipe and shall accomplish at least 75 percent of the complete penetration.

2. Joint welds shall be continuous for the full length of the seam, and shall be built up uniformly at the center of the weld to form a reinforcement on both sides of the plate. The bead on the outside of the pipe shall have a height of at least 1/16-inch and no more than 3/32-inch and a minimum width of at least one and one-half times the thickness of the plate; provided that in any case the weld and penetration shall be of sufficient width so that both edges to be joined shall be entirely involved in the weld, regardless of a possible inaccuracy in the line of travel of the automatic electrode. Where the welding method permits a considerable deviation in the line of travel of the welding head, place a scribed line parallel to and at a fixed distance from the edges of the plates prior to welding so that the location of the welding bead with regard to the plate joints may be readily checked.

3. Where welding on small pipe is done from one side only, remove the bead on the inside of the pipe by chipping so that the finished weld on the inside of the pipe will be practically flush with the plates. The inside bead will in no case be required to be larger than the outside bead but shall be of sufficient size so that, upon its removal, the inside fusion lines and any defects near the under surface of the weld metal will be exposed.

4. If complete penetration and reinforcement on both sides of butt-welded joints are not satisfactorily accomplished, when the welding is done from one side, then chip out the reverse side to the extent necessary to secure a clean surface of the originally deposited weld metal and make an automatic welding pass on the reverse side. The bead on the inside of the pipe shall be not more than 1/16-inch in height and the width of the bead shall be not less than 3/8-inch with smoothly tapered edges. Before making the second weld, chip out the underside of the first weld with a round-nosed tool until entirely solid and clean metal is reached.

5. Welding shall be subject to the requirement that there shall be no valley, groove, or undercut along the edge of or in the center of the weld, and that the deposited metal shall be fused smoothly and uniformly into the plate surface at the edges of the joint.

6. If the normal welding process is interrupted for any reason, take special care when welding is resumed to get full penetration and thorough fusion between the weld metal and the plates and the weld metal previously deposited. Where welding is interrupted by faulty machine operation, chip back the weld to where the presence of solid, clean metal indicates correct machine operation before resuming welding operations.

D. Shop Circumferential Joints and Spiral Seam Joints: Shop circumferential and spiral seam joints shall be double butt welded. The details of shop circumferential and spiral seam joints shall conform to the requirements for longitudinal joints as given above. Circumferential joints in bends and welded fabricated fittings need not be made by automatic welding methods.

E. Defects: Completely chip out porosity and cracks, trapped welding flux, or other defects in the welds in a manner which will permit proper and complete repair by welding. Repair defective welds by hand welding. Where the defect is so extensive as to make a hand repair impractical, use automatic welds.

F. Equipment: In welding by an automatic process, both the rate of deposition of weld metal and the rate of travel of the electrode shall be automatically controlled. Use the submerged arc welding process for automatic welding.

3.04 SHOP TESTING

A. General: After completion of fabrication and welding in the shop, and prior to the application of any lining or coating, test each component according to the following requirements.

B. Shop Test Requirements:

1. Perform tests of production welds in accordance with AWWA C200 for each heat of steel used. A guided-bend test specimen shall be considered as having passed only if no crack or other open defect exceeding 1/8-inch measured in any direction is present in the weld metal or heat affected zone of the base material after the bending. A tension test specimen shall be considered as having passed only if failure occurs in the base metal at a stress in excess of the minimum specified tensile strength. There shall be at least one set of welding tests as described in AWWA C200, Section 3.3.5 for each 1,000 linear feet of spiral seam weld in addition to tests specified in Section 3.3.6 of the same standard.

2. Test each straight pipe section in the shop by the hydrostatic test method.

3. Inspect all welds in the expanded portion of the pipe bell in accordance with the magnetic particle test.

4. Test backgouge and completed weld of all manual process groove welds by the liquid penetrant method. Test completed fillet welds by the liquid penetrant method.

5. Any production weld or manual process weld that appears to be of poor quality as determined by the District's Representative shall be subjected to 100 percent

radiographic testing. One hundred percent ultrasonic testing may be used in lieu of 100 percent radiographic testing.

6. After shop fabrication, retest each pipe section with a mitered bend or reducer. Test the mitered or butt joints by 100 percent radiographic testing.

7. After shop fabrication, retest each pipe section with an attached outlet. Test the collar or wrapper with the soap and compressed air method. Test the outlet by the liquid penetrant method.

8. Test each slip-on or ring type flange welded to the pipe by the liquid penetrant method and with the soap and compressed air method.

C. Test Methods:

1. Shop Hydrostatic Test: Vent air from the pipe section before the test pressure is applied. Hold the test pressure on each section for a sufficient length of time to permit inspection of all joints.

2. Use the following hydrostatic test pressure for testing straight pipe sections:

$$P = \frac{2ST}{D}$$

Where P = Hydrostatic test pressure, PSI
S = Stress, PSI, use 75% of the minimum yield point of the steel
T = Wall thickness of the steel pipe section to be tested in inches
D = Actual outside diameter of the steel pipe section to be tested in inches

3. When subjected to the above hydrostatic test pressure, the pipe shall show no leaks, distortion, or other defects. Repair any leaks or other defects which develop during the hydrostatic test by chipping out and rewelding, after which the repaired section shall again be tested until it shows no leaks or other defects.

4. Test Bulkheads: Furnish and attach suitable dished heads and blind flanges for making the hydrostatic tests, and after completion of the tests, remove the heads and properly restore the ends of the sections.

5. Radiographic Test: Make the radiographs in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Pressure Vessels. Repair defects in the welds disclosed by the radiographs. Submit all radiographs and the notation of areas for repair to the District's Representative for review.

6. Ultrasonic Test: Make the ultrasonic tests in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Pressure Vessels. Repair defects in the welds disclosed by ultrasonic testing. Prepare a report of the ultrasonic testing and submit to the District's Representative for review.

7. Soap and Compressed Air Test: Use compressed air at maximum 40-psi pressure into the joint, and while the joint is under pressure, swab every portion of every welded seam forming a part of the joint with a heavy soap solution or a commercial

bubble-producing leak test fluid. Examine for leakage. Repair any defects disclosed by the test by chipping out, rewelding the chipped section, and retesting. Drill and tap the necessary test holes, and plug weld the holes after testing.

8. Liquid Penetrant Test: Conform to the requirements specified in ASTM E 165, Method B. The materials used shall be either water washable or nonflammable. Products: "Spotcheck" by the Magnaflux Corporation or "Met-L-Check Flaw-Findr" by the Met-L-Check Company. Chip out all defects, reweld, and retest the section affected until it shows no leaks or other defects.

9. Magnetic Particle Test: Magnetic particle test shall conform to the requirements specified in ASTM E 709, using the wet particle technique. Chip out all defects, reweld, and retest the section affected until it shows no leaks or other defects.

D. Pipe Fit Up at Flexible Pipe Couplings:

1. The following procedures shall be witnessed and accepted by the District’s Representative in order to verify that the pipes are appropriately sized where the pipes are to be joined by a flexible coupling.

2. Obtain the specifications and fabrication tolerances for the specific flexible pipe coupling to be used. Deliver this information and the flexible pipe coupling to the pipe manufacturer. See Standard Specifications Section 15122. At each location where a flexible pipe coupling is to be installed, fabricate the pipe to a tolerance that will ensure proper fit of the flexible pipe coupling per the coupling manufacturer’s requirements.

3. After fabrication of the pipe sections and application of the required coatings on the pipe, assemble the two pipe ends and the flexible coupling in the shop in the same alignment and configuration as the pipe will be assembled in the field. Check for ease of assembly and any evidence of an inadequate seal between the pipe and flexible pipe coupling.

4. If any evidence of inadequate seal is observed, repair the pipe in a manner acceptable to the District’s Representative. Repeat the assembly and repair process until satisfactory results are achieved. If excessive repairs to the pipe are needed, the District’s Representative may require, at his sole discretion, that a new section of pipe be fabricated.

5. Before disassembling the parts, mark the parts so that they can be re-assembled in the same orientation in the field.

6. Before any final acceptance by the District’s Representative, test, and repair as necessary, any damages to the pipe coatings and linings caused by the fit-up procedure.

3.05 ALIGNMENT CRITERIA

A. For horizontal and vertical curve alignment, use straight or beveled pipe of normal or one-half normal lengths pulled partially open on one side of the joint or use pipes with a welded mitered bend of up to 10 degrees next to the bell end. Design pipes with a bend in excess of 10 degrees as a special. Do not use angular deflections at butt strap joints.

B. Deflection by Pulled Joints:

1. For rubber gasket joints, do not pull joint more than one-half of the watertight extensibility provided by the bell and spigot design or more than 3/4-inch on the outside of the curve. Minimum interior joint space shall be 1/2-inch.

2. For welded joints, do not pull joint to exceed the minimum overlap of the assembled bell and spigot lap joint or more than 1/2-inch on the outside of the curve. Minimum overlap of the assembled joint shall be 1-inch or 3 times the pipe wall thickness, whichever is greater per AWWA C206. Minimum interior joint space shall be 1/4-inch.

C. Deflection By Beveled Joints: For welded joints only, use pipe sections having beveled bell ends for curves and angles in the alignment which cannot be accomplished using the maximum allowable deflection by pulled joints. Beveled pipe sections used in curved alignment shall be of standard length except when shorter sections are required to fit the radius of curvature in which case all sections shall be of equal length. Do not bevel spigot ends. The beveled end of a pipe shall not have a deflection from a plane perpendicular to the pipe axis exceeding 5 degrees. Form the bell end perpendicular to the plane of the beveled end, so there is no loss of lap joint tolerance. Do not pull beveled joints.

D. Deflection By Mitered Bends: For rubber gasket joints and welded joints, use pipe sections with welded mitered bends of up to 10 degrees next to the bell end for curves and angles which cannot be accomplished using the maximum allowable deflections by pulled or beveled joints. Pipe sections with mitered bends used in curved alignment shall be of standard length except when shorter sections are required to fit the radius of curvature in which case all sections shall be of equal length.

3.06 THICKNESS OF INTERIOR MORTAR LINING

Conform to AWWA C205 except provide minimum thickness of mortar lining over steel cylinder and steel specials as follows:

Nominal Pipe Size (inches)	Lining Thickness (inches)
6 through 12	5/16
14 and 16	1/2
18 through 36	3/4

3.07 THICKNESS OF EXTERIOR MORTAR COATING OVER METALSURFACES

Conform to AWWA C205 except provide 1-1/4 inches minimum thickness of mortar coating over all metal surfaces, except at flanges. Coating within one bolt length of a flange shall be held to 50 percent of the above thickness.

3.08 PROTECTIVE COATING ON PIPE ENDS WITH MORTAR LINING AND COATING

Coat the exposed bare steel surfaces of the spigot and bell ends of each pipe section in the shop. Apply primer to the interior and exterior steel surfaces to a 2-mil dry film thickness.

3.09 POLYETHYLENE TAPE PIPE COATING WITH MORTAR ARMOR COAT

Where it is shown on the Drawings that polyethylene tape coating with mortar armor coat is to be used on the exterior of the pipe and specials, see Standard Specification Section 09957.

3.10 PRODUCT MARKING

Plainly mark each length of straight pipe and each special at the bell end to identify the proper location of the pipe item by reference to the layout schedule. For beveled joints and mitered bends at the bell end, show the degree of bevel or miter and the point on the circumference to be laid uppermost.

3.11 SHIPPING AND HANDLING

A. When loading pipes and specials for shipment to the project site, use wooden stringers between pipe layers and secure the load with padded chains or ribbon binders. Place internal braces for pipes 24 inches in diameter and larger prior to loading.

B. Lift pipes and specials for loading with wide nylon straps, wide canvas or padded slings, wide padded forks, and skids designed to prevent damage to the pipes and specials. Do not use cable slings or chains.

C. Place plastic caps over the ends of the pipes and specials. Replace caps damaged during shipment to the project site.

D. Do not drop, roll, or damage the pipes and specials.

3.12 INSTALLATION

See Standard Specification Section 15251.

END OF SECTION

STANDARD SPECIFICATION

SECTION 15065 PLASTIC (PVC) GRAVITY SEWER PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section includes materials, installation, and testing of PVC gravity sewer pipe conforming to ASTM D3034 or ASTM F789. Size range is 4 through 12 inches.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings

B. Trenching, Backfilling, and Compacting: STD SPEC 02223

C. Precast Circular Concrete Manholes: STD SPEC 03461

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300

B. Submit reports on testing per ASTM D3034 or ASTM F789 (pipes 4 inches through 12 inches).

C. Submit cut sheets showing invert elevations, ground elevations, and cuts every 25 feet. Show lateral locations.

PART 2 - MATERIALS

2.01 PVC MATERIAL

Additives and fillers, including stabilizers, antioxidants, lubricants, colorants, etc., shall not exceed 10 parts by weight per 100 of PVC resin in the compound.

2.02 PIPE

Pipe 4 through 12 inches shall conform to ASTM D3034, SDR 35, or ASTM F789.

2.03 JOINTS

Provide elastomeric gasket joints of the push-on type, conforming to ASTM D3212.

2.04 GASKETS

Gaskets for push-on joints shall conform to ASTM F477.

2.05 FITTINGS

Fittings for pipe 4 through 12 inches shall conform to ASTM D3034, SDR 35, or ASTM F789.

2.06 MANDREL FOR FIELD TESTING OF PIPE DEFLECTION

A. Be a rigid, nonadjustable, odd-numbering-leg (nine legs minimum) mandrel having an effective length not less than its nominal diameter.

B. Have a minimum diameter at any point along the full length as follows:

Pipe Material	**Nominal Pipe Size (inches)**	**Minimum Mandrel Diameter (inches)**
PVC-ASTM D3034 (SDR 35)	6	5.619
	8	7.524
	10	9.405
	12	11.191

C. Be fabricated of steel; be fitted with pulling rings at each end; be stamped or engraved on some segment other than a runner indicating the pipe material specification, nominal size, and mandrel outside diameter (e.g., PVC, D 3034-8”-7.524”); and be furnished in a carrying case labeled with the same data as stamped or engraved on the mandrel.

D. All costs incurred by the Contractor attributable to mandrel and deflection testing, including any delays, shall be borne by the Contractor at no cost to the District.

PART 3 - EXECUTION

3.01 INSTALLING PVC SEWER PIPE

A. Install in accordance with Section 02223, ASTM D2321

B. Lay pipe without break, upgrade from structure to structure, with the socket ends of the pipe upgrade.

C. Do not use the pipe as a drain for removing water that has infiltrated into the trench.

D. After joint assembly, bring the bedding material up to pipe spring line. Bedding material shall be imported sand per Section 02223 Place the bedding material on each side of the pipe. Tamp the bedding material into final position at pipe spring line and continue to the top of the pipe. Relative compaction shall be in conformance with Section 02223

E. Then place bedding material to 1 foot above the top of the pipe and compact to the same relative compaction as in the pipe zone per Section 02223. The remainder of the trench backfill shall be native material, installed per Section 02223.

F. Do not use hydro-hammers to compact bedding or backfill.

3.02 INSTALLING LATERALS

A. A. Each wye branch fitting shall have its barrel diameter equal to the diameter of the sanitary sewer main and the spur (or branch) diameter as indicated in the drawings. Do not place wye branches within 5 feet of any structure.

B. Install wye fittings so that the outlet branch is inclined upward at an angle of 45 degrees. Plug wye branch fittings that are to be left unconnected with a stopper or plug. Join laterals to wye branch fittings at the sanitary sewer main by eighth bends. Eighth bends and quarter bends are a part of lateral sewer line.

C. End of the lateral shall be at least 3 feet below the existing or proposed grade of the ground at existing structure to be served or as called for in the drawings.

D. Where possible, laterals shall run perpendicular to the sewer main at a minimum grade of 1%. Bed laterals the same as the sewer main into which they connect.

E. Plug laterals with stopper in the socket of the last joint. Seal stopper in place so that it will withstand the internal pressure during the test for leakage and so that it may be removed without damage to the socket.

F. Mark the location of each lateral by chiseling a letter "S" 1-1/2 inches high on the top of the curb. If the terminal point of the lateral is more than 8 feet beyond the curb line or curb improvements do not exist, provide and install a 4-inch by 4-inch by 3-foot 0-inch stake extending 2 inches above the ground and placed at the end of the connection.

3.03 INSTALLING PIPE AT MANHOLES AND STRUCTURES

A. Place a 2-foot PVC length of pipe of the same inside diameter as the adjoining pipe at the inlet and outlet to each manhole or structure. Use one of the following methods:

1. Directly cast a manhole coupling into the manhole base. Provide rubber-ring gasket in the coupling.

2. Stretch a rubber-ring gasket around the pipe to serve as a water stop when cast into the structure wall.

B. Do not cast pipe bells into manholes or structures. Cut off the bell so that no recess or offset appears on the exposed face from the inside wall of the pipe to the outside wall of the pipe. The pipe shall have a plain end, flush with the inside wall of the manhole or structure, or as shown in the drawings.

3.04 TESTING FOR DEFECTS OF INSTALLED PIPE

Following placement and compaction of backfill and prior to placing permanent pavement, ball and mandrel the pipe to measure for obstructions (excessive deflections, joint offsets, and lateral pipe intrusions).

3.05 FIELD TESTING FOR PIPE DEFLECTION

A. Test installed pipe to ensure that vertical deflections for plastic pipe do not exceed the maximum allowable deflection. Maximum allowable deflections shall be governed by the mandrel requirements stated herein and shall nominally be:

Nominal Pipe Size	Percentage
Up to and including 12 inches	5.0

B. The maximum average inside diameter shall be equal to the average outside diameter per applicable ASTM standard minus two minimum wall thicknesses per applicable ASTM standards. Manufacturing and other tolerances shall not be considered for determining maximum allowable deflections.

C. Perform deflection tests not sooner than 30 days after completion of placement and compaction of backfill. Clean and inspect the pipe for offsets and obstructions prior to testing.

D. Pull a mandrel through the pipe by hand to verify that maximum allowable deflections have not been exceeded. Prior to use, the mandrel shall be certified by an independent testing laboratory. Use of an uncertified mandrel or a mandrel altered or modified after certification will invalidate test. If the mandrel fails to pass, the pipe will be deemed to be overdeflected.

E. Uncover any overdeflected pipe and, if not damaged, reinstall. Remove damaged pipe from the site. Any pipe subjected to any method or process other than removal, which attempts, even successfully, to reduce or cure any overdeflection, shall be uncovered, removed from the site, and replaced with new pipe.

3.06 LEAKAGE TEST

A. Test for leakage by means of an air test. Conduct air tests per F1417, Table 1. Test each section of pipe between manholes, along with the manholes.

B. Test each section of pipe between two successive manholes by plugging pipe outlets with test plugs. Add air slowly until the internal pressure is raised to 4.0 psig. The compressor used to add air to the pipe shall have a blowoff valve set at 5 psig so that the internal pressure in the pipe never exceeds 5 psig. Maintain the internal pressure of 4 psig for at least two minutes to allow the air temperature to stabilize, then disconnect the air supply and allow the pressure to decrease to 3.5 psig. Measure the time in minutes that is required for the internal air pressure to drop from 3.5 psig to 2.5 psig. If the pressure drop from 3.5 psig to 2.5 psig occurs in less time than the specified values, overhaul the pipe and, if necessary, replace and re-lay the pipe until the joints and pipe hold satisfactorily under this test.

C. Guard against the sudden expulsion of a poorly installed plug or a plug that is partially deflated.

3.07 TESTING FOR ALIGNMENT AND GRADE

A. After the pipe has been installed, tested for leakage, backfilled to existing grade, and manholes raised to grade and resurfaced, "ball" the pipe from manhole to manhole with a sewer scrubbing ball.

B. Request television inspection by the District's Representative. If deficiencies are observed, the District's Representative will make a videotape and defects requiring correction will be noted. Upon completing the corrective work, notify the District's Representative; the affected portion of the pipeline system will be retelevised. Costs for re-television inspection will be billed to the Contractor

END OF SECTION

STANDARD SPECIFICATION
SECTION 15080 MISCELLANEOUS PIPING SPECIALTIES

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes miscellaneous valves, fittings, piping materials and installation. Testing shall be in accordance with associated facilities.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Cold Applied Wax Tape Coating: STD SPEC 09952.

D. Polyethylene Sheet or Tube Encasement: STD SPEC 09954.

E. Steel Transmission Pipe: STD SPEC 15061.

F. Disinfection of Piping: STD SPEC 15141.

G. Pressure Testing of Piping: STD SPEC 15144.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit manufacturer's catalog data, descriptive literature and assembly drawings. Show dimensions, materials of construction by specification reference and grade, linings and coatings.

PART 2 - MATERIALS

2.01 GENERAL

Valves and miscellaneous components are identified on the Standard Drawings by size and type.

2.02 CORPORATION STOPS - BRONZE, 2 INCHES AND SMALLER

For working pressures from zero to 300 psi, use Ford Ballcorp Type FB1100-x-Q, or District approved equal. Stops shall be bronze (ASTM B 62) with inlet male iron pipe threads and outlet with quick joint for copper water tube. Quick joint shall consist of a threaded nut , an external nut stop, stainless steel gripper ring, and gasket. Gripper rings can only be used once. If the threaded nut of the quick joint is loosen after assembly and the copper water tube removed from the corporation stop, a new gripper ring shall be used in the reinstallation of the copper water tube and the corporation stop. Compression or pack joints will not be allowed.

2.03 BALL VALVES - BRONZE, 2 INCHES AND SMALLER

A. For 1-inch and 2-inch valves with working pressures from zero to 300 psi, use Ford Ball Valve Curb Stop B11, James Jones J-1905, or District approved equal. Valves shall be bronze (ASTM B 62) with both ends female iron pipe threads and full port. Provide brass handles, use Ford HB-34 and HB-67S, James Jones, or District approved equal.

B. For 1/2-inch valves with working pressures from zero to 600 psi, use NIBCO T-580-BR, Stockham S-216-BR-R-T, or District approved equal. Valves shall have threaded ends, two piece bronze body, standard port, bronze trim, chrome plated ball, and blowout proof stem. Use a lever handle for non-buried installations and a tee handle for buried installations.

2.04 ANGLE VALVES - BRONZE, 2 INCHES AND SMALLER

For working pressures from zero to 300 psi, use NIBCO T-335Y, Stockham B-222T, or District approved equal. Valves shall be bronze (ASTM B 62), union bonnet, angle design, 300 psi WOG rated with both ends female iron pipe threads.

2.05 ANGLE VALVES - BRONZE HYDRANT HEAD

For working pressures from zero to 300 psi, use James Jones J-344 H.P. or District approved equal. Valves shall be bronze (ASTM B 62) with 4-inch inlet female iron pipe threads and 2-1/2-inch outlet male national standard hose threads with cap and chain.

2.06 INSULATING COUPLINGS

For working pressures from zero to 300 psi, use insulating couplings to avoid galvanic or electrolytic corrosion wherever dissimilar metals are connected. Couplings shall be steel; lined with an inert, non-conductive, linen impregnated laminate material; both ends female iron pipe threads; and rated to 300 psi working pressure at 225°F. Exterior surface of coupling is uncoated, bare steel. Couplings shall be Lochinvar V-Line as supplied by Corrosion Control Products Company or District approved equal.

2.07 SERVICE SADDLES - BRONZE, 2 INCHES AND SMALLER

A. Perform wet taps on existing asbestos cement pipe, ductile iron pipe, and PVC pressure pipe with working pressures 200 psi or less. Provide service saddles that have been specifically designed to fit the type, size, and class of pipe of the installation.

B. Provide service saddles with full width, cast bronze bodies conforming to ASTM B 62, O-ring gaskets, and iron pipe threads. Provide Type 304 stainless steel double band straps with four bolts or a single wide strap with four bolts. All stainless steel shall be fully passivated for enhanced corrosion resistance. Use tapping machines and cutting tools that have been specifically designed for the type of pipe to be drilled.

C. Service saddles for use on existing pipe with working pressures 200 psi or less shall be Ford Style 202BS, Romac Industries Style 202BS, or District approved equal.

2.08 TAPPING SLEEVES

A. Perform wet taps on existing asbestos cement pipe, ductile iron pipe, and PVC pressure pipe with working pressures 150 psi or less. Provide tapping sleeves that have been specifically designed to fit the type, size and class of pipe of the installation.

B. Tapping sleeves shall be of Type 304 stainless steel construction with two half sleeves and flanged outlet. Sleeve halves shall be bolted together with stainless steel bolts and nuts. Gaskets shall completely surround the pipe to be tapped and be the same length as the sleeves. Gaskets shall be SBR conforming to ASTM D 2000. Flanged outlet shall be flat faced conforming to ANSI B16.5, Class 150. Use tapping machines and cutting tools that have been specifically designed for the type of pipe to be tapped.

C. Tapping sleeves for use on pipe with working pressures 150 psi or less shall be Ford Stainless Tapping Sleeve Style FTSS, Romac Industries FTS420, Smith-Blair 665 Stainless Steel Tapping Sleeve, or District approved equal.

2.09 WELD-ON OUTLETS

A. Perform dry taps on existing welded steel pipe unless the District cannot take the pipeline out of service. Prior to making the tap, submit to the District's Representative a letter outlining the procedures to be followed.

B. Use a manufactured steel wrapper plate, outlet pipe, and flange. Cement mortar line the outlet pipe prior to the installation and cement mortar coat the wrapper and outlet pipe after welding to the existing steel pipe. Provide weld-on outlets that conform to the applicable requirements of Standard Specification Section 15061.

PART 3 - EXECUTION

3.01 INSTALLATION

Installation shall be in accordance with manufacturer's recommendations. Tightening of nuts, bolts, screws, flanges shall be accomplished so that zero leakage is obtained.

A. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing screwed valves.

B. Lubricate bolt threads with oil or graphite prior to installation.

C. Tighten nuts uniformly and progressively.

D. After testing, coat exposed surfaces of bolts and nuts to be buried with primer for wax tape coating per Standard Specification Section 09952.

E. Wrap buried ferrous fittings and appurtenances with polyethylene material per Standard Specification Section 09954.

3.02 PRESSURE TESTING

Test miscellaneous piping specialties at the same time that the connecting pipelines are pressure tested. See Standard Specification Section 15144 for pressure testing requirements. Repair leaks in piping and retest.

3.03 DISINFECTION

See Standard Specification Section 15141 for chlorination requirements.

END OF SECTION

STANDARD SPECIFICATION
SECTION 15081 WATER SERVICE ASSEMBLIES

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of water service assemblies. Assemblies shall be installed at the locations as shown on the Drawings or as established in the field by the District's Representative. Meter boxes shall not be located in paved roads, driveways, sidewalks, or walkways.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Trenching, Backfilling, and Compacting: STD SPEC 02223.

D. General Concrete Construction: STD SPEC 03000.

E. Miscellaneous Metalwork: STD SPEC 05121.

F. Painting and Coating: STD SPEC 09900.

G. Cold Applied Wax Tape Coating: STD SPEC 09952.

H. Polyethylene Sheet and Tube Encasement: STD SPEC 09954.

I. Corrosion Control for Buried Piping: STD SPEC 13110.

J. Steel Transmission Pipe: STD SPEC 15061.

K. Miscellaneous Piping Specialties: STD SPEC 15080.

L. Resilient Seated Gate Valves: STD SPEC 15101.

M. Disinfection of Piping: STD SPEC 15141.

N. Pressure Testing of Piping: STD SPEC 15144.

O. Copper Pipe and Tube: STD SPEC 15220.

P. Ductile Iron Pipe: STD SPEC 15240.

Q. Polyvinyl Chloride (PVC) Pressure Pipe (AWWA C900): STD SPEC 15292.

R. Polyvinyl Chloride (PVC) Distribution Pipe (AWWA C905): STD SPEC 15293.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit manufacturer's catalog data, descriptive literature, and assembly drawings. Show dimensions, materials of construction by specification reference and grade, and coatings.

1.04 MASONRY RETAINING WALLS

If the meter box or aboveground portion of the assembly is located within a cut slope or embankment fill, a masonry retaining wall shall be constructed on three sides around the box or assembly. Construct the concrete foundation and retaining wall similar to the requirements that San Diego Gas and Electric uses for their facilities. The face of wall shall be a minimum of one foot beyond the outside surfaces of the box or the dimensional values of the concrete pad to be poured for the assembly as shown on the Standard Drawings. Use tan colored slump block and grout each cell solid. Where a meter box has been installed, pour a concrete pad between the box and retaining wall on three sides and extend to the adjacent sidewalk or curb. The concrete pad to be poured around the aboveground assembly shall extend to the face of the three walls and also to the adjacent sidewalk or curb. The District’s Representative will decide whether the requirements of this paragraph are being followed by the Contractor. If in the opinion of the District’s Representative modifications or changes are necessary, the work shall be performed as directed.

PART 2 - MATERIALS

2.01 GENERAL

After the specified components have been installed by others, the District will furnish and install those items named on the Standard Drawings as part of the water service fee. In general, the District will provide a meter and ball valve. The customer can connect their service line to the ball valve after the District has completed their work. Use a non-metallic pipe nipple at the ball valve.

2.02 SERVICE SADDLES - BRONZE

See Standard Specification Sections 15240, 15292, or 15293 as indicated by the pipeline material shown on the Drawings. Use service saddles for outlets on ductile iron and PVC pressure pipe installations with working pressures of 200 psi or less. Use service saddles for outlets on PVC distribution pipe installations with working pressures of 150 psi or less.

2.03 WELD ON OUTLETS - STEEL

See Standard Specification Section 15061.

2.04 FLANGED OUTLETS

A. See Standard Specification Sections 15061 and 15240. Use Class 300 flanged outlets for the 2-inch and smaller assemblies on steel pipe and ductile iron pipe installations with working pressures greater than 200 psi, but less than 300 psi. Install a Class 300 cast bronze reducing flange with iron pipe threads and insulating flange kit on the flanged outlet.

B. See Standard Specification Sections 15061, 15240, 15292, or 15293 as indicated by the pipeline material shown on the Drawings. Use flanged outlets for the 3-inch and larger assemblies. Use Class 150 flanges for working pressures of 250 psi or less. Use Class 300 flanges for working pressure greater than 250 psi, but less than 300 psi.

2.05 INSULATING COUPLINGS

See Standard Specification Section 15080. Use insulating couplings on installations wherever dissimilar metals are connected. Use insulating couplings with service saddles on ductile iron pipe installations with working pressures of 200 psi or less. Use insulating couplings at steel weld on outlets with working pressure of 200 psi or less. Install the insulating coupling to the service saddle with a close brass nipple. Install the insulating coupling to the steel weld on outlet with a close nipple of Type 316 stainless steel.

2.06 CORPORATION STOPS - BRONZE

See Standard Specification Section 15080. Use corporation stops on installations with working pressures of 300 psi or less.

2.07 RESILIENT SEATED GATE VALVES

See Standard Specification Section 15101. Use resilient seated gate valves for the 3-inch and larger assemblies with working pressures of 250 psi or less, and with valve ends as shown in the Standard Drawings.

2.08 INSULATING FLANGE KITS

See Standard Specification Section 13110. Use insulating flange kits on installation wherever ferrous and non-ferrous flanges are connected and will be buried.

2.09 COPPER WATER TUBE AND FITTINGS

See Standard Specification Section 15220. Use copper water tube and brass pipe with the appropriate fittings as shown in the Standard Drawings.

2.10 PVC PRESSURE PIPE (AWWA C900)

See Standard Specification Section 15292.

2.11 DUCTILE IRON PIPE

See Standard Specification Section 15240.

2.12 ANGLE BALL VALVES - BRONZE

A. For 1-inch services with working pressures from zero to 300 psi, use Ford Angle Ball Meter Valve BA43-444W-Q or District approved equal. Valves shall be bronze (ASTM B 62) with lockwing, inlet quick joint for copper water tube, and meter swivel nut outlet with nut drilled for wire seal.

B. For 1-1/2-inch or 2-inch services with working pressures from zero to 300 psi, use Ford Angle Ball Meter Valve BFA43-666W-Q and BFA43-777W-Q respectively or District approved equal. Valves shall be bronze (ASTM B 62) with lockwing, inlet quick joint for copper water tube, and meter flange outlet.

C. Valve inlets shall have a quick joint for copper water tube. Quick joint shall consist of a threaded nut, an external nut stop, stainless steel gripper ring, and gasket. Gripper rings can only be used once. If the threaded nut of the quick joint is loosen and the angle ball valve is removed from the copper water tube, a new gripper ring shall be used in the reinstallation of the angle ball valve on the copper water tube. Compression or pack joints will not be allowed.

2.13 METER BOXES AND COVERS

A. Provide a meter box and cover for each water service assembly as shown on the Standard Drawings. In non-traffic areas, provide a precast concrete meter box and a two-piece concrete polymer cover with polymer concrete meter reading lid unless shown otherwise. In traffic areas, provide a precast concrete meter box with a galvanized steel cover designed for traffic loading. For potable water service assemblies, use polymer covers with a natural concrete coloration. For recycled water service assemblies, use polymer covers that have a purple color added to the polymer mix.

B. For 1-inch services with working pressures from zero to 300 psi, use J&R Concrete Products, Inc. No. W51/2, or District approved equal.

C. For 1-inch services with dual meters and working pressures from zero to 300 psi, use J&R Concrete Products, Inc. No. W7, or District approved equal.

D. For 1-1/2-inch services with working pressures from zero to 300 psi, use J&R Concrete Products, Inc. No. W7, or District approved equal.

E. For 2-inch services with working pressures from zero to 300 psi, use J&R Concrete Products, Inc. No. W7, or District approved equal.

2.14 WAX TAPE COATING

See Standard Specification Section 09952.

2.15 POLYETHYLENE ENCASEMENT

See Standard Specification Section 09954.

2.16 CORROSION CONTROL COMPONENTS

See Standard Specification Section 13110.

2.17 GUARD POSTS

See Standard Specification Section 05121. Provide guard posts around the assembly when directed by the District's Representative to protect the installation.

PART 3 - EXECUTION

3.01 INSTALLATION

A. See Standard Specification Section 02223 for earthwork requirements. Use imported sand in the pipe base, pipe zone, and under the meter boxes.

B. Install piping and valves per the instructions contained in the appropriate Standard Specification for the material used.

C. Piping from the main to the water service assembly shall be placed on a continuous upward grade to avoid pocketing air.

3.02 INSTALLING INSULATING COUPLINGS

Install insulating couplings where dissimilar metals are to be joined. Apply Teflon tape to the outside threads of the close brass or stainless steel nipple before installing the threaded nipple into the 2-inch coupling and service saddle or weld on outlet. Joints shall be watertight.

3.03 INSTALLING WAX TAPE COATING

Wrap insulating couplings where installed on ductile iron pipe steel weld on outlet, and flanged outlets having insulating flange kits with wax tape coating per Standard Specification Section 09952. Wrap the anode lead with pipe clamp where it attaches to the copper tube with wax tape coating to encapsulate the clamp and protect it from the soil.

3.04 INSTALLING POLYETHYLENE ENCASEMENT

Where a service saddle, steel weld on outlet, or flanged outlet is used at the main, the entire saddle or fitting with valve shall be double wrapped with polyethylene material. Wrap ferrous pipe risers including base bends per Standard Specification Section 09954. Complete the wrap prior to placing concrete thrust blocks on base bends. Repair polyethylene material damaged during construction.

3.05 INSTALLING CORROSION CONTROL COMPONENTS

Install insulating flange kits, zinc anodes, and pipe clamps with wax tape coating per Standard Specification Section 13110.

3.06 INSTALLING METER BOXES

A. Locate all water service assemblies behind the adjacent concrete curb or sidewalk. The District requires the concrete meter boxes and covers to be installed in non-traffic areas.

B. Place and compact trench backfill and sand cushion under meter box to 90% relative compaction. Set the precast concrete box over the meter valve and place in the alignment shown. Top of box shall be flush with finish grade, top of curb, or sidewalk.

3.07 PLACING CONCRETE

Place concrete anchor blocks around the elbow of the pipe riser. Where a thrust block is required, place concrete against the base bends and undisturbed ground. Allow concrete to set and be hard enough to be self-supporting. Place and compact trench backfill up to the subgrade of the concrete pad on grade. After the District has completed their work and the customer has installed their service line, complete the assembly by pouring a concrete pad on grade around the pipe risers. This pad shall extend for the width specified and for a length that encompasses the entire assembly. Concrete shall be Class C per Standard Specification Section 03000.

3.08 SETTING GUARD POSTS

Position guard posts to protect the aboveground water service assembly. Locate posts as directed by the District's Representative. Excavate a hole 16 inches in diameter by 3-1/2 feet deep for each post. Set posts plumb, fill holes with concrete to 2 inches above finish grade, and crown to slope away from post. Posts shall be embedded a minimum of 3 feet in concrete. Fill posts with grout and crown top. Concrete shall be Class C per Standard Specification Section 03000.

3.09 PAINTING AND COATING

A. For potable water service assemblies in traffic areas, do not paint the precast concrete meter box cover galvanized steel cover. For recycled water service assemblies in traffic areas, paint the meter box galvanized steel cover per Standard Specification Section 09900, System No. 60. Color of finish coat shall be purple.

B. Paint aboveground ferrous surfaces of the pipe risers, elbows or bends, valves, and adjustable pipe supports per Standard Specification Section 09900, System No. 20. Color of finish coat shall be OSHA Blue for potable water and purple for reclaimed water.

C. Paint aboveground surfaces of the guard posts per Standard Specification Section 09900, System No. 20. Color of finish coat shall be OSHA Yellow.

3.10 PRESSURE TESTING

Test water service assemblies at the same time that the connecting pipelines are pressure tested. See Standard Specification Section 15144 for pressure testing requirements. Repair leaks in piping and retest.

3.11 DISINFECTION

See Standard Specification Section 15141 for chlorination requirements.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of blow-off assemblies. Unless otherwise noted on the Drawings, use the 2-inch assembly for pipelines 12 inches and smaller; and, the 4-inch assembly for pipelines 14 inches and larger. Assemblies shall be installed at the locations as shown on the Drawings, behind curbs or sidewalks, at the end of capped pipes, or as established in the field by the District's Representative.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Trenching, Backfilling, and Compacting: STD SPEC 02223.

D. General Concrete Construction: STD SPEC 03000.

E. Miscellaneous Metalwork: STD SPEC 05121.

F. Painting and Coating: STD SPEC 09900.

G. Cold Applied Wax Tape Coating: STD SPEC 09952.

H. Polyethylene Sheet or Tube Encasement: STD SPEC 09954.

I. Corrosion Control for Buried Piping: STD SPEC 13110.

J. Steel Transmission Pipe: STD SPEC 15061.

K. Miscellaneous Piping Specialties: STD SPEC 15080.

L. Resilient Seated Gate Valves: STD SPEC 15101.

M. Disinfection of Piping: STD SPEC 15141.

N. Pressure Testing of Piping: STD SPEC 15144.

O. Copper Pipe and Tube: STD SPEC 15220.

P. Ductile Iron Pipe: STD SPEC 15240.

Q. Steel Pipe for Minor Applications: STD SPEC 15253.

R. Polyvinyl Chloride (PVC) Pressure Pipe (AWWA C900): STD SPEC 15292.

S. Polyvinyl Chloride (PVC) Distribution Pipe (AWWA C905): STD SPEC 15293.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit manufacturer's catalog data, descriptive literature, and assembly drawings. Show dimensions, materials of construction by specification reference and grade, linings and coatings.

1.04 MASONRY

If the meter box or aboveground portion of the assembly is located within a cut slope or embankment fill, a masonry retaining wall shall be constructed on three sides around the box or assembly. Construct the concrete foundation and retaining wall similar to the requirements that San Diego Gas and Electric uses for their facilities. The face of wall shall be a minimum of one foot beyond the outside surfaces of the box or the dimensional values of the concrete pad to be poured for the assembly as shown on the Standard Drawings. Use tan colored slump block and grout each cell solid. Where a meter box has been installed, pour a concrete pad between the box and retaining wall on three sides and extend to the adjacent sidewalk or curb. The concrete pad to be poured around the aboveground assembly shall extend to the face of the three walls and also to the adjacent sidewalk or curb. The District’s Representative will decide whether the requirements of this paragraph are being followed by the Contractor. If in the opinion of the District’s Representative modifications or changes are necessary, the work shall be performed as directed.

PART 2 - MATERIALS

2.01 SERVICE SADDLES - BRONZE

See Standard Specification Sections 15240, 15292, or 15293 as indicated by the pipeline material shown on the Drawings. Use service saddles with 2-inch outlets on ductile iron and PVC pressure pipe installations with working pressures of 200 psi or less. Use service saddles for 2-inch outlets on PVC distribution pipe installations with working pressures of 150 psi or less.

2.02 WELD ON OUTLETS - STEEL

See Standard Specification Section 15061.

2.03 FLANGED OUTLETS

A. See Standard Specification Section 15240. Use Class 300 flanged outlets for the 2-inch blow-off assemblies on ductile iron pipe installations with working pressures greater than 200 psi, but less than 300 psi. Install a Class 300 cast bronze reducing flange with iron pipe threads and insulating flange kit on the flanged outlet.

B. See Standard Specification Section 15061. Use Class 300 flanged outlets for the 2-inch blow-off assemblies on steel pipe installations with working pressures greater than 200 psi, but less than 300 psi. Install a Class 300 cast bronze reducing flange with iron pipe threads and insulating flange kit on the flanged outlet. See Standard Specification Sections 15061, 15240, 15292, or 15293 as indicated by the pipeline material shown on the Drawings. Use flanged outlets for the 4-inch blow-off assemblies. Use Class 150 flanges for working pressures of 250 psi or less. Use Class 300 flanges for working pressures greater than 250 psi, but less than 300 psi.

2.04 INSULATING COUPLINGS

See Standard Specification Section 15080. Use insulating couplings on installations wherever dissimilar metals are connected. Use insulating couplings with 2-inch service saddles on ductile iron pipe installations with working pressures of 200 psi or less. Use insulating couplings with 2-inch steel weld on outlets with working pressure of 200 psi or less. Install the insulating coupling to the service saddle with a close brass nipple. Install the insulating coupling to the steel weld on outlet with a close nipple of Type 316 stainless stell.

2.05 CORPORATION STOPS - BRONZE

See Standard Specification Section 15080. Use corporation stops on installations with working pressures of 300 psi or less.

2.06 RESILIENT SEATED GATE VALVES

See Standard Specification Section 15101. Use 6-inch resilient seated gate valves for the 4-inch blow-off assemblies with working pressures of 200 psi or less, and with valve ends as shown in the Standard Drawings.

2.07 BALL VALVES

Use gear box driven flanged ball valves for the 4-inch blow-off assemblies with working pressures greater than 200 psi.

2.08 COPPER WATER TUBE AND FITTINGS

See Standard Specification Section 15220.

2.09 PVC PRESSURE PIPE (AWWA C900)

See Standard Specification Section 15292.

2.10 DUCTILE IRON PIPE

See Standard Specification Section 15240.

2.11 STEEL PIPE FOR MINOR APPLICATIONS

See Standard Specification Section 15253.

2.12 ANGLE VALVES - BRONZE

For 2-inch assemblies, see Standard Specification Section 15080. Valve inlets shall have a fitting to adapt from iron pipe threads to copper. Use solder joint fittings for working pressures from zero to 300 psi. Valve outlets shall have a cast bronze reducing elbow with close nipple, and bronze extension nipple with male iron pipe threads by male hose threads. Provide plastic hose cap with chain ring and chain. Use James Jones J-341 and J-668, or District approved equal.

2.13 METER BOXES AND COVERS

In non-traffic areas, provide a meter box and cover for each 2-inch blow-off assembly consisting of a precast concrete meter box extension section, and a two-piece polymer concrete cover with a polymer concrete reading lid. UseJ&R Concrete Products, Inc. No. W6B, or District approved equal. For potable water assemblies, use polymer covers with a natural concrete coloration. For recycled water assemblies, use polymer covers that have a purple color added to the polymer mix.

2.14 VALVE BOXES AND COVERS

In traffic areas, provide a valve box and cover for each 2-inch blow-off assembly consisting of a frame, lid, and pipe sleeve. Construct frame and lid of cast iron and design for traffic loading. Castings shall be smooth, clean, and free from blisters, blowholes, and shrinkage. Machine bearing surfaces of frame and lid to provide a close fit without rocking. Cast on the lid the words "OMWD" and "WATER" or "RW." Frame and lid shall be South Bay Foundry SBF 1243, or District approved equal. The pipe sleeve shall be 12-inch diameter PVC gravity sewer pipe conforming to ASTM D 3034, SDR 35.

2.15 ANGLE VALVES - BRONZE HYDRANT HEAD

See Standard Specification Section 15080.

2.16 BREAK-OFF RISERS

A. For working pressures of 250 psi and less, provide pipe spools of the indicated length with flat faced flanged ends. Provide Class 53 ductile iron pipe with Class 150 threaded flanges conforming to Standard Specification Section 15240. Line interior of pipe with cement mortar and provide double thickness (1/8-inch minimum) per AWWA C104. Score one end of the spool 4 inches from the flange face. Cut a V-groove 1/4-inch wide and to a depth of 1/8-inch minimum to 3/16-inch maximum on the pipe exterior.

B. For working pressures greater than 250 psi, but less than 300 psi, provide pipe spools of the indicated length with flat faced flanged ends. Provide Class 53 ductile iron pipe with Class 300 threaded flanges conforming to Standard Specification Section 15240. Line interior of pipe with cement mortar and provide double thickness (1/8-inch minimum) per AWWA C104. Score one end of the spool 5 inches from the flange face. Cut a V-groove 1/4-inch wide and to a depth of 1/8-inch minimum to 3/16-inch maximum on the pipe exterior.

2.17 WAX TAPE COATING

See Standard Specification Section 09952.

2.18 POLYETHYLENE ENCASEMENT

See Standard Specification Section 09954.

2.19 CORROSION CONTROL COMPONENTS

See Standard Specification Section 13110.

2.20 MARKER POSTS

Provide a marker post for each 2-inch blow-off assembly when located in areas where the meter box or valve box would not be clearly visible such as open terrain or cross country. 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 inches by 4 inches, and surfaced on four sides.

2.21 GUARD POSTS

See Standard Specification Section 05121. Provide two guard posts for each 4-inch blow-off assembly except where assembly is located adjacent to a paved street with concrete curbs.

PART 3 - EXECUTION

3.01 INSTALLATION

A. See Standard Specification Section 02223 for earthwork requirements. Use imported sand in the pipe base and pipe zone.

B. Install piping per the instructions contained in the appropriate Standard Specification for the material used.

C. Piping from the main to the blow-off valve shall be placed on a continuous upward grade to avoid pocketing air.

3.02 INSTALLING INSULATING COUPLINGS

Install insulating couplings where dissimilar metals are to be joined. Apply Teflon tape to the outside threads of the close brass or stainless steel nipple before installing the threaded nipple into the coupling and service saddle or weld on outlet. Joints shall be watertight.

3.03 INSTALLING WAX TAPE COATING

Wrap service saddles including insulating couplings where installed on ductile iron pipe, steel weld on outlet, and flanged outlets having insulating flange kits with wax tape coating per Standard Specification Section 09952.

3.04 INSTALLING POLYETHYLENE ENCASEMENT

Where a service saddle, steel weld on outlet, or flanged outlet is used at the main, the entire saddle or fitting with corporation stop orvalve shall be double wrapped with polyethylene material. Wrap ferrous pipe, risers, and base bends per Standard Specification Section 09954. Complete the wrap prior to placing concrete thrust blocks on base bends. Repair polyethylene material damaged during construction.

3.05 INSTALLING CORROSION CONTROL COMPONENTS

Install insulating flange kits, bond wires, zinc anodes, and pipe clamps with wax tape coating per Standard Specification Section 13110.

3.06 INSTALLING METER BOXES AND COVERS

A. Where possible, locate all 2-inch blow-off assemblies behind the adjacent concrete curb or sidewalk. The District requires the concrete meter boxes and covers be installed in a non-traffic area, unless otherwise shown or other conditions prevail.

B. In non-traffic areas, place and compact trench backfill under meter box to 90% relative compaction. Place a 6-inch thick layer of 3/4-inch crushed rock under the meter box. Set the precast concrete box over the angle valve and on the crushed rock bed. Place the box in the alignment shown. Top of box shall be flush with finish grade, top of curb, or sidewalk.

3.07 INSTALLING VALVE BOXES AND COVERS

In traffic area, place and compact trench backfill approximately up to the height of the pipe clamp on the copper water tube. Do not bury the clamp or wire connection. Set the pipe sleeve over the valve assembly and center in place. Maintain the pipe sleeve in a vertical position during backfilling. Slip the valve box frame over the pipe sleeve and adjust both to finish grade. Pour a concrete ring around the valve box frame. Concrete shall be Class C per Standard Specification Section 03000. In paved areas, top of concrete ring shall be 1-inch below finish grade of adjacent surfaces. In non-paved areas, top of valve box frame and concrete ring shall be flush with the natural or finish grade. Where paved, overlay the concrete ring with 1-inch compacted thickness of asphalt concrete pavement. Valve box frame and lid shall be flush with the finish surface of the pavement.

3.08 PLACING CONCRETE

Place concrete anchor block around the elbow of the riser. Where a thrust block is required, place concrete against the elbow and undisturbed ground with the bearing area as shown on the Standard Drawings. Allow concrete to set and be hard enough to be self-supporting. Place and compact trench backfill up to the subgrade of the concrete anchor block. Pour a concrete anchor block below grade around the riser section to force the aboveground grooved spool to break on an impact. Cover the anchor block with backfill material and compact up to the subgrade of the concrete pad on grade. Pour a concrete pad on grade around the break-off riser. Concrete shall be Class C per Standard Specification Section 03000.

3.09 SETTING MARKER POSTS

Locate marker post adjacent to the meter box or valve box or as directed by the District's Representative. Cut redwood post to a 5-foot length and chamfer the top. Paint post per Standard Specification Section 09900, System No. 60. Use white paint for the finish coats and blue or purple paint for the top 4 inches of the chamfered end. Excavate a hole 16 inches in diameter by 2 feet deep. Set the redwood post plumb, fill hole with concrete to 2 inches above finish grade, and crown to slope away from post. On the side facing the meter box or valve box, stencil on the post in 2-inch-high blue or purple letters the word "WATER" or the abbreviation "RW" and the distance in feet from the marker post to the meter box or valve box. Concrete shall be Class C per Standard Specification Section 03000.

3.10 SETTING GUARD POSTS

Position guard posts to protect the riser pipe and hydrant head in the 4-inch blow-off assemblies. Locate posts 2-1/2 feet to each side and 2 feet in front of the riser pipe. Excavate a hole 16 inches in diameter by 3-1/2 feet deep for each post. Set posts plumb, fill holes with concrete to 2 inches above finish grade, and crown to slope away from post. Posts shall be embedded a minimum of 3 feet in concrete. Fill posts with grout and crown top. Concrete shall be Class C per Standard Specification Section 03000.

3.11 PAINTING AND COATING

A. In traffic areas, paint top side of valve box cover in the 2-inch blow-off assemblies per Standard Specification Section 09900, System No. 20. Color of finish coat shall be OSHA Blue for potable water and purple for reclaimed water.

B. Paint aboveground surface of the riser pipe, hydrant head, and guard posts in the 4-inch blow-off assemblies per Standard Specification Section 09900, System No. 20. Color of finish coat shall be OSHA Yellow for potable water and purple for reclaimed water except for the guard posts.

3.12 PRESSURE TESTING

Test blow-off assemblies at the same time that the connecting pipelines are pressure tested. See Standard Specification Section 15144 for pressure testing requirements. Repair leaks in piping and retest.

3.13 DISINFECTION

See Standard Specification Section 15141 for chlorination requirements.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of manual air release assemblies. Unless otherwise noted on the Drawings, use 2-inch assembly for pipelines 4 inches and larger. Assemblies shall be installed at the locations as shown on the Drawings, behind curbs or sidewalks, at the end of capped pipes, or as established in the field by the District's Representative. When pipes are 12 inches and larger, use combination air valve assemblies in lieu of manual air release assemblies.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Trenching, Backfilling, and Compacting: STD SPEC 02223.

D. General Concrete Construction: STD SPEC 03000.

E. Painting and Coating: STD SPEC 09900.

F. Cold Applied Wax Tape Coating: STD SPEC 09952.

G. Polyethylene Sheet or Tube Encasement: STD SPEC 09954.

H. Corrosion Control for Buried Piping: STD SPEC 13110.

I. Steel Transmission Pipe: STD SPEC 15061.

J. Miscellaneous Piping Specialties: STD SPEC 15080.

K. Disinfection of Piping: STD SPEC 15141.

L. Pressure Testing of Piping: STD SPEC 15144.

M. Copper Pipe and Tube: STD SPEC 15220.

N. Ductile Iron Pipe: STD SPEC 15240.

O. Polyvinyl Chloride (PVC) Pressure Pipe (AWWA C900): STD SPEC 15292.

P. Polyvinyl Chloride (PVC) Distribution Pipe (AWWA C905): STD SPEC 15293.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit manufacturer's catalog data, descriptive literature, and assembly drawings. Show dimensions, materials of construction by specification reference and grade, and coatings.

1.04 MASONRY

If the meter box is located within a cut slope or embankment fill, a masonry retaining wall shall be constructed on three sides around the box. Construct the concrete foundation and retaining wall similar to the requirements that San Diego Gas and Electric uses for their facilities. The face of wall shall be a minimum of one foot beyond the outside surfaces of the box as shown on the Standard Drawings. Use tan colored slump block and grout each cell solid. Pour a concrete pad between the box and retaining wall on three sides and extend to the adjacent sidewalk or curb. The District's Representative will decide whether the requirements of this paragraph are being followed by the Contractor. If in the opinion of the District's Representative modifications or changes are necessary, the work shall be performed as directed.

PART 2 - MATERIALS

2.01 SERVICE SADDLES - BRONZE

See Standard Specification Sections 15240, 15292 or 15293 as indicated by the pipeline material shown on the Drawings. Use service saddles for outlets on ductile iron and PVC pressure pipe installations with working pressures of 200 psi or less. Use service saddles for outlets on PVC distribution pipe installations with working pressures of 150 psi or less.

2.02 WELD ON OUTLETS - STEEL

See Standard Specification Section 15061.

2.03 FLANGED OUTLETS

A. See Standard Specification Section 15240. Use Class 300 flanged outlets for the 2-inch manual air release assemblies on ductile iron pipe installations with working pressures greater than 200 psi, but less than 300 psi. Install a Class 300 cast bronze reducing flange with iron pipe threads and insulating flange kit on the flanged outlet.

B. See Standard Specification Section 15061. Use Class 300 flanged outlets for the 2-inch manual air release assemblies on steel pipe installations with working pressures greater than 200 psi, but less than 300 psi. Install a Class 300 cast bonze reducing flange with iron pipe threads and insulating flange kit on the flanged outlet.

2.04 INSULATING COUPLINGS

See Standard Specification Section 15080. Use insulating couplings on installations wherever dissimilar metals are connected. Use insulating couplings with 2-inch service saddles on ductile iron pipe installations with working pressures of 200 psi or less. Use insulating couplings with 2-inch steel weld on outlets with working pressures of 200 psi or less. Install the insulating coupling to the service saddle with a close brass nipple. Install the insulating couplings to the steel weld on outlet with a close nipple of Type 316 stainless steel.

2.05 CORPORATION STOPS - BRONZE

See Standard Specification Section 15080. Use corporation stops on installation with working pressures of 300 psi or less.

2.06 COPPER WATER TUBE AND FITTINGS

See Standard Specification Section 15220.

2.07 ANGLE VALVES - BRONZE

For 2-inch assemblies, see Standard Specification Section 15080. Valve inlets shall have a fitting to adapt from iron pipe threads to copper. Use solder joint fittings for working pressures from zero to 300 psi. Valve outlets shall have a cast bronze reducing elbow with close nipple and bronze extension nipple with male iron pipe threads by male hose threads. Provide plastic hose cap with chain ring and chain. Use James Jones J-341 and J-668, or District approved equal.

2.08 METER BOXES AND COVERS

In non-traffic areas, provide a meter box and cover for each 2-inch manual air release assembly consisting of a precast concrete meter box extension section, and a two-piece polymer concrete cover with polymer concrete reading lid. Use J&R Concrete Products, Inc. No. W6B, or District approved equal. For potable water assemblies, use polymer covers with a natural concrete coloration. For recycled water assemblies, use polymer covers that have a purple color added to the polymer mix.

2.09 VALVE BOXES AND COVERS

In traffic areas, provide a valve box and cover for each assembly consisting of a frame, lid, and pipe sleeve. Construct frame and lid of cast iron and design for traffic loading. Castings shall be smooth, clean, and free from blisters, blowholes, and shrinkage. Machine bearing surfaces of frame and lid to provide a close fit without rocking. Cast on the lid the words "OMWD" and "WATER" or "RW." Frame and lid shall be South Bay Foundry SBF 1243, or District approved equal. The pipe sleeve shall be 12-inch diameter PVC gravity sewer pipe conforming to ASTM D 3034, SDR 35.

2.10 WAX TAPE COATING

See Standard Specification Section 09952.

2.11 POLYETHYLENE ENCASEMENT

See Standard Specification Section 09954.

2.12 CORROSION CONTROL COMPONENTS

See Standard Specification Section 13110.

2.13 MARKER POSTS

Provide a marker post for each manual air release assembly when located in areas where the meter box or valve box would not be clearly visible such as open terrain or cross country. 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 inches by 4 inches, and surfaced on four sides.

PART 3 - EXECUTION

3.01 INSTALLATION

A. See Standard Specification Section 02223 for earthwork requirements. Use imported sand in the pipe base and pipe zone.

B. Install piping per the instructions contained in the appropriate Standard Specification for the material used.

C. Piping from the main to the manual air release valve shall be placed on a continuous upward grade to avoid pocketing air.

3.02 INSTALLING INSULATING COUPLINGS

Install insulating couplings where dissimilar metals are to be joined. Apply Teflon tape to the outside threads of the close brass or stainless steel nipple before installing the threaded nipple into the 2-inch coupling and service saddle or weld on outlet. Joints shall be watertight.

3.03 INSTALLING WAX TAPE COATING

Wrap insulating couplings where installed on ductile iron pipe, steel weld on outlets, and flanged outlets having insulating flange kits with wax tape coating per Standard Specification Section 09952.

3.04 INSTALLING POLYETHYLENE ENCASEMENT

Where a service saddle, steel weld on outlet, or flanged outlet is used at the main, the entire saddle or fitting with corporation stop shall be double wrapped per Standard Specification Section 09954.

3.05 INSTALLING CORROSION CONTROL COMPONENTS

Install insulating flange kits, zinc anodes, and pipe clamps with wax tape coating per Standard Specification Section 13110.

3.06 INSTALLING METER BOXES AND COVERS

A. Where possible, locate all manual air release assemblies behind the adjacent concrete curb or sidewalk. The District requires the concrete meter boxes and covers be installed in non-traffic areas, unless otherwise shown or other conditions prevail.

B. In non-traffic areas, place and compact trench backfill under meter box to 90% relative compaction. Place a 6-inch thick layer of 3/4-inch crushed rock under the meter box. Set the precast concrete box over the angle valve and on the crushed rock. Place the box in the alignment shown. Top of box shall be flush with finish grade, top of curb, or sidewalk.

3.07 INSTALLING VALVE BOXES AND COVERS

A. In traffic areas, place and compact trench backfill approximately up to the height of the pipe clamp on the copper water tube. Do not bury the clamp or wire connection. Set the pipe sleeve over the valve assembly and center in place. Maintain the pipe sleeve in a vertical position during backfilling. Slip the valve box frame over the pipe sleeve and adjust both to finish grade. Pour a concrete ring around the valve box frame. Concrete shall be Class C per Standard Specification Section 03000. In paved areas, top of concrete ring shall be 1-inch below finish grade of adjacent surfaces. In non-paved areas, top of valve box frame and concrete ring shall be flush with the natural or finish grade. Where paved, overlay the concrete ring with 1-inch compacted thickness of asphalt concrete pavement. Valve box frame and lid shall be flush with the finish surface of the pavement.

3.08 SETTING MARKER POSTS

Locate marker post adjacent to the meter box or valve box or as directed by the District's Representative. Cut redwood post to a 5-foot length and chamfer the top. Paint post per Standard Specification Section 09900, System No. 60. Use white paint for the finish coats and blue or purple paint for the top 4 inches of the chamfered end. Excavate a hole 16 inches in diameter by 2 feet deep. Set the redwood post plumb, fill hole with concrete to 2 inches above finish grade, and crown to slope away from post. On the side facing the meter box, stencil on the post in 2-inch-high blue or purple letters the word "WATER" or the abbreviation "RW" and the distance in feet from the marker post to the meter box or valve box. Concrete shall be Class C per Standard Specification Section 03000.

3.09 PAINTING AND COATING

In traffic areas, paint top side of valve box cover per Standard Specification Section 09900, System No. 20. Color of finish coat shall be OSHA Blue for potable water and purple for recycled water.

3.10 PRESSURE TESTING

Test manual air release assemblies at the same time that the connecting pipelines are pressure tested. See Standard Specification Section 15144 for pressure testing requirements. Repair leaks in piping and retest.

3.11 DISINFECTION

See Standard Specification Section 15141 for chlorination requirements.

END OF SECTION

STANDARD SPECIFICATION
SECTION 15092 COMBINATION AIR VALVE ASSEMBLIES

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of combination air valve assemblies, 3 inches and smaller. Assemblies shall be of the size and installed at the locations as shown on the Drawings or as established in the field by the District's Representative. For assemblies 4 inches and larger, a special design will be required.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Trenching, Backfilling, and Compacting: STD SPEC 02223.

D. General Concrete Construction: STD SPEC 03000.

E. Miscellaneous Metalwork: STD SPEC 05121.

F. Painting and Coating: STD SPEC 09900.

G. Cold Applied Wax Tape Coating: STD SPEC 09952.

H. Polyethylene Sheet or Tube Encasement: STD SPEC 09954.

I. Corrosion Control for Buried Piping: STD SPEC 13110.

J. Steel Transmission Pipe: STD SPEC 15061.

K. Miscellaneous Piping Specialties: STD SPEC 15080.

L. Resilient Seated Gate Valves: STD SPEC 15101.

M. Combination Air Release and Vacuum Valves: STD SPEC 15108.

N. Disinfection of Piping: STD SPEC 15141.

O. Pressure Testing of Piping: STD SPEC 15144.

P. Copper Pipe and Tube: STD SPEC 15220.

Q. Ductile Iron Pipe: STD SPEC 15240.

R. Steel Pipe for Minor Applications: STD SPEC 15253.

S. Polyvinyl Chloride (PVC) Pressure Pipe (AWWA C900): STD SPEC 15292.

T. Polyvinyl Chloride (PVC) Distribution Pipe (AWWA C905): STD SPEC 15293.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit manufacturer's catalog data, descriptive literature, and assembly drawings. Show dimensions, materials of construction by specification reference and grade, linings and coatings.

1.04 MASONRY RETAINING WALLS

If the aboveground portion of the assembly is located within a cut slope or embankment fill, a masonry retaining wall shall be constructed on three sides around the assembly. Construct the concrete foundation and retaining wall similar to the requirements that San Diego Gas and Electric uses for their facilities. The face of wall shall be a minimum of one foot beyond the dimensional values of the concrete pad to be poured for the assembly as shown on the Standard Drawings. Use tan colored slump block and grout each cell solid. The concrete pad to be poured around the assembly shall extend to the face of the three walls and also to the adjacent sidewalk or curb. The District’s Representative will decide whether the requirements of this paragraph are being followed by the Contractor. If in the opinion of the District’s Representative modifications or changes are necessary, the work shall be performed as directed.

PART 2 - MATERIALS

2.01 SERVICE SADDLES - BRONZE

See Standard Specification Sections 15240, 15292 or 15293 as indicated by the pipeline material shown on the Drawings. Use service saddles for outlets on ductile iron and PVC pressure pipe installations with working pressures of 200 psi or less. Use service saddles for outlets on PVC distribution pipe installations with working pressures of 150 psi or less.

2.02 WELD ON OUTLETS - STEEL

See Standard Specification Section 15061.

2.03 FLANGED OUTLETS

A. See Standard Specification Section 15240. Use Class 300 flanged outlets for the 1-inch and 2-inch combination air valve assemblies on ductile iron pipe installations with working pressures greater than 200 psi, but less than 300 psi. Install a Class 300 cast bronze reducing flange with iron pipe threads and insulating flange kit on the flanged outlet.

B. See Standard Specification Section 15061. Use Class 300 flanged outlets for the 1-inch and 2-inch combination air valve assemblies on steel pipe installations with working pressures greater than 200 psi, but less than 300 psi. Install a Class 300 cast bonze reducing flange with iron pipe threads and insulating flange kit on the flanged outlet.

C. See Standard Specification Sections 15061, 15240, 15292, or 15293 as indicated by the pipeline material shown on the Drawings. Use flanged outlets for the 3-inch combination air valve assemblies. Use Class 150 flanges for working pressures of 250 psi or less. Use Class 300 flanges for working pressures greater than 250 psi, but less than 300 psi. Install a ductile iron quarter bend with matching flanges to the outlet.

2.04 INSULATING COUPLINGS

See Standard Specification Section 15080. Use insulating couplings on installations wherever dissimilar metals are connected. Use insulating couplings with 1-inch and 2-inch service saddles on ductile iron pipe installations with working pressures of 200 psi or less. Use insulating couplings with 1-inch and 2-inch steel weld on outlets with working pressures of 200 psi or less. Install the insulating coupling to the service saddle with a close brass nipple. Install the insulating coupling to the steel weld on outlet with a close nipple of Type 316 stainless steel.

2.05 CORPORATION STOPS - BRONZE

See Standard Specification Section 15080. Use corporation stops on installations with working pressures of 300 psi or less.

2.06 RESILIENT SEATED GATE VALVES

See Standard Specification Section 15101. Use flanged resilient seated gate valves for the 3-inch combination air valve assemblies with working pressures of 225 psi or less.

2.07 BALL VALVES

Use flanged ball valves for the 3-inch combination air valve assemblies with working pressures greater than 225 psi.

2.08 INSULATING FLANGE KITS

See Standard Specification Section 13110. Use insulating flange kits on installations wherever ferrous and non-ferrous flanges are connected and will be buried.

2.09 COPPER WATER TUBE AND FITTINGS

See Standard Specification Section 15220.

2.10 STEEL PIPE FOR MINOR APPLICATIONS

See Standard Specification Section 15253.

2.11 BALL VALVES - BRONZE

A. See Standard Specification Section 15080. Use threaded ball valves with handles for the 1-inch and 2-inch combination air valve assemblies installed aboveground with working pressures of 300 psi or less. Valve inlets shall have a fitting to adapt from iron pipe threads to copper. Use solder joint fittings for working pressures from zero to 300 psi.

2.12 COMBINATION AIR RELEASE AND VACUUM VALVES

See Standard Specification Section 15108.

2.13 AIR VALVE ENCLOSURES

A. Use air valve enclosures that are manufactured from 3/16-inch thick polyethylene material with ultraviolet (UV) inhibitors. Enclosures shall be a two piece assembly consisting of a bolt down base with a removable cover. Cover shall lock to base with an integral auto-latch and padlock hasp. Enclosure cover shall have vent slots equally spaced on the circumference near the top. Vent slots shall be covered on the inside with stainless steel insect screens. Color of enclosures shall be Sandstone. Provide a colored band all around the enclosures in the area of the vent slots for identification purposes. Use OSHA blue for potable water and purple for recycled water installations.

B. For 1-inch and 2-inch assemblies, use Advantage Series Air and Vacuum Valve Enclosure Part Number VCAS-1824-SM as distributed by Pipeline Products or District approved equal.

C. For 3-inch assemblies, use Advantage Series Air and Vacuum Valve Enclosure Part Number VCAS-1830-SM as distributed by Pipeline Products or District approved equal.

2.14 WAX TAPE COATING

See Standard Specification Section 09952.

2.15 POLYETHYLENE ENCASEMENT

See Standard Specification Section 09954.

2.16 CORROSION CONTROL COMPONENTS

See Standard Specification Section 13110.

2.17 GUARD POSTS

See Standard Specification Section 05121. Provide two guard posts for each air valve enclosure except where enclosure is located adjacent to a paved street with concrete curbs.

2.18 POLYVINYL CHLORIDE (PVC) CONDUIT

Use rigid non-metallic PVC, schedule 40, 90 degrees C rise rating, conduit conforming to NEMA TC-2 and UL-651.

PART 3 - EXECUTION

3.01 INSTALLATION

A. See Standard Specification Section 02223 for earthwork requirements. Use imported sand in the pipe base and pipe zone.

B. Install piping and valves per the instructions contained in the appropriate Standard Specification for the material used.

C. Piping from the main to the combination air release and vacuum valve shall be placed on a continuous upward grade to avoid pocketing air.

3.02 INSTALLING INSULATING COUPLINGS

Install insulating couplings where dissimilar metals are to be joined. Apply Teflon tape to the outside threads of the close brass or stainless steel nipple before installing the threaded nipple into the coupling and service saddle or weld on outlet. Joints shall be watertight.

3.03 INSTALLING WAX TAPE COATING

Wrap insulating couplings where installed on ductile iron pipe, steel weld on outlets, and flanged outlets having insulating flange kits with wax tape coating per Standard Specification Section 09952.

3.04 INSTALLING POLYETHYLENE ENCASEMENT

Where a service saddle, steel weld on outlet, or flanged outlet is used at the main, the entire saddle or fitting with corporation stop or valve shall be double wrapped per Standard Specification Section 09954.

3.05 INSTALLING CORROSION CONTROL COMPONENTS

Install insulating flange kits, zinc anodes, and pipe clamps with wax tape coating per Standard Specification Section 13110.

3.06 INSTALLING AIR VALVE ENCLOSURES

Locate enclosure as shown on the Drawings or as directed by the District's Representative. Place and compact trench backfill. Pour a concrete pad around the riser pipe and air valve for the air valve enclosure. Concrete shall be Class C per Standard Specification Section 03000. Set enclosure base over air valve and center in place. Use drilled in stainless steel anchors with stainless steel fender washers to attach the enclosure base to the concrete pad. Set enclosure cover over base for a complete installation.

3.07 SETTING GUARD POSTS

Position guard posts to protect the enclosure and assembly. Locate posts 2-1/2 feet to each side and 1-foot in front of the concrete pad. Excavate a hole 16 inches in diameter by 3-1/2 feet deep for each post. Set posts plumb, fill holes with concrete to 2 inches above finish grade, and crown to slope away from post. Posts shall be embedded a minimum of 3 feet in concrete. Fill posts with grout and crown top. Concrete shall be Class C per Standard Specification Section 03000.

3.08 PAINTING AND COATING

Paint aboveground surfaces of the guard posts per Standard Specification Section 09900, System No. 20. Color of finish coat shall be OSHA Yellow.

3.09 PRESSURE TESTING

Test combination air valve assemblies at the same time that the connecting pipelines are pressure tested. See Standard Specification Section 15144 for pressure testing requirements. Repair leaks in piping and retest.

3.10 DISINFECTION

See Standard Specification Section 15141 for chlorination requirements.

END OF SECTION

STANDARD SPECIFICATION
SECTION 15101 RESILIENT SEATED GATE VALVES

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of manually operated, resilient seated gate valves including accessories, linings, coatings, valve boxes, extension stems, anchors, and marker posts. Size range is 3 inches through 24 inches.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Trenching, Backfilling, and Compacting: STD SPEC 02223.

D. General Concrete Construction: STD SPEC 03000.

E. Painting and Coating: STD SPEC 09900.

F. Polyethylene Sheet or Tube Encasement: STD SPEC 09954.

G. Fusion-Bonded Epoxy Lining and Coating: STD SPEC 09961.

H. Corrosion Control for Buried Piping: STD SPEC 13110.

I. General Piping Requirements: STD SPEC 15050.

J. Disinfection of Piping: STD SPEC 15141.

K. Pressure Testing of Piping: STD SPEC 15144.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit valve manufacturer's catalog data, descriptive literature, and assembly drawings. Show dimensions, materials of construction by specification reference and grade, linings, and coatings.

C. Submit manufacturer's affidavit of compliance with referenced standards.

D. Submit coating application test records for measuring coating thickness and holiday detection for the valve interior linings and exterior coatings. Describe repair procedures used.

E. Submit valve box manufacturer's catalog data. Show dimensions and materials of construction.

PART 2 - MATERIALS

2.01 GENERAL

A. Provide valves complete with operating handwheel or operating nut, linings, coatings, valve box, extension stem, anchor, and marker post.

B. Cast or mold onto the valve body or bonnet the name of the manufacturer and the valve size. Do not attach identification plates to the valve body or bonnet.

C. Provide valves with the same type ends as the pipe or fittings, or with ends that have been designed for use on the pipe being installed.

D. Unless otherwise indicated, valves shall be the same size as the pipe in which they are installed.

E. Unless otherwise indicated, valves shall have a working pressure rating not less than the pipe in which they are installed.

2.02 RESILIENT SEATED GATE VALVES, 3 INCHES THROUGH 12 INCHES

For working pressures from zero to 250 psi, valves shall be resilient seated, non-rising stem and conform to the requirements of AWWA C515. Provide valves with resilient wedge disc, unobstructed waterway, counter-clockwise opening and designed for a working pressure of 250 psi. Construct valves of ductile iron conforming to ASTM A 395 or A 536. Bronze for internal working parts, including stems, shall not contain more than 2% aluminum nor more than 7% zinc, bronze shall be ASTM B 763 Alloy C99500, except that stem bronze shall have a minimum tensile strength of 60,000 psi, a minimum yield strength of 30,000 psi, and a minimum of 12% elongation in 2-inches. Provide O-ring seals. Provide Type 304 or 316 stainless steel body bolts conforming to ASTM F 593. Provide 2-inch AWWA operating nut for buried installations. Provide handwheel for aboveground or in vault installations. Gate valves shall be American Flow Control Series 2500, U.S. Pipe Metroseal 250, or District approved equal.

2.03 RESILIENT SEATED GATE VALVES, 14 INCHES THROUGH 24 INCHES

For working pressures from zero to 250 psi, valves shall be resilient seated, non-rising stem and conform to the requirements of AWWA C515. Provide valves with resilient wedge disc, unobstructed waterway, counter-clockwise opening and designed for a working pressure of 250 psi. Construct and provide valves as described in paragraph 2.02. Provide bevel or worm gear operator. Gate valves shall be American Flow Control Series 2500, U.S. Pipe Metroseal 250, or District approved equal.

2.04 LINING AND COATING FOR VALVES

Coat interior and exterior ferrous surfaces of the valves with fusion-bonded epoxy per Standard Specification Section 09961. Do not coat bronze, rubber, or stainless steel items. Coating shall be holiday free on interior surfaces in contact with water.

2.05 PACKING, O-RINGS, AND GASKETS

Unless otherwise stated; packing, O-rings, and gaskets shall be one of the following nonasbestos materials.

A. Teflon.

B. Kevlar aramid fiber.

C. Acrylic or aramid fiber bound by nitrile. Provide Garlock "Bluegard," Klinger "Klingersil C4400," or District approved equal.

D. Buna-N (Nitrile).

2.06 BOLTS, NUTS AND GASKETS FOR FLANGES

See Standard Specification Section 15050.

2.07 VALVE BOXES

A. Provide a valve box for each buried potable water valve consisting of a frame, cover, and one-piece extension pipe. Construct frame and cover of cast iron and design for traffic loading. Castings shall be smooth, clean, and free from blisters, blowholes, and shrinkage. Machine bearing surfaces of frame and cover to provide a close fit without rocking. Cast on the cover the words "OMWD" and "WATER". Frame and cover shall be South Bay Foundry SBF 1208-N, or District approved equal. Extension pipe shall be 8-inch diameter, polyvinyl chloride (PVC), plastic irrigation pipe (PIP) conforming to Soil Conservation Service specification SCS 430DD with a pressure rating of 100 psi, a pipe stiffness dimension ratio (SDR) of 41, and an outside diameter of 8.160 inches.

B. Provide a valve box for each buried recycled water valve consisting of a frame, cover, and one-piece extension pipe. Construct triangular shaped frame and cover of cast iron and design for traffic loading. Castings shall be smooth, clean, and free from blisters, blowholes, and shrinkage. Machine bearing surfaces of frame and cover to provide a close fit without rocking. Cast frame into a circular precast concrete body section. Cast on the cover the words “OMWD” and “RW”. Frame and cover shall be J&R Concrete Products, Inc. No. V4-T or District approved equal. Extension pipe shall be 8-inch diameter, polyvinyl chloride (PVC), conforming to AWWA C900, Class 150, and an outside diameter of 9.05 inches.

2.08 EXTENSION STEMS

Where the valve operating nut is more than 2 feet below the valve box cover, provide an extension stem to bring the operating nut to a point 6 inches below the surface of the cover. Construct stem of steel using pipe, bar stock, and plates to the dimensions shown on the Standard Drawings. Field verify required stem length prior to fabrication. Hot dip galvanize completed stem after fabrication.

2.09 POLYETHYLENE ENCASEMENT

See Standard Specification Section 09954.

2.10 CORROSION CONTROL COMPONENTS

See Standard Specification Section 13110.

2.11 ANCHORS

Provide anchors on valves that have non-restrained joints or that are installed with pipe having non-restrained joints. Anchor type depends on valve size and working pressure as shown in the Standard Drawings and shall be one of the following installations.

A. Provide steel anchor straps and bolts, or reinforcing steel. Hot dip galvanize steel straps and bolts after fabrication. Completely encase in concrete after placing on valve.

B. Provide reinforced concrete anchor and adapter with thrust collar. Design and sizing of the anchor will be based on the highest pressure the main will be subjected to, such as test or surge.

2.12 MARKER POSTS

Provide a marker post for each buried valve except where valve is located in a paved street. 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 inches by 4 inches, and surfaced on four sides.

PART 3 - EXECUTION

3.01 INSPECTION BEFORE INSTALLATION

A. Operate the valve from closed to fully open, then close again before installing. Check for broken, cracked, or missing parts; malfunctioning stem; scored surfaces on interior lining; and faulty operation.

B. The District's Representative will conduct in the field an independent inspection of the lining and coating for compliance with the criteria in Standard Specification Section 09961. Coated items failing his inspection will be cause for rejection.

3.02 INSTALLATION

A. Prior to installing the valve in its final location, clean the interior of the valve of all contaminants and place valve in a closed position.

B. Check all body bolts on the valve for tightness. Handle valve carefully and do not damage linings and coatings. Repair any or all damage to the satisfaction of the District's Representative.

C. Install the valve per the piping instructions contained in the appropriate Standard Specification for the material used. Do not use valve to force the pipeline into position. Support piping to avoid line stresses on the valve. Do not deflect valve pipe joints.

D. Install flanged joints per the installation instructions in Standard Specification Section 15050.

3.03 INSTALLING POLYETHYLENE ENCASEMENT

Wrap buried valves, flanged joints, mechanical joints, flanged pipe spools with thrust collars, and adapters with polyethylene material per Standard Specification Section 09954. Complete the wrap prior to placing concrete anchor blocks. Repair polyethylene material damaged during construction.

3.04 INSTALLING ANCHORS

Install concrete anchors over valves or around thrust collars after completion of the polyethylene encasement. Place concrete per Standard Specification Section 02223.

3.05 INSTALLING VALVE BOXES

A. Place and compact trench backfill to the height of the valve stem. Set the one piece extension pipe over the operating nut and center in place. Maintain the extension pipe in a vertical position during backfilling. Slip the valve box frame over the extension pipe and adjust both to finish grade. Pour a concrete ring around the valve box frame. Concrete shall be Class C per Standard Specification Section 03000. In paved areas, top of concrete ring shall be 1-inch below finish grade of adjacent surfaces. In non-paved areas, top of valve box frame and concrete ring shall be flush with the natural or finish grade. Where paved, overlay the concrete ring with 1-inch compacted thickness of asphalt concrete pavement. Valve box frame and cover shall be flush with the finish surface of the pavement.

B. Terminate tracer wire where installed in valve boxes as shown in the Standard Drawings. Secure tracer wire to the exterior surface of the extension pipe with plastic adhesive tape. Drill a hole at the top of the extension pipe for wire entry and provide 24 inches of coiled wire.

3.06 SETTING MARKER POSTS

Locate marker post as directed by the District's Representative. Cut redwood post to a 5-foot length and chamfer the top. Paint post per Standard Specification Section 09900, System No. 60. Use white paint for the finish coats and blue or purple paint for the top 4 inches of the chamfered end. Excavate a hole 16 inches in diameter by 2 feet deep. Set the redwood post plumb, fill hole with concrete to 2 inches above finish grade, and crown to slope away from post. On the side facing the valve box, stencil on the post in 2-inch-high blue or purple letters the word "WATER" or the abbreviation "RW" and the distance in feet from the marker post to the valve box. Concrete shall be Class C per Standard Specification Section 03000.

3.07 PAINTING AND COATING

A. Coat valves located aboveground, or in vaults and structures, the same as the adjacent pipes and per Standard Specification Section 09900. Do no apply flame spray coating to fusion-bonded epoxy coated valves. Apply finish coats in the field. Color of finish coat shall match the color of the adjacent piping. Coat handwheels the same as the valves.

B. Paint top side of valve box covers per Standard Specification Section 09900, System No. 20. Color of finish coat shall be as follows:

1. Normally open inline or branch valve is OSHA Blue for potable water or purple for reclaimed water.

2. Branch valve to a fire hydrant assembly is OSHA Yellow.

3. Branch valve to one or more water service assemblies is OSHA White.

4. Normally closed inline or branch valve is OSHA Red.

3.08 FIELD TESTING

Operate gate valves through 10 full cycles of opening and closing. Valves shall operate from full open to full close without sticking or binding. If valves stick or bind, repair or replace the valve and repeat the tests.

3.09 PRESSURE TESTING

Test gate valves at the same time that the connecting pipelines are pressure tested. See Standard Specification Section 15144 for pressure testing requirements. Repair leaks in the gate valves and joints of the interconnecting piping and retest.

3.10 DISINFECTION

See Standard Specification Section 15141 for chlorination requirements.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of combination air release and vacuum valves, 3 inches and smaller for potable or recycled water.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Combination Air Valve Assemblies: STD SPEC 15092.

D. Disinfection of Piping: STD SPEC 15141.

E. Pressure Testing of Piping: STD SPEC 15144.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit manufacturer's catalog data and detail drawings showing all valve parts and described by material of construction, specification reference, and grade or type.

PART 2 - MATERIALS

2.01 VALVE DESIGN AND OPERATION

A. The combination air-release and vacuum-relief valve shall be of a single chamber design with solid cylindrical HDPE control floats housed in a tubular stainless steel body with epoxy powder-coated cast iron, steel, or stainless steel ends secured by means of stainless steel tie rods or by a flanged connection. The valve shall have an integral orifice mechanism that shall operate automatically to limit transient pressure rise or shock induced by closure to twice valve rated working pressure. Provide a double (small and large) orifice design.

B. The intake orifice area shall be equal to the nominal size of the valve. The large orifice sealing shall be affected by the flat face of the control float seating against a nitrile rubber O-ring housed in dovetail groove circumferentially surrounding the orifice. Discharge of pressurized air shall be controlled by the seating and unseating of a small orifice nozzle on a natural rubber seal affixed into the control float. The nozzle shall have a flat seating land surrounding the orifice.

C. Provide a 1/4-inch NPT test/bleed cock.

D. Prior to the ingress of liquid into the valve chamber, as when the pipeline is being filled, valve shall vent through the large orifice. At higher water approach velocities, the valve shall automatically discharge air through the orifice mechanism and reduce water approach velocity.

E. Valve shall not exhibit leaks or weeping of liquid past the large orifice seal at operating pressures of 7 psi to twice rated working pressure.

F. Valves shall respond to the presence of air by discharging it through the small orifice at any pressures within the specified design range and shall remain leak tight in the absence of air.

G. Valves shall react immediately to pipeline drainage or water column separation by the full opening of the large orifice so as to allow unobstructed air intake at the lowest possible negative internal pipeline pressure.

2.02 MATERIALS OF CONSTRUCTION

Materials of construction for combination air-release and vacuum-relief valves for water service shall be as follows:

Item	Material	Specification
Top flange, lower flange	Stainless Steel	AISI Type 304L
Top cover	ABS plastic	–
Barrel	Stainless steel	AISI Type 304L
Floats	HDPE	–
Air-release nozzle or orifice mechanism	Stainless steel	AISI Type 304
Nozzle seal	Natural rubber	–
Nozzle seal retaining plate	Stainless steel	AISI Type 304
Tie rods assembly and support fasteners	Stainless steel	AISI Type 304
Float O-ring seals	Nitrile rubber	–

2.03 SEATING

Valves shall seal driptight at pressures shown on the Drawings.

2.04 VALVE END CONNECTIONS

A. Valves, 2 inches and smaller, shall have threaded ends. Valves, 3 inches and larger, shall have flanged ends.

B. Flanges for Class 150 valves shall comply with ASME B16.1, Class 125. Flanges for Class 300 valves shall comply with ASME B16.1, Class 250.

C. Threaded ends shall comply with ASME B1.20.1.

2.05 COMBINATION AIR RELEASE AND VACUUM VALVES 3 INCHES AND SMALLER

A. Valves, 2 inches and smaller, shall have a maximum working pressure of 363 psi. Valves shall be Vent-O-Mat Model No 025 RBX 2521 or Model No. 050 RBX 2521, or District approved equal.

B. Valves, 3 inches, shall have a maximum working pressure of 232 psi and Class 150 rating. Valves shall be Vent-O-Mat Model No. 050 RBX 1631 or District approved equal.

C. Valves, 3 inches, shall have a maximum working pressure of 363 psi and Class 300 rating. Valves shall be Vent-O-Mat Model No. 080 RBX 2531 or District approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. See Standard Specification Section 15092 for complete assembly installation.

B. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing screwed valves. Joints shall be watertight.

C. Clean flange stud bolts and nuts by wire brushing, coat threads of stud bolts with lubricant, and tighten nuts uniformly and progressively. If flanges leak under pressure testing, loosen, or remove the nuts, reseat or replace the gasket, reinstall or retighten the nuts, and retest the joints. Joints shall be watertight.

3.02 PRESSURE TESTING

Test valves at the same time that the connecting pipelines are pressure tested. See Standard Specification Section 15144 for pressure testing requirements. Repair leaks in the valves and joints of the interconnecting piping and retest.

3.03 DISINFECTION

See Standard Specification Section 15141 for chlorination requirements.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of fire hydrant assemblies for various working pressures. Assemblies shall be installed at the locations as shown on the Drawings or as established in the field by the District's Representative.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Trenching, Backfilling, and Compacting: STD SPEC 02223.

D. General Concrete Construction: STD SPEC 03000.

E. Miscellaneous Metalwork: STD SPEC 05121.

F. Painting and Coating: STD SPEC 09900.

G. Polyethylene Sheet or Tube Encasement: STD SPEC 09954.

H. General Piping Requirements: STD SPEC 15050.

I. Steel Transmission Pipe: STD SPEC 15061.

J. Resilient Seated Gate Valves: STD SPEC 15101.

K. Disinfection of Piping: STD SPEC 15141.

L. Pressure Testing of Piping: STD SPEC 15144.

M. Ductile Iron Pipe: STD SPEC 15240.

N. Steel Pipe for Minor Applications: STD SPEC 15253.

O. Polyvinyl Chloride (PVC) Pressure Pipe (AWWA C900): STD SPEC 15292.

P. Polyvinyl Chloride (PVC) Distribution Pipe (AWWA C905): STD SPEC 15293.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit manufacturer's catalog data, descriptive literature, and assembly drawings. Show dimensions, materials of construction by specification reference and grade, linings, and coatings.

C. Submit manufacturer’s certificate of compliance with AWWA C503 for fire hydrants designed for a working pressure of 150 psi.

1.04 MASONRY RETAINING WALLS

If the aboveground portion of the assembly is located within a cut slope or embankment fill, a masonry retaining wall shall be constructed on three sides around the assembly. Construct the concrete foundation and retaining wall similar to the requirements that San Diego Gas and Electric uses for their facilities. The face of wall shall be a minimum of one foot beyond the dimensional values of the concrete pad to be poured for the assembly as shown on the Standard Drawings. Use tan colored slump block and grout each cell solid. The concrete pad to be poured around the assembly shall extend to the face of the three walls and also to the adjacent sidewalk or curb. The District’s Representative will decide whether the requirements of this paragraph are being followed by the Contractor. If in the opinion of the District’s Representative modifications or changes are necessary, the work shall be performed as directed.

PART 2 - MATERIALS

2.01 GENERAL

A. Provide wet barrel hydrants with a rated working pressure suitable for the pressure zone of the installation.

B. Unless noted otherwise, provide two-way fire hydrants having one 2-1/2-inch and one 4-inch outlet. In commercial or high density residential zoned areas, or as shown on the Drawings, provide three-way fire hydrants with two 2-1/2-inch and one 4-inch outlet. Threads on outlets shall conform to NFPA No. 1963, Standard for Screw Threads and Gaskets for Fire Hose Connections. Provide bronze or plastic cap with chain on each outlet.

C. Equip wet barrel fire hydrants with slow opening and closing type valves.

2.02 FLANGED OUTLETS

See Standard Specification Sections 15061, 15240, 15292, or 15293 as indicated by the pipeline material shown on the Drawings. Use 6-inch flanged outlets for the fire hydrant assemblies. Use Class 150 flanges for working pressures of 250 psi or less. Use Class 300 flanges for working pressures greater than 250 psi, but less than 300 psi.

2.03 RESILIENT SEATED GATE VALVES

See Standard Specification Section 15101. Use 6-inch resilient seated gate valves for the fire hydrant assemblies with working pressures of 250 psi or less, and with valve ends as shown in the Standard Drawings.

2.04 BALL VALVES

Use 6-inch flanged ball valves for the fire hydrant assemblies with working pressure greater than 250 psi.

2.05 PVC PRESSURE PIPE (AWWA C900)

See Standard Specification Section 15292.

2.06 STEEL PIPE FOR MINOR APPLICATIONS

See Standard Specification Section 15253.

2.07 HYDRANTS

A. For 150 psi maximum working pressure, provide hydrants that conform to AWWA C503. Construct hydrant of all bronze conforming to ASTM B 62 and cast head in either one or two parts. Drill base flange of hydrant to the 6 hole San Diego standard with six 7/8-inch diameter bolt holes on a 9-1/2-inch bolt circle. Use O-ring gaskets for stem seals and between head pieces. Outlets shall be fully serviceable in the field. Two-way hydrants shall be Long Beach Model 125, Clow Model 2050, or District approved equal. Three-way hydrants shall be Long Beach Model 130, Clow Model 2060, or District approved equal.

B. For 200 psi maximum working pressure, provide hydrants that are constructed similar to the requirements of AWWA C503 but are designed for a working pressure of 200 psi. Construct hydrant of all bronze conforming to ASTM B 62 and cast head in either one or two parts. Drill base flange of hydrant to the 6 hole San Diego standard with six 7/8-inch diameter bolt holes on a 9-1/2-inch bolt circle. Use O-ring gaskets for stem seals and between head pieces. Outlets shall be fully serviceable in the field. Two-way hydrants shall be Clow Model 2050, or District approved equal.

C. For 300 psi maximum working pressure, provide wharf hydrants with angle plug design and single outlet. Construct hydrant of all bronze conforming to ASTM B 62. Threaded inlet shall be 4-inch and conform to ANSI B1.20.1, NPT. Threaded outlet shall be 2-1/2-inch, conform to NFPA No. 1963, and have cap and chain. Wharf hydrants shall be James Jones J-344 H.P. or District approved equal. Connect hydrant to riser flange with a 5-inch long threaded brass nipple conforming to ASTM B 43, regular wall thickness; and a ductile iron reducing threaded flange conforming to ANSI B16.42 Class 150 or 300 as shown.

2.08 BREAK-OFF RISERS

A. For working pressures of 200 psi and less, provide pipe spools of the indicated length with flat faced flanged ends. Provide Class 53 ductile iron pipe with Class 150 threaded flanges. Drill flanged ends to the 6 hole San Diego standard with six 7/8-inch diameter bolt holes on a 9-1/2-inch bolt circle. Line interior of pipe with cement mortar and provide double thickness (1/8-inch minimum) per AWWA C104. Score one end of the spool 4 inches from the flange face. Cut a V-groove 1/4-inch wide and to a depth of 1/8-inch minimum to 3/16-inch maximum on the pipe exterior.

B. For working pressures greater than 200 psi, but less than 300 psi, provide pipe spools of the indicated length with flat faced flanged ends. Provide Class 53 ductile iron pipe with Class 150 threaded flanges conforming to Standard Specification Section 15240. Line interior of pipe with cement mortar and provide double thickness (1/8-inch minimum) per AWWA C104. Score one end of the spool 4 inches from the flange face. Cut a V-groove 1/4-inch wide and to a depth of 1/8-inch minimum to 3/16-inch maximum on the pipe exterior.

C. For working pressures greater than 250 psi, but less than 300 psi, provide pipe spools of the indicated length with flat faced flanged ends. Provide Class 53 ductile iron pipe with Class 300 threaded flanges conforming to Standard Specification Section 15240. Line interior of pipe with cement mortar and provide double thickness (1/8-inch minimum) per AWWA C104. Score one end of the spool 5 inches from the flange face. Cut a V-groove 1/4-inch wide and to a depth of 1/8-inch minimum to 3/16-inch maximum on the pipe exterior.

2.09 BURY SECTIONS

Provide two-piece bury sections consisting of an elbow and extension. Design bury sections for a working pressure of 200 psi. Construct of cast iron conforming to ASTM A 126 Class B, or ductile iron conforming to ASTM A 395 or A 536. Provide bury elbow with integral base and mechanical joint by flat faced flanged end. Provide pipe extension with flat faced flanged ends and of the required length to adjust the hydrant to grade. Drill flanged ends to the 6 hole San Diego standard with six 7/8-inch diameter bolt holes on a 9-1/2-inch bolt circle. Line the interior of the bury section with cement mortar to a 5/16-inch thickness. Line interior of mechanical joint bells per Standard Specification Section 09900, System No. 5. Coat the exterior with asphalt varnish.

2.10 BOLTS, NUTS AND GASKETS FOR RISERS AND BURY SECTIONS

See Standard Specification Section 15050.

2.11 POLYETHYLENE ENCASEMENT

See Standard Specification Section 09954.

2.12 GUARD POSTS

See Standard Specification Section 05121. Provide two guard posts for each fire hydrant assembly except where assembly is located adjacent to a paved street with concrete curbs.

2.13 REFLECTIVE PAVEMENT MARKERS

Fire hydrant markers shall be of the reflective type and colored blue. Markers shall conform to Section 85 of the State Standard Specifications, State of California, Department of Transportation, Caltrans, latest editions.

PART 3 - EXECUTION

3.01 INSPECTION BEFORE INSTALLATION

Operate the valves on the fire hydrant from closed to fully open, then close again before installing. Check for broken, cracked, or missing parts; malfunctioning stems; and faulty operation.

3.02 INSTALLATION

A. See Standard Specification Section 02223 for earthwork requirements. Use imported sand in the pipe base and pipe zone.

B. Install piping and valves per the instructions contained in the appropriate Standard Specification for the material used.

C. Piping from the main to the hydrant shall be placed level or on a continuous upward grade to avoid pocketing air.

D. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing screwed hydrants. Joints shall be watertight.

E. Install flanged joints per the installation instructions in Standard Specification Section 15050.

3.03 INSTALLING POLYETHYLENE ENCASEMENT

After applying primer for wax tape coating to all buried bolts and nuts, wrap bury section including mechanical joint and flanged ends with polyethylene material per Standard Specification Section 09954. Complete the wrap prior to placing concrete thrust block, concrete anchor block on bury section, and concrete pad on grade. Repair polyethylene material damaged during construction.

3.04 PLACING CONCRETE

Place concrete against the bury elbow section and the undisturbed ground with the bearing area as shown on the Standard Drawings. Allow concrete to set and be hard enough to be self-supporting. Place and compact trench backfill up to the subgrade of the concrete anchor block. Pour a concrete anchor block below grade around the bury section to force the aboveground grooved spool to break on an impact. Cover the anchor block with backfill material and compact up to the subgrade of the concrete pad on grade. Pour a concrete pad on grade around the break-off riser. Concrete shall be Class C per Standard Specification Section 03000.

3.05 SETTING GUARD POSTS

Position guard posts to protect the fire hydrant assembly. Locate posts 2-1/2 feet to each side and 2 feet in front of the hydrant. Excavate a hole 16 inches in diameter by 3-1/2 feet deep for each post. Set posts plumb, fill holes with concrete to 2 inches above finish grade, and crown to slope away from post. Posts shall be embedded a minimum of 3 feet in concrete. Fill posts with grout and crown top. Concrete shall be Class C per Standard Specification Section 03000.

3.06 PAINTING AND COATING

Paint aboveground surfaces of the break-off riser, hydrant, guard posts, and top side of valve box cover per Standard Specification Section 09900, System No. 20. Color of finish coat shall be OSHA Yellow.

3.07 INSTALLING FIRE HYDRANT MARKERS

Install a blue reflective marker opposite each fire hydrant. Place the marker on the pavement and locate 6 inches off the centerline of the traffic striping or reflective pavement markers towards the hydrant. Install markers in accordance with Section 85 of the State Standard Specifications.

3.08 PRESSURE TESTING

Test fire hydrant assemblies at the same time that the connecting pipelines are pressure tested. See Standard Specification Section 15144 for pressure testing requirements. Repair leaks in the fire hydrant assemblies and joints of the interconnecting piping and retest.

3.09 DISINFECTION

See Standard Specification Section 15141 for chlorination requirements.

END OF SECTION

STANDARD SPECIFICATION
SECTION 15110 AUTOMATIC CONTROL VALVES

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of globe pattern, diaphragm-actuated control valves for pressure reducing with check feature and pressure relief.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Fusion-Bonded Epoxy Lining and Coating: STD SPEC 09961.

D. General Piping Requirements: STD SPEC 15050.

E. Disinfection of Piping: STD SPEC 15141.

F. Pressure Testing of Piping: STD SPEC 15144.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit valve manufacturer's catalog data, descriptive literature, and assembly drawings. Show dimensions, materials of construction by specification reference and grade, linings, and coatings.

PART 2 - MATERIALS

2.01 GENERAL

A. Provide valves complete with pilot controls, linings, coatings, and other specified optional features.

B. Cast or mold onto the valve body the name of the manufacturer, the valve size, and seat direction. Attach additional product identification plates to the valve body and cover. Do not remove, paint over, or make these identification plates illegible.

C. Unless otherwise indicated, valves shall be the same size as the pipe in which they are installed.

D. Unless otherwise indicated, valves shall have the same working pressure rating as the pipe in which they are installed.

2.02 VALVE DESIGN AND OPERATION

A. Valves shall be hydraulically actuated, diaphragm type. The body shall contain a removable seat insert. A resilient rubber disc shall form a drip-tight seal with the valve seat when pressure is applied above the diaphragm. The diaphragm assembly shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.

B. All major components of the pilot control system shall be manufactured by the same company that manufacturers the main valve. The main valve diaphragm shall either be vulcanized at the stem hole to ensure against wicking of the product within the diaphragm or the diaphragm shall utilize an FDA-approved nonwicking material and an elastomeric insert seal at the stem hole. The diaphragm shall not be used as a seating surface.

C. Provide guides at both ends of the stem or provide a center-guided stem. For design utilizing guides at both ends of the stem, provide a bearing in the valve cover and an integral bearing in the valve seat. Provide valve position indicator. Repairs and modifications other than the replacement of the main valve body shall be possible without removing the main valve from the line.

2.03 MATERIALS OF CONSTRUCTION

Materials of construction shall be as follows:

Component	Material	Specification
Main Valve Body and Cover	Ductile Iron	ASTM A 536, Grade 65-45-12
Disc Retainer and Diaphragm Washer	Stainless Steel	ASTM A 276, A 351, or A 743, Type 303
Main Valve Trim: Seat, Disc Guide, and Cover Bearing	Stainless Steel	ASTM A 276, A 351, or A 743, Type 303
Disc and Diaphragm	Buna-N	—-
Stem, Nut, and Spring	Stainless Steel	ASTM A 276, A 351, or A 743, Type 303
Cover Bolts and Nuts	Carbon Steel, Zinc Coated	ASTM A 307
Pilot Controls	Bronze and Stainless Steel	ASTM B 62, and Type 303
Piping and Tubing	Brass and Copper	ASTM B 43, ASTM B 42 and B 88

2.04 LINING AND COATING FOR VALVES

Coat interior and exterior ferrous surfaces of the valves with fusion-bonded epoxy per Standard Specification Section 09961. Do not coat bronze, rubber, or stainless steel items. Coating shall be holiday free on interior surfaces.

2.05 VALVE END CONNECTIONS

A. Globe pattern valves, smaller than 1-1/2 inches, shall have screwed ends. Globe pattern valves, 1-1/2 inches and larger, shall have flanged ends.

B. Angle pattern valves, smaller than 2 inches, shall have screwed ends. Angle pattern valves, 2 inches and larger, shall have flanged ends.

C. Screwed ends shall conform to ANSI B1.20.1, NPT.

D. Flanges for ductile iron valves shall conform to ANSI B16.42, Class 150 or Class 300. Flanges shall be flat faced. Do not provide raised face mating flanges on the connecting piping. Provide flanges that match the flange of the connecting valve or other equipment.

2.06 VALVES

A. Pressure Reducing and Check Valves:

Valves shall maintain a constant downstream pressure and shall close tight when flow reversals occur. The pressure reducing pilot controls shall be adjustable over a range of 30 to 300 psi. Provide Y-type strainers, isolation valves, check valves, flow stabilizers, opening and closing speed controls in the pilot control piping and tubing. The valves shall be globe pattern and have a valve position indicator. Valves shall be Cla-Val Model 90-01, or District approved equal.

B. Pressure Relief Valves:

Valves shall maintain a maximum upstream pressure by opening to relieve high pressure. The pressure relief pilot controls shall operate such that as excessive line pressure is dissipated the valve slowly closes. Pilot controls shall be adjustable over a range of 20 to 200 psi. Provide "Dura-Kleen" stems, Y-type strainers, isolation valves, and opening speed controls in the pilot control piping and tubing. The valves shall be globe or angle pattern as shown on the Drawings and have a valve position indicator. Valves shall be Cla-Val Model No. 50-01, or District approved equal.

2.07 PACKING, O-RINGS, AND GASKETS

Unless otherwise stated; packing, O-rings, and gaskets shall be one of the following nonasbestos materials.

A. Teflon.

B. Kevlar aramid fiber.

C. Acrylic or aramid fiber bound by nitrile. Provide Garlock “Bluegard,” Klinger “Klingersil C4400,” or District approved equal.

D. Buna-N (Nitrile).

2.08 BOLTS, NUTS AND GASKETS FOR FLANGES

See Standard Specification Section 15050.

PART 3 - EXECUTION

3.01 INSPECTION BEFORE INSTALLATION

A. Check for broken, cracked, or missing parts; malfunctioning stem; scored surfaces on interior lining; and damage to pilot control system.

B. The District's Representative will conduct in the field an independent inspection of the lining and coating for compliance with the criteria in Standard Specification Section 09961. Coated items failing his inspection will be cause for rejection.

3.02 INSTALLATION

A. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing screwed valves. Joints shall be watertight.

B. Install control valves in a horizontal position and provide temporary support until the final pipe supports are installed. Install piping per the instructions contained in the appropriate Standard Specification for the material used. Do not damage linings, coatings, or accessory items during the installation. Repair any or all damage to the satisfaction of the District's Representative.

C. Install flanged joints per the installation instructions in Standard Specification Section 15050.

3.03 PAINTING AND COATING

Do not paint or coat valves located aboveground, or in vaults and structures. Do not paint or coat exterior surfaces of fusion-bonded epoxy valves, bronze, stainless steel, or identification plates.

3.04 PRESSURE TESTING

Test automatic control valves at the same time that the connecting pipelines are pressure tested. See Standard Specification Section 15144 for pressure testing requirements. Repair leaks in the valves and joints of the interconnecting piping and retest.

3.05 DISINFECTION

See Standard Specification Section 15141 for chlorination requirements.

END OF SECTION

STANDARD SPECIFICATION
SECTION 15112 BACKFLOW PREVENTION ASSEMBLIES

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of backflow preventer assemblies and detector check assemblies. Assemblies shall be installed at the locations as shown on the Drawings or as established in the field by the District's Representative. The District will perform the initial test of the completed assembly to certify the installation. Future maintenance and annual certification of the assembly shall be the responsibility of the Customer.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Trenching, Backfilling, and Compacting: STD SPEC 02223.

D. General Concrete Construction: STD SPEC 03000.

E. Miscellaneous Metalwork: STD SPEC 05121.

F. Painting and Coating: STD SPEC 09900.

G. Polyethylene Sheet or Tube Encasement: STD SPEC 09954.

H. Fusion-Bonded Epoxy Lining and Coating: STD SPEC 09961.

I. General Piping Requirements: STD SPEC 15050.

J. Disinfection of Piping: STD SPEC 15141.

K. Pressure Testing of Piping: STD SPEC 15144.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit manufacturer's catalog data, descriptive literature, and assembly drawings. Show dimensions, materials of construction by specification reference and grade, linings, and coatings.

C. Submit manufacturer's certificate of compliance with AWWA C511 for reduced pressure principle backflow preventers.

1.04 MASONRY RETAINING WALLS

If the aboveground portion of the assembly is located within a cut slope or embankment fill, a masonry retaining wall shall be constructed on three sides around the assembly. Construct the concrete foundation and retaining wall similar to the requirements that San Diego Gas and Electric uses for their facilities. The face of wall shall be a minimum of one foot beyond the dimensional values of the concrete pad to be poured for the assembly as shown on the Standard Drawings. Use tan colored slump block and grout each cell solid. The concrete pad to be poured around the assembly shall extend to the face of the three walls and also to the adjacent sidewalk or curb. The District's Representative will decide whether the requirements of this paragraph are being followed by the Contractor. If in the opinion of the District's Representative modifications or changes are necessary, the work shall be performed as directed.

1.05 PRIVATE PUMPING FACILITIES

The addition of a backflow prevention assembly to any given size water service assembly will reduce the available water service pressure. A larger size water service and backflow prevention assembly may be required to provide adequate water service pressure. The District will not provide pumping facilities to increase water service pressure. Private pumping facilities shall be independent and located downstream of backflow prevention assemblies.

1.06 THERMAL EXPANSION

The addition of a backflow prevention assembly to a water service will constitute a closed system. The District will not provide thermal expansion facilities for this condition. Provide sufficient facilities for thermal expansion and check for proper operation of existing thermal or pressure relief devices.

PART 2 - MATERIALS

2.01 MANUFACTURERS

Provide backflow prevention assemblies of the described type that are on the "List of Approved Backflow Prevention Assemblies" as issued by the State of California, Department of Health Services. A copy of the list is available from the District's Backflow Department.

2.02 BACKFLOW PREVENTERS

A. General: Backflow preventers shall be the same size as and never smaller than the upstream water service assembly. Where normal minimum water service pressure is less than 80 psi; the District may require the next larger assembly size.

B. Backflow preventers of the reduced pressure principle type shall conform to the material specifications of the state approved manufacturers. See the instructions in paragraph 2.01 for obtaining the “List of Approved Backflow Assemblies”.

C. Backflow preventers, 2 inches and smaller, shall be of the conventional in-line design for installation in a horizontal position. See the instructions in paragraph 2.01 for obtaining the “List of Approved Backflow Assemblies”.

D. Backflow preventers, 2-1/2 inches through 10 inches, shall be of the conventional in-line design for installation in a horizontal position. Provide adjustable pipe supports to augment the installation to prevent flange damage. See the instructions in paragraph 2.01 for obtaining the “List of Approved Backflow Assemblies”.

E. DETECTOR CHECKS

F. General: Detector checks shall be sized according to the demands of the fire protection system. Provide double check detector checks for Class 1, 2, 3, and 4 fire protection systems. Provide reduced pressure detector checks for Class 5 and greater fire protection systems.

G. Double check detector checks shall conform to AWWA C510 with a minimum rated working pressure of 175 psi for operation on cold water pipelines. Provide two independently acting, spring loaded check valves; two resilient seated gate valves with outside stem and yoke; four, full ported, bronze ball valve test cocks; and a low flow by-pass line with registration meter and a double check valve assembly in series. Assemble the by-pass meter and double check valves to the main line assembly as an integral unit. The meter shall be a totalizing type with registration in cubic feet. Main check valves shall be constructed for servicing without removing the assembly from the line. Construct main line valve bodies and covers of ductile iron conforming to ASTM A 536 Grade 65-45-12 with bronze trim conforming to ASTM B 584 Alloy C83600. Construct by-pass line components of bronze or brass.

1. Double check detector checks, 4 inches through 8 inches, shall be of the compact design (“N” series) for inlet flow in a vertical up direction and outlet flow in a vertical down direction. Provide valve setters with the appropriate end connections to augment the installation. Double check detector checks shall be Cla-Val Model DD8N, Febco Model 876V, or District approved equal.

2. In lieu of the compact design, double check detector checks, 4 inches through 10 inches, shall be of the conventional in-line design for installation in a horizontal position. Provide adjustable pipe supports to augment the installation. Double check detector checks shall be Cla-Val Model DD7L, Febco Model 806YD, or District approved equal.

H. Reduced pressure detector checks, 4 inches through 10 inches, shall be similar to backflow preventers of the reduced pressure type described in paragraph 2.02, B. Provide a by-pass line with registration meter and a bronze reduced pressure backflow preventer assembly in series. The by-pass reduced pressure backflow preventer shall operate identically to the main line assembly and open to detect initial flow. The meter shall be a totalizing type with registration in cubic feet. Reduced pressure detector checks shall be of the conventional in-line design for installation in a horizontal position. Provide adjustable pipe supports to augment the installation to prevent flange damage. Detector checks shall be Cla-Val Model RD7L, Febco Model 826YD, or District approved equal.

I. Where required by the fire department, provide an exposed inlet connection on the downstream side of the detector check. Replace the ductile iron bend with a ductile iron flanged tee. Install a flange with a 4-inch threaded outlet on the run. Thread a 4-inch brass nipple into the flange and install a swing check valve and a two-way, 90 degree, angle inlet connection. The 4-inch swing check valve shall be of brass construction with spring loaded check and have threaded ends. The inlet connection shall be a two-way, 90 degree angle outlet of cast brass construction with 4-inch by 2-1/2-inch size. Provide either single or double clapper style as specified by the fire department and pin lug swivels. Cast on the top of the connection the words “AUTO SPKR” or “STANDPIPE” as directed by the fire department. Provide brass plug with chain for each inlet swivel. The swing check valve and inlet connection shall be as manufactured by Potter-Roemer, Inc. or District approved equal.

2.03 LINING AND COATING OF ASSEMBLIES

Coat interior and exterior ferrous surfaces of the backflow preventers and detector checks with fusion-bonded epoxy per Standard Specification Section 09961. Do not coat bronze, rubber, or stainless steel items.

2.04 VALVE END CONNECTIONS

A. Valves, 2 inches and smaller, shall have screwed ends. Valves, 2-1/2 inches and larger, shall have flanged ends.

B. Screwed ends shall conform to ANSI B1.20.1,NPT.

C. Flanged ends shall conform to ANSI B16.1, Class 125.

2.05 PACKING, O-RINGS, AND GASKETS

Unless otherwise stated; packing, O-rings, and gaskets shall be one of the following nonasbestos materials.

A. Teflon.

B. Kevlar aramid fiber.

C. Acrylic or aramid fiber bound by nitrile. Provide Garlock "Bluegard," Klinger "Klingersil C4400," or District approved equal.

D. Buna-N (Nitrile).

2.06 BOLTS, NUTS AND GASKETS FOR FLANGES

See Standard Specification Section 15050.

2.07 VALVE SETTERS

Provide valve setters to augment the installation of the compact design (“N” series) detector checks. Valve setters shall be constructed with integral support arms between the elbows to transfer thrust downstream. Construct valve setters of ductile iron conforming to ASTM A 536 Grade 65-45-12. Coat interior and exterior surfaces of the ductile iron with fusion-bonded epoxy per Standard Specification Section 09961. End connections shall be a combination of flanged ends and mechanical joints as shown on the Standard Drawings. Flanged ends shall conform to ANS B16.1 Class 125. Valve setters shall be Cla-Val Model VS, Febco Model 611, or District approved equal.

2.08 ADJUSTABLE PIPE SUPPORTS

Provide adjustable pipe support of welded steel construction with fusion-bonded epoxy coating. Locate the pipe supports under flanges or valve bodes as shown. Provide 2-inch galvanized steel pipe, cut to length, and place between the collar and base. Provide Material Resources “Standon Pipe Support Model S-89,” or District approved equal.

2.09 POLYETHYLENE ENCASEMENT

See Standard Specification Section 09954.

2.10 GUARD POSTS

See Standard Specification Section 05121. Provide guard posts around the assembly when directed by the District’s Representative to protect the installation.

2.11 ENCLOSURE

Provide an enclosure over and around the assembly when directed by the District’s Representative to protect installation.

PART 3 - EXECUTION

3.01 INSPECTION BEFORE INSTALLATION

Operate the shutoff valves and test cocks on the assemblies from closed to fully open, then close again before installing. Check for broken, cracked, or missing parts; malfunctioning stems; and faulty operation.

3.02 INSTALLATION

A. See Standard Specification Section 02223 for earthwork requirements. Use imported sand in the pipe base and pipe zone.

B. Install piping and riser section per the instructions contained in the appropriate Standard Specification for the material used.

C. Piping from the main to the backflow prevention assembly shall be placed level or on a continuous upward grade to avoid pocketing air. No outlets will be allowed in the piping between the main and the assembly. Trench backfilling shall not commence until the

District's Representative has inspected this section of piping and is satisfied with the installation.

D. Install backflow prevention assemblies in a horizontal position, aboveground, and at the dimensions shown on the Standard Drawings. Locate the assemblies where shown or as established in the field by the District's Representative. The District shall be the final authority as to location, installation, size, and type of backflow prevention assembly required.

E. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing screwed valves. Joints shall be watertight.

F. Install flanged joints per the installation instructions in Standard Specification Section 15050.

3.03 INSTALLING POLYETHYLENE ENCASEMENT

After applying primer for wax tape coating to all buried bolts and nuts, wrap ferrous pipe risers including base bends and valve setters with polyethylene material per Standard Specification Section 09954. Complete the wrap prior to placing concrete anchor blocks or concrete trust blocks on base bends or valve setters. Repair polyethylene material damaged during construction.

3.04 PLACING CONCRETE

Place concrete anchor blocks around the elbow of the pipe riser or valve setter. Where a thrust block is required, place concrete against the base bends and undisturbed ground. Place concrete back to back between the base bends. Allow concrete to set and be hard enough to be self-supporting. Place and compact trench backfill up to the subgrade of the concrete pad on grade. Pour a concrete pad on grade around the pipe risers. Concrete shall be Class C per Standard Specification Section 03000.

3.05 SETTING GUARD POSTS

Position guard posts to protect the backflow prevention assembly. Locate posts as directed by the District's Representative. Excavate a hole 16 inches in diameter by 3-1/2 feet deep for each post. Set posts plumb, fill holes with concrete to 2 inches above finish grade, and crown to slope away from post. Posts shall be embedded a minimum of 3 feet in concrete. Fill posts with grout and crown top. Concrete shall be Class C per Standard Specification Section 03000.

3.06 INSTALLING THE ENCLOSURE

Set enclosure over the assembly and center in place as directed by the District's Representative. Use driller in or adhesive stainless steel anchors to attach the enclosure to the concrete pad.

3.07 PAINTING AND COATING

A. Paint aboveground surfaces of the pipe risers, elbows or bends, and adjustable pipe supports per Standard Specification Section 09900, System No. 20. Color of finish coat shall be OSHA Blue. Do not paint backflow prevention assemblies.

B. Paint aboveground surfaces of the guard posts per Standard Specification Section 09900, System No. 20. Color of finish coat shall be OSHA Yellow.

3.08 PRESSURE TESTING

Test backflow prevention assemblies at the same time that the connecting pipelines are pressure tested. See Standard Specification Section 15144 for pressure testing requirements. Repair leaks in the backflow prevention assemblies and joints of the interconnecting piping and retest.

3.09 DISINFECTION

See Standard Specification Section 15141 for chlorination requirements.

3.10 INITIAL TESTING

Upon completion of the installation and inspection by the District's Representative, an initial test will be performed by certified personnel of the District's Backflow Department. The initial test will be conducted to certify the adequacy and operational compliance of the assembly with both state and District regulations. Backflow prevention assemblies will not be placed into service until the District has tested and certified the installation.

END OF SECTION

STANDARD SPECIFICATION
SECTION 15122 FLEXIBLE PIPE COUPLINGS

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of flexible pipe couplings for steel pipe, PVC pressure pipe, PVC distribution pipe, and ductile iron pipe.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Painting and Coating: STD SPEC 09900.

D. Cold Applied Wax Tape Coating: STD SPEC 09952.

E. Polyethylene Sheet or Tube Encasement: STD SPEC 09954.

F. Fusion-Bonded Epoxy Lining and Coating: STD SPEC 09961.

G. Corrosion Control for Buried Piping: STD SPEC 13110.

H. General Piping Requirements: STD SPEC 15050.

I. Disinfection of Piping: STD SPEC 15141.

J. Pressure Testing of Piping: STD SPEC 15144.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit manufacturer's catalog data, descriptive literature, and assembly drawings. Show manufacturer's model or figure number for each type of coupling or joint for each type of pipe material for which couplings are used.

C. Submit manufacturer's recommended torques to which the coupling bolts shall be tightened.

D. Show dimensions, materials of construction by specification reference and grade, linings, and coatings.

E. Show number, size and material of construction of the rods and lugs for each joint harness on the project.

PART 2 - MATERIALS

2.01 COUPLING SYSTEM DESIGN AND COMPONENT UNIT RESPONSIBILITY

Gaskets, bolts, nuts, glands, end rings, and hardware for pipe couplings of all types shall be furnished by the manufacturer of the pipe coupling and shall be designed as an integral system by the pipe coupling manufacturer. Gaskets shall be designed for the coupling and appropriately sized to provide a watertight seal at the design pressure and temperature. Gaskets, bolts, nuts, glands, end rings, and hardware for pipe couplings shall be shipped with the pipe coupling and shall be clearly labeled indicating the origin of the material, including place and date of manufacture. Manufacturer's printed installation instructions shall be packaged with each pipe coupling.

2.02 STEEL FLEXIBLE PIPE COUPLINGS

A. Steel couplings shall have center sleeves and end rings made of carbon steel conforming to AWWA C219, Section 4. Minimum center sleeve length shall be 5 inches for pipe sizes 3/4-inch through 4-1/2 inches; 7 inches for pipe sizes 5 inches through 24 inches; and 10 inches for pipe sizes larger than 24 inches.

B. Sleeve bolts in exposed service or buried shall be Type 304 stainless steel per AWWA C219, Section 4.

C. Steel end follower rings shall be cast, forged, or hot rolled in one piece. Do not use rings fabricated from two or more shapes.

D. Wall thickness of sleeve shall be at least that specified for the size of pipe in which the coupling is to be used.

E. Gaskets shall be Buna-N.

2.03 DUCTILE IRON FLEXIBLE PIPE COUPLINGS

A. Couplings shall have center sleeves and end rings made of ductile iron conforming to AWWA C219, Section 4.

B. Sleeve bolts in exposed service or buried shall be Type 304 stainless steel per AWWA C219, Section 4.

C. Gaskets shall be Buna-N.

2.04 FLEXIBLE PIPE COUPLINGS FOR PLAIN END STEEL PIPE

Couplings shall be steel, Dresser Style 38, Smith-Blair Type 411, Baker Series 200, or District approved equal.

2.05 FLEXIBLE PIPE COUPLINGS FOR PLAIN END DUCTILE IRON PIPE, PVC PRESSURE PIPE, OR PVC DISTRIBUTION PIPE

Couplings shall be ductile iron, Dresser Style 153, Smith-Blair Type 441, Baker Series 228, or District approved equal.

2.06 TRANSITION COUPLINGS

Couplings for connecting different pipes having different outside diameters shall be steel: Dresser Style 62 or 162, Smith-Blair Series 413 or 415, Baker Series 212 or 220, or District approved equal. Couplings shall have an integral full circumference ring pipe stop at the midpoint of the coupling. Inside diameter of coupling pipe stop shall equal inside diameter of smaller diameter pipe.

2.07 FLANGED COUPLING ADAPTERS FOR STEEL PIPE

Adapters shall be steel, Dresser Style 128, Smith-Blair Type 913, Baker Series 602, or District approved equal. Flange ends shall match the flange of the connecting pipe.

2.08 FLANGED COUPLING ADAPTERS FOR DUCTILE IRON PIPE, PVC PRESSURE PIPE, OR PVC DISTRIBUTION PIPE

Adapters shall be ductile iron or steel, Dresser Style 127 or 128, Smith-Blair Type 912 or 913, Baker Series 601 or 602, or District approved equal. Flange ends shall match the flange of the connecting pipe.

2.09 FLANGED COUPLING ADAPTERS FOR EXISTING ASBESTOS CEMENT PIPE

Adapters shall be ductile iron, Dresser Style 127 or 128, Smith-Blair Series 912, or District approved equal. Flange ends shall match the flange of the connecting pipe. Verify in the field the actual outside diameter of the existing pipe to be connected.

2.10 LINING AND COATING FOR COUPLINGS

Coat interior and exterior ferrous surfaces of flexible pipe couplings, transition couplings, and flanged coupling adapters with fusion-bonded epoxy per Standard Specification Section 09961. Coating shall be holiday free on interior surfaces.

2.11 JOINT HARNESSES

A. Provide joint harnesses for flexible pipe couplings located in vaults and structures where the piping is not restrained or anchored. Joint harnesses of this design shall be limited to a maximum pipe size of 8 inches and only applies to steel pipe.

B. Steel ring plates shall conform to ASTM A 36; ASTM A 283, Grade B, C or D; or ASTM A 285, Grade C. Ring plates shall be as shown on the Drawings.

C. Tie bolts or studs shall be as shown in the following table. Bolt or stud material shall be high-strength alloy steel conforming to ASTM A 193, Grade B7. Nuts shall conform to ASTM A 194, Grade 2H.

Nominal Pipe Size (inches)	Number of Bolts/Studs	Diameter (inches)
2	2	5/8
3	2	5/8
4	2	5/8
6	2	5/8
8	2	5/8

D. Provide washers for each nut. Washers shall be of the same material as the nuts.

2.12 BOLTS, NUTS AND GASKETS FOR FLANGES

See Standard Specification Section 15050.

2.13 WAX TAPE COATING

See Standard Specification Section 09952.

2.14 POLYETHYLENE ENCASEMENT

See Standard Specification Section 09954.

2.15 CORROSION CONTROL COMPONENTS

See Standard Specification Section 13110.

PART 3 - EXECUTION

3.01 INSTALLING COUPLINGS OR ADAPTERS

A. Clean oil, grease, scale, and dirt from pipe ends. Repair any damage or holidays in the shop applied coating before installing couplings or adapters. Clean gaskets in flexible pipe couplings, transition couplings, and flanged coupling adapters before installing.

B. Clean sleeve bolts and nuts by wire brushing before installing in end rings. Lubricate threads of bolts and nuts with oil or graphite prior to installation. Tighten nuts uniformly and in a progressive diametrically opposite sequence, and torque with a calibrated torque wrench.

C. If couplings or adapters leak under pressure testing, loosen or remove the nuts and sleeve bolts, reset or replace the gaskets, reinstall or retighten the bolts and nuts, and retest the coupling or adapter. Couplings and adapters shall be watertight.

D. After testing, wrap sleeve bolts and nuts of buried couplings or adapters with wax tape coating per Standard Specification Section 09952.

E. Wrap buried couplings and adapters with polyethylene material per Standard Specification Section 09954.

F. Where couplings or adapters are installed on buried metallic pipe, provide bond wires across the coupling and bond the follower ring to the pipe per Standard Specification Section 13110.

3.02 INSTALLING FLANGED JOINTS

See Standard Specification Section 15050 for installation instructions.

3.03 PAINTING AND COATING

Coat flexible pipe couplings, transition couplings, flanged coupling adapters and joint harnesses located aboveground, or in vaults and structures, the same as the adjacent pipes and per Standard Specification Section 09900. Do not apply flame spray coating to fusion-bonded epoxy coated couplings. Apply finish coats in the field. Color of finish coat shall match color of the adjacent piping.

3.04 PRESSURE TESTING

Test couplings and adapters at the same time that the connecting pipelines are pressure tested. See Standard Specification Section 15144 for pressure testing requirements. Repair leaks in piping and retest.

3.05 DISINFECTION

See Standard Specification Section 15141 for chlorination requirements.

END OF SECTION

STANDARD SPECIFICATION
SECTION 15141 DISINFECTION OF PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and procedures for disinfection of water mains by the continuous feed method or by the slug method. Do not use the tablet method to disinfect pipelines. Disinfect in accordance with AWWA C651, except as modified below. Other methods of disinfection will only be allowed with the written permission of the District's Representative.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Pressure Testing of Piping: STD SPEC 15144.

1.03 JOB CONDITIONS

A. Discharge of chlorinated water into watercourses or surface waters is regulated by the National Pollutant Discharge Elimination System (NPDES). Apply to cognizant environmental regulation authority and obtain permit for permission to discharge. Disposal of the chlorinated disinfection water and the flushing water is the Contractor's responsibility.

B. Schedule the rate of flow and locations of discharges in advance to permit review and coordination with District and cognizant regulatory authorities: San Diego County Health Department. If there is any question that the chlorinated discharge will cause damage to the environment, then a reducing agent shall be applied to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water. See AWWA C651, Appendix C for neutralizing chemicals.

C. Use potable water for chlorination. Provide a reduced pressure backflow prevention assembly if source of potable water is from District waterlines.

D. Submit request for use of water from waterlines of District 48 hours in advance.

PART 2 - MATERIALS

2.01 LIQUID CHLORINE

Inject with a solution feed chlorinator and a water booster pump into the pipeline at a metered rate for the continuous feed or slug method. Use an experienced operator and follow the instructions of the chlorinator manufacturer.

2.02 CALCIUM HYPOCHLORITE (DRY)

Use tablets in wet trenches when connecting to existing waterlines to minimize contamination.

2.03 SODIUM HYPOCHLORITE (SOLUTION)

Further dilute in water to desired concentration and swab or spray the inside surfaces of all new piping at connection points to existing waterlines.

2.04 CHLORINE RESIDUAL TEST KIT

For measuring chlorine concentration, supply and use a medium range, drop count, titration kit or an orthotolidine indicator comparator with wide range color discs. Products: Hach Chemical or Hellige. Maintain kits in good working order available for immediate test of residuals at points of sampling.

PART 3 - EXECUTION

3.01 CONTINUOUS FEED METHOD

Introduce potable water into the pipeline at a constant measured rate. Feed the chlorine solution into the same water at a measured rate. Proportion the two rates so that the chlorine concentration in the pipeline is maintained at a minimum concentration of 50 mg/l. Check the concentration at points downstream during the filling to ascertain that sufficient chlorine is being added.

3.02 SLUG METHOD

Introduce potable water into the pipeline at a constant measured rate. At the start of the test section, feed the chlorine solution into the same water pipeline at a measured rate so that the chlorine concentration created in the pipeline is 300 mg/l. Feed the chlorine for a sufficient period to develop a solid column or "slug" of chlorinated water that will, as it passes along the line, expose all interior surfaces to a concentration of at least 300 mg/l for at least three hours.

3.03 DISINFECTION OF VALVES AND APPURTENANCES

During the period that the chlorine solution or slug is in the section of pipeline, open and close valves to obtain a chlorine residual at hydrants and other pipeline appurtenances.

3.04 CONFIRMATION OF RESIDUAL

A. After the chlorine solution applied by the continuous feed method has been retained in the pipeline for 24 hours, confirm that a chlorine residual of 25 mg/l minimum exists along the pipeline by sampling at air valves and other points of access.

B. With slug method, confirm by sampling as the slug passes each access point and as it leaves the pipeline.

3.05 PIPELINE FLUSHING

After confirming the chlorine residual, flush the excess chlorine solution from the pipeline until the chlorine concentration in the water leaving the pipe is non-detectable. Use an Environmental Protection Agency approved reducing agent such as Vita-D-Chlor or District approved equal if discharge of chlorinated water would be damaging to the environment.

3.06 BACTERIOLOGIC QUALITY TESTS

A. The Contractor shall provide the services of an acceptable state certified laboratory to take all samples, deliver to laboratory, and provide written test results to the District's Representative.

B. Perform bacteriologic quality testing after disinfection, final flushing, and refilling of the pipeline. Collect two consecutive sets of acceptable samples taken at least 24 hours apart from the pipeline. Take samples from the pipeline at 1500-foot intervals and from each end. Repeat the process 24 hours later at the same sample points. The sample point spacing may be adjusted in the field by the District's Representative.

C. Deliver samples to a certified laboratory within three hours after collecting and have a bacteriologic quality test performed. Test for coliform organisms and perform a heterotrophic plate count for each sample taken. Coordinate the collection of the samples with the laboratory's hours of operation and allow adequate time for the test results.

D. All samples must show the absence of coliform organisms and all heterotrophic plate counts must be less than 500 colonie forming unit/ml.

3.07 REPETITION OF PROCEDURE

If the initial disinfection fails to produce required residuals and bacteriologic quality tests, conduct investigations into the cause of the contamination and correct the condition. Repeat the disinfection process and the testing until satisfactory results are obtained.

3.08 TEST FACILITY REMOVAL

After satisfactory disinfection, replace air valves, restore the pipe coating, and complete the pipeline where temporary distribution or test facilities were installed.

3.09 FINAL CONNECTIONS TO EXISTING WATERLINES

New waterlines and appurtenances shall be completely installed, disinfected, flushed, and satisfactory bacteriological sample results received prior to permanent connections being made to the active distribution system. Sanitary construction practices shall be followed during installation of the final connection, such that there is no contamination of the new or existing waterlines with foreign material or groundwater.

3.10 CUTTING INTO EXISTING WATERLINES

A. When connecting to existing waterlines, use extreme caution to minimize contamination of the interior passageways of the existing pipe, valves, and fittings. If the trench is wet, apply liberal quantities of hypochlorite to open trench areas to lessen the danger of pollution. Use tablets in this situation for slow and continuous release of hypochlorite as water is pumped from the excavation. Prior to the installation of new piping, swab or spray the interior surfaces of all pipe, valves, and fittings with a 1-percent hypochlorite solution.

B. Within 24 hours of making a connection to an existing waterline, a bacteriologic quality test shall be performed by a state certified laboratory. Collect a sample from the existing waterline at the nearest access point to the connection. The sample shall be collected, delivered, and tested as described in paragraph 3.06. If the sample fails the test, the District's Representative will direct the Contractor to perform corrective action and retest.

END OF SECTION

STANDARD SPECIFICATION
SECTION 15144 PRESSURE TESTING OF PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes pressure and leakage testing of pressure pipelines and appurtenances for transmission and distribution mains.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Disinfection of Piping: STD SPEC 15141.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit test bulkhead locations, pipe attachment details, methods to prevent excessive pipe wall stresses, blocking to overcome thrust conditions and design calculations.

C. Submit request for use of water from waterlines of District 48 hours in advance.

PART 2 - MATERIALS

2.01 TEST BULKHEADS

Design and fabricate test bulkheads per Section VIII of the 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 material at the bulkhead design pressure. Include air-release and water drainage connections.

2.02 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.

2.03 TEST FLUID AND TEMPORARY PIPING

Use only potable water for the hydrostatic pressure test. Provide a reduced pressure backflow prevention assembly if source of potable water is from District 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.

2.04 TEST EQUIPMENT

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

PART 3 - EXECUTION

3.01 TESTING PREPARATION

A. 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 for at least 7 days 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 direction of the District's Representative only.

B. Provide any temporary piping needed to carry the test fluid to the piping that is to be tested. After the test has been completed and demonstrated to comply with the specifications, disconnect and remove temporary piping. Do not remove exposed vent and drain valves at the high and low points in the tested piping; remove any temporary buried valves and cap the associated outlets. Plug taps or connections to the existing piping from which the test fluid was obtained.

C. Provide temporary drain lines needed to carry testing fluid away from the pipe being tested. Remove such temporary drain lines after completing the pressure testing.

3.02 CLEANING

Before conducting hydrostatic pressure tests, flush pipes with water to remove dirt and debris. Maintain a flushing velocity of at least 3 fps for water testing. Flush pipes for time period as given by the formula:

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

in which:

T = flushing time (seconds)

L = pipe length (feet).

3.03 TESTING AND DISINFECTION SEQUENCE

A. Perform required disinfection after pressure testing, except when pipeline being tested is connected to a potable water pipeline.

B. Locate and install test bulkheads, temporary valves and connections to existing pipelines, and other appurtenances in a manner to provide air gap separation between existing potable water pipelines and pipeline being tested. Disinfect water and pipeline being tested before pressure testing when connected to a potable water pipeline.

C. See Standard Specification Section 15141 for chlorination requirements.

3.04 LENGTH OF TEST SECTION

Test the pipeline in sections. In any one test, do not exceed more than 2,500 feet, the distance between closed valves, or as directed by the District's Representative.

3.05 INITIAL PIPELINE FILLING

Maximum rate of filling with test fluid shall not cause water velocity in pipeline to exceed one foot per second. Expel air from the pipeline while filling and prior to testing. Provide necessary outlets to fill and test pipeline. Allow 72 hours for the water filled pipeline to soak and release entrapped air prior to testing.

3.06 TESTING NEW PIPE WHICH CONNECTS TO EXISTING PIPE

Prior to hydrostatic pressure testing new pipelines which are to be connected to existing pipelines, isolate the new pipeline from the existing pipeline by means of test bulkheads, spectacle flanges, or blind flanges. After the new pipeline has been successfully pressure tested, see Standard Specification Section 15141 for instructions to continue with the disinfection and connection work.

3.07 PRESSURE AND DURATION OF TEST

A. Base pipeline test pressures on the test hydraulic gradient elevation (HGL) as shown on the Drawings. Test pressure shall be the difference between the test HGL elevation and the invert elevation of the pipeline at the low point in the test section multiplied by 0.433 (psi). If no test HGL is shown, subject the pipeline at the low point in the test section to a hydrostatic test pressure which is 50 psi in excess of the rated class pressure of the pipe.

B. Maintain the pipeline test pressure for the following duration and restore the test pressure whenever it drops 5 psi. Use a calibrated recorder during the test and provide a record of the test to the District.

Nominal Pipe Size (inches)	Duration of Test (hours)
18 and less	4
20 and greater	8

3.08 ALLOWABLE LEAKAGE

A. Apply the test pressure with a positive displacement pump. Provide a snubber or dampener between the pump and the pipeline to reduce instantaneous pressure pulses to 10-percent of the test pressure. Draw test fluid from containers in which the volume of water can be readily measured or through a positive displacement meter.

B. Leakage shall be considered as the total amount of water pumped into the pipeline during the test period. The allowable leakage for aboveground and buried piping having threaded, soldered, welded, flanged, push-on joint, mechanical joint, and rubber gasket joint shall be zero.

3.09 REPETITION OF TEST

If the actual leakage exceeds the allowable, locate and correct the faulty work and repeat the test until the leakage does not exceed the allowable. Restore the work and all damage resulting from the leak and its repair. All visible leakage shall be eliminated.

3.10 BULKHEAD AND TEST FACILITY REMOVAL

After a satisfactory pressure test and disinfection, drain the water; remove test bulkheads, temporary valves and piping, and other test facilities; connect to existing facilities; and restore the pipe coatings.

END OF SECTION

STANDARD SPECIFICATION
SECTION 15220 COPPER PIPE AND TUBE

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of copper pipe, tube, and fittings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Trenching, Backfilling, and Compacting: STD SPEC 02223.

D. General Piping Requirements: STD SPEC 15050.

E. Disinfection of Piping: STD SPEC 15141.

F. Pressure Testing of Piping: STD SPEC 15144.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit manufacturer's catalog data and descriptive literature for copper pipe, tube, fittings, miscellaneous piping materials, and solder. Show dimensions and materials of construction by specification reference and grade.

PART 2 - MATERIALS

2.01 COPPER WATER TUBE

Copper water tube shall conform to ASTM B 88. Tubing located above ground, in vaults and structures shall be Type K, drawn temper (hard). Buried tubing shall be Type K, annealed temper (soft), except 3-inch tube shall be Type K, drawn temper (hard).

2.02 PIPE AND NIPPLES

Pipe and short threaded nipples shall be brass conforming to ASTM B 43 or copper conforming to ASTM B 42, regular wall thickness, except that pipe and nipples of sizes 1-inch and smaller shall be extra strong. Threads shall conform to ASME B1.20.1, NPT.

2.03 SOLDER JOINT FITTINGS

A. Wrought copper solder joint seamless fittings shall be designed for use with copper water tube and conform to ASTM B 75 and ASME B16.22. Material shall be UNS C10200, C12000, or C12200.

B. Cast copper solder joint pressure fitting shall be designed for use with copper water tube and conform to ASME B16.18.

C. Use solder joint fittings for working pressures of 300 psi or less.

2.04 THREADED FITTINGS

Cast bronze threaded fittings shall be designed for use with brass or copper pipe and nipples and conform to ASME B16.15, Class 125 and 250. Use Class 125 fittings for working pressures of 200 psi or less. Use Class 250 fittings for working pressures greater than 200 psi, but less than 400 psi.

2.05 FLANGES AND FLANGED FITTINGS

Cast bronze pipe flanges and flanged fittings shall conform to ASME B16.24, Class 150 or Class 300. Use Class 150 flanged fittings for working pressures of 225 psi or less. Use Class 300 flanged fittings for working pressures greater than 225 psi; but less than 500 psi. Provide flat faced flanges. Use solder joint or threaded end companion flanges. Companion flanges with solder joint or threaded end shall be limited to the pressure rating of the pipe connection and not the flanged joint.

2.06 SOLDER

Solder shall be 95-5 (95-percent tin and 5-percent antimony) conforming to ASTM B 32, Alloy Grade Sb5 or silver solder conforming to AMS 4773C. Do not use lead or cored solder.

2.07 SOLDERING FLUX

Soldering flux shall comply with ASTM B 813.

2.08 BOLTS, NUTS AND GASKETS FOR FLANGES

See Standard Specification Section 15050.

PART 3 - EXECUTION

3.01 GENERAL

A. Install pipe and tube without springing, forcing, or stressing the pipe, tube, or any connecting valves.

B. Provide pipe hangers and supports for pipe and tube where installed above ground, in vaults and structures.

C. Use soldered joints and fittings with copper water tube in buried and exposed service.

D. Use threaded joints and fittings with brass or copper piping in buried and exposed service.

3.02 INSTALLATION

A. Tube cutters shall always be sharp. Do not take too deep a cut with each turn of the cutter or back and forth motion of a saw blade.

B. Cut tubing square and remove burrs. Use a sizing ring on the ends of soft copper tubing, and bring to true dimension and roundness. Clean the surfaces to be soldered with fine emery cloth, cleaning pads, or special wire brushes. Rub hard enough to remove the surface film of oil, grease, heavy oxide, and soil, but not hard enough to remove metal. Coat clean surfaces with a thin film of non-toxic and non-corrosive flux, assemble joint full depth, and remove excess flux before soldering.

C. Make soldered joints in accordance with ASTM B 828. Solder shall penetrate to the full depth of the cup in joints and fittings. Solderers shall comply with ASME B31.3, paragraph 333.

D. Bends in soft copper tubing shall be long sweep. Shape bends with shaping tools. Form bends without flattening, buckling, or thinning the tubing wall at any point.

E. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to male pipe threads before mating threaded joint. Joints shall be watertight.

F. Install flanged joints per the installation instructions in Standard Specification Section 15050.

3.03 INSTALLING BURIED TUBING

A. See Standard Specification Section 02223 for earthwork requirements.

B. Remove foreign matter and dirt from inside of tubing and keep clean during and after laying.

C. Handle tubing in a manner to avoid any damage to the tubing.

D. Grade the bottom of the trench to the line and grade to which the tubing is to be laid. Remove hard spots that would prevent a uniform thickness of pipe base material (imported sand). Before laying the tubing, check the grade and correct any irregularities found.

3.04 PRESSURE TESTING

Test copper pipe, tube, and fittings at the same time that the connecting pipelines are pressure tested. See Standard Specification Section 15144 for pressure testing requirements. Repair leaks in piping and retest.

3.05 DISINFECTION

See Standard Specification Section 15141 for chlorination requirements.

END OF SECTION

STANDARD SPECIFICATION
SECTION 15240 DUCTILE IRON PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of ductile iron pipe and fittings. Size range is 4- to 24-inch nominal pipe size.

1.02 PIPE IDENTIFICATION SYMBOLS

Interpret pipe identification symbols used on the Drawings as follows: DI-12"-350 or DI-12"-53 designates type of pipe (ductile iron); nominal pipe size (12 inches); and pipe wall thickness (pressure Class 350 or special thickness Class 53).

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Trenching, Backfilling, and Compacting: STD SPEC 02223.

D. General Concrete Construction: STD SPEC 03000.

E. Miscellaneous Metalwork: STD SPEC 05121.

F. Glass Linings and Coatings: STD SPEC 09870.

G. Painting and Coating: STD SPEC 09900.

H. Cold Applied Wax Tape Coating: STD SPEC 09952.

I. Polyethylene Sheet or Tube Encasement: STD SPEC 09954.

J. Corrosion Control for Buried Piping: STD SPEC 13110.

K. General Piping Requirements: STD SPEC 15050.

L. Miscellaneous Piping Specialties: STD SPEC 15080.

M. Flexible Pipe Couplings: STD SPEC 15122.

N. Disinfection of Piping: STD SPEC 15141.

O. Pressure Testing of Piping: STD SPEC 15144.

1.04 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Provide affidavit of compliance with standards referenced in this specification, e.g. AWWA C151. Submit copy of report of pressure tests for qualifying the designs of all sizes and types of AWWA C153 fittings that are being used in the project. The pressure test shall demonstrate that the minimum safety factor described in AWWA C153, Section 5.5, is met.

C. Submit manufacturer's data sheets on ductile iron pipe, joints, and fittings including dimensions, wall thickness, weight, coating, lining, and deflections at push-on and mechanical joints.

D. Submit tabulated layout schedule and drawing showing location and dimensions of pipe and fittings including:

1. Pipe station and top of pipe or centerline elevation at each change of grade and alignment.

2. Elements of curves and bends, both in horizontal and vertical alignment, including elements of the resultant true angular deflections in cases of combined curvature.

3. The limits of each reach of pipe pressure class or thickness class and of restrained joints.

4. The limits of each reach of concrete encasement or encasement in casing.

5. Locations and details of bulkheads for field hydrostatic testing of the pipeline.

6. Locations of closures for length adjustment and for construction convenience.

7. Locations of manholes and other points of access for placement of mortar lining at field joints and removal of test bulkheads.

8. Locations of valves and other mechanical equipment.

E. Submit calculations and test data proving that the proposed restrained joint arrangement can transmit the required forces with a minimum safety factor of 1.5.

F. Submit certificate that cement for mortar lining complies with ASTM C 150, designating type.

G. Submit test report on physical properties of rubber compound used in the gaskets.

H. Submit weld procedure specification, procedure qualification record, and welder's qualifications prior to any welding to ductile iron pipe.

I. Submit manufacturer's catalog data and descriptive literature on marking tape.

1.05 INSPECTION AND FIELD VERIFICATION

A. The District's Representative or his authorized representative may inspect materials, production, and testing of pipes, fittings, and special pieces at manufacturer's plant.

B. Where new pipelines are to be connected to existing waterlines of the District, the Contractor shall verify in the field the location, elevation, pipe material, pipe outside diameter, and any other characteristics of the existing waterline before proceeding with the installation. This field verification shall be performed in the presence of the District's Representative. Adjust and align the new piping as necessary to meet the field conditions and provide all required material, labor, and equipment to make the connection.

PART 2 - MATERIALS

2.01 DUCTILE IRON PIPE

Pipe shall be ductile iron conforming to AWWA C151. Provide pipe in nominal 18- or 20-foot laying lengths.

2.02 PIPE MARKING

Plainly mark each length of straight pipe to identify the design pressure class or thickness class, the wall thickness, and date of manufacture. Mark the spigot end of restrained joint pipe to show clearly the required depth of insertion into the bell.

2.03 PIPE WALL THICKNESS

A. Minimum wall thickness for pipe having push-on or mechanical joints, restrained joints, plain ends, or cast flange ends shall be Pressure Class 350, unless otherwise shown on the Drawings.

B. Minimum wall thickness for pipe having threaded flanges shall be Special Thickness Class 53 per AWWA C151.

C. Minimum wall thickness for pipe having grooved end joints shall be as shown in the following table unless otherwise noted on the Drawings:

Pipe and Fitting Size (inches)	Special Thickness Per AWWA C151
16 and Smaller	Class 53
18	Class 54
20	Class 55
24	Class 56

2.04 FITTINGS

A. Provide ductile iron push-on or mechanical joint fittings conforming to AWWA C110 with a rated working pressure of 350 psi.

B. In lieu of paragraph 2.04, A., provide ductile iron fittings conforming to AWWA C153 with a minimum rated working pressure of 350 psi. Provide fittings constructed of Grade 70-50-05 ductile iron having a minimum weight equal to the weight tabulated in AWWA C153. Use mechanical joint fittings or fittings with bells and gasket ends conforming to the dimensional values of AWWA C111. Mechanical joint glands shall be Grade 70-50-05 ductile iron and cast in one continuous ring. Fittings with repaired defects are not acceptable and will be rejected.

C. For mechanical joint fittings with glands, use tee-head or non-hex head bolts and head nuts for joint makeup and gasket seating. Bolts and nuts shall be carbon steel and coated with a corrosion inhibiting fluoropolymer composite material. Provide Tripac 2000 Blue Coating System, or District approved equal.

D. For grooved end fittings, use ductile iron fittings conforming to AWWA C110 or C153. Grooves or shouldered ends shall conform to AWWA C606.

E. Material for fittings with welded on bosses shall have a Charpy notch impact value of minimum 10 ft-lbs under the conditions defined in AWWA C151. Test completed welds by the liquid penetrant method per ASTM E 165.

2.05 FLANGES

A. Flanges on ductile iron fittings shall conform to AWWA C110 or ASME B16.42 Class 150 with a minimum rated working pressure of 250 psi.

B. For flanged fittings with working pressures greater than 250 psi, use ductile iron fittings conforming to ANSI B16.42 Class 300.

C. Threaded flanges shall be solid back, flat faced, Class 125 per AWWA C115.

D. Flanged pipe shall be either cast or threaded. Flanged pipe shall be shop fabricated, not field fabricated. Threaded flanges shall comply with AWWA C115. Flanges shall be individually fitted and machine tightened in the shop, then machined flat and perpendicular to the pipe barrel. Flanges shall be backfaced parallel to the face of flange. Prior to assembly of the flange onto the pipe, apply a thread compound to the threads to provide a leak-free connection. There shall be zero leakage through the threads at a hydrostatic test pressure of 250 psi without the use of the gasket.

E. Material for blind flanges shall be ductile iron.

2.06 LINING AND COATING FOR PIPE AND FITTINGS

A. Line interior of potable or recycled water pipe and fittings with cement mortar per AWWA C104. Provide double thickness lining and use cement conforming to ASTM C 150, Type II. Also, line interior of bells and pipe spigots in contact with water per Standard Specification Section 09900, System No. 5, and be holiday free. Apply linings in shop.

B. Line interior of sewer pipe and fittings with glass lining per Standard Specification Section 09870. Coat blind flanges the same. Glass lining and coating shall be holiday free.

C. Coat exterior of buried pipe and fittings with an asphalt material per AWWA C151. Apply coating in shop.

D. Coat blind flanges per Standard Specification Section 09900, System No. 5, and be holiday free. Apply coating in shop.

E. Coat the grooved and shouldered ends of pipe to be in contact with mechanical clamp-type couplings per Standard Specification Section 09900, System No. 5, and be holiday free. Apply coating in shop.

F. Coat the ends of plain end pipe where flexible pipe couplings are to be installed per Standard Specification Section 09900, System No. 5, and be holiday free. Apply coating in shop.

2.07 BOLTS, NUTS AND GASKETS FOR FLANGES

See Standard Specification Section 15050.

2.08 INSULATING FLANGE KITS

See Standard Specification Section 13110.

2.09 OUTLETS

A. For outlets 2 inches and smaller with working pressures 200 psi or less, drill the pipe and attach a service saddle to the pipe except for sewer applications. Provide service saddles with full width, cast bronze bodies conforming to ASTM B 62, O-ring gaskets, and iron pipe threads. Provide Type 304 stainless steel double band straps with four bolts or a single wide strap with four bolts. All stainless steel shall be fully passivated for enhanced corrosion resistance. Service saddles shall be Ford Style 202BS, Romac Industries Style 202BS, Smith-Blair Model 393, or District approved equal.

B. For outlets 2 inches and smaller with working pressures greater than 200 psi and all sewer applications, use a ductile iron tee with a flanged outlet. Install a ductile iron reducing flange with iron pipe threads and insulating bushing on the outlet.

C. For outlets 3 inches and larger, use a ductile iron tee with a flanged outlet.

2.10 MECHANICAL CLAMP-TYPE COUPLINGS AND ADAPTER FLANGES

A. Mechanical clamp-type couplings and flange adapters for grooved end pipe shall be ductile iron, ASTM A 536 Grade 65-45-12. Bolts shall conform to ASTM A 183, 110,000 psi tensile strength. Gaskets shall be EPDM (ethylene propylene diene monomer) for water and Buna-N for sewer and shall conform to ASTM D 2000.

B. Couplings for pipe, 24 inches and smaller, shall conform to AWWA C606 for flexible radius ductile iron pipe, except where rigid radius couplings are required to connect to fittings. Couplings shall be Victaulic Style 31 or District approved equal.

C. Grooved end flange adapters for piping having an operating pressure of 150 psi and less shall be Victaulic Style 341 or 342, or District approved equal. Flange dimensions shall conform to ASME B16.1 Class 125.

2.11 FLEXIBLE PIPE COUPLINGS

See Standard Specification Section 15122.

2.12 TYPE OF PIPE JOINTS

A. Joints in aboveground piping or piping located in vaults and structures shall be flanged, unless mechanical clamp-type couplings or adapter flanges are shown on the Drawings.

B. Joints in buried piping shall be of the restrained push-on, push-on, or mechanical joint type per AWWA C111 except where flanged joints are required to connect to valves, meters, and other equipment. Provide unrestrained buried joints except where restrained joints are specifically shown on the Drawings. Restrained push-on joints shall be American Cast Iron Pipe Company "Flex-Ring," "Lok-Ring," or "Lok-Fast," U.S. Pipe "TR Flex," or District approved equal. All weldments for restrained joints shall be tested by the liquid penetrant method per ASTM E 165. Push-on joints shall be American Cast Iron Pipe Company "Fastite," U.S. Pipe "Tyton," or District approved equal.

C. Provide plain end pipe where flexible pipe couplings are to be used.

2.13 MECHANICAL JOINT RESTRAINT SYSTEM

The restraining mechanism shall consist of a follower gland having a seal gasket and individually actuated wedges that increase their resistance to pullout as pressure or external forces increase. The system manufacturer shall provide all the components (follower ring, wedges, and gaskets) for the restraining device. The device shall be capable of full mechanical joint deflection during assembly and the flexibility of the joint shall be maintained after burial. The joint restraint ring and its wedging components shall be constructed of ductile iron conforming to ASTM A 536, Grade 60-42-10. The wedges shall be ductile iron, heat-treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with mechanical joint bells conforming to AWWA C111 and AWWA C153. The design shall use torque limiting twist-off nuts to provide actuation of the restraining wedges. The mechanical joint restraint shall be available in the size range of 4 through 24 inches. Minimum rated pressure shall be 350 psi for sizes 16 inches and smaller and 250 psi in sizes 18 inches and larger. Mechanical joint restraint shall be EBAA Iron, Inc. Megalug Series 1100, or District approved equal.

2.14 DUCTILE IRON PIPE WELDMENTS

A. All welding to ductile iron pipe, such as for bosses or joint restraint shall be done at the place of manufacture of the pipe. Perform welding by skilled welders who have experience in the method and materials to be used. Welders shall be qualified under the standard qualification procedures of the ASME Boiler and Pressure Vessel Code, Section IX, Welding Qualifications.

B. Welds shall be of uniform composition, neat, smooth, full strength, and ductile. Completely grind out porosity and cracks, trapped welding flux, and other defects in the welds in such a manner that will permit proper and complete repair by welding.

C. Completed welds shall be inspected at the place of manufacture by the liquid penetrant method. Conform to the requirements specified in ASTM E 165, Method A, Type I or Type II. The materials used shall be water washable and nonflammable.

2.15 POLYETHYLENE ENCASEMENT

See Standard Specification Section 09954.

2.16 WAX TAPE COATING

See Standard Specification Section 09952.

2.17 CORROSION CONTROL COMPONENTS

See Standard Specification Section 13110.

2.18 CEMENT MORTAR

Cement mortar for buttering and pointing the inside joints shall consist of one part cement to 1-1/2 parts sand by damp loose volume. The quantity of mixing water shall be no more than necessary for handling and placing. Cement shall conform to ASTM C 150, Type II. Sand shall conform to ASTM C 144 for masonry sand.

2.19 MARKING TAPE

Use detectable marking tape consisting of one layer of aluminum foil laminated between two colored layers of inert plastic film. The lamination bond should be strong enough that the layers can not be separated by hand. Tape shall be a minimum of 5 mils thick and 6 inches wide. Tape shall bear a continuous, printed message every 16 to 36 inches warning of the installation buried below. Tape shall be Terra Tape, Linetec, or District approved equal.

2.20 MARKER POSTS

Provide marker posts for buried pipelines at 500 feet on center except where pipeline is located in a paved street or as directed by the District's Representative. 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 inches by 4 inches, and surfaced on four sides.

PART 3 - EXECUTION

3.01 PRODUCT MARKING

Plainly mark each length of straight pipe to identify the ductile iron wall thickness and date of manufacturer. Mark the spigot end of restrained joint pipe to show clearly the required depth of insertion into the bell.

3.02 DELIVERY AND TEMPORARY STORAGE OF PIPE

A. Limit onsite pipe storage to a maximum of one week. Place the pipe alongside the trench in the order in which it is to be installed and secure it from rolling. Support the pipe on wooden blocks, sandbags, mounds of sand, or other suitable supports. Do not roll or drop the pipe on the ground or allow the pipe to fall from the pipe trailer trucks.

B. Avoid cracking of the cement mortar lining. If necessary, use plastic sheet bulkheads to close pipe ends and keep lining moist.

C. Do not install pipe or fittings with damaged linings. Patch damaged areas in the field with material similar to the original. Where damage can not be repaired in the field, replace the defective pipe or fittings.

3.03 HANDLING OF PIPE

Lift pipes with mechanical equipment using wide belt slings. Do not use cable slings or chains. Do not move pipe by inserting any devices or pieces of equipment into the pipe barrel.

3.04 SANITATION OF PIPE INTERIOR

A. During laying operations, do not place tools, clothing, or other materials in the pipe. Keep the interior of the pipe clean as the pipeline construction progresses. The purpose of maintaining a clean interior is to aid in the passage of the bacteriologic quality testing after disinfection for potable water pipelines.

B. When pipelaying is not in progress, including the noon hour, close the ends of the installed pipe with a plug to deter entry of vermin, children, dirt, storm water, or foreign material.

3.05 INSTALLING PIPE IN TRENCH

A. See Standard Specification Section 02223 for earthwork requirements.

B. Inspect each pipe and fitting before lowering into the trench. The District's Representative will inspect all pipe prior to installation for damage to the interior protective coatings. Patch damaged areas in the field with material similar to the original. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.

C. Handle pipe in a manner to avoid any damage to the pipe. Do not drag pipe over the ground, drop it onto the ground, or drop objects on it. Do not drop or dump pipe into trenches.

D. Laying tolerances for the installed pipe shall not vary greater than 0.3-foot horizontally, or greater than 0.1-foot vertically from the alignment and elevations shown on the Drawings.

E. Grade the bottom of the trench to the line and grade to which the pipe is to be laid. Remove hard spots that would prevent a uniform thickness of pipe base material (imported sand). Before laying each section of the pipe, check the grade and correct any irregularities found. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between bell holes, except that the grade may be disturbed for the removal of pipe handling slings.

F. At the location of each joint, dig bell holes in the bottom of the trench and at the sides to permit visual inspection of the entire joint and to prevent the pipe from being supported by the bell end or fitting.

G. Keep the trench in a dewatered condition during pipelaying. Removal of water shall be in conformance with Standard Specification Section 02223.

H. For pipes 24 inches in diameter, the amount of pipe to be laid and assembled in a trench shall be limited to a distance of approximately 320 feet. No additional pipe will be allowed to be installed in the trench until the other related operations of pipeline construction are completed. Other operations include, but are not limited to, bond wires, backfilling and compacting, completion of interior joints, and inspection of the interior by the District's Representative. The intent of this limitation is to provide a safe environment for the construction and inspection of the pipeline. The interior of the pipeline is considered a confined or enclosed space having a limited means of egress which is subject to the accumulation of toxic or flammable contaminants or has an oxygen deficient atmosphere.

3.06 INSTALLING POLYETHYLENE ENCASEMENT

Wrap buried pipe, fittings, and flanged joints with polyethylene material per Standard Specification Section 09954. Use only tube type for pipe. Complete the wrap prior to placing concrete anchors, collars, supports or thrust blocks per Standard Specification Section 02223. Repair polyethylene material damaged during construction.

3.07 ASSEMBLING PIPE JOINTS

A. The spigot and integral bell shall be dirt free and slide together without displacing the rubber ring gasket. Lay the pipe section with the integral bell facing the direction of laying. "

B. Clean the groove of the bell of all foreign materials. Insert the gasket into the groove of the bell prior to installation. Observe the correct direction of the shaped gasket. Feel that the gasket is completely and evenly seated in the groove.

C. Lubricate the exposed gasket surface and the beveled spigot up to the full insertion length with the lubricant supplied by the pipe manufacturer. If the lubricated pipe end touches dirt, clean the pipe end and reapply lubricant.

D. Insert the spigot into the bell and force it slowly into position.

E. Check that the rubber ring gasket has not left the groove during assembly by passing a feeler gage around the completed joint.

F. Assemble restrained joints per manufacturer's instructions.

3.08 INSTALLING BURIED FITTINGS

A. The District's Representative will inspect all fittings prior to installation for damage to the interior protective coatings. Coating shall be holiday free on interior surfaces. Patch damaged areas in the field with material similar to the original.

B. For mechanical joint fittings, clean the bell socket and the plain end of the pipe of all foreign material and dirt. Place the gland on the pipe spigot with the lip extension toward the plain end. Lubricate the pipe spigot and gasket. Use the same lubricant as supplied by the pipe manufacturer. Install the gasket on the pipe spigot with the narrow edge of the gasket toward the plain end. Insert the pipe into the bell socket and press the gasket firmly into the gasket recess. Keep the joint straight during assembly. Push the gland towards the socket and center it around the pipe with the gland lip against the gasket. Insert bolts and hand tighten nuts. Make joint deflection after assembly but before tightening nuts. Uniformly tighten bolts and nuts in a progressive diametrically opposite sequence, and torque nuts to 75- to 90-foot pounds with a calibrated torque wrench. Coat exposed surfaces of tee-head bolts and nuts after tightening with primer for wax tape coating per Standard Specification Section 09952.

C. For push-on joint fittings, clean the bell ends of the fitting of all foreign material and dirt. Insert the gasket in the groove of the bell and make sure the gasket faces the correct direction. Feel that the gasket is completely and evenly seated in the groove. When pipe is cut in the field, bevel the plain end prior to installation. Lubricate the exposed gasket surface and the beveled pipe spigot with the same lubricant supplied by the pipe manufacturer. Insert the spigot into the bell and force it slowly into position. Keep the joint straight while pushing. Make joint deflection after the joint is assembled.

3.09 JOINT DEFLECTIONS FOR BURIED PIPE

A. When necessary to deflect pipe from a straight line in either the horizontal or vertical plane, do not exceed the following joint deflection angles for unrestrained buried pipe or fittings. The angles shown are for each joint and are maximum deflections.

Nominal Pipe Size (inches)	Non-Restrained Mechanical Joint (degrees)	Push-On Joint (degrees)
4	6-1/2	4
6	5-1/2	4
8	4	4
10	4	4
12	4	4
14	3	2-1/2
16	3	2-1/2
18	2-1/2	2-1/2
20	2-1/2	2-1/2
24	2	2-1/2

B. For restrained joints, do not exceed 80% of the manufacturer's recommended maximum deflection.

3.10 INSTALLING PIPE IN VAULTS

A. Install pipe in vaults without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment. Provide temporary supports and place the assembled piping at the correct grade and position in the vault.

B. Provide pipe supports per Standard Specification Section 05121.

3.11 INSTALLING FLANGED JOINTS

See Standard Specification Section 15050 for installation instructions.

3.12 INSTALLING INSULATING FLANGE KITS

Install insulating flange kits with coatings per Standard Specification Section 13110.

3.13 INSTALLING SERVICE SADDLES

A. Place the service saddle on the pipe and hand tighten the nuts while positioning the saddle in its final location. Uniformly tighten the nuts in a progressive diametrically opposite sequence and torque with a calibrated torque wrench to the saddle manufacturer's recommended values.

B. Connect a corporation stop to the saddle per Standard Specification Section 15080. Apply Teflon joint compound or tape to the male threads before installing the corporation stop. Make joints watertight.

C. Mount a tapping machine on the corporation stop to cut a hole in the pipe with a shell type cutter made specifically for ductile iron pipe. Do not use other devices or hand equipment to bore through the pipe wall.

D. Wrap service saddle including body, straps, bolts, nuts, and adjacent surfaces of the pipe with polyethylene material per Standard Specification Section 09954

3.14 INSTALLING MECHANICAL CLAMP-TYPE COUPLINGS OR ADAPTER FLANGES

A. Install mechanical clamp type couplings and adapter flanges on grooved end pipe and fittings in accordance with the manufacturer's recommendations and the following.

B. Clean oil, grease, and dirt from the grooved end pipe and fittings. Repair any damage or holidays in the shop applied coating before installing coupling or adapter. Apply the coupling manufacturer's gasket lubricant to the gasket exterior including lips, pipe ends, and housing interiors.

C. Lubricate threads of bolts and nuts with oil or graphite prior to installation. Uniformly tighten bolts and nuts alternately and evenly until coupling segments are seated. Use torques as recommended by the coupling manufacturer.

3.15 INSTALLING FLEXIBLE PIPE COUPLINGS

Install flexible pipe couplings per Standard Specification Section 15122.

3.16 INSTALLING CORROSION CONTROL COMPONENTS

Install bond wires, anodes, and test stations per Standard Specification Section 13110.

3.17 POINTING INSIDE JOINT RECESSES FOR PIPES 24 INCHES IN DIAMETER

A. Backfill the trench before pointing the inside joint recesses with cement mortar. Joints shall be pointed immediately after backfilling and at no time shall the completion of the pointing be further than 320 feet behind pipe laying.

B. Working inside the pipe, remove foreign substances from joint recesses and pack with cement mortar. Finish the surface with a steel trowel to match adjoining pipe.

C. Remove excess mortar and other construction debris from the pipe interior. Sweep pipe clean of all foreign substances.

3.18 INSTALLING MARKING TAPE

After the pipe zone has been backfilled and compacted, place the marking tape on the compacted pipe zone material and center over the pipe. Run tape continuously along the trench and tie ends of tape together. Wrap marking tape around valve box extension pipes and continue along pipe.

3.19 SETTING MARKER POSTS

Locate marker posts on centerline of pipeline and space at 500 feet on center. Cut redwood post to a 5-foot length and chamfer the top. Paint post per Standard Specification Section 09900, System No. 60. Use white paint for the finish coats. For potable water, use blue paint for the top 4 inches of the chamfered end and stencil in 2-inch-high blue letters the word "WATER" on the post. For recycled water, use purple paint for the top 4 inches of the chamfered end and stencil in 2-inch-high purple letters the abbreviation "RW" on the post. For sewer, use green paint for the top 4 inches of the chamfered end and stencil in 2-inch-high green letters the word "SEWER" on the post. Excavate a hole 16 inches in diameter by 2 feet deep. Set the redwood post plumb, fill hole with concrete to 2 inches above finish grade, and crown to slope away from post. Concrete shall be Class C per Standard Specification Section 03000.

3.20 PAINTING AND COATING

A. Coat exterior surfaces of bare ductile iron pipe in vaults per Standard Specification Section 09900, System No. 10. Apply coats in the field.

B. Coat exterior surfaces of mechanical clamp-type couplings, adapter flanges, and flexible pipe couplings the same as the adjacent pipes.

3.21 PRESSURE TESTING

See Standard Specification Section 15144 for pressure testing requirements.

3.22 DISINFECTION

See Standard Specification Section 15141 for chlorination requirements.

END OF SECTION

PROVIDED AS A COURTESY BY: PACIFIC PIPELINE SUPPLY

STANDARD SPECIFICATION
SECTION 15251 INSTALLATION OF STEEL TRANSMISSION PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes the installation of cement mortar lined and di-electric coated and/or cement-mortar coated steel pipe including pipe bedding, pipeline closures, connections, encasement, marking tape, and marker posts.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Trenching, Backfilling, and Compacting: STD SPEC 02223.

D. General Concrete Construction: STD SPEC 03000.

E. Miscellaneous Metalwork: STD SPEC 05121.

F. Painting and Coating: STD SPEC 09900.

G. Polyethylene Sheet or Tube Encasement: STD SPEC 09954.

H. Polyethylene Tape Pipe Coating: STD SPEC 09957.

I. Corrosion Control for Buried Piping: STD SPEC 13110.

J. General Piping Requirements: STD SPEC 15050.

K. Steel Transmission Pipe: STD SPEC 15061.

L. Flexible Pipe Couplings: STD SPEC 15122.

M. Disinfection of Piping: STD SPEC 15141.

N. Pressure Testing of Piping: STD SPEC 15144.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit installation schedule.

C. Submit welder qualification certificates and records for each welder.

D. Submit certificates of welding rods used for field welding.

E. Submit manufacturer's catalog data and descriptive literature on marking tape.

PART 2 - MATERIALS

2.01 PIPE MATERIAL

See Standard Specification Section 15061.

2.02 BOLTS, NUTS AND GASKETS FOR FLANGES

See Standard Specification Section 15050.

2.03 POLYETHYLENE TAPE PIPE COATING

See Standard Specification Section 09957.

2.04 POLYETHYLENE ENCASEMENT

See Standard Specification Section 09954.

2.05 CORROSION CONTROL COMPONENTS

See Standard Specification Section 13110.

2.06 CEMENT MORTAR

A. Cement mortar for buttering, pointing, and grouting shall consist of one part cement to 1-1/2 parts sand by damp loose volume. The quantity of mixing water shall be no more than necessary for handling and placing. Cement shall conform to ASTM C 150, Type II. Sand for buttering and pointing the inside joints shall conform to ASTM C 144 for masonry sand. Sand for grouting the exterior joints shall conform to ASTM C 33 for fine aggregate or to ASTM C 35 for plaster sand.

B. Where time is of the essence or at the option of the Contractor, a rapid set cement may be used to point the inside joint or grout the exterior pipe joint and shorten the set up time before backfilling. Use a non gas-liberating type, chloride free, cement base, premixed product in 50-pound bags requiring only the addition of water for the required consistency. Grout shall be CTS Cement Manufacturing Company "Rapid Set Non-Shrink Multipurpose Grout" or District approved equal.

2.07 MARKING TAPE

Use detectable marking tape consisting of one layer of aluminum foil laminated between two colored layers of inert plastic film. The lamination bond should be strong enough that the layers can not be separated by hand. Tape shall be a minimum of 5 mils thick and 6 inches wide. Tape shall bear a continuous, printed message every 16 to 36 inches warning of the installation buried below. Tape shall be Terra Tape, Linetec, or District approved equal.

2.08 MARKER POSTS

Provide marker posts for buried pipelines at 500 feet on center except where pipeline is located in a paved street or as directed by the District's Representative. 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 inches by 4 inches, and surfaced on four sides. As an alternate to the redwood post, use 4-inch diameter, Schedule 80 PVC pipe, filled with cement grout, and painted white.

PART 3 - EXECUTION

3.01 DELIVERY AND TEMPORARY STORAGE OF PIPE

A. Limit onsite pipe storage to a maximum of one week. Place the pipe in the numerical order in which it is to be installed and secure it from rolling. Support the pipe on wooden blocks, sandbags, mounds of sand, or other suitable supports. Place the supports at about the one quarter point from the pipe ends. Do not roll or drop the pipe on the ground or allow the pipe to fall from the pipe trailer trucks.

B. Do not remove the plastic caps placed over the ends until the pipe is ready to be placed in the trench. Plastic caps may be opened temporarily to spray water inside the pipe for moisture control. Replace plastic caps damaged during shipment.

3.02 HANDLING OF PIPE

A. Lift pipes and specials with mechanical equipment using spreader beams or wide belt slings. Do not use cable slings or chains directly bearing on the pipe. Lift pipes at two points, at approximately 1/3 to 1/4 of the pipe length from the pipe ends.

B. For pipes 24 inches in diameter and larger, maintain internal braces placed in pipes until backfilling is completed. Where the pipe is to be concrete encased, do not remove internal braces until the concrete has set hard and the subsequent backfill has been completed.

C. Measure each pipe and special to check the laying length against the tabulated layout schedule for fabrication accuracy. Mark the required stab depth of the spigot end around the circumference of each pipe and special prior to joint assembly.

3.03 SANITATION OF PIPE INTERIOR

A. During laying operations, do not place tools, food, clothing, trash, or other materials in the pipe. Keep the interior of the pipe clean as the pipeline construction progresses. The purpose of maintaining a clean interior is to aid in the passage of the bacteriologic quality testing after disinfection.

B. When pipelaying is not in progress, including the noon hour, close the ends of the installed pipe with a plug to deter entry of vermin, children, dirt, and storm water.

3.04 INSTALLING PIPE IN TRENCH

A. See Standard Specification Section 02223 for earthwork requirements.

B. Lay pipes uphill if the grade exceeds 10 percent.

C. Place and compact the pipe base material (imported sand).

D. Cut a depression to accommodate the pipe bell, external joint filler form, and polyethylene encasement at valves and flanges; and, spaces to permit removal of the pipe handling slings.

E. Handle pipe and specials in a manner to avoid any damage to the pipe or coatings. Do not drop pipe or specials into trenches under any circumstances.

F. Lay each pipe and special in the order and position shown on the tabulated layout schedule. Lower the pipe onto the pipe base and install it to line and grade along its full length on firm bedding except at the bell and at the sling depressions. Laying tolerances for the installed pipe shall not vary greater than 0.3-foot horizontally, or greater than 0.1-foot vertically from the alignment and elevations shown on the tabulated layout schedule.

G. When installing pipe with beveled joints or mitered bends at the bell end, do not deviate the pipe top mark by more than 2 inches from the vertical line passing through the pipe center.

H. Do not cut or modify a fabricated steel special in the field. Notify the District's Representative immediately in the event of interferences with the installation of adjoining components.

I. For pipes smaller than 24 inches in diameter, the District will require that the Contractor provide video camera inspection with tape recording of the completed interior mortar joints in the installed pipe at an interval of approximately 960 feet or less. This inspection will be reviewed by the District's Representative. No additional pipe will be allowed to be installed in the trench until the interior joints have been inspected and repaired. An interior joint will be considered a failed joint when cement mortar does not fill the gap 100 percent between the adjacent mortar linings of the two joined pipes. All failed joints will be repaired by cutting out the joint and installing a butt strap closure. The inspection equipment shall be capable of providing distance readings; high quality visual transmission to the monitor; tape recording; brightness, contrast, and focus adjustments; 360-degree camera head rotation within a 90-degree plane from the longitudinal centerline of the pipe; and remote operation.

J. For pipes 24 inches in diameter and larger, the amount of pipe to be laid and assembled in a trench shall be limited to a distance of approximately 320 feet. No additional pipe will be allowed to be installed in the trench until the other related operations of pipeline construction are completed. Other operations include, but are not limited to, joint welding or bond wires, grouting of exterior pipe joints, backfilling and compacting, removal of internal braces, completion of interior joints, and inspection by the District’s Representative. The intent of this limitation is to provide a safe environment for the construction and inspection of the pipeline. The interior of the pipeline is considered a confined or enclosed space having a limited means of egress which is subject to the accumulation of toxic or flammable contaminants or has an oxygen deficient atmosphere.

3.05 INSTALLING POLYETHYLENE ENCASEMENT

Wrap buried valve and flanges with polyethylene material per Standard Specification Section 09954. Repair polyethylene material damaged during construction.

3.06 ASSEMBLING PIPE JOINTS

A. Clean the ends of the pipe to be joined of foreign material.

B. For rubber gasket joints, apply a nontoxic water soluble vegetable soap solution to the inside of the bell of the pipe in the trench and to the rubber gasket and spigot groove of the pipe to be installed. Stretch the rubber gasket into the groove of the spigot end of the pipe to be inserted and distribute it uniformly around the circumference. Immediately lower the pipe to be installed into the trench and, without tilting the pipe, enter its spigot into the bell of the pipe in the trench. Use come-a-longs or pipe jacks to drive spigot end home horizontally. Maintain joint recess recommended by pipe manufacturer for made-up joint.

C. For field welded joints and pipes smaller than 24 inches in diameter, lower the pipe to be installed into the trench. Slightly tilt up the pipe to be installed and enter its spigot into the top portion of the bell of the pipe in the trench. Continue to lower the pipe to be installed and push the spigot end into the bell horizontally to the marked stab depth on the spigot. Maintain a minimum 1/4-inch joint space, or as recommended by the pipe manufacturer.

D. For field welded joints and pipes 24 inches in diameter and larger, lower the pipe to be installed into the trench. Slightly tilt up the pipe to be installed and enter its bell onto the top portion of the spigot of the pipe in the trench. Continue to lower the pipe to be installed and push the bell onto the spigot horizontally to the marked stab depth on the spigot. Maintain a minimum 1/4-inch joint space for welded joints or as recommended by the pipe manufacturer.

E. Where deflections at joints are required to maintain horizontal and vertical alignment, the joint can be pulled up to the maximum limits as specified per Standard Specification Section 15061. Do not exceed the deflection limits indicated.

3.07 INSTALLING PIPE IN VAULTS

A. Install pipe in vaults without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment. Provide temporary supports and place the assembled piping at the correct grade and position in the vault.

B. Provide pipe supports per Standard Specification Section 05121.

3.08 INSTALLING FLANGED JOINTS

See Standard Specification Section 15050 for installation instructions.

3.09 INSTALLING INSULATING FLANGE KITS

Install insulating flange kits with coatings per Standard Specification Section 13110.

3.10 INSTALLING MECHANICAL CLAMP-TYPE COUPLINGS

A. Install mechanical clamp-type couplings in accordance with the manufacturer's recommendations and the following.

B. Clean oil, grease, and dirt from the grooved and shouldered ends of pipe. Repair any damage or holidays in the shop applied coating before installing couplings. Apply the coupling manufacturer's gasket lubricant to the gasket exterior including lips, pipe ends, and housing interiors.

C. Lubricate threads of bolts and nuts with oil or graphite prior to installation. Uniformly tighten bolts and nuts alternately and evenly until coupling segments are seated. Apply torque to nuts with a calibrated torque wrench as recommended by the coupling manufacturer.

3.11 INSTALLING FLEXIBLE PIPE COUPLINGS

Install flexible pipe couplings and joint harnesses where shown per Standard Specification Section 15122.

3.12 FIELD WELDED JOINTS

A. Field welding shall be completed and inspected prior to the application of cement mortar to the interior joint and cement grout to the exterior joint.

B. Provide single or double welded lap joints and butt strap closures where indicated on the Drawings. The minimum overlap of the assembled lap joint shall be 1-inch or 3 times the pipe wall thickness, whichever is greater per AWWA C206.

C. Field welding shall be in accordance with AWWA C206. Welder's qualifications shall be in accordance with AWWA C206 Section 4.4. Any welder performing work shall have been qualified for the process involved within the past three years. Welders shall present a copy of their certification to the District's Representative prior to performing any field welding.

D. If joint faying surfaces are rusted or pitted where weld metal is to be deposited, clean them by wire brushing or abrasive blast cleaning.

E. Provide a 2-inch minimum overlap for the butt strap on each of the adjoining pipe ends. Butt weld the longitudinal seams of the butt strap before completing the circumferential fillet welds. The longitudinal seams of the butt strap shall be offset from the pipe seams by a minimum of 3 inches. Do not install butt straps with angular deflections.

F. To apply a fillet weld to the exterior joint of lap welded pipe or butt strap closures, deposit weld material in successive layers. Minimum size of fillet weld shall be equal to the steel cylinder thickness. Complete each pass around the entire circumference of the pipe before commencing the next pass. Use electrodes recommended by the pipe fabricator. Do not deposit more than 1/8-inch of throat thickness per pass. The minimum number of passes or beads in the completed weld shall be as follows:

Steel Cylinder Thickness (inches)	Fillet Weld Minimum Number of Passes
0.2500 and Less	2
Greater than 0.2500	3

G. Clean each layer of deposited weld metal prior to depositing the next layer of weld metal, including the final pass, by a power-driven wire brush.

H. In lieu of exterior welded joints, the interior may be welded where the pipe diameter is greater than 24 inches. Backfill to one foot over the top of pipe except at the joints. Complete the interior weld prior to filling the outside joint recess with cement mortar.

3.13 PIPELINE CLOSURE ASSEMBLIES

A. Use pipeline closure assemblies (butt straps) to unite sections of pipeline laid from opposite directions and to adjust the field length of the pipeline to meet structures, other pipelines, and points established by design stations.

B. Center the shaped steel butt straps over the ends of the pipe sections they are to join and provide a minimum of 2 inches of overlap on the pipe ends. Weld the butt straps to the outside of the pipes with complete circumferential fillet welds equal in size to the thinnest part being joined and on the inside where indicated. Butt weld the longitudinal seams of the butt strap before completing the circumferential fillet welds.

1. Where butt straps are to be installed with no interior access available, perform welding from the outside of the pipe only. Prepare the longitudinal seams of the butt strap for a full penetration butt weld. Use an interior backing plate in the gap for the full width of the joint. Provide carbon steel plates equal to the thickness of the pipe wall by 1-inch wide by the width of the joint. Fillet weld the backing plates to each interior side of the bottom half of the butt strap. Each backing plate shall project 1/2-inch above the longitudinal seam of the bottom half of the butt strap. Once the butt welds of the longitudinal seams are complete, then the circumferential fillet welds at each end of the butt strap can be completed.

2. Where butt straps are to be installed with interior access available, perform welding from both the inside and outside of the pipe. Prepare the outside longitudinal seams of the butt strap for a full penetration butt weld. Use an interior backing plate in the gap for the full width of the joint minus 1-inch. Provide carbon steel plates equal to the thickness of the pipe wall by 1-inch wide by the width of the joint minus 1-inch. Fillet weld the backing plates to each interior side of the bottom half of the butt strap. Each backing plate shall project 1/2-inch above the longitudinal seam of the bottom half of the butt strap and be centered in the longitudinal length of the butt strap. Once the butt welds of the outside longitudinal seams are complete, then the outside circumferential fillet welds at each end of the butt strap can be completed. When the outside welds are complete, fillet weld around the inside backing plate and then complete the inside circumferential fillet welds at each end of the butt strap.

C. Cement mortar line the interior of closure assemblies to a mortar thickness equal to the adjoining pipe sections. Clean the inside steel surfaces by wire brushing or power brushing. Apply a cement and water wash coat prior to applying the cement mortar. Pack the cement mortar into the recess of the joint and steel trowel finish to match the adjoining pipes.

D. Apply a cement and water wash coat to the inside face of the closure plug and once dry apply cement mortar to the inside face. Thread plug into coupling once cement mortar is dry and seal weld.

E. Where the pipe is di-electric coated, install field applied polyethylene tape pipe coating with cement mortar overcoat to the exterior surfaces of the closure assemblies. As an alternative to finishing the field joint coating, install field applied heat-shrinkable pipe joint sleeves with cement mortar overcoat to the closure assemblies. Install field joint coating per Standard Specification Section 09957.

F. Cement mortar coat the exterior of closure assemblies. Clean the outside steel surfaces of the butt strap and adjoining pipes by wire brushing or power brushing. Apply a cement and water wash coat to the steel surfaces and allow to dry. Wrap welded wire fabric reinforcement or expanded metal lath around the exposed steel and secure in place. Crimp the metal wires of the fabric or the metal lath at 4-inch spacing around the pipe to support the fabric or lath 3/8-inch from the exposed steel surface. Trowel cement mortar over the exposed steel surfaces in a two coat application. Apply the scratch coat and four hours later the finish coat. The finish coat may be applied sooner if the scratch coat is hard and self supporting. The cement mortar coating shall be equal in thickness to the adjacent coatings and have no voids, cracks, or blisters. Keep the coating moist by sprinkling or spraying with water to retard drying while curing.

3.14 CONNECTION TO EXISTING WATERLINES

Where new pipelines are to be connected to existing steel waterlines of the District, the Contractor shall verify in the field the location, elevation, pipe material, pipe outside diameter, and any other characteristics of the existing waterline before proceeding with the installation. Where rod wrapped concrete cylinder pipe exists, weld the reinforcing rod wrap to the cylinder wall of the pipe for a sufficient distance to anchor the rod wrap from movement at the point of connection. Do not cut or damage the rod wrap under any circumstances and do not cut the concrete cylinder pipe until the rod wrap has been anchored. This field verification shall be performed in the presence of the District's Representative.

3.15 INSTALLING CORROSION CONTROL COMPONENTS

Install bond wires, anodes, and test stations per Standard Specification Section 13110.

3.16 COMPLETING INTERIOR MORTAR JOINTS FOR PIPES SMALLER THAN 24 INCHES IN DIAMETER

A. Insert a tight-fitting swab or squeegee in the bell end of the pipe in the trench.

B. When ready to insert the spigot, coat the face of the cement mortar lining at the bell with a sufficient amount of stiff cement mortar to fill the space between adjacent mortar linings of the two pipes to be joined.

C. Immediately after joining the pipes, draw the swab or squeegee through the pipe to remove all excess mortar and expel it from the open pipe end.

D. Do not move the pipe after the swab has been pulled past the joint.

E. For pipes that have field welded joints, tack weld the joint after the swab has been pulled. Allow the mortar to harden before completing the field welded joint. Welding on pipes with fresh mortar joints will evaporate the moisture in the mortar and result in failure of the joint.

3.17 COMPLETING INTERIOR MORTAR JOINTS FOR PIPES 24 INCHES IN DIAMETER AND GREATER

A. Backfill the trench before applying interior lining at joints. Joints shall be lined immediately after backfilling and at no time shall the completion of the lining be further than 320 feet behind pipe laying.

B. Do not remove the internal braces until backfilling has been completed or until the concrete encasement and subsequent backfill are completed.

C. Working inside the pipe, remove foreign substances which adhere to the steel joint rings, clean them, and pack cement mortar into each joint. Finish the surface with a steel trowel to match the adjoining pipes.

D. Remove by sweeping excess mortar and other construction debris from the pipe interior as the pipeline construction progresses.

3.18 COMPLETING EXTERIOR PIPE JOINTS WHERE DI-ELECTRIC COATED

Install field applied polyethylene tape pipe coating with cement-mortar overcoat. As an alternative to finishing the field joint coating, install field applied heat-shrinkable pipe joint sleeves with cement mortar overcoat to the closure assemblies. Install field joint coating per Standard Specification Section 09957.

3.19 COMPLETING EXTERIOR PIPE JOINTS WHERE CEMENT-MORTAR COATED

A. Fill exterior joint recess with cement grout using a fabric form placed around the joint and secured with steel straps. At the option of the Contractor, a rapid set cement grout may be used to shorten the set up time before backfilling.

B. Pour and rod the grout from one side only until it is visible on the opposite side.

C. In approximately one hour, top off the joint with additional grout and shade with backfill material.

3.20 TRENCH BACKFILL

A. Provide sufficient space along each side of the pipe and trench wall to observe that the pipe zone material (imported sand) fills all spaces below pipe spring line.

B. Start the backfilling operations specified in Standard Specification Section 02223 after completing the exterior pipe joints and the cement grout is hard enough to be self-supporting.

C. No exterior pipe joint shall be backfilled until it has been inspected by the District's Representative.

3.21 PROTECTION OF MORTAR LINING

Until the pipeline is filled with water, install bulkheads and apply moisture inside the bulkheaded portions in a manner that will effectively prevent the drying out of the mortar lining.

3.22 INSTALLING MARKING TAPE

After the pipe zone has been backfilled and compacted, place the marking tape on the compacted pipe zone material and center over the pipe. Run tape continuously along the trench and tie ends of tape together. Wrap marking tape around valve box extension pipes and continue along pipe.

3.23 SETTING MARKER POSTS

Locate marker posts on centerline of buried pipeline and space at 500 feet on center. Cut redwood post to a 5-foot length and chamfer the top. Paint post per Standard Specification Section 09900, System No. 60. Use white paint for the finish coats. For potable water, use blue paint for the top 4 inches of the chamfered end and stencil in 2-inch-high blue letters the work “WATER” on the post. For recycled water, use purple paint for the top 4 inches of the chamfered end and stencil in 2-inch-high purple letters the abbreviation "RW" on the post. Excavate a hole 16 inches in diameter by 2 feet deep. Set the redwood post plumb, fill hole with concrete to 2 inches above finish grade, and crown to slope away from post. Concrete shall be Class C per Standard Specification Section 03000.

3.24 PAINTING AND COATING

A. Coat exterior surfaces of bare steel pipe in vaults per Standard Specification Section 09900, System No. 10. Apply finish coats in the field.

B. Coat exterior surfaces of mechanical clamp-type couplings and flexible pipe couplings the same as the adjacent pipes.

C. Do not paint or coat exposed insulating flange kits in vaults. Kits shall be electrically non-conductive and any paint on the washers and nuts will prevent the proper function of the kit.

3.25 PRESSURE TESTING

See Standard Specification Section 15144 for pressure testing requirements.

3.26 DISINFECTION

See Standard Specification Section 15141 for chlorination requirements.

END OF SECTION

STANDARD SPECIFICATION
SECTION 15253 STEEL PIPE FOR MINOR APPLICATIONS

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, fabrication, installation, and testing of steel pipe used inside and outside of pressure reducing stations, meter stations, and for other miscellaneous buried appurtenances. The steel pipe shall be cement mortar lined and either di-electric coated, cement mortar coated, or shop prime coated. This section describes steel pipe not specified in Standard Specification Section 15061. Size range is 4- to 12-inch nominal pipe size.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Miscellaneous Metalwork: STD SPEC 05121.

D. Painting and Coating: STD SPEC 09900.

E. Polyethylene Sheet or Tube Encasement: STD SPEC 09954.

F. Polyethylene Tape Pipe Coating: STD SPEC 09957.

G. Corrosion Control for Buried Piping: STD SPEC 13110.

H. General Piping Requirements: STD SPEC 15050.

I. Steel Transmission Pipe: STD SPEC15061.

J. Flexible Pipe Couplings: STD SPEC 15122.

K. Disinfection of Piping: STD SPEC 15141.

L. Pressure Testing of Piping: STD SPEC 15144.

M. Installation of Steel Transmission Pipe: STD SPEC 15251.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit piping layout drawings showing location and dimensions of all pipe and fittings. Include laying lengths of valves and other equipment determining piping dimensions. Label or number each fitting or piece of pipe and provide the following information for each item:

1. Material of construction, with ASTM or API reference and grade.

2. Wall thickness of steel pipe and fittings.

3. Details of lining and coating.

4. Manufacturer's certificates of compliance with referenced pipe standards, e.g., ASTM A 53, ASTM A 135, API 5L.

5. Call out weld sizes and dimensions of grooved ends, flanges, fittings, joint harnesses, annular thrust ring plates, and butt strap closures.

C. Shop drawings of all pipe and fittings shall be submitted to the District's Representative for review. The Contractor and Engineer of Work shall both review and mark the review action taken, before submitting to District. Shop drawings shall be complete in all respects. If the shop drawings show any deviations from the requirements of the Drawings and Standard Specifications because of standard shop practices or other reasons, the deviations and the reasons therefore shall be set forth in the Shop Drawing Submittal Form included in Standard Specification Section 01300.

1.04 INSPECTION AND FIELD VERIFICATION

A. The District’s Representative or his authorized representative may inspect materials, fabrication, and testing at the manufacturer’s plant.

B. Where new pipelines are to be connected to existing waterlines of the District, the Contractor shall verify in the field the location, elevation, pipe material, pipe outside diameter, and any other characteristics of the existing waterline before proceeding with the pipe fabrication or installation. This field verification shall be performed in the presence of the District’s Representative. Adjust and align the new piping as necessary to meet the field conditions and provide all required material, labor, and equipment to make the connection.

PART 2 - MATERIALS

2.01 STEEL PIPE

Pipe shall be black carbon steel conforming to ASTM A 53, Type E or S, Grade B; API 5L, Grade B; or ASTM A 135, Grade B. Pipes shall be standard weight per ASME B36.10.

2.02 STEEL FITTINGS

A. Steel fittings are defined as a special piece of pipe other than a normal straight section. Elbows, crosses, tees, and reducers are fittings.

B. Fittings shall be butt-welded conforming to ASME B16.9. Material shall be wrought steel conforming to ASTM A 234, Grade WPB. Wall thickness shall be the same as the pipe.

2.03 CEMENT FOR INTERIOR MORTAR LINING

Use cement conforming to ASTM C 150, Type II. Minimum cement mortar lining thickness for steel pipe and fittings shall be 5/16 inches.

2.04 CEMENT FOR EXTERIOR MORTAR COATING

Use cement conforming to ASTM C 150, Type II. Minimum cement mortar coating thickness for buried steel pipe and fittings shall be 1-1/4 inches. Coating within one bolt length of a flange shall be held to a thinner application to allow for assemble of all bolts.

2.05 POLYETHYLENE TAPE PIPE COATING (DI-ELECTRIC COATED)

See Standard Specification Section 09957.

2.06 FLANGES

A. Provide flanges that match the flange of the connecting valve or other equipment.

B. Provide welding neck flanges for attachment to wrought steel fittings. Provide welding neck or slip on flanges for attachment to pipe. Slip on flanges shall be double welded. Flange material shall conform to ASTM A 105, A 181, or A 182. Flanges shall be flat faced.

C. Class 150 flanges shall comply with AWWA C207, Class E or ASME B16.5, Class 150.

D. Class 300 flanges shall comply with AWWA C207, Class F or ASME B16.5, Class 300.

2.07 BOLTS, NUTS AND GASKETS FOR FLANGES

See Standard Specification Section 15050.

2.08 INSULATING FLANGE KITS

See Standard Specification Section 13110.

2.09 OUTLETS

A. For threaded outlets 3 inches and smaller, use a thredolet type per AWWA Manual M11 (Current Edition), Chapter 13. Outlets shall be 3000 pound WOG forged steel per ASTM A 105 or ASTM A 216, Grade WCB. Threads shall comply with ASME B1.20.1, NPT. Outlets shall be Bonney Forge Co. "Thredolet", Allied Piping Products Co. "Branchlet", or District approved equal. Do not use pipe couplings for outlets.

B. For flanged outlets 4 inches and larger, use a tee with a welding neck flange.

2.10 MECHANICAL CLAMP-TYPE COUPLINGS

Mechanical clamp-type couplings for grooved end pipe shall be ductile iron, ASTM A 536, Grade 65-45-12. Bolts shall conform to ASTM A 183, 110,000 psi tensile strength. Gaskets shall be EPDM (ethylene propylene diene monomer) conforming to ASTM D 2000. Couplings shall conform to AWWA C606 for flexible, square cut grooved joints in IPS steel pipe. Couplings shall be Victaulic Style 77, or District approved equal.

2.11 TYPE OF PIPE JOINTS

A. Joints in vaults shall be flanged to connect to valves and other equipment.

B. Joints between pipe, fittings, and welding neck flanges shall be full penetration butt weld. Joints between pipe and slip on flange shall be fillet welds to the interior and exterior.

C. Provide grooved end pipe where mechanical clamp-type couplings are to be used. Grooved end joint shall be flexible, square cut per AWWA C606, Table 2.

D. Provide plain end pipe where flexible pipe couplings are to be used. Couplings and harnesses shall conform to Standard Specification Section 15122.

E. Provide butt strap closures to connect sections of pipe laid from opposite directions and to adjust the field lengths to meet the conditions of the installation. Butt straps shall be the same thickness and material as the pipe wall, at least 10 inches wide, rolled to fit the outside cylinder diameter in two half sections, and shall be centered over the plain ends of the pipe sections they are to join. Weld a 5-inch threaded, steel, standard half coupling to the interior and exterior of the top butt strap half section to provide access for mortar lining the inside of the joint. Provide a threaded steel plug for the coupling.

2.12 PAINTING AND COATING APPLIED IN SHOP

A. Wrap exterior surfaces of buried pipe with polyethylene tape pipe coating and apply cement mortar overcoat where shown on the Drawings as di-electric coated per Standard Specification Section 09957. Apply coating in shop.

B. Cement mortar coat buried pipe where shown on the Drawings. Apply coating in shop.

C. Coat the exterior bare surfaces of the pipe per Standard Specification Section 09900, System No. 15 (primer coat only). Apply primer in shop to a 2-mil dry film thickness.

D. Coat inside surfaces of threaded outlets and blind flanges per Standard Specification Section 09900, System No. 5. Apply coating in shop.

E. Coat the grooved ends of pipe to be in contact with mechanical clamp-type couplings per Standard Specification Section 09900, System No. 5. Apply coating in shop.

F. Coat the ends of plain end pipe where flexible pipe couplings are to be installed per Standard Specification Section 09900, System No. 5. Apply coating in shop.

2.13 POLYETHYLENE ENCASEMENT

See Standard Specification Section 09954.

2.14 CORROSION CONTROL COMPONENTS

See Standard Specification Section 13110.

2.15 MARKING TAPE

Use detectable marking tape consisting of one layer of aluminum foil laminated between two colored layers of inert plastic film. The lamination bond should be strong enough that the layers can not be separated by hand. Tape shall be a minimum of 5 mils thick and 6 inches wide. Tape shall bear a continuous, printed message every 16 to 36 inches warning of the installation buried below. Tape shall be Terra Tape, Linetec, or District approved equal.

PART 3 - EXECUTION

3.01 FABRICATION, ASSEMBLY, AND ERECTION

A. Beveled ends for butt welding shall conform to ASME B16.25. Remove slag by chipping or grinding. Surfaces shall be clean of paint, oil, rust, scale, slag, and other material detrimental to welding. When welding the reverse side, chip out slag before welding.

B. Fabrication shall comply with ASME B31.3, Chapter V. Welding procedure and performance qualifications shall be in accordance with Section IX, Articles II and III, respectively, of the ASME Boiler and Pressure Vessel Code.

C. Apply full penetration weld to exterior joint of butt welded pipe, fittings, and welding neck flanges. Apply fillet welds to the interior and exterior circumference of the pipe and slip on flanges. Minimum size of fillet weld shall be equal to the steel cylinder thickness. Complete each pass around the entire circumference of the pipe before commencing the next pass. Use electrodes recommended by the pipe fabricator. Do not deposit more than 1/8-inch of throat thickness per pass. The minimum number of passes or beads in the completed weld shall be as follows:

Steel Cylinder Thickness (inch)	Minimum Number of Passes for Welded Joints
0.2500 and Less	2
Greater than 0.2500	3

D. Use the shielded metal arc welding (SMAW) process for welding.

E. Welding preparation shall comply with ASME B31.3, paragraph 328.4. Limitations on imperfections in welds shall conform to the requirements in ASME B31.3, Table 341.3.2, and paragraph 341.4 for visual examination.

F. Identify welds in accordance with ASME B31.3, paragraph 328.5.

G. Clean each layer of deposited weld metal prior to depositing the next layer of weld metal, including the final pass, by a power-driven wire brush.

H. Welding electrodes shall comply with AWS A5.1.

I. After shop fabrication and prior to shop applied linings and coatings, test each welded joint by the liquid penetrant method. Conform to the requirements specified in ASTM E 165. The materials used shall be either water washable or nonflammable. Products “Spotcheck” by the Magnaflux Corporation or “Met-L-Check Flaw-Findr” by the Met-L-Check Company. Chip out all defects, reweld, and retest the section affected until it shows no leaks or other defects.

3.02 DELIVERY AND TEMPORARY STORAGE OF PIPE

Lift pipe with wide belt slings. Do not use cable slings or chains. Support the pipe on wooden blocks and secure it from rolling. Do not roll or drop the pipe on the ground or allow the pipe to fall from the delivery trucks. Do not remove the plastic caps placed over the ends until the pipe is ready to be placed in the trench or installed in the vault.

3.03 INSTALLING BURIED PIPE

See Standard Specification Section 15251 for installation requirements of buried steel pipe. Install the pipe with butt straps, metallic bond wires, marking tape, and other appurtenant items for the installation. Wrap buried valves and flanges with polyethylene material per Standard Specification Section 09954. Repair polyethylene material damaged during construction.

3.04 INSTALLING PIPE IN VAULTS

A. Install pipe in vaults without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment. Provide temporary supports and place the assembled piping at the correct grade and position in the vault.

B. Provide pipe supports per Standard Specification Section 05121.

3.05 INSTALLING FLANGED JOINTS

See Standard Specification Section 15050 for installation instructions.

3.06 INSTALLING INSULATING FLANGE KITS

Install insulating flange kits with coatings per Standard Specification Section 13110.

3.07 INSTALLING MECHANICAL CLAMP-TYPE COUPLINGS

A. Install mechanical clamp-type couplings in accordance with the manufacturer's recommendations and the following.

B. Clean oil, grease, and dirt from the grooved ends of pipe. Repair any damage or holidays in the shop applied coating before installing couplings. Apply the coupling manufacturer's gasket lubricant to the gasket exterior including lips, pipe ends, and housing interiors.

C. Lubricate threads of bolts and nuts with oil or graphite prior to installation. Uniformly tighten bolts and nuts alternately and evenly until coupling segments are seated. Apply torque to nuts with a calibrated torque wrench as recommended by the coupling manufacturer.

3.08 INSTALLING FLEXIBLE PIPE COUPLINGS

Install flexible pipe couplings and joint harnesses where shown per Standard Specification Section 15122.

3.09 INSTALLING CORROSION CONTROL COMPONENTS

Install bond wires, anodes, and test stations per Standard Specification Section 13110.

3.10 PAINTING AND COATING

A. Coat exterior surfaces of bare steel pipe in vaults per Standard Specification Section 09900, System No. 10. Apply finish coats in the field.

B. Coat exterior surfaces of mechanical clamp-type couplings, flexible pipe couplings, and joint harnesses the same as the adjacent pipes.

3.11 PRESSURE TESTING

See Standard Specification Section 15144 for pressure testing requirements. Test pipe for minor applications at the same time that the primary pipelines are tested.

3.12 DISINFECTION

See Standard Specification Section 15141 for chlorination requirements.

END OF SECTION

STANDARD SPECIFICATION
SECTION 15257 STEEL PIPE, FUSION-BONDED EPOXY LINED AND COATED

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, fabrication, installation, and testing of fusion-bonded epoxy lined and coated steel pipe used inside and outside of pressure reducing stations and meter stations. Size range is 4- to 12-inch nominal pipe size.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Miscellaneous Metalwork: STD SPEC 05121.

D. Painting and Coating: STD SPEC 09900.

E. Polyethylene Sheet or Tube Encasement: STD SPEC 09954.

F. Corrosion Control for Buried Piping: STD SPEC 13110.

G. General Piping Requirements: STD SPEC 15050.

H. Flexible Pipe Couplings: STD SPEC 15122.

I. Disinfection of Piping: STD SPEC 15141.

J. Pressure Testing of Piping: STD SPEC 15144.

K. Installation of Steel Transmission Pipe: STD SPEC 15251.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit piping layout drawings showing location and dimensions of all pipe and fittings. Include laying lengths of valves and other equipment determining piping dimensions. Label or number each fitting or piece of pipe and provide the following information for each item:

1. Material of construction, with ASTM or API reference and grade.

2. Wall thickness of steel pipe and fittings.

3. Details of epoxy lining and coating, thickness, materials, and testing.

4. Manufacturer's certificates of compliance with referenced pipe standards, e.g., ASTM A 53, ASTM A 135, API 5L.

5. Call out all weld sizes and dimensions of grooved ends, flanges, fittings, and joint harnesses.

C. Submit coating application test records for measuring coating thickness and holiday detection for each pipe section and fitting. Describe repair procedures used.

1.04 INSPECTION AND FIELD VERIFICATION

A. The District's Representative or his authorized representative may inspect materials, fabrication, and testing at the manufacturer's plant.

B. Where new pipelines are to be connected to existing waterlines of the District, the Contractor shall verify in the field the location, elevation, pipe material, pipe outside diameter, and any other characteristics of the existing waterline before proceeding with the pipe fabrication or installation. This field verification shall be performed in the presence of the District's Representative. Adjust and align the new piping as necessary to meet the field conditions and provide all required material, labor, and equipment to make the connection.

PART 2 - MATERIALS

2.01 STEEL PIPE

Pipe shall be black carbon steel conforming to ASTM A 53, Type E or S, Grade B; API 5L, Grade B; or ASTM A 135, Grade B. Pipes shall be standard weight per ASME B36.10.

2.02 STEEL FITTINGS

A. Steel fittings are defined as a special piece of pipe other than a normal straight section. Elbows, crosses, tees, and reducers are fittings.

B. Fittings shall be butt-welded conforming to ASME B16.9. Material shall be wrought steel conforming to ASTM A 234, Grade WPB. Wall thickness shall be the same as the pipe.

2.03 SHOP APPLIED EPOXY LINING AND COATING

Lining and coating shall be a 100% solids, thermosetting, fusion-bonded, dry powder epoxy resin. Provide Scotchkote 134 or 206N, Lilly Powder Coatings "Pipeclad 1500 Red", or District approved 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 (Minimum)	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)

2.04 SHOP AND FIELD APPLIED EPOXY COATING FOR PATCHING

Use a two-component, 80% solids, liquid epoxy resin, such as Scotchkote 306 or District approved equal.

2.05 FLANGES

A. Provide flanges that match the flange of the connecting valve or other equipment.

B. Provide welding neck flanges for attachment to wrought steel fittings. Provide welding neck or slip on flanges for attachment to pipe. Slip on flanges shall be double welded. Flange material shall conform to ASTM A 105, A 181, or A 182. Flanges shall be flat faced.

C. Class 150 flanges shall comply with AWWA C207, Class E or ASME B16.5, Class 150.

D. Class 300 flanges shall comply with AWWA C207, Class F or ASME B16.5, Class 300.

2.06 BOLTS, NUTS AND GASKETS FOR FLANGES

See Standard Specification Section 15050.

2.07 INSULATING FLANGE KITS

See Standard Specification Section 13110.

2.08 OUTLETS

A. For threaded outlets 3 inches and smaller, use a thredolet type per AWWA Manual M11 (Current Edition), Chapter 13. Outlets shall be 3000 pound WOG forged steel per ASTM A 105 or ASTM A 216, Grade WCB. Threads shall comply with ASME B1.20.1, NPT. Outlets shall be Bonney Forge Co. "Thredolet," Allied Piping Products Co. "Branchlet," or District approved equal. Do not use pipe couplings for outlets.

B. For flanged outlets 4 inches and larger, use a tee with a welding neck flange.

2.09 MECHANICAL CLAMP-TYPE COUPLINGS

A. Mechanical clamp-type couplings for grooved end pipe shall be ductile iron, ASTM A 536, Grade 65-45-12. Bolts shall conform to ASTM A 183, 110,000 psi tensile strength. Gaskets shall be EPDM (ethylene propylene diene monomer) conforming to ASTM D 2000. Couplings shall conform to AWWA C606 for flexible, square cut grooved joints in IPS steel pipe. Couplings shall be Victaulic Style 77, or District approved equal.

B. Line and coat couplings the same as the pipe. Color shall match the color of the pipe fusion epoxy coating.

2.10 TYPE OF PIPE JOINTS

A. Joints in vaults shall be flanged to connect to valves and other equipment.

B. Joints between pipe, fittings, and welding neck flanges shall be full penetration butt welds. Joints between pipe and slip on flanges shall be fillet welds to the interior and exterior. Do not field weld to join components.

C. Provide grooved end pipe where mechanical clamp-type couplings are to be used. Grooved end joint shall be flexible, square cut per AWWA C606, Table 2. Apply 10 mils maximum of fusion epoxy coating to the grooved end pipe surface.

D. Provide plain end pipe where flexible pipe couplings are to be used. Couplings and harnesses shall conform to Standard Specification Section 15122. Line and coat couplings and harnesses the same as the pipe. Color shall match the color of the pipe fusion epoxy coating.

2.11 POLYETHYLENE ENCASEMENT

See Standard Specification Section 09954.

PART 3 - EXECUTION

3.01 FABRICATION, ASSEMBLY, AND ERECTION

A. Beveled ends for butt welding shall conform to ASME B16.25. Remove slag by chipping or grinding. Surfaces shall be clean of paint, oil, rust, scale, slag, and other material detrimental to welding. When welding the reverse side, chip out slag before welding.

B. Fabrication shall comply with ASME B31.3, Chapter V. Welding procedure and performance qualifications shall be in accordance with Section IX, Articles II and III, respectively, of the ASME Boiler and Pressure Vessel Code.

C. Apply full penetration weld to exterior joint of butt welded pipe, fittings, and welding neck flanges. Apply fillet welds to the interior and exterior circumference of the pipe and slip on flanges. Minimum size of fillet weld shall be equal to the steel cylinder thickness. Complete each pass around the entire circumference of the pipe before commencing the next pass. Use electrodes recommended by the pipe fabricator. Do not deposit more than 1/8-inch of throat thickness per pass. The minimum number of passes or beads in the completed weld shall be as follows:

Steel Cylinder Thickness (inches)	Minimum Number of Passes for Welded Joints

0.2500 and Less	2
Greater than 0.2500	3

D. Use the shielded metal arc welding (SMAW) process for welding.

E. Welding preparation shall comply with ASME B31.3, paragraph 328.4. Limitations on imperfections in welds shall conform to the requirements in ASME B31.3, Table 341.3.2, and paragraph 341.4 for visual examination.

F. Identify welds in accordance with ASME B31.3, paragraph 328.5.

G. Clean each layer of deposited weld metal prior to depositing the next layer of weld metal, including the final pass, by a power-driven wire brush.

H. Welding electrodes shall comply with AWS A5.1.

I. After shop fabrication and prior to shop applied epoxy, test each welded joint by the liquid penetrant method. Conform to the requirements specified in ASTM E 165. The materials used shall be either water washable or nonflammable. Products: "Spotcheck" by the Magnaflux Corporation or "Met-L-Check Flaw-Findr" by the Met-L-Check Company. Chip out all defects, reweld, and retest the section affected until it shows no leaks or other defects.

3.02 SHOP APPLICATION OF FUSION-BONDED EPOXY

A. Apply lining and coating per AWWA C213 except as modified herein.

B. Grind 0.020-inch (minimum) off the weld caps on the pipe weld seams before beginning the surface preparation and heating of the pipe.

C. Grind surface irregularities, welds, and weld spatter smooth before applying the epoxy. The allowable grind area shall not exceed 0.25 square foot per location, and the maximum total grind area shall not exceed 1 square foot per pipe section. Do not use any pipe section in which these requirements cannot be met.

D. Grind outside sharp corners, such as the outside edges of flanges and harness plates, to a minimum radius of 1/4-inch.

E. Uniformly preheat the pipe prior to blast cleaning to remove moisture from the surface. The preheat shall be sufficient to ensure that the pipe temperature is at least 5°F above the dew point temperature during blast cleaning and inspection.

F. Sandblast surfaces per SSPC SP-5. Protect beveled pipe ends from the abrasive blast cleaning.

G. Apply a phosphoric acid wash to the pipe after sandblasting. The average temperature of the pipe, measured in three different locations, shall be 80°F to 130°F during the acid wash procedure. The acid wash shall be a 5% by weight phosphoric acid solution. The duration in which the acid is in contact with the pipe surface shall be determined by using the average pipe 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, remove the acid from the pipe with demineralized water having a maximum conductivity of 5 micromhos/cm at a minimum nozzle pressure of 2,500 psi.

H. Apply epoxy lining and coating by either the electrostatic spray or fluidized bed process. Minimum thickness of lining and coating shall be 12 mils each, except for grooved end pipe surfaces. Heat and cure per the epoxy manufacturer's recommendations. The heat source shall not leave a residue or contaminant on the metal surface. Do not allow oxidation of surfaces to occur prior to lining and coating. Do not permit surfaces to flash rust before lining and coating.

3.03 QUALITY OF LINING AND COATING APPLICATIONS

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

3.04 SHOP TESTING OF LINING AND COATING

A. Test lining and coating with a low-voltage wet sponge holiday detector in accordance with AWWA C213, Section 5.3.3. If the number of holidays or pinholes is fewer than one per 10 square feet of coating surface, repair the holidays and pinholes by applying the coating manufacturer's recommended patching compound to each holiday or pinhole and retest. If the number of holidays or pinholes exceeds one per 10 square feet, remove the entire pipe lining and coating and recoat the entire piping and retest.

B. 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.

C. Measure the lining and coating thickness at three locations on each 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 6-inch intervals along the pipe length. 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 pipe does not meet these criteria, remove the entire lining and coating and recoat the entire pipe section or fitting.

D. The District's Representative will conduct in the field an independent inspection of the lining and coating for compliance with the above criteria. Coated items failing his inspection will be cause for rejection.

3.05 DELIVERY AND TEMPORARY STORAGE OF PIPE

Lift pipe with wide belt slings. Do not use cable slings or chains. Support the pipe on padded wooden blocks. Do not roll or drop the pipe on the ground or allow the pipe to fall from the delivery trucks. Protect the lining and coating of the pipe from damage or scratches. Cover pipe with plastic sheets and secure until ready for installation.

3.06 INSTALLING BURIED PIPE

See Standard Specification Section 15251 for installation requirements of buried steel pipe. Install the pipe with polyethylene encasement and other appurtenant items for the installation. Inspect the lining and coating, and repair damaged areas in the field as described herein.

3.07 INSTALLING PIPE IN VAULTS

A. Install pipe in vaults without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment. Provide temporary supports and place the assembled piping at the correct grade and position in the vault.

B. Provide pipe supports per Standard Specification Section 05121.

3.08 INSTALLING FLANGED JOINTS

See Standard Specification Section 15050 for installation instructions.

3.09 INSTALLING INSULATING FLANGE KITS

Install insulating flange kits with coatings per Standard Specification Section 13110.

3.10 INSTALLING MECHANICAL CLAMP-TYPE COUPLINGS

A. Install mechanical clamp-type couplings in accordance with the manufacturer's recommendations and the following.

B. Clean oil, grease, and dirt from the grooved ends of pipe. Repair any damage or holidays in the shop applied coating before installing couplings. Apply the coupling manufacturer's gasket lubricant to the gasket exterior including lips, pipe ends, and housing interiors.

C. Lubricate threads of bolts and nuts with oil or graphite prior to installation. Uniformly tighten bolts and nuts alternately and evenly until coupling segments are seated. Apply torque to nuts with a calibrated torque wrench as recommended by the coupling manufacturer.

3.11 INSTALLING FLEXIBLE PIPE COUPLINGS

Install flexible pipe couplings and joint harnesses where shown per Standard Specification Section 15122.

3.12 FIELD REPAIRS TO LINING AND COATING

Patch scratches and damaged areas incurred while installing fusion-bonded epoxy pipe with a two-component, 80% solids (minimum), liquid epoxy resin. Wire brush or sandblast the damaged areas per SSPC SP-10. Lightly abrade or sandblast the pipe lining and coating on the sides of the damaged area before applying the liquid epoxy coating. Apply the liquid epoxy coating 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, remove the entire pipe lining and coating and recoat the entire piping and retest. Apply the liquid epoxy coating to a minimum dry-film thickness of 12 mils.

3.13 PAINTING AND COATING

Coat exterior surfaces of fusion-bonded epoxy pipe in vaults per Standard Specification Section 09900, System No. 10. Apply finish coat in field. Do not apply prime coat.

Coat exterior surfaces of mechanical clamp-type couplings, flexible pipe couplings, and joint harnesses the same as the adjacent pipes.

3.14 PRESSURE TESTING

See Standard Specification Section 15144 for pressure testing requirements. Test pipe at the same time that the primary pipelines are tested.

3.15 DISINFECTION

See Standard Specification Section 15141 for chlorination requirements.

END OF SECTION

STANDARD SPECIFICATION
SECTION 15290 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of polyvinyl chloride (PVC) pipe and fittings with iron pipe size outside diameters for miscellaneous applications. Size range is 1/2- to 6-inch nominal size.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Trenching, Backfilling and Compacting: STD SPEC 02223.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit manufacturer's catalog data and descriptive literature for PVC, pipe, fittings, solvent, and miscellaneous materials. Show dimensions and materials of construction by specification reference and grade.

PART 2 - MATERIALS

2.01 PVC PIPE

PVC pipe shall be Schedule 40 or 80, Type I, Grade I (Class 12454-B), conforming to ASTM D 1784 and D 1785. Provide PVC pipe with the schedule as shown on the Drawings.

2.02 NIPPLES

Short nipples shall be the same as the PVC pipe.

2.03 FITTINGS

Provide fittings that have the same schedule as the PVC pipe.

A. Fittings shall be Schedule 40 conforming to ASTM D 2466 for socket-type.

B. Fittings shall be Schedule 80 conforming to ASTM D 2464 for threaded type and ASTM D 2467 for socket type.

2.04 JOINTS

A. Pipe and fitting joints shall be solvent welded except where threaded joints are required.

B. Solvent cement for socket joints shall comply with ASTM D 2564 and F 656.

PART 3 - EXECUTION

3.01 GENERAL

A. Do not install PVC pipe when the temperature is below 40 degrees F or above 90 degrees F.

B. Store fittings indoors in their original cartons.

C. Store solvent cement indoors or, if outdoors, shade from direct sunlight exposure. Do not use solvent cements which have exceeded the shelf life marked on the storage container.

D. Before installation, check pipe and fittings for cuts, scratches, gouges, buckling, kinking, or splitting on pipe ends. Remove any pipe section containing defects by cutting out the damaged section as a complete cylinder.

3.02 INSTALLATION

Do not drag PVC pipe over the ground, drop it into the ground, or drop objects on it. Cut pipe ends square and remove all burrs, chips, and filings before joining pipe or fittings. Bevel solvent welded pipe ends as recommended by the pipe manufacturer.

3.03 SOLVENT WELDED JOINTS

A. Prior to solvent welding, remove fittings and couplings from their cartons and expose them to the air for at least one hour to the same temperature conditions as the pipe.

B. Wipe away loose dirt and moisture from the ID and OD of the pipe end and the ID of the fitting before applying solvent cement. Do not apply solvent cement to wet surfaces.

C. Make up solvent welded joints per ASTM D 2855.

D. Allow at least 8 hours of drying time before moving solvent welded joints or subjecting the joints to any internal or external loads or pressures.

3.04 INSTALLING BURIED PIPE

A. See Standard Specification Section 02223 for earthwork requirements. Use imported sand in the pipe base and pipe zone.

B. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.

C. Grade the bottom of the trench to the line and grade to which the pipe is to be laid. Remove hard spots that would prevent a uniform thickness of pipe base material. Before laying the pipe, check the grade with a straightedge and correct any irregularities found.

D. Do not backfill the pipe trench until the solvent welded joints have set. Support the pipe uniformly and continuously over its entire length on firm, stable bedding. Do not use blocking to change pipe grade or to support pipe in the trench.

END OF SECTION

STANDARD SPECIFICATION
SECTION 15292 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE (AWWA C900)

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of PVC pressure pipe conforming to AWWA C900. Size range is 4- to 12-inch nominal pipe size.

1.02 PIPE IDENTIFICATION SYMBOLS

Interpret pipe identification symbols used on the Drawings as follows: PVC-8"-150 designates type of pipe (polyvinyl chloride); nominal pipe size (8 inches); and working pressure rating (Class 150).

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Trenching, Backfilling, and Compacting: STD SPEC 02223.

D. General Concrete Construction: STD SPEC 03000.

E. Glass Linings and Coatings: STD SPEC 09870.

F. Painting and Coating: STD SPEC 09900.

G. Cold Applied Wax Tape Coating: STD SPEC 09952.

H. Polyethylene Sheet or Tube Encasement: STD SPEC 09954.

I. Fusion-Bonded Epoxy Lining and Coating: STD SPEC 09961.

J. General Piping Requirements: STD SPEC 15050.

K. Miscellaneous Piping Specialties: STD SPEC 15080.

L. Flexible Pipe Couplings: STD SPEC 15122.

M. Disinfection of Piping: STD SPEC 15141.

N. Pressure Testing of Piping: STD SPEC 15144.

1.04 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Provide affidavit of compliance with AWWA C900.

C. Submit fully dimensioned cross section of the bell and barrel of the pipe. Show the bell maximum outside diameter in the pressurized area and its minimum wall thickness at the same location.

D. Submit copies of the following manufacturer required tests conducted on the project pipe:

1. Quick-burst strength of pipe and couplings.

2. Flattening resistance of pipe.

3. Record of additional tests after test sample failure.

E. Submit manufacturer's literature on ductile iron fittings including dimensions, thickness, weight, coating, lining, and a statement of inspection and compliance with the acceptance tests of AWWA C110 or C153. Submit copy of report of pressure tests for qualifying the designs of all sizes and types of AWWA C153 fittings that are being used in the project. The pressure test shall demonstrate a minimum safety factor of three times the rated working pressure as described in AWWA C153, Section 5.5.

F. Submit manufacturer's catalog data and descriptive literature for high deflection couplings, repair couplings, service saddles, restrained joints, tracer wire, marking tape, and miscellaneous piping materials.

G. Submit restrained joint system installation instructions. Include bolt torque limitations and assembly tolerances.

1.05 INSPECTION AND FIELD VERIFICATION

A. The District's Representative or his authorized representative may inspect materials, productions, and testing at manufacturer's plant.

B. Where new pipelines are to be connected to existing waterlines of the District, the Contractor shall verify in the field the location, elevation, pipe material, pipe outside diameter, and any other characteristics of the existing waterline before proceeding with the pipe installation. This field verification shall be performed in the presence of the District's Representative. Adjust and align the new piping as necessary to meet the field conditions and provide all required material, labor, and equipment to make the connection.

PART 2 - MATERIALS

2.01 PVC PIPE

Provide PVC pipe conforming to AWWA C900 with material cell classification 12454-B per ASTM D 1784. Provide standard pipe having integral bell and spigot with elastomeric gasket and cast iron equivalent outside diameter. Provide pipe in standard 20-foot laying lengths. Straight pipe sections with plain ends for use with high deflection couplings are not available. Random lengths will not be permitted. Provide either Class 150 or 200 pressure rating as shown on the Drawings. Where PVC pipe is to be installed with restrained joints, provide Class 200 pipe.

2.02 PVC PIPE COLORING AND MARKING FOR RECYCLED WATER SERVICE

PVC pipe shall be purple (Pantone 522) and shall be marked on both sides of the pipe with the wording "CAUTION: RECYCLED WATER--DO NOT DRINK." The lettering shall be minimum 1-inch-high black letters and shall be repeated every 36 inches. The purple coloring shall be achieved by adding pigment to the PVC material as the pipe is being manufactured.

2.03 HIGH DEFLECTION COUPLINGS

Provide PVC couplings with twin elastomeric gaskets which allows 2 degrees of deflection at each gasket for a total of 4 degrees per coupling. Provide couplings for cast iron equivalent outside diameter with 200 psi working pressure rating. Provide CertainTeed High Deflection (HD) Stop Couplings, or District approved equal.

2.04 CLOSURE/REPAIR COUPLINGS

Provide PVC couplings with twin elastomeric gaskets which are designed to connect plain ends of straight pipe. Provide couplings for cast iron equivalent outside diameter with 200 psi working pressure rating. Do not deflect pipe in these couplings. Provide CertainTeed Closure/Repair Couplings, or District approved equal.

2.05 FITTINGS

A. Provide ductile iron fittings conforming to AWWA C110 with a minimum rated working pressure of 350 psi. Provide fittings with bells and gaskets specifically designed for cast iron equivalent outside diameter PVC pipe. Use mechanical joint fittings or fittings with bells and gasket ends.

B. In lieu of paragraph 2.05, A., provide ductile iron fittings conforming to AWWA C153 with a minimum rated working pressure of 350 psi. Provide fittings constructed of Grade 70-50-05 ductile iron having a minimum weight equal to the weight tabulated in AWWA C153. Provide fittings with bells and gaskets specifically designed for cast iron equivalent outside diameter PVC pipe. Use mechanical joint fittings or fittings with bells and gasket ends conforming to the dimensional values of AWWA C111. Mechanical joint glands shall be Grade 70-50-05 ductile iron and cast in one continuous ring. Fittings with repaired defects are not acceptable and will be rejected.

C. For mechanical joint fittings with glands, use tee-head or non-hex head bolts and hex head nuts for joint makeup and gasket seating. Bolts and nuts shall be carbon steel and coated with a corrosion inhibiting fluoropolymer composite material. Provide Tripac 200 Blue Coating System, or District approved equal.

2.06 LINING AND COATING FOR FITTINGS

A. Line interior of fittings for water pipelines with cement mortar per AWWA C104 and line interior of bells per Standard Specification Section 09900, System No. 5. Provide double thickness lining and use cement conforming to ASTM C150 Type II. Coating on interior bells shall be holiday free.

B. Coat exterior of fittings for water pipelines with an asphalt material per AWWA C151.

C. As an alternative to paragraph 2.06, A and B, line and coat fittings and bells with fusion-bonded epoxy per Standard Specification Section 09961. Coating shall be holiday free on the interior surfaces of the fittings, including the bells.

D. All fittings for sewer force mains shall be glass lined and coated per Standard Specification Section 09870. Coating shall be holiday free on the interior surfaces of the fittings, including the bells.

2.07 FLANGES

Flanges on ductile iron fittings shall conform to AWWA C110 or ASME B16.42 Class 150 with a minimum rated working pressure of 250 psi.

2.08 BOLTS, NUTS AND GASKETS FOR FLANGES

See Standard Specification Section 15050.

2.09 OUTLETS

A. For outlets 2 inches and smaller with working pressures 200 psi or less, attach a service saddle to the pipe. Provide service saddles with full width, cast bronze bodies conforming to ASTM B 62, O-ring gaskets, and iron pipe threads. Provide Type 304 stainless steel double band straps with four bolts or a single wide strap with four bolts. All stainless steel shall be fully passivated for enhanced corrosion resistance. All saddles shall be pre-sized at the factory for installation on cast iron equivalent outside diameter PVC pipe conforming to AWWA C900. Service saddles shall be Ford Style 202BS, Romac Industries Style 202BS, Smith-Blair Model 393, or District approved equal.

B. For outlets 3 inches and larger, use a ductile iron tee with a flanged outlet.

C. For outlets on existing pipes, see Standard Specification Section 15080 for material requirements.

2.10 RESTRAINED JOINTS

When the working pressure is less than 150 psi, provide restrained joints where indicated on the Drawings. Restrained joints shall be provided by restraining systems that incorporate a series of machined serrations on the inside diameter of a restraint ring to provide positive restraint. Restraining systems shall meet or exceed the requirements of UNI-B-13-94 or ASTM F 1674 and the following:

A. Restraint devices for PVC bell-and-spigot joints shall consist of a split restraint ring installed on the spigot, connected to a solid backup ring seated behind the bell.

B. Restraint devices for connection to ductile iron mechanical joints shall consist of a split restraint ring installed on the PVC pipe behind the ductile iron fitting follower gland and gasket and shall retain the full deflection capability of the joint.

C. The split restraint ring shall be machined to match the cast iron equivalent outside diameter of the pipe, provide full 360-degree support around the barrel of the pipe, and shall incorporate a series of machined serrations for gripping the outside surface of the pipe. The serrations shall be uniform and extend the full circumference of the clamp. The ring shall also incorporate a positive means of avoiding applying excessive clamping force to the pipe.

D. Materials used in the restraint device shall be ductile iron conforming to ASTM A 536, Grade 65-45-12.

E. T-bolts, studs, and connecting hardware shall be high strength, low alloy material in accordance with AWWA C111.

F. Design restraining devices to have a minimum of 2:1 safety factor based on the design strength of the pipe. See Section 3.11 for installation directions.

G. Restraining devices shall be Uni-Flange Block Buster Series 1300 and 1350, or District approved equal.

2.11 FLEXIBLE PIPE COUPLINGS

See Standard Specification Section 15122.

2.12 FLANGE COUPLING ADAPTERS

See Standard Specification Section 15122.

2.13 POLYETHYLENE ENCASEMENT

See Standard Specification Section 09954.

2.14 TRACER WIRE

Use AWG No. 8 stranded copper wire with high molecular weight polyethylene (HMW/PE) insulation specifically designed for direct burial in corrosive soil or water. Polyethylene insulation shall conform to ASTM D 1248, Type 1, Class C. Wires with cut or damaged insulation are not acceptable and replacement of the entire wire which has been damaged will be required at the Contractor's expense.

2.15 MARKING TAPE

Use detectable marking tape consisting of one layer of aluminum foil laminated between two colored layers of inert plastic film. The lamination bond should be strong enough that the layers can not be separated by hand. Tape shall be a minimum of 5 mils thick and 6 inches wide. Tape shall bear a continuous, printed message every 16 to 36 inches warning of the installation buried below. Tape shall be Terra Tape, Linetec, or District approved equal.

2.16 MARKER POSTS

Provide marker posts for buried pipelines at 500 feet on center except where pipeline is located in a paved street or as directed by the District's Representative. 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 inches by 4 inches, and surfaced on four sides.

PART 3 - EXECUTION

3.01 PRODUCT MARKING

Legibly mark pipe in blue at 5-foot intervals and each coupling to identify the nominal pipe size, OD base, PVC, dimension ratio number and pressure class, AWWA C900, and the seal of the testing agency that verified the suitability of the material for potable water service where applicable.

3.02 DELIVERY AND TEMPORARY STORAGE OF PIPE

A. Ship, store, and place pipe at the storage yard or installation site, supporting the pipe uniformly. Avoid scratching the pipe surface. Do not stack higher than 4 feet nor stack with weight on bells. Cover to protect from sunlight.

B. Do not install pipe that is gouged or scratched forming a clear depression.

C. Do not install pipe contaminated with a petroleum product (inside or outside).

D. Do not install any pipe that shows evidence of exposure to sunlight, age, surface deterioration, or other physical damage. The decision of the District's Representative shall be final as to the acceptability of the pipe to be installed.

3.03 HANDLING OF PIPE

Lift pipes with mechanical equipment using wide belt slings or a continuous fiber rope which avoids scratching the pipe. Do not use cable slings or chains. Pipes up to 12 inches in diameter may be lowered by rolling on two ropes controlled by snubbing. Pipes up to 6 inches in diameter can be lifted by hand.

3.04 SANITATION OF PIPE INTERIOR

A. During laying operations, do not place tools, food, clothing, trash, or other materials in the pipe. Keep the interior of the pipe clean as the pipeline construction progresses. The purpose of maintaining a clean interior is to aid in the passage of the bacteriologic quality after disinfection.

B. When pipelaying is not in progress, including the noon hour, close the ends of the installed pipe with a plug to deter entry of vermin, children, dirt, storm water, or foreign material.

3.05 PIPE LAYOUT FOR STRAIGHT AND CURVED ALIGNMENTS

A. Use integral bell end pipe for straight alignments and for radii greater than 1,150 feet.

B. Use the following various combinations of plain end pipe lengths with high deflection couplings and integral bell end pipe for curved alignments in both horizontal and vertical directions. Do not bend pipe between couplings. Saw cut integral bell end of standard pipe and bevel end for use with deflection couplings. Pipe lengths shorter than 9 feet will not be used unless specifically authorized by the District's Representative.

   1. Use 9.5-foot plain end pipe lengths with deflection couplings for all radii between 140 feet to 270 feet.

2. Use 19-foot plain end pipe lengths with deflection couplings for all radii between 270 feet to 560 feet.

3. Use an integral bell end pipe length joined together with a 19-foot plain end pipe length to form a chord. Use deflection couplings on each end of the chord and continue this combination through the curved alignment for all radii between 560 feet to 1,150 feet.

3.06 INSTALLING PIPE IN TRENCH

A. See Standard Specification Section 02223 for earthwork requirements.

B. Inspect each pipe and fitting before lowering into the trench. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.

C. Handle pipe in a manner to avoid any damage to the pipe. Do not drag pipe over the ground, drop it onto the ground, or drop objects on it. Do not drop or allow pipe to fall into trenches.

D. Laying tolerances for the installed pipe shall not vary greater than 0.3-foot horizontally, or greater than 0.1-foot vertically from the alignment and elevations shown on the Drawings.

E. Grade the bottom of the trench to the line and grade to which the pipe is to be laid. Remove hard spots that would prevent a uniform thickness of pipe base material (imported sand). Before laying each section of the pipe, check the grade and correct any irregularities found. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between bell holes, except that the grade may be disturbed for the removal of pipe handling slings.

F. At the location of each joint, dig bell holes in the bottom of the trench and at the sides to permit visual inspection of the entire joint and to prevent the pipe from being supported by the bell end or fitting.

G. Keep the trench in a dewatered condition during pipelaying. Removal of water shall be in conformance with Standard Specification Section 02223.

3.07 ASSEMBLING PIPE JOINTS

A. The spigot and integral bell or coupling shall be dirt free and slide together without displacing the rubber ring gasket. Lay the pipe section with the integral bell facing the direction of laying.

B. Clean the groove of the bell or coupling of all foreign materials. If the gasket groove is dirty or contains debris, carefully remove the gasket and clean the groove. Insert the gasket back into the groove of the bell or coupling prior to installation. Observe the correct direction of the shaped gasket. Feel that the gasket is completely and evenly seated in the groove.

C. Mark the full insertion depth on the spigot end of the pipe. This mark indicates when the pipe is fully inserted into the bell or coupling. Lubricate the exposed gasket surface and the beveled spigot up to the full insertion mark with the lubricant supplied by the pipe manufacturer. For repair couplings, lubricate pipe for the entire distance the coupling will travel on the pipe. If the lubricated pipe end touches dirt, clean the pipe end and reapply lubricant.

D. Insert the spigot into the bell or coupling and force it slowly into position.

E. Check that the rubber ring gasket has not left the groove during assembly by passing a feeler gage around the completed joint.

3.08 INSTALLING BURIED FITTINGS

A. The District's Representative will inspect all fittings prior to installation for damage to the interior protective coatings. Coating shall be holiday free on interior surfaces. Patch damaged areas in the field with material similar to the original.

B. For mechanical joint fittings, clean the bell socket and the plain end of the pipe of all foreign material and dirt. Place the gland on the pipe spigot with the lip extension toward the plain end. Lubricate the pipe spigot and gasket. Use the same lubricant as supplied by the pipe manufacturer. Install the gasket on the pipe spigot with the narrow edge of the gasket toward the plain end. Insert the pipe into the bell socket and press the gasket firmly into the gasket recess. Keep the joint straight during assembly. Push the gland towards the socket and center it around the pipe with the gland lip against the gasket. Insert bolts and hand tighten nuts. Make joint deflection after assembly but before tightening nuts. Uniformly tighten bolts and nuts in a progressive diametrically opposite sequence, and torque nuts to 75- to 90-foot-pounds with a calibrated torque wrench. Coat exposed surfaces of tee-head bolts and nuts after tightening with primer for wax tape coating per Standard Specification Section 09952.

C. For push-on joint fittings, clean the bell ends of the fitting of all foreign material and dirt. Insert the gasket in the groove of the bell and make sure the gasket faces the correct direction. Feel that the gasket is completely and evenly seated in the groove. When pipe is cut in the field, bevel the plain end prior to installation. Lubricate the exposed gasket surface and the beveled pipe spigot with the same lubricant supplied by the pipe manufacturer. Insert the spigot into the bell and force it slowly into position. Keep the joint straight while pushing. Make joint deflection after the joint is assembled.

D. When necessary to deflect pipe from a straight line in either the horizontal or vertical plane, do not exceed the following joint deflection angles for buried fittings. The angles shown are for each joint and are maximum deflections.

Nominal Pipe Size (inches)	Mechanical Joint (degrees)	Push-on Joint (degrees)
4	6-1/2	4
6	5-1/2	4
8	4	4
10	4	4
12	4	4

3.09 INSTALLING FLANGED JOINTS

See Standard Specification Section 15050 for installation instructions.

3.10 INSTALLING SERVICE SADDLES

A. Place the service saddle on the pipe and hand tighten the nuts while positioning the saddle in its final location. Uniformly tighten the nuts in a progressive diametrically opposite sequence and torque with a calibrated torque wrench to the saddle manufacturer's recommended values.

B. Connect a corporation stop to the saddle per Standard Specification Section 15080. Apply Teflon joint compound or tape to the male threads before installing the corporation stop. Make joints watertight.

C. Mount a tapping machine on the corporation stop to cut a hole in the pipe with a shell type cutter made specifically for PVC pipe. Do not use other devices or hand equipment to bore through the pipe wall.

3.11 INSTALLING RESTRAINED JOINTS

A. Follow the manufacturer's installation instructions for the restrained joint system. Tighten the clamping bolts on the restraint rings to the recommended torque. Do not over-tighten the retaining nuts behind the restrainer ears.

B. Wrap restrained joint including bolts and nuts with wax tape coating per Standard Specification Section 09952.

3.12 INSTALLING FLEXIBLE PIPE COUPLINGS

Install flexible pipe couplings per Standard Specification Section 15122.

3.13 INSTALLING FLANGE COUPLING ADAPTERS

Install flange coupling adapters per Standard Specification Section 15122.

3.14 INSTALLING POLYETHYLENE ENCASEMENT

Wrap buried service saddles, fittings, flanged joints, and restrained joints with polyethylene material per Standard Specification Section 09954. Wrap metallic items and buried joints with polyethylene sheet and overlap the adjoining pipe a minimum of one foot. Secure in place with 2-inch-wide plastic adhesive tape. Complete the wrap prior to placing concrete anchors, supports, or thrust blocks per Standard Specification Section 02223. Repair polyethylene material damaged during construction.

3.15 INSTALLING TRACER WIRE

Prior to backfill, install tracer wire on top of pipe and secure in place with 2-inch wide plastic adhesive tape at maximum 10-foot intervals. Run tracer wire continuously along pipe and terminate in adjacent valve boxes for buried assemblies or buried valves. Where buried splices occur, use an electrical splicing kit consisting of a split bolt connector, mold, and a two part encapsulating epoxy resin such as Scotchcast, or District approved equal. Provide

24 inches of coiled wire at access points for attachment of pipe locating equipment. Each installed run of pipe shall be capable of being located using the tracer wire. Protect wire insulation from damage during installation and backfilling. Wire insulation that is broken, cut, or damaged shall be replaced.

3.16 INSTALLING MARKING TAPE

After the pipe zone has been backfilled and compacted, place the marking tape on the compacted pipe zone material and center over the pipe. Run tape continuously along the trench and tie ends of tape together. Wrap marking tape around valve box extension pipes and continue along pipe.

3.17 SETTING MARKER POSTS

Locate marker posts on centerline of pipeline and space at 500 feet on center. Cut redwood post to a 5-foot length and chamfer the top. Paint post per Standard Specification Section 09900, System No. 60. Use white paint for the finish coats. For potable water, use blue paint for the top 4 inches of the chamfered end and stencil in 2-inch-high blue letters the word "WATER" on the post. For recycled water, use purple paint for the top 4 inches of the chamfered end and stencil in 2-inch-high purple letters the abbreviation "RW" on the post. Excavate a hole 16 inches in diameter by 2 feet deep. Set the redwood post plumb, fill hole with concrete to 2 inches above finish grade, and crown to slope away from post. Concrete shall be Class C per Standard Specification Section 03000.

3.18 PRESSURE TESTING

See Standard Specification Section 15144 for pressure testing requirements.

3.19 DISINFECTION

See Standard Specification Section 15141 for chlorination requirements.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of PVC distribution pipe conforming to AWWA C905. Size range is 14- to 24-inch nominal pipe size. Maximum working pressure will be limited to 150 psi with a dimension ratio (DR) of 18.

1.02 PIPE IDENTIFICATION SYMBOLS

Interpret pipe identification symbols used on the Drawings as follows: PVC-14"-DR 18 designates type of pipe (polyvinyl chloride); nominal pipe size (14 inches); and dimension ratio (DR 18).

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Trenching, Backfilling, and Compacting: STD SPEC 02223.

D. General Concrete Construction: STD SPEC 03000.

E. Painting and Coating: STD SPEC 09900.

F. Cold Applied Wax Tape Coating: STD SPEC 09952.

G. Polyethylene Sheet or Tube Encasement: STD SPEC 09954.

H. Fusion-Bonded Epoxy Lining and Coating: STD SPEC 09961.

I. General Piping Requirements: STD SPEC 15050.

J. Miscellaneous Piping Specialties: STD SPEC 15080.

K. Flexible Pipe Couplings: STD SPEC 15122.

L. Disinfection of Piping: STD SPEC 15141.

M. Pressure Testing of Piping: STD SPEC 15144.

1.04 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Provide affidavit of compliance with AWWA C905.

C. Submit copies of the following manufacturer required tests conducted on the project pipe:

1. Quick-burst strength of pipe.

2. Flattening resistance of pipe.

3. Impact resistance of pipe.

4. Acetone-immersion test of pipe material.

5. Internal pressure and vacuum tests of joints per ASTM D 3139.

6. Laboratory tests of gaskets per ASTM F 477.

7. Record of additional tests after test sample failure.

D. Submit manufacturer's literature on ductile iron fittings including dimensions, thickness, weight, coating, lining, and a statement of inspection and compliance with the acceptance tests of AWWA C110 or C153. Submit copy of report of pressure tests for qualifying the designs of all sizes and types of AWWA C153 fittings that are being used in the project. The pressure test shall demonstrate a minimum safety factor of three times the rated working pressure as described in AWWA C153, Section 5.5.

E. Submit manufacturer's catalog data and descriptive literature for couplings, service saddles, tracer wire, marking tape, and miscellaneous piping materials.

1.05 INSPECTION AND FIELD VERIFICATION

A. The District's Representative or his authorized representative may inspect materials, production, and testing at manufacturer's plant.

B. Where new pipelines are to be connected to existing waterlines of the District, the Contractor shall verify in the field the location, elevation, pipe material, pipe outside diameter, and any other characteristics of the existing waterline before proceeding with the pipe installation. This field verification shall be performed in the presence of the District's Representative. Adjust and align the new piping as necessary to meet the field conditions and provide all required material, labor, and equipment to make the connection.

PART 2 - MATERIALS

2.01 PVC PIPE

Provide PVC pipe conforming to AWWA C905 with material cell classification 12454-B per ASTM D 1784. Provide standard pipe having integral bell and spigot with elastomeric gasket. Provide pipe in standard 20-foot laying lengths. Straight pipe sections with plain ends for use with high deflection couplings are not available. Random lengths will not be permitted. Provide pipe with cast iron equivalent outside diameter and a dimension ratio (DR) of 18.

2.02 PVC PIPE COLORING AND MARKING FOR RECYCLED WATER SERVICE

PVC pipe shall be purple (Pantone 522) and shall be marked on both sides of the pipe with the wording "CAUTION: RECYCLED WATER--DO NOT DRINK." The lettering shall be minimum 1-inch-high black letters and shall be repeated every 36 inches. The purple coloring shall be achieved by adding pigment to the PVC material as the pipe is being manufactured.

2.03 HIGH DEFLECTION COUPLINGS

Provide ductile iron connecting pieces with push-on joints for a maximum deflection per each joint as tabulated in paragraph 3.08, D. Couplings shall conform to the same criteria as specified for fittings. Provide U.S. Pipe Bell and Bell TYTON Connecting Pieces, or District approved equal.

2.04 FITTINGS

A. Provide ductile iron fittings conforming to AWWA C110 with a minimum rated working pressure of 350 psi. Provide fittings with bells and gaskets specifically designed for cast iron equivalent outside diameter PVC pipe. Use mechanical joint fittings or fittings with bells and gasket ends.

B. In lieu of paragraph 2.04, A., provide ductile iron fittings conforming to AWWA C153 with a minimum rated working pressure of 350 psi. Provide fittings constructed of Grade 70-50-05 ductile iron having a minimum weight equal to the weight tabulated in AWWA C153. Provide fittings with bells and gaskets specifically designed for cast iron equivalent outside diameter PVC pipe. Use mechanical joint fittings or fittings with bells and gasket ends conforming to the dimensional values of AWWA C111. Mechanical joint glands shall be Grade 70-50-05 ductile iron and cast in one continuous ring. Fittings with repaired defects are not acceptable and will be rejected.

C. For mechanical joint fittings with glands, use tee-head or non-hex head bolts and hex head nuts for joint makeup and gasket seating. Bolts and nuts shall be carbon steel and coated with a corrosion inhibiting fluoropolymer composite material. Provide Tripac 200 Blue Coating System, or District approved equal.

2.05 LINING AND COATING FOR FITTINGS

A. Line interior of fittings with cement mortar per AWWA C104 and line interior of bells per Standard Specification Section 09900, System No. 5. Provide double thickness lining and use cement conforming to ASTM C150 Type II. Coating on interior bells shall be holiday free.

B. Coat exterior of fittings with an asphalt material per AWWA C151.

C. As an alternative to paragraphs 2.05, A. and B., line and coat fittings and bells with fusion-bonded epoxy per Standard Specification Section 09961. Coating shall be holiday free on interior surfaces of the fittings including the bells.

2.06 FLANGES

Flanges on ductile iron fittings shall conform to AWWA C110 or ASME B16.42 Class 150 with a minimum rated working pressure of 250 psi.

2.07 BOLTS, NUTS AND GASKETS FOR FLANGES

See Standard Specification Section 15050.

2.08 OUTLETS

A. For outlets 2 inches and smaller with working pressure 150 psi or less, attach a service saddle to the pipe. Provide service saddles constructed completely of Type 304 stainless steel. Saddles shall be a two-piece, full circumference shell band bolted together with six bolts. Saddles shall have O-ring gaskets and outlets for iron pipe threads. All stainless steel shall be fully passivated for enhanced corrosion resistance. All saddles shall be sized for installation on cast iron equivalent outside diameter PVC pipe conforming to AWWA C905. Service saddles shall be Romac Industries Style 305, or District approved equal.

B. For outlets 3 inches and larger, use a ductile iron tee with a flanged outlet.

C. For outlets on existing pipes, see Standard Specification Section 15080 for material requirements.

2.09 RESTRAINED JOINTS

Restrained joints are not allowed on C905 pipe.

2.10 FLEXIBLE PIPE COUPLINGS

See Standard Specification Section 15122.

2.11 FLANGE COUPLING ADAPTERS

See Standard Specification Section 15122.

2.12 POLYETHYLENE ENCASEMENT

See Standard Specification Section 09954.

2.13 TRACER WIRE

Use AWG No. 8 stranded copper wire with high molecular weight polyethylene (HMW/PE) insulation specifically designed for direct burial in corrosive soil or water. Polyethylene insulation shall conform to ASTM D 1248, Type 1, Class C. Wires with cut or damaged insulation are not acceptable and replacement of the entire wire which has been damaged will be required at the Contractor's expense.

2.14 MARKING TAPE

Use detectable marking tape consisting of one layer of aluminum foil laminated between two colored layers of inert plastic film. The lamination bond should be strong enough that the layers cannot be separated by hand. Tape shall be a minimum of 5 mils thick and 6 inches wide. Tape shall bear a continuous, printed message every 16 to 36 inches warning of the installation buried below. Tape shall be Terra Tape, Linetec, or District approved equal.

2.15 MARKER POSTS

Provide marker posts for buried pipelines at 500 feet on center except where pipeline is located in a paved street or as directed by the District's Representative. 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 inches by 4 inches, and surfaced on four sides.

2.16 FACTORY TESTING OF PIPE

A. Test the quick-burst strength of pipe produced from each extrusion outlet at the beginning of production of each specific material, style, or size; thereafter, test one sample every 24 hours. Test a minimum of five specimens total. Test in accordance with ASTM D 1599. At least three of the test specimens from the production lot shall have a portion of the required markings located at least one pipe diameter away from an end closure. For bell-end pipe, include the bell (with any reinforcement sleeve) as part of at least two specimens.

B. Hydrostatically test each length of pipe including the joint in accordance with Section 4.6 of AWWA C905.

C. Test the flattening resistance of pipe produced from each extrusion outlet at the beginning of production of each specific material or size; thereafter, test one sample every eight-hour shift. Test a minimum of three specimens total. Test per ASTM D 2241, Section 7.6.

D. Test the pipe produced from each extrusion outlet by the acetone-immersion method at the beginning of production of each specific material or size; thereafter, test one sample every eight-hour shift. Test per ASTM D 2152.

E. Perform the sustained pressure test described in ASTM D 2241 at the beginning of production.

F. Perform other factory testing per ASTM D 2241 and AWWA C905.

G. The phrase "beginning of production" means the beginning of production of pipe for this project. Do not use test results from other projects.

H. When any product fails to meet a specified test requirement, perform additional tests to determine which products are acceptable of those produced from the same extruder or mold as of the last favorable test. Reject pipe that fails to meet any test requirement.

PART 3 - EXECUTION

3.01 PRODUCT MARKING

Legibly mark pipe at 5-foot intervals to identify the nominal pipe size, OD base, PVC, dimension ratio number and pressure class, AWWA C905, manufacturer's name and production code, and the seal of the testing agency that verified the suitability of the material for potable water service where applicable.

3.02 DELIVERY AND TEMPORARY STORAGE OF PIPE

A. Ship, store, and place pipe at the storage yard or installation site, supporting the pipe uniformly. Avoid scratching the pipe surface. Do not stack higher than 4 feet nor stack with weight on bells. Cover to protect from sunlight.

B. Do not install pipe that is gouged or scratched forming a clear depression.

C. Do not install pipe contaminated with a petroleum product (inside or outside).

D. Do not install any pipe that shows evidence of exposure to sunlight, age, surface deterioration, or other physical damage. The decision of the District’s Representative shall be final as to the acceptability of the pipe to be installed.

3.03 HANDLING OF PIPE

Lift pipes with mechanical equipment using wide belt slings. Do not use cable slings or chains.

3.04 SANITATION OF PIPE INTERIOR

A. During laying operations, do not place tools, food, clothing, trash, or other materials in the pipe. Keep the interior of the pipe clean as the pipeline construction progresses. The purpose of maintaining a clean interior is to aid in the passage of the bacteriological quality testing after disinfection.

B. When pipelaying is not in progress, including the noon hour, close the ends of the installed pipe with a plug to deter entry of vermin, children, dirt, storm water, or foreign material.

3.05 PIPE LAYOUT FOR STRAIGHT AND CURVED ALIGNMENTS

A. Use integral bell end pipe for straight alignments and for radii greater than 1,150 feet.

B. Use the following various combinations of plain end pipe lengths with high deflection couplings and integral bell end pipe for curved alignments in both horizontal and vertical directions. Do not bend pipe between couplings. Saw cut integral bell end of standard pipe and bevel end for use with deflection couplings. Pipe lengths shorter than 9 feet will not be used unless specifically authorized by the District's Representative.

1. Use 9.5-foot plain end pipe lengths with deflection couplings for all radii between 140 feet to 270 feet.

2. Use 19-foot plain end pipe lengths with deflection couplings for all radii between 270 feet to 560 feet.

3. Use an integral bell end pipe length joined together with a 19-foot plain end pipe length to form a chord. Use deflection couplings on each end of the chord and continue this combination through the curved alignment for all radii between 560 feet to 1,150 feet.

3.06 INSTALLING PIPE IN TRENCH

A. See Standard Specification Section 02223 for earthwork requirements.

B. Inspect each pipe and fitting before lowering into the trench. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.

C. Handle pipe in a manner to avoid any damage to the pipe. Do not drag pipe over the ground, drop it onto the ground, or drop objects on it. Do not drop or allow pipe to fall into trenches.

D. Laying tolerances for the installed pipe shall not vary greater than 0.3-foot horizontally, or greater than 0.1-foot vertically from the alignment and elevations shown on the Drawings.

E. Grade the bottom of the trench to the line and grade to which the pipe is to be laid. Remove hard spots that would prevent a uniform thickness of pipe base material (imported sand). Before laying each section of the pipe, check the grade and correct any irregularities found. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between bell holes, except that the grade may be disturbed for the removal of pipe handling slings.

F. At the location of each joint, dig bell holes in the bottom of the trench and at the sides to permit visual inspection of the entire joint and to prevent the pipe from being supported by the bell end or fitting.

G. Keep the trench in a dewatered condition during pipelaying. Removal of water shall be in conformance with Standard Specification Section 02223.

3.07 ASSEMBLING PIPE JOINTS

A. The spigot and integral bell shall be dirt free and slide together without displacing the rubber ring gasket. Lay the pipe section with the integral bell facing the direction of laying.

B. Clean the groove of the bell of all foreign materials. If the gasket groove is dirty or contains debris, carefully remove the gasket and clean the groove. Insert the gasket back into the groove of the bell prior to installation. Observe the correct direction of the shaped gasket. Feel that the gasket is completely and evenly seated in the groove.

C. Mark the full insertion depth on the spigot end of the pipe. This mark indicates when the pipe is fully inserted into the bell. Lubricate the exposed gasket surface and the beveled spigot up to the full insertion mark with the lubricant supplied by the pipe manufacturer. If the lubricated pipe end touches dirt, clean the pipe end and reapply lubricant.

D. Insert the spigot into the bell and force it slowly into position.

E. Check that the rubber ring gasket has not left the groove during assembly by passing a feeler gage around the completed joint.

3.08 INSTALLING BURIED FITTINGS

A. The District's Representative will inspect all fittings prior to installation for damage to the interior protective coatings. Coating shall be holiday free on interior surfaces. Patch damaged areas in the field with material similar to the original.

B. For mechanical joint fittings, clean the bell socket and the plain end of the pipe of all foreign material and dirt. Place the gland on the pipe spigot with the lip extension toward the plain end. Lubricate the pipe spigot and gasket. Use the same lubricant as supplied by the pipe manufacturer. Install the gasket on the pipe spigot with the narrow edge of the gasket toward the plain end. Insert the pipe into the bell socket and press the gasket firmly into the gasket recess. Keep the joint straight during assembly. Push the gland towards the socket and center it around the pipe with the gland lip against the gasket. Insert bolts and hand tighten nuts. Make joint deflection after assembly but before tightening nuts. Uniformly tighten bolts and nuts in a progressive diametrically opposite sequence, and torque nuts to 75- to 90-foot-pound with a calibrated torque wrench. Coat exposed surfaces of tee-head bolts and nuts after tightening with primer for wax tape coating per Standard Specification Section 09952.

C. For push-on joint fittings, clean the bell ends of the fitting of all foreign material and dirt. Insert the gasket in the groove of the bell and make sure the gasket faces the correct direction. Feel that the gasket is completely and evenly seated in the groove. When pipe is cut in the field, bevel the plain end prior to installation. Lubricate the exposed gasket surface and the beveled pipe spigot with the same lubricant supplied by the pipe manufacturer. Insert the spigot into the bell and force it slowly into position. Keep the joint straight while pushing. Make joint deflection after the joint is assembled.

D. When necessary to deflect pipe from a straight line in either the horizontal or vertical plane, do not exceed the following joint deflection angles for buried fittings. The angles shown are for each joint and are maximum deflections.

Nominal Pipe Size (inches)	Mechanical Joint (degrees)	Push-on Joint (degrees)
14	3	2-1/2
16	3	2-1/2
18	2-1/2	2-1/2
20	2-1/2	2-1/2

24	2	2-1/2

3.09 INSTALLING FLANGED JOINTS

See Standard Specification Section 15050 for installation instructions.

3.10 INSTALLING SERVICE SADDLES

A. Place the service saddle on the pipe and hand tighten the nuts while positioning the saddle in its final location. Uniformly tighten the nuts in a progressive diametrically opposite sequence and torque with a calibrated torque wrench to the saddle manufacturer's recommended values.

B. Connect a corporation stop to the saddle per Standard Specification Section 15080. Apply Teflon joint compound or tape to the male threads before installing the corporation stop. Make joints watertight.

C. Mount a tapping machine on the corporation stop to cut a hole in the pipe with a shell type cutter made specifically for PVC pipe. Do not use other devices or hand equipment to bore through the pipe wall.

3.11 INSTALLING FLEXIBLE PIPE COUPLINGS

Install flexible pipe couplings per Standard Specification Section 15122.

3.12 INSTALLING FLANGE COUPLING ADAPTERS

Install flange coupling adapters per Standard Specification Section 15122.

3.13 INSTALLING POLYETHYLENE ENCASEMENT

Wrap buried service saddles, fittings and flanged joints with polyethylene material per Standard Specification Section 09954. Wrap metallic items and buried joints with polyethylene sheet and overlap the adjoining pipe a minimum of one foot. Secure in place with 2-inch-wide plastic adhesive tape. Complete the wrap prior to placing concrete anchors, supports, or thrust blocks per Standard Specification Section 02223. Repair polyethylene material damaged during construction.

3.14 INSTALLING TRACER WIRE

Prior to backfill, install tracer wire on top of pipe and secure in place with 2-inch wide plastic adhesive tape at maximum 10-foot intervals. Run tracer wire continuously along pipe and terminate in adjacent valve boxes for buried assemblies or buried valves. Where buried splices occur, use an electrical splicing kit consisting of a split bolt connector, mold, and two part encapsulating epoxy resin such as Scotchcast, or District approved equal. Provide 24 inches of coiled wire at access points for attachment of pipe locating equipment. Each installed run of pipe shall be capable of being located using the tracer wire. Protect wire insulation from damage during installation and backfilling. Wire insulation that is broken, cut, or damaged shall be replaced.

3.15 INSTALLING MARKING TAPE

After the pipe has been backfilled and compacted, place the marking tape on the compacted pipe zone material and center over the pipe. Run tape continuously along the trench and tie ends of tape together. Wrap marking tape around valve box extension pipes and continue along pipe.

3.16 SETTING MARKER POSTS

Locate marker posts on centerline of pipeline and space at 500 feet on center. Cut redwood post to a 5-foot length and chamfer the top. Paint post per Standard Specification Section 09900, System No. 60. Use white paint for the finish coats. For potable water, use blue paint for the top 4 inches of the chamfered end and stencil in 2-inch-high blue letters the word "WATER" on the post. For recycled water, use purple paint for the top 4 inches of the chamfered end and stencil in 2-inch-high purple letters the abbreviation "RW" on the post. Excavate a hole 16 inches in diameter by 2 feet deep. Set the redwood post plumb, fill hole with concrete to 2 inches above finish grade, and crown to slope away from post. Concrete shall be Class C per Standard Specification Section 03000.

3.17 PRESSURE TESTING

See Standard Specification Section 15144 for pressure testing requirements.

3.18 DISINFECTION

See Standard Specification Section 15141 for chlorination requirements.

END OF SECTION