

El Dorado Irrigation District

Technical Specifications



Revision History

Section Number and Name	Date
All Technical Specifications (Section Numbers Only)	8/25/2017
33 13 00 DISINFECTING WATER MAINS	8/1/2017
33 01 30.13 SEWER SYSTEM TESTING	8/28/2017
31 23 33 TRENCH EXCAVATION, BACKFILL AND COMPACTION	8/28/2017
33 12 13 DOMESTIC SERVICE LINES AND APPURTENANCES	10/2/2017
40 05 81.13 FIRE HYDRANT ASSEMBLIES	10/23/2017
40 05 78.13 AIR AND VACUUM VALVE ASSEMBLIES	11/27/2017
32 12 16 ASPHALT PAVING NON-COUNTY ROADS	11/27/2017
33 13 10 WATER PIPING SYSTEM TESTING - NEW	11/29/2017
31 23 33 TRENCH EXCAVATION, BACKFILL AND COMPACTION	2/16/2018
33 13 10 WATER PIPING SYSTEM TESTING	3/5/2018
09 91 23.13 INTERIOR TANK COATING - NEW	9/26/2018
33 12 13.26 IN-TRACT SERVICE LINES - NEW	11/1/2018
31 23 33 TRENCH EXCAVATION, BACKFILL AND COMPACTION	11/1/2018
32 16 00 CURBS, GUTTERS, SIDEWALKS, AND DRIVEWAYS - NEW	1/10/2019
33 01 90 ABANDONMENT OF FACILITIES	5/3/2019
40 05 64 BUTTERFLY VALVES	6/13/2019
33 13 00 DISINFECTING WATER MAINS	8/27/2019
31 23 33 TRENCH EXCAVATION, BACKFILL AND COMPACTION	9/24/2019
33 13 00 DISINFECTING WATER MAINS	1/9/2020
03 00 00 CONCRETE AND REINFORCING STEEL	2/13/2020
33 12 13 DOMESTIC SERVICE LINES AND APPURTENANCES	2/13/2020
09 91 23.13 INTERIOR TANK COATING	5/27/2020
09 91 23.16 EXTERIOR TANK COATING - NEW	5/27/2020
31 23 33 TRENCH EXCAVATION, BACKFILL AND COMPACTION	8/17/2021
33 01 30.13 SEWER SYSTEM TESTING	8/17/2021
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32 17 23.43 ADJUSTING MANHOLES & VALVE BOXES - NEW	2/7/2022
09 91 23.13 INTERIOR TANK COATING	3/18/2022

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GENERAL CONSTRUCTION REQUIREMENTS
(Developer Projects)

1.0 GENERAL

1.1 Scope - This section describes general conditions and requirements for construction of the water and sewer systems. The developer/engineer shall prepare such general and special supplemental conditions as are necessary to define the project specifics, nature and location of the work, contractual arrangements, payment for work and any other matters concerning the owner and his contractor. The District's Technical Specifications shall also be incorporated into and made a part of the contract for the construction of all projects.

2.0 PRECONSTRUCTION

2.1 Preconstruction Meeting - Following final approval of plans, signed agreements, payment of fees, and issuance of all permits, a preconstruction meeting shall be scheduled by the developer/engineer. No construction shall begin until a preconstruction meeting has been held with the District's Inspection Division. Five business days notice shall be given to schedule a preconstruction meeting.

2.2 A minimum of four copies of shop drawings and/or descriptive literature for materials proposed for use but not included in the District's "Manufacturer's List" shall be submitted to the District and receive favorable review prior to being used in the work. Prior to submittal to the District, each submittal shall be favorably reviewed by the contractor and engineer. To assure that each submittal has been first reviewed by the contractor and engineer, each submittal shall contain the date of review and the name of the reviewer for the contractor and engineer, along with a statement that the submittal has been reviewed and that it meets the specified requirements for the project. A stamp may be used for this purpose as long as the date and the signature are original for each submitted item. After review, two copies will be returned to the contractor.

Each submittal package shall include a Submittal Transmittal form containing the following information:

- A. Project Name and District Project Number.
- B. Contractor's name.
- C. The submittal item number, beginning with 001.
- D. Date of the submittal.

- E. The requested date of return of the submittal (not less than two weeks, and three weeks for electrical submittals).
- F. The specification section and paragraph number.
- G. Any deviation from project requirements or District standards.
- H. In the lower right hand corner, a 3" x 4" block shall be set aside for District use. This area shall remain free of text or drawing information. Each sheet of shop drawing or sketch submitted shall have the same size area and location dedicated for District use.

When the contractor elects to incorporate material included on the District's "Materials List" a complete product submittal will not be required, but the contractor shall submit a Certificate of Compliance from their supplier, certifying that the supplied item is on the District's Material List.

District review of any submittal shall not relieve the contractor of responsibility to comply with all requirements of the approved plans and District standards. District review shall be only for conformance with the design concept of the project and for compliance with the information given in the approved plans and shall not extend to means, methods, sequences, techniques or procedures of construction, safety precautions or programs incident thereto. The review of a component as such will not indicate acceptance of the assembly in which the item functions. The contractor will be responsible for coordination of assemblies consisting of separate components.

- 2.3 Substitutions - Articles or materials not specified by the District's Manufacturers List must be submitted to the District for consideration per Section 2.2.
- 2.4 Quality of Material - Materials and equipment to be incorporated into the project shall be new. In case a reference is not clear as to which of several available grades is desired, the highest quality material shall be used.
- 2.5 Permits - All permits shall be submitted to the District at the preconstruction meeting. The following shall be required of the contractor:
 - A. Encroachment - Where construction will encroach into the public right-of-way, the Contractor shall obtain all necessary encroachment permits from the County Department of Transportation and/or from Caltrans.
 - B. Explosives - Where the contractor anticipates the use of explosives in conjunction with construction, a blasting permit shall be first obtained from the appropriate agency, and all nearby property owners shall be notified (see Section 31 23 33).

3.0 CONSTRUCTION

3.1 Protection/Operation of Existing Facilities - A primary concern of the District, is the protection and operation of the District's facilities. No developer or contractor will be allowed to operate any existing valves or to cause a shutdown of any portion of the system without prior approval from the District's Operations and Maintenance (O&M) Department. Operation of valves during a shutdown will be done by O&M Department personnel. Any planned shutdown shall be discussed at the preconstruction meeting or at least three working days in advance of the work. Shutdowns will only be allowed if no other reasonable alternative exists, such as the use of a "hot-tap" connection. When shutdowns are required, the District will make an evaluation of whether the shutdown should be done during the day or during the night or on weekends. Contractor/developer economics will be weighed less heavily in the decision than in the interruption and inconvenience to existing customers. Any shutdown will require an approval of a notification plan for existing customers by the District.

3.2 Compaction Tests - The District will require certified compaction tests from the engineer/developer to confirm compliance with compaction specifications. Compaction shall be tested at locations selected by the Inspector.

The contractor shall make all necessary excavations for compaction tests as directed by the District.

3.3 Utilities and Existing Facilities - The contractor shall contact all owners of underground facilities known to be in the area of construction and request marking of these facilities through Underground Services Alert (USA). USA's phone number is (800) 642-2444.

The fact that any underground utility and/or facility is not shown on the plans shall not relieve the contractor's responsibility to comply with these standards. It shall be the contractor's responsibility to ascertain prior to commencing work, the existence of any underground utilities, which may be subject to damage by reason of his operations.

The District will locate its facilities upon satisfactory advanced notification.

3.4 Shipment and Delivery - All pipe shall be braced and studded to prevent damage during shipment. Any damaged pipe or fittings delivered and unloaded at trench side shall be removed by the contractor from the work site upon notification by the District Inspector.

Loading and unloading of pipe, as well as placement in the trench, shall be done with straps at each end. Chains, cables or other similar devices

that may damage the pipe, shall not be allowed to come into contact with the pipe.

- 3.5 Quality of Workmanship - All work shall be performed by persons experienced in the specific work, under competent supervision and in a manner satisfactory to the District.
- 3.6 Exposing Existing Facilities - When connections are to be made to any existing pipe or appurtenance where the actual size, elevation, or position of the facility is unknown, the contractor shall excavate and expose the existing facility prior to submitting the "Request for Tie-In" (Form E-9).
- 3.7 Connections to Existing Facilities - The contractor shall initiate a request for a connection to existing facilities on the form provided by the District. The contractor shall submit a form a minimum of three business days before the requested connection. Connections shall be scheduled only on Tuesdays through Thursdays. Connection requests that interrupt service to more than 10 customers shall be submitted not less than 5 business days before the connection date. Connections will not be approved for days before or after a holiday.

The operation of any existing District valve or other facility shall be by District personnel only.

The contractor shall be fully prepared to complete the connection in the time allotted and shall not stop work until the facilities are restored to service or until directed to do so by the District. All possible preparatory work shall be completed to the satisfaction of the District prior to a connection.

- 3.8 Hot Taps - The contractor shall notify the District Inspector of the scheduled time for all hot taps. Taps shall be made in accordance with the plans. All welds on steel mains shall be made by certified pipe welders.

The contractor shall initiate a request for a hot tap of existing facilities on the form provided by the District. The contractor shall submit the form a minimum of 3 business days before the requested hot tap. The contractor shall submit information on the tapping sleeve prior to submitting the request for a hot tap.

- 3.9 Abandonment - Abandonment of existing water lines, sewer lines, and/or structures shall be as shown on the plans. Pipelines cut shall be sealed with an appropriate plug.
- 3.10 Inspection Field Acceptance and Guarantee Period - The Engineering Department is responsible for inspection of all excavation and pipe laying

including appurtenant structures and trench backfill from trench foundation to subgrade. All such work shall be available for inspection at all times. Construction shall begin within five days after the preconstruction meeting. 48 hours notice shall be given prior to the start of any construction and 24 hours notice for specific inspection requests. Failure to provide proper notification may delay the starting date of inspection since the Engineering Department may not be able to inspect the work and cannot accept any work for which inspection has not been arranged. The primary responsibility for compliance with all District requirements and standards rests with the developer and/or contractor. Any acceptance of a portion of the work by a District Inspector does not relieve the developer/contractor of this basic responsibility.

Field acceptance is made by the District Inspector and will not coincide with the date of final acceptance of the work. The one-year warranty period for all work shall begin on the date of field acceptance. Any defective work discovered during this period shall be repaired or replaced and a new one-year period shall begin for that corrected work.

All overtime, holiday or weekend inspection will be subject to District approval.

Field acceptance will be withheld until work not accepted by the District is reconstructed and complies with District Standards.

- 3.11 Public Relations - The contractor shall conduct its affairs in a manner, which will minimize disturbance to residents in the vicinity of the work. The job site shall be maintained in a condition, which shall bring no discredit to the District or its personnel, and all affected improvements shall be restored to at least their original condition.
- 3.12 Defective Work - Any defective materials or workmanship, which shall become evident within one year after field acceptance; shall be replaced or repaired without cost to the District. Refusal of the contractor to correct defective work which is clearly his responsibility may be just cause to bring legal action to correct the deficiencies as well as to withhold exoneration of performance and payment bonds.
- 3.13 High Water Table - Where the water table is, or anticipated to be, within the trench excavation, pipe zone material shall be reviewed and have prior approval from the District. The District may require a sand/cement slurry or a fabric envelope of crushed rock.
- 3.14 Protection of Existing Utilities - The contractor shall be responsible for the care and protection of all existing sewer pipe, water pipe, gas mains,

culverts, or other facilities and structures that may be encountered in or near the area of the work.

In the event of damage to any existing facilities during the progress of the work and of the failure of the contractor to exercise the proper precautions, the contractor will pay for the cost of all repairs and protection to said facilities. The contractor's work may be stopped until repair operations are complete.

3.15 Recycled Water for Construction grading etc.

The following are the procedures and guidelines for the use of recycled water for construction grading, dust control, compaction and temporary reservoirs.

- A. All construction connections shall be tagged with warning tags, as follows: Warning- Reclaimed Water, Do Not Drink.

Use tags as manufactured by T. Christy Enterprises or approved equal. Tags shall be affixed to stationary tanks, water trucks, and all service points or any other inlet or outlet using recycled water.

- B. Water trucks, water tanks, or any other receptacle, including but not limited to pipe or hose used for storage or conveyance of recycled water must be approved through EID and the El Dorado County Department of Environmental Health.

- C. No fittings hose, or pipe, or any other appurtenance used for recycled water shall connect to a potable domestic water source.

- D. All PVC pipe extending from the point of connection to EID's system shall be marked: "Caution Recycled Water." The PVC piping shall conform to all material specifications as set forth by EID.

- E. Any water truck, water tank, or other storage receptacle to be converted from recycled water use to potable domestic water use shall be thoroughly cleaned and disinfected to the satisfaction of the El Dorado County Department of Environmental Health and EID.

Contact EID's Customer Services Department prior to connection to the District's system at (530) 622-4513, to arrange for inspection to ensure compliance with District Standards.

Failure to comply with any of the above requirements places the construction site in violation of District Rules and Regulations, and will result in termination of service until appropriate corrective steps have been taken.

END OF SECTION

CONCRETE AND REINFORCING STEEL

1.0 GENERAL

- 1.1 Scope - This specification includes concrete materials, mixing, placement, formwork, reinforcement and curing.
- 1.2 Submittals - Prior to placement, the following shall be submitted:
- A. Supplier's concrete mix data sheet showing contents and proportions of cement, aggregate, water, and any admixtures.
 - B. Reinforcing steel schedule, if requested.
- 1.3 Workmanship and Methods - Concrete work, including detailing of reinforcing, shall be in accordance with the best standard practices and as set forth in the ACI Building Code, Manuals, and Recommended Practices.

2.0 MATERIALS

- 2.1 Concrete - Portland cement concrete shall be composed of portland cement, fine aggregate, coarse aggregate, admixtures if used, and water, proportioned and mixed as specified in the Caltrans Standard Specifications Section 90, "Portland Cement Concrete".

Thrust block concrete shall be a 3,600 PSI Class 2 mix where it shall reach 3,600 PSI at 28 days. This mix shall conform to Sections 51 and 90 of Caltrans most recent specifications.

Slabs, structures, etc. concrete shall be a 4,000 PSI Class 1 mix where it shall reach 4,000 PSI at 28 days unless otherwise specified by the Engineer. This mix shall conform to Sections 51 and 90 of Caltrans most recent specifications.

Minor concrete (curbs, gutters, sidewalks, driveways, etc.) shall be a 463 lb/cu. yd. cementitious mix. This mix shall conform to Sections 73 and 90 of Caltrans most recent specifications.

Rapid setting batch mixed concrete may be used. Accelerating admixtures may be added to the concrete mix as approved by the District.

- 2.2 Grout - Grout shall be composed of 1 part Type II Portland Cement to 1 ½ parts sand. The sand shall be washed, well-graded sand such that all will pass a No. 8 sieve. Water shall be clean potable water. The quantity of

water to be used in the preparation of grout shall be the minimum required to produce a mixture sufficiently workable for the purpose intended. Grout shall attain a minimum compressive strength of 2,000 psi in 28 days.

Rapid setting, non-shrink, "5-minute" grout may be used or required in certain circumstances with prior approval from the District.

- 2.3 Reinforcing Steel - Reinforcing steel shall conform to ASTM A 615, Grade 60. Reinforcing steel shall be fabricated in accordance with the current edition of the Manual of Standard Practice, published by the Concrete Reinforcing Steel Institute. Reinforcing steel shall be delivered to the site bundled and tagged for identification.
- 2.4 Tie Wire - Tie wire shall be 16 gage minimum, black, soft annealed.
- 2.5 Bar Supports - Bar supports in beams and slabs exposed to view after form stripping shall be galvanized or plastic coated. Concrete supports shall be used for reinforcing concrete placed on grade.
- 2.6 Forms - Forms shall be accurately constructed of clean lumber and shall be braced to provide sufficient strength and rigidity to hold the concrete and to withstand the necessary pressure and consolidation without deflection from the prescribed lines.

The surface of forms against which concrete is placed shall be smooth and free from irregularities, dents, sags, or holes. The surface shall leave uniform form marks conforming to the general lines of the structure.

3.0 EXECUTION

- 3.1 Formwork - The contractor shall notify the District a minimum of two working days before his intended placement of concrete to enable the District to check the form lines, grades, and other required items before placement of concrete.

Unless otherwise indicated on the plans, all exposed sharp concrete edges shall be $\frac{3}{4}$ -inch chamfered.

Before placing concrete, the form surface shall be clean and coated with an EPA approved form oil of high penetrating qualities where applicable.

- 3.2 Reinforcement - Reinforcing steel shall be placed in accordance with the current edition of Recommended Practice for Placing Reinforcing Bars, published by the Concrete Reinforcing Steel Institute.

All reinforcing steel shall be of the required sizes and shapes and placed where shown on the drawings.

Reinforcing steel shall not be straightened or re-bent in a manner that will damage the material. The contractor shall not use bars with bends not shown on the drawings. ALL STEEL SHALL BE COLD BENT - DO NOT USE HEAT.

All bars shall be free from rust, scale, oil, or any other coating which would reduce or destroy the bond between concrete and steel. Minor surface rust or mill scale that is well-adhered to the bar is acceptable

Reinforcement steel shall be positioned in accordance with the drawings and secured by using annealed wire ties or clips at intersections and supported by concrete or metal supports, spacers, or metal hangers. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage. Bars, additional to those shown on the drawings, which may be found necessary or desirable by the District for the purpose of securing reinforcement in position, shall be provided.

All reinforcing steel and wire mesh shall be completely encased in concrete. Reinforcement shall be placed a minimum of two-inches clear of any metal pipe or fittings and three inches clear from any earthen form. The reinforcement shall be so secured in position that it will not be displaced during the placement of concrete.

Reinforcing dowels shall be secured in place prior to placing concrete. The contractor shall not press dowels into the concrete after the concrete has been placed. The minimum lap for all reinforcement shall be 40 bar diameters. Additional reinforcement shall be placed around the pipe or openings as indicated in the drawings.

Wire mesh reinforcement is to be rolled flat before being placed in the form. The contractor shall support and tie wire mesh to prevent movement during concrete placement. Welded wire fabric shall be extended to within two inches of the edges of the slab. Splices shall be lapped at least 1 ½ courses of the fabric and a minimum of six inches. Laps and splices shall be securely tied at ends and at least every 24 inches with 16-gage black annealed steel wire. The contractor shall pull the fabric into position as the concrete is placed by means of hooks, and then work concrete under the steel to ensure that it is at the proper distance above the bottom of the slab.

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

3.4 Placing Concrete - Concrete, batch mixed, shall be placed in the forms before taking its initial set. No concrete shall be placed in water except with approval of the District. No concrete shall be placed if the mix temperature reaches 90°F, or greater and no concrete shall be placed when temperatures are below 40°F, except as otherwise provided under ACI guidelines for "cold weather concrete" debris and ice shall be removed from spaces to be occupied by concrete before placement. Standing water shall be removed from place of deposit before concrete is placed unless a tremie is to be used or unless otherwise permitted by both the licensed design engineer and the District.

Concrete shall not be placed until all reinforcement is securely and properly fastened in its correct position and loose form ties at construction joints have been retightened. All dowels, bucks, sleeves, hangers, pipes, conduits, bolts, and any other fixtures required to be embedded therein shall be placed and adequately anchored, and all forms shall be cleaned and oiled as specified.

Placement of concrete in which initial set has occurred or re-tempered concrete will not be permitted.

No concrete shall be placed during rainstorms or high velocity winds. Concrete placed immediately before rain shall be protected to prevent the water from coming in contact with it or winds causing excessive drying. Sufficient protective covering shall be kept on hand at all times for protection purposes.

As the concrete is placed in the forms, or in excavations to be filled with concrete, it shall be thoroughly settled and compacted throughout the entire layer by internal vibration and tamping bars. Concrete shall not be permitted to fall more than five feet and shall be deposited as nearly as practicable to its final position.

All concrete surfaces upon which or against which the concrete is to be placed, and to which new concrete is to adhere, shall be bush hammered/roughened to specified amplitude, thoroughly cleaned, wet or sandblasted to bare aggregate as directed. An approved bonding agent shall be used before the concrete is deposited.

Concrete shall not be deposited in large quantities in one place and worked along the forms with the vibrator or otherwise. No concrete shall be dropped freely into place from a height greater than five feet. Tremies shall be used for placing concrete where the drop is over five feet. Placement of concrete on slopes shall commence at the bottom of the slope.

Concrete shall be placed in horizontal layers not to exceed 18-inches in depth and shall be brought up evenly in all parts of the forms.

Equipment used to convey concrete from the mixer to the location of final placement shall have capabilities to achieve the placement requirements.

Concrete shall be placed in accordance as described below:

1. At a rate to provide an adequate supply of concrete at the location of placement.
2. At a rate so concrete at all times has sufficient workability such that it can be consolidated by the intended methods.
3. Without segregation or loss of materials.
4. Without interruptions sufficient to permit loss of workability between successive placements that would result in cold joints.
5. Deposited as near to its final location as practicable to avoid segregation due to rehandling or flowing.

Concrete that has been contaminated or has lost its initial workability to the extent that it can no longer be consolidated by the intended methods shall not be used.

After starting, concreting shall be carried on as a continuous operation until the completion of a panel or section, as defined by its boundaries or predetermined joints. Concrete shall be consolidated by suitable means during placement and shall be worked around reinforcement and embedment's and into corners of forms.

- 3.5 Thrust Blocks – Concrete shall either be wet set and backfilled immediately or hardened for 24 hours prior to backfill. Contractor shall notify the Engineer prior to the placement of concrete which method will be used. Any concrete that has cured from the “plastic” state to the “green” state shall not be backfilled or otherwise subjected to disturbance from compaction equipment.
- 3.6 Concrete Finishing - Immediately upon the removal of forms, all voids shall be neatly filled with cement mortar.

The surfaces of concrete to be permanently exposed to view shall be smooth, free from projections, and thoroughly filled with mortar.

Exposed surfaces of concrete not finished against forms, such as horizontal or sloping surfaces, shall be screeded to a uniform surface and worked with suitable tools to a light broom finish.

- 3.7 Protection and Curing of Concrete - The contractor shall protect all concrete against damage. Exposed surfaces of new concrete shall be protected from the direct rays of the sun and from frost by being kept damp for at least two weeks after the concrete has been placed, or by using an approved curing process.
- 3.8 Joints and Bonding - Concrete work shall be constructed as a monolith as much as practical. Where not specified or indicated otherwise, all slabs and walls shall have construction joints at intervals not greater than 30-feet. In order to preserve the strength and water tightness of the structures, no other joints shall be made except as authorized by the Engineer. At construction joints, the concrete in place shall be thoroughly cleaned of laitance, grease, oil, mud, dirt, curing compounds, mortar droppings, or other objectionable matter by means of a bush hammer or heavy sandblasting. The surfaces shall be washed just prior to the succeeding concrete placement. Keyways in joints shall be provided as indicated on the Plans. Material for keyways shall be steel, plastic or lumber treated with form release coating, applied in accordance with the manufacturer's published instructions.

Construction joints shall be washed free of sawdust, chips, and other debris after forms are built and immediately before the concrete placement. Should formwork confine sawdust, chips, or other loose matter in such a manner that it is impossible to remove them by flushing with water, a vacuum cleaner shall be used for their removal, after which the cleaned surfaces shall be flushed with water. A cleanout hole shall be provided at the base of each wall and column for inspection and cleaning.

Expansion, contraction, and construction joints shall be constructed where indicated on the Plans. Waterstops, expansion joint material, synthetic rubber sealing compound, and other similar materials, shall be as specified elsewhere herein.

- 3.9 Consolidating Concrete – Concrete shall be placed with the aid of acceptable mechanical vibrators. Vibration shall be supplemented by manual forking or spading adjacent to the forms on exposed faces in order to secure smooth dense surfaces. The concrete shall be thoroughly consolidated around reinforcement, pipes, or other embedded items built into the work. The vibration shall be sufficiently intense to cause the concrete to flow and settle readily into place and to visibly affect the concrete over a radius of a least 18-inches.

Sufficient vibrators shall be on hand at all times to vibrate the concrete as placed. In addition to the vibrators in actual use while concrete is being placed, the Contractor shall have on hand one spare vibrator in serviceable condition. No concrete shall be placed until it has been ascertained that all vibrating equipment, including spares, is in serviceable condition.

Special care shall be taken to place the concrete solidly against the forms to leave no voids. Every precaution shall be taken to make all concrete solid, compact, and smooth, and if for any reason the surfaces or interiors have voids or are in any way defective, such concrete shall be repaired in a manner acceptable to the Engineer.

- 3.10 Footings and Slabs On-Grade – Concrete to be placed on ground or compacted fill shall not be placed until the subgrade is in a moist condition acceptable to the Engineer. If necessary, the subgrade shall be well sprinkled with water not less than 6 hours and no more than 20 hours in advance of placing concrete. If it becomes dry prior to the actual placing of concrete, it shall be sprinkled again, without forming pools of water. No concrete shall be placed if the subgrade is muddy or soft.

END OF SECTION

PRECAST CONCRETE VAULTS

1.0 GENERAL

- 1.1 Scope - The work covered by this section shall consist of furnishing all materials, accessories, equipment, tools, transportation, service, labor and performing all operations to furnish and install the precast concrete vaults in accordance with this section of the specifications and applicable drawings. Excavation and backfill to be in accordance with Section 31 23 16.

Precast concrete vaults and covers shall be manufactured in a plant especially designed for that purpose and shall conform to the shapes and dimensions indicated on the plans.

- 1.2 Submittals - Prior to installation the following is to be submitted:

A. Submit manufacturer's catalog data on precast items. Show dimensions of vault, thickness of walls, and top slab. Show reinforcing. Show materials of construction by ASTM reference and grade.

- 1.3 Design Loads - Design loads shall consist of dead load, live load, impact, and, in addition, loads due to water table and any other loads which may be imposed upon the structure. Live loads shall be for HS-20 per AASHTO standard specifications for highway bridges. Design wheel load shall be 16 kips. The live load shall be that which produces the maximum shears and bending moments in the structure. Minimum wall thickness shall be six inches.

2.0 MATERIALS

- 2.1 Concrete - Portland cement concrete shall conform to Class A as specified in the Caltrans Standard Specifications Section 90, "Portland Cement Concrete."

- 2.2 Reinforcement - Reinforcement shall be deformed reinforcement in accordance with ASTM A615 or ASTM A497 for welded deformed wire fabric.

- 2.3 Joint Sealing Compound - Joint sealing compound shall be impermeable to water; have high bonding strength to steel, concrete, etc., maintain permanent plasticity; resistant to applicable chemical exposure; and complies with the applicable Federal Specifications.

- 2.4 Access Door - Access doors shall be Type JD-AL as manufactured by the Bilco Company, New Haven, Conn., or equal.
- 2.5 Vents - Vents shall be constructed from 6-inch C-900 PVC pipe and fittings. Fittings shall be socket-welded type.

Each vault shall have two vents, one upper and one lower.

Install 304 stainless steel insect screen over vent openings above ground.

3.0 EXECUTION

- 3.1 Installation - Openings or "knockouts" in precast concrete vaults shall be located as shown on the drawings and shall be sized sufficiently to permit passage of the largest dimension of pipe and/or flange. Upon completion of installation, all voids or openings in the vault walls around pipes shall be filled with 3,000 psi non-shrink grout.

All joints between precast concrete vault sections shall be made watertight. The joint sealing compound shall be installed according to the manufacturer's recommendations to provide a watertight joint, which remains impermeable throughout the design life of the structure.

Access doors shall be built up so that the hatch is flush with the surrounding surface unless otherwise specified on the drawings or by the District. The contractor is responsible for placing the cover at the proper elevation where paving is to be installed and shall make all necessary adjustments so that the cover meets these requirements.

The vault floor shall contain an 18-inch diameter hole for installation of a gravity drain or sump. The vault floor shall be constructed so that there is a positive slope to the sump.

- 3.2 Exterior Coating - All exterior surfaces shall be coated with a minimum 30 mil (wft) of bitumastic 30 mil.

END OF SECTION

PAINTING AND COATING

1.0 GENERAL

1.1 Scope - This section governs materials and application of painting and coating for exposed pipe and appurtenances.

1.2 Submittals - Prior to application, the following shall be submitted:

A. Paint or coating manufacturer's product data sheet showing suitability of material for intended use including instruction on surface preparation and application.

1.3 Color Schedule - Above-ground or exposed facilities shall be color coded to differentiate from potable water, reclaimed water, and wastewater facilities as follows:

Potable Water: Medium Blue

Reclaimed Water: OSHA Safety Purple

Wastewater: OSHA Safety Green

2.0 MATERIALS

2.1 Alkyd Primer - All primer shall be lead free and rust-inhibitive synthetic-alkyd based. It shall be designed for use with an alkyd enamel finish coat.

2.2 Alkyd Enamel - Enamel shall be a high gloss industrial type, lead free, synthetic alkyd based, intended for use on exterior metal surfaces.

2.3 Bituminous Mastic - Bituminous mastic shall be coal-tar pitch based and shall have a minimum of 68% solids by volume.

2.4 Epoxy Paint - Epoxy shall be a colored polyamide cured epoxy with not less than 49% solids by volume.

All coatings and pigments to be used on potable water services shall have FDA approval for use with potable water.

3.0 EXECUTION

3.1 General - The requirements for painting and coating ferrous surfaces shall generally conform to the SSPC (Steel Structures Painting Council) and to

the manufacturer's recommendations. Application of the paint or coating system shall not be permitted if, in the opinion of the District, the equipment, climate, or safety conditions do not meet the above recommendations.

The contractor shall stir, strain, and keep coating materials at a uniform consistency during application. Each coating shall be applied evenly, free of brush marks, sags, runs and other evidence of poor workmanship. Finished surfaces shall be free from defects and blemishes.

The contractor shall not use thinners unless permitted by the District. If thinning is allowed, the maximum allowable amount of thinner per gallon of coating material as recommended by the manufacturer shall be used. Coating materials shall be stirred at all times when adding thinner and the coating material surface shall not be flooded with thinner prior to mixing. The contractor shall not reduce coating materials more than is absolutely necessary to obtain the proper application characteristics and to obtain the specified dry film thickness.

Deliver all paints to the job site in the original, unopened containers.

3.2 Surfaces not to be Coated - The following surfaces shall not be painted and shall be protected during the painting of adjacent areas:

- A. Mortar-coated pipe and fittings
- B. Concrete surfaces (i.e. vaults)
- C. Stainless steel
- D. Anodized aluminum
- E. Nameplates
- F. Manhole frames and covers
- G. Grease fittings
- H. Glass
- I. Brass, copper or bronze
- J. Platform gratings
- K. Buried pipe, unless specifically required in the piping specifications

3.3 Surface Preparation - The contractor shall not prepare more surface area than can be coated in one day. Pipe that has already been factory primed or painted shall not be sandblasted. All surfaces shall be prepared in accordance with the manufacturer's recommendations.

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 (Steel Structure Painting Council).

3.4 Shop Applied Primer - Surfaces that are shop primed shall receive a field touch up of primer to cover all scratches or abraded areas.

3.5 Alkyd Enamel - All above-ground or exposed piping, fire hydrants, and exposed metalwork shall be painted using an alkyd system.

A. Surface Preparation:

1. All rust, mill scale, or weld splatter shall be removed by sandblasting or power tool cleaning.
2. All unpainted surfaces shall be solvent cleaned.
3. All abraded or scratched enamel coatings shall be sanded smooth or receive power tool cleaning.
4. All failures in the existing coating shall be sandblasted.
5. All existing surfaces to be repainted shall be washed with TSP and stiff bristle brush.

B. Primer - All unpainted or damaged surfaces shall be coated with primer to a dry-film thickness or not less than 2 mils.

C. Finish Coat - The finish coats shall be two or more coats of alkyd enamel applied to a dry-film thickness of 3 mils, providing a total painted dry film thickness of not less than 5 mils.

3.6 Bituminous Mastic - Buried metal (flanges, non-stainless steel nuts and bolts, flexible couplings, exposed reinforcing steel, etc.) shall be coated with a minimum of 20 mils of bituminous mastic.

All surfaces coated with bituminous mastic shall be covered with 8 mil polyethylene wrap.

3.7 Epoxy Coating - Only those metal surfaces specifically called out, shall be epoxy coated and applied as follows:

A. Surfaces to be epoxy coated shall be sandblasted.

B. Sandblasted surfaces shall be coated with primer to a dry film thickness of 3 mils.

C. Two coats of epoxy paint shall be applied (4 mils each) to the primed surface. The manufacturer's recommended drying time between coats shall be followed.

D. The contractor shall prepare multiple-component coatings using all of the contents of the container for each component as packaged by the paint manufacturer. Partial batches and multiple component

coatings that have been mixed beyond their pot life shall not be used. Touch up paint shall be provided. The contractor shall mix only the components specified and furnished by the paint manufacturer. The contractor shall not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

3.8 Application Limitation - Paint or coating shall not be applied under the following conditions:

- A. When the surrounding air temperature or the temperature of the surface to be coated is below 40 degrees Fahrenheit or as recommended by the manufacturer of the specified coating system.
- B. When the temperature of the surface to be coated is more than 5 degrees Fahrenheit below the air temperature or when the surface temperature is over 120 degrees Fahrenheit .
- C. When the surface to be coated is wet, moist, or contaminated with any foreign matter.
- D. During rain, fog, or mist, or when the relative humidity exceeds 80%.
- E. When the temperature is less than 5 degrees Fahrenheit above the dewpoint.

If above conditions are prevalent, the application of coating shall be delayed or postponed until conditions are favorable. Dew or moisture condensation should be anticipated and if such conditions are prevalent, coating work shall be delayed until mid-morning to be certain that the surfaces are dry. The day's coating shall be completed in time to permit the film sufficient drying time prior to damage by climatic conditions.

If a change in climatic conditions damages a coating application, the contractor shall repair the damaged coating to its specified condition as directed by the District.

Paint shall be applied in such a manner as to assure an even, smooth, uniform adhering coat free from dirt, runs, brush marks and laps, and shall be applied as recommended by the manufacturer. Paint shall not be applied when freshly painted surfaces can become damaged by rain, fog, or condensation or when inclement weather can be anticipated. Fresh paint damaged by the elements shall be replaced by the contractor at his expense. Drop cloths shall be used to protect floors, equipment, piping and other exposed surfaces from spattering and spillage. Paint shall be

allowed to dry thoroughly between applications of successive coats. The manufacturer's recommended time between coats will be used as a guide by the District as to when the next coat of paint may be applied. The District must give approval before successive coats are applied.

The contractor shall notify the District after surface preparation and after the application of each coat of paint.

4.0 TESTING

- 4.1 General - The District will perform such tests as are required to ensure compliance with all phases of the work including surface preparation, abrasive blast cleaning, and the application of the coating systems.

If the item has an improper finish color or insufficient film thickness, the surface shall be cleaned and topcoated with the specified paint material to obtain the specified color and coverage. Visible areas of chipped, peeled, or abraded paint shall be hand or power-sanded, feathering the edges. The areas shall then be primed and finish coated in accordance with the specifications. Work shall be free of runs, bridges, shiners, laps, or other imperfections.

END OF SECTION

INTERIOR TANK COATING

1.0 GENERAL

- 1.1 Scope - The work includes the surface preparation and application of protective coatings to all specified surfaces of the interior, including all attachments, appurtenances, and accessories. The Contractor shall provide all labor, materials, equipment and incidentals required to complete the interior tank coating.

The work to be accomplished includes the complete removal of all existing interior linings and the replacement with an NSF ANSI Standard 61 certified immersion grade lining system. The lining within the vapor areas shall be a three-coat system with an organic zinc-rich primer and two coats of epoxy. All internal areas below this vapor area shall receive an amine cured elastomeric epoxy. As part of this effort the contractor shall apply caulking to any interfaces or crevices (e.g. roof plate lap seams) that precludes proper coating application.

The Contractor shall dispose 100% of all wastes from abrasive blasting and any other wastes or debris generated during work. The Contractor shall sample and test wastes as required by applicable regulatory agencies, and as necessary for classification of wastes prior to disposal. The Contractor shall bear all costs for waste sampling, testing, accumulation, transport, and disposal, including the cost for wastes classified as hazardous and non-hazardous.

When the new interior coating has completely cured, the Contractor shall clean and disinfect the tank per the latest AWWA Standards and Specifications.

After filling the tank, the District shall test the tank water for bacteriologic and volatile organic contamination, and for aesthetic quality. The District shall not accept the project until the tank water meets the California Water Quality Control Board and federal drinking water standards. In addition, the tank will not be accepted until the coating system is free of taste and odor associated with the coating product and does not impart any adverse aesthetic quality to District water.

The District shall conduct a one-year warranty inspection and the Contractor shall provide floor protection, lighting, and scaffolding during the inspection. The Contractor shall be present at the inspection and disinfect the tank after any necessary repairs are complete.

At least two days prior to start of work, the Contractor shall arrange with the District for a pre-construction conference at the job site to ensure that all parties are familiar with the entire project, including specifications and the manufacturer's printed application instructions.

1.2 Submittals – The Contractor must submit the following plans and programs for the District's review and acceptance prior to the pre-construction meeting. The Contractor shall provide a separate submittal for each material to be used in the work.

A. The Contractor shall submit Manufacturers' Product Data Sheets and Safety Data Sheets on all materials to be used including, but not limited to coatings, thinners, solvents, inhibitors, and abrasive media.

Acceptance of the submittal does not relieve the Contractor from the responsibility to conduct the work in strict accordance with the requirements of this Specification, or to adequately protect the environment, health and safety of all workers involved in the project including any members of the public who may be affected by the project.

Contractor shall maintain copies of submittal data at the jobsite at all times and shall furnish a complete set of submittal data for use by the Inspector.

B. Containment Design: A description of the containment proposed for use during both surface preparation and paint application to prevent emission of dust and other particulate.

C. Heater equipment and containment: All heating equipment shall be proposed on and approved showing secondary containment for all fuels. Additionally, the contractor shall have all necessary fire prevention equipment on site in accordance with all OSHA rules and regulations.

D. The Contractor shall include the following data in the submittal:

1. Weight in pounds/gallon – ASTM D-2196
2. % solids by volume – ASTM D-2369
3. Percent solids by weight – ASTM D-2369
4. Air cure dry time to re-coat – ASTM D-1640

5. Minimum adhesion to steel substrate – ASTM D-4541 using a type II instrument (Minimum acceptable adhesion shall be 800 psi).
 6. Adhesion between coats – ASTM D-4541
 7. Manufacturer's batch numbers and dates of manufacture for materials to be furnished as part of this project.
 8. Letter from dehumidification manufacture that the equipment has been properly sized as per the specification requirements.
- E. The Contractor shall include technical data documenting that the material to be provided complies with these specifications. Submittals will not be accepted until all requirements of this specification have been confirmed.
- F. The Contractor shall include the following data in the manufacturer's recommended handling and installation instructions for the proposed paint system submittal:
1. Storage – including maximum and minimum storage temperatures
 2. Surface preparation
 3. Coating repair
 4. Application equipment
 5. Mixing and application of coating system – including a table of minimum and maximum time to re-coat as a function of temperature
 6. Curing – including curing time required before holiday testing, and curing time required before immersion as function of temperature and coating thickness. Minimum and maximum re-coat times.
 7. Ventilation and Containment System
 8. Acceptable temperatures at the time of application
- G. The Contractor shall include the following data in the equipment submittal:

1. Details of vacuum system for removing dust and abrasive from abrasive blast cleaned surfaces.
 2. The manufacturer's latest written operation instructions including recommendations for air filter maintenance and change interval for air compressors used for work.
- H. The Contractor shall include the following data in the report submittal:
1. Actual weight of blast cleaning abrasive used for field abrasive blast cleaning, submitted within 24 hours after blasting is completed.
 2. Quantity of coating material used for each coat, submitted within 24 hours after completion of each coat.
 3. Name of laboratories proposed to be used to test wastes and tank water prior to testing any materials.
 4. Laboratory test results for representative waste samples prior to removing any waste materials from the job site. At a minimum, the samples shall be tested for total concentrations of the 17 metals identified in Title 22, for comparison to Total Threshold Limit Concentrations (TTLC) values. The California Waste Extraction Test (WET) shall be performed for each analyte of each sample for which the total concentration exceeds 10 times the STLC value, if any, as specified in Title 22. Toxic Characteristic Leaching Procedure (TCLP) testing shall be performed for each analyte of each sample for which the total concentration exceeds 20 times the TCLP values, if any, specified in the Federal Resource Conservation and Recovery Act. Reactivity, corrosively, and Ignitability testing shall be performed as required by Title 22 and/or the District or representative of the disposal facility.
 5. Receipts from disposal site for all wastes. Receipts shall identify disposed material and source, show quantity of disposed material in tons or cubic yards, and show method used for final disposition as buried, incinerated, and chemically treated and/or other means.
- I. The Contractor shall include the following data in the disposal plan submittal:
1. Certification that the materials disposal plan complies with all applicable requirements of: The Federal Resource

Conservation and Recovery Act; Title 22 and Title 26 of the California Administrative Code; and other applicable regulations of local, state and federal agencies having jurisdiction over the disposal of spent abrasive blast media, removed coating materials, and other waste, whether hazardous or non-hazardous.

2. The name and Environmental Laboratory Accreditation Program Certificate number of laboratory that will sample and test spent abrasive blast media and removed coating materials. Include statement of the laboratory's certified testing areas and analyses that the laboratory is qualified to perform.
3. Written permission to dispose of material from disposal site representative. Include name, address, and telephone number of disposal site and of representative.
4. The District shall provide written acceptance of the disposal plan prior to disposal of any wastes.

- 1.3 Contractor - The contractor shall be a licensed Painting and Decorating Contractor in the State of California (C-33 Classification) and SSPC certified. They shall have a minimum of five (5) years practical experience and successful history in the application of specified products to surfaces of steel water storage tanks.

All coating and surface preparation work shall be performed by skilled personnel demonstrating experience, as listed above. Resumes of personnel shall be submitted to the District for approval prior to the pre-construction meeting. Continuity of personnel shall be maintained throughout the duration of the cleaning and coating work and any changes in key personnel shall be subject to the approval of the District.

Applicator Training: Application of coating is considered specialized work. Personnel performing this work shall be trained in proper methods of application.

- 1.4 Governing Standards - The following standards (including the most recent update or version) shall govern the work unless specified otherwise in these specifications.

SSPC-Vol.1,	Steel Structures Painting Manual, Good Painting Practice.
SSPC-Vol.2,	Steel Structures Painting Manual, Systems and Specifications.
SSPC-SP 1	Solvent Cleaning
SSPC-SP 2	Hand Tool Cleaning
SSPC-SP 3	Power Tool Cleaning
SSPC-SP 5	White Metal Blast Cleaning
SSPC-SP 6	Commercial Blast Cleaning
SSPC-SP 7	Brush-Off Blast Cleaning
SSPC-SP 10	Near White Blast Cleaning
SSPC-SP 11	Power Tool Cleaning to Bare Metal
SSPC-SP 15	Power Tool Cleaning to Commercial Grade
SSPC-SP Guide 11	Stripe Coating
SSPC-AB 1	Mineral and Slag Abrasives
SSPC-AB 2	Specification for Cleanliness of Recycled Ferrous Metallic Abrasives
SSPC-PA 1	Shop, Field and Maintenance Painting
SSPC-PA 2	Measurement of Dry Film Thickness with Magnetic Gages
SSPS-PA Guide 3	Guide to Safety in Paint Application
SSPS-PA Guide 12	Lighting
SSPC-Guide to Vis 1	Visual Standard for Abrasive Blast Cleaned Steel
SSPC-Guide to Vis 3	Visual Standard for Hand and Power Tool Cleaned Steel
SSPC-V15 (3-93)	Visual Standard for Power & Hand-Tool Cleaned Steel
SSPC Publication No. 91-12	Coating and Lining Inspection Manual
SSPC	Visual Comparison Manual
ASTM D4138	Standard Test Method for Measurement of Dry Paint Thickness of Protective Coating Systems by Destructive Means
ASTM D4285	Standard Test Method for Indicating Oil or Water in Compressed Air
Guide 6	Guide for Containing Debris Generated During Paint Removal Operations
SSPC Technology	Guide No. 12 for Illumination of Industrial Painting Projects
ASTM D4414	Standard Practice for Measurement of Wet Film Thickness by Notch Gages
ASTM D4417	Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
ASTM D5402	Standard Test Methods for Assessing the Solvent Resistance of Organic Coatings Using Solvent Rubs

ASTM D7091	Standard Test Method for Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals
ASTM E337	Standard Test Method for Measuring Humidity with a Psychrometer
AWWA D102	Standard for Painting Steel Water-Storage Tanks
AWWA C652 ISO-8502-3	Disinfection of Water Storage Facilities. Preparation of Steel Substrates
AWWA M42	Manual of Water Supply Practices, Steel Water Storage Tanks
29 CFR 1910	Occupational Safety and Health Regulations for General Industry
29 CFR 1926	Occupational Safety and Health Regulations for the Construction Industry
Health and Safety Code, Div. 20, Chapter 6.5, 6.67, 6.7, 6.95	Hazardous Waste Control Law, Health and Safety Code
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 302	Designation, Reportable Quantities and Notification
49 CFR 171-179	Hazardous Materials Regulations
ISO 8502-3	Preparation of Steel Substrates before Application of Paints and Related Products
NACE SP0188-06	Standard Practice for Discontinuity (Holiday) Testing of Protective Coatings
NACE SP0178-89	Standard Recommended Practice for Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to be Lined for Immersion Service
EPA - SW 846	Test Methods for Evaluating Solid Waste - Physical/Chemical Methods
EPA - Method 1311	Toxicity Characteristic Leaching Procedure (TCLP)
EPA - Method 3050	Acid Digestion of Sediment, Sludge, and Soils
All applicable State and Federal OSHA safety standards.	

1.4 Safety - The Contractor shall comply with all Federal, State, and Local applicable safety regulations and requirements. All scaffolding shall be equipped with interior stairways. No exterior ladders will be allowed.

Ventilation, electrical grounding, and care in handling coatings, paints, solvents and equipment are important safety precautions during coating projects. Contractor shall conform with safety requirements set forth by regulatory agencies applicable to the construction industry and manufacturer's printed instructions and appropriate technical bulletins and manuals. The Contractor shall provide and require use of personal protective life saving equipment for all persons working in or about the project site.

Access Facilities: all ladders, scaffolding and rigging shall be designed for their intended uses. Ladders and scaffolding shall be erected where requested by Engineer to facilitate inspection and be moved by the Contractor to locations requested by the Engineer.

- 1.5 Definitions - "Lining" refers to protective materials used or applied to interior surfaces.

"Coating" refers to protective materials used or applied on interior surfaces, or any protective material in general.

"Vapor Area" refers to the underside of the roof, including the roof support structure and upper 6 inches of the shell.

"Immersion Area" refers to all surfaces below the Vapor Area.

"Engineer" refers to the District Director of Engineering or his/her designated representative.

- 1.6 Quality Assurance - Quality assurance procedures and practices shall be used to monitor all phases of surface preparation, application and inspection throughout the duration of the project. Procedures or practices not specifically defined herein may be used provided they meet recognized and acceptable professional standards and are approved by the Engineer.

All materials furnished, and all work accomplished shall be subject to inspection by the Engineer. The Contractor shall be held strictly to the true intent of the Specifications in regard to quality of materials, workmanship, and diligent execution of the specification.

The District will assign a fulltime coating inspector to verify the level of quality of the lining work. Work accomplished in the absence of prescribed inspection may be required to be removed and replaced under the proper inspection. The entire cost of removal and replacement, including the cost of all materials used in the work thus removed, shall be borne by the Contractor regardless of whether the work removed is found to be defective or not. Work covered up without the authority of the Engineer, shall, upon

order of the Engineer, be uncovered to the extent required. The Contractor shall similarly bear the entire cost of performing all the work and furnishing all the materials necessary for the removal of the covering and its subsequent replacement, as directed and approved by the Engineer.

The Engineer will make, or have made, such tests as deemed necessary to assure the work is being accomplished in accordance with the requirements of these specifications. Unless otherwise specified, the cost of such testing will be borne by the District. In the event such tests reveal non-compliance with the requirements of the specifications, the Contractor shall bear the cost of such corrective measures deemed necessary by the Engineer, as well as the cost of subsequent retesting. It is understood and agreed the making of tests shall not constitute an acceptance of any portion of the work, nor relieve the Contractor from compliance with the terms of these specifications.

2.0 MATERIALS

2.1 General - Materials specified are those which have been evaluated for the specific service. Products are listed to establish a standard of quality. Standard products of manufacturers other than those specified will be accepted when proven to the satisfaction of the District they are equal in composition, durability, usefulness and convenience for the purpose intended. Substitutions will be considered provided the following minimum conditions are met:

- A. The proposed coating system shall have a dry film thickness equal to or greater than that of the specified system.
- B. The proposed coating system shall employ an equal or greater number of separate coats.
- C. The proposed coating system shall employ coatings of the same generic type.
- D. All requests for substitution shall carry full descriptive literature and directions for application, along with complete information on generic type, non-volatile content by volume and a list of 10 similar projects, all at least five years old, where the coatings have been applied to similar exposure. Substitutions shall be endorsed in writing from the materials manufacturer that these substituted materials will provide equivalent performance as those specified.
- E. If the above-mentioned data appears to be in order, the Engineer may require that the Contractor provide certified laboratory data sheets showing the results of complete spectrographic and durability

tests accomplished on the proposed substitute. An independent testing laboratory satisfactory to the Engineer shall accomplish tests and all costs incurred in the testing program shall be borne by the Contractor. In any case, the Engineer shall be sole and final judge of the acceptability of any proposed substitution. Requests for substitution must be approved in writing.

All materials shall be brought to the jobsite in the original sealed containers. They shall not be opened or used until the Engineer has physically inspected containers and obtained necessary data from information printed on containers or labels. Materials exceeding storage life recommended by the manufacturer shall be rejected.

Flammability, toxicity, allergenic properties, and any other characteristic requiring field precautions shall be identified, and specific safety practices shall be stipulated.

All coating and disinfection materials shall be stored in enclosed structures to protect them from weather and excessive heat or cold. Flammable coatings must be stored to conform with local, county, state and federal safety codes for flammable coating materials. At all times coatings shall be protected from freezing.

Contractor shall use products of the same manufacturer for all coats.

2. Abrasives - Surface preparation will be based upon comparison with: "Pictorial Surface Preparation Standards for Painting Steel Surfaces," SSPC-Vis 1 and/or SSPC-Vis 3 as described herein. Anchor profile for prepared surfaces shall be measured by using a nondestructive instrument such as a Testex Press-0-Film System in accordance with ASTM D4417. Temperature and dewpoint requirements noted above and herein shall apply to all surface preparation operations, except low and high temperature limits. The Contractor shall use abrasive grit for field blast cleaning conforming to the following:
 - A. Produce a surface profile of 3 to 4 mils for the floor, shell, roof supports, ladder, and over flow.
 - B. New, clean and free of contaminants, and containing no hazardous materials.
 - C. Certified by California Air Resources Board, Executive Order G-565.
 - D. Conform to all applicable requirements of the Local Air Quality District.

E. Kleen Blast or approved equal. No sand abrasives are allowed.

2.3 Coating System - Interior coating materials for immersed surfaces of the tank must appear on the current National Sanitation Foundation (ANSI/NSF) Standard 61-1999. They shall conform to the regulations and applicable requirements of local, state and federal air pollution and health regulatory agencies.

A. Interior coating materials for immersed surfaces of the tank and piping must appear on the current National Sanitation Foundation (ANSI/NSF) Standard 61-1999. They shall conform to the regulations and applicable requirements of local, State and Federal air pollution and health regulatory agencies.

1. Vapor Area: Zinc primer coatings shall be similar or equal to AWWA Standard D102-17 Inside Coating System No. 5 (ICS-5). Materials have been listed herein as standards of quality.
2. Vapor Area: Epoxy coatings shall be similar or equal to AWWA Standard D102-17 Inside Coating System No. 5 (ICS-5). Materials have been listed herein as standards of quality.
3. Immersion Area: Epoxy coating shall be similar or equal to AWWA Standard D102-11 Inside Coating System No. 3 (ICS-3). Materials have been listed herein as standards of quality.
4. Joint sealant shall be a flexible polyurethane or polysulfide product, similar or equal to Federal Specification TT-S-230. Materials listed herein as standards of quality.

3.0 EXECUTION

3.1 General - All surface preparation and coating application shall conform to applicable standards of SSPC and the manufacturer's printed instructions. Material applied prior to approval of the surface by the Engineer shall be removed and reapplied to the satisfaction of the Engineer at the expense of the Contractor.

All work shall be performed by skilled craftsmen qualified to accomplish the required work in a manner comparable with the best standards of practice. Continuity of personnel shall be maintained, and transfer of key personnel shall be coordinated with the District.

The Contractor shall provide a supervisor to be at the work site during cleaning, application and disinfection operations. The supervisor shall have

the authority to sign any change orders, coordinate work and make other decisions pertaining to the fulfillment of their contract.

Contractor shall provide approved sanitary facilities for all project personnel, as no existing facilities will be available to the Contractor. Facilities shall be maintained during the project to complete standards established by the District and shall be removed prior to Contractor's departure from the site at completion of the project.

The Contractor shall provide, at his own expense, all necessary power for his operations.

Dust, dirt, oil, grease or any foreign matter which will affect the adhesion or durability of the finish must be removed by washing with clean rags dipped in an approved commercial cleaning solvent, rinsed with clean water and wiped dry with clean rags.

The Contractor's coating equipment shall be designed for application of materials specified and shall be maintained in first class working condition. Compressors shall have suitable traps and filters to remove water and oils from the air. Blotter test shall be accomplished at each start-up period and as deemed necessary by the Engineer. Contractor's equipment shall be subject to approval of the Engineer.

- A. Cleanliness of compressed air supply shall be verified daily, and as deemed necessary by the Engineer, by directing a stream of air, without abrasive, from the blast nozzle or approved opening downstream from separator onto a white blotter or cloth for twenty seconds in accordance with ASTM D4285. If air contamination is evident, change filters, clean traps, add moisture separators or filters, or make adjustments as necessary to achieve clean, dry air.

3.2 Delivery, Storage, and Hauling

- A. The Contractor shall deliver materials as follows:
 - 1. Delivery of abrasive grit shall be in original labeled moisture-proof bags or airtight bulk containers. Abrasives shall not be reused.
 - 2. Delivery of coating system materials shall be in original, unopened containers with seals unbroken and labels intact. Labels shall identify type of material, color, and batch number. No material shall exceed six months from the original batch manufacturing date.

B. The Contractor shall store materials as follows:

1. Store materials in a single, approved location.
2. Store coating system materials in enclosed, secure, and ventilated structures, and maintain temperature inside the structure within the temperature range recommended by the manufacturer.
3. Keep storage location clean, neat, and free of fire hazards.
4. All operating equipment shall be placed into secondary containment to prevent accidental spills.

C. The Contractor shall handle materials as follows:

1. Avoid spilling thinners, solvents, paint products or other materials that contain toxic substances. All compressors and operating equipment shall be placed in secondary containment. All sewer or site drains shall be covered.

D. Remove discarded thinners, solvents, and paint products from the job-site daily.

3.3 Control of Visible Emissions - Visible emissions from dust producing operations or equipment are restricted to no greater than Level 1 (1% of workday) as defined in SSPC Guide 6 from the full containment (regulated) area. Assess visible emissions in accordance with 40 CFR 60, App A, Method 22.

Do not permit any visible emissions to extend beyond containment or the regulated area(s). Visible emissions extending beyond the regulated area are cause for immediate project shut down until the cause of the emissions is corrected.

Immediately cleanup and properly dispose of visible dust and debris that extends beyond the regulated or protected areas.

The Contractor shall conduct all operations so as to confine abrasive blasting debris and coating overspray to within the bounds of the containment (site). The Contractor shall take all precautions necessary to prevent adverse off-site consequences of coating operations. Any complaints received by the District relating to any such potential offsite problems will be immediately delivered to the Contractor. The Contractor shall immediately halt work and shall take whatever corrective action is required to mitigate any such problems. All costs associated with protection

of off-site properties and/or correction of damage to property as a result of coating operations shall be borne directly by the Contractor at no additional expense to the District.

3.4 Surface Preparation (General) – The latest revision of the following surface preparation specifications of SSPC shall form a part of this specification. (Note: an element of surface area is defined as any given 9 square inches of surface).

- A. Solvent Cleaning (SSPC-SP1): Removal of oil, grease, soil and other contaminants by use of solvents, emulsions, cleaning compounds, steam cleaning or similar materials and methods, which involve a solvent or cleaning action.
- B. Brush-off Blast Cleaning (SSPC-SP7): Blast cleaning to remove loose rust, loose mill scale, and other detrimental foreign matter present to the degree specified.
- C. Commercial Blast Cleaning (SSPC-SP6): Blast cleaning to commercial grade cleanliness, until at least thirty-three percent of each element of surface area is free of all visible residues.
- D. Near-White Blast Cleaning (SSPC-SP10): Blast cleaning to near-white metal cleanliness, until at least ninety-five percent of each element of surface area is free of all visible residues.
- E. Powertool Cleaning to Bare Metal (SSPC-SP11): Powertool cleaning to bare metal cleanliness, until each element of surface area is free of all visible residues and has a minimum of 1 mil profile.
- F. Powertool Cleaning to Commercial Grade (SSPC-SP15): Powertool cleaning to commercial cleanliness, until at least thirty-three percent of each element of surface area is free of all visible residues and has a minimum of 1 mil profile.

Slag, weld spatter, or sharp edges such as those created by flame cutting and shearing not previously removed by the tank fabricator, erector or installer shall be removed by chipping and grinding. All sharp edges shall be peened, ground or otherwise blunted as required by the Engineer in accordance with NACE SP0178. The rolled edges of angles, channels, and wide flange beams do not normally require further rounding unless specifically directed by the Engineer.

Abrasive blasting nozzles shall be equipped with "deadman" emergency shut-off nozzles. Blast nozzle pressure shall be a minimum of 95 P.S.I. and shall be verified by using an approved nozzle pressure gage at each start-

up period or as directed by the Engineer. Number of nozzles used during all blast cleaning operations must be sufficient to insure timely completion of project as approved and directed by the Engineer.

All blast hose connections shall be connected with external couplings. These connections shall be taped with duct tape prior to pressurizing. All taped connections shall be visually inspected for leaks within five minutes after start of blast cleaning operations and at the end of blast cleaning operations. Leaking connections shall be immediately repaired to prevent further damage.

Particle size of abrasives used in blast cleaning shall be that which will produce a surface profile or anchor pattern specified herein, or in accordance with recommendations of the manufacturer of the specified coating system to be applied, subject to approval of the Engineer.

Abrasive used in blast cleaning operations shall be new, washed, graded and free of contaminants, which would interfere with adhesion of coatings and shall not be reused unless specifically approved by the District. Abrasives shall be certified for unconfined dry blasting pursuant to the California Administrative Code, Section 92520 of Subchapter 6, title 17, and shall appear on the current listing of approved abrasives.

The Contractor shall select an abrasive media that is proper for the quality of surface preparation specified. Should it be determined that the production rate and quality of the surface preparation is less than required, it shall be the Contractor's responsibility to use other types and/or sizes of abrasive to meet the requirements of this contract. At no time shall considerations of extra-effort be considered by the Engineer unless, in the opinion of the Engineer the Contractor has explored all alternative means of abrasive blasting during their operations.

Blast cleaning from rolling scaffolds shall only be performed within the confines of the interior perimeter of the scaffold. Reaching beyond the limits of the perimeter will be allowed only if blast nozzle is maintained in a position, which will produce a profile acceptable to the Engineer.

The Contractor shall keep the area of work in a clean condition and shall not permit blasting materials to accumulate as to constitute a nuisance or hazard to the prosecution of the work or the operation of the existing facilities. Spent abrasives and other debris shall be removed at the Contractor's expense as directed by the Engineer. If waste is determined to be hazardous, disposal by Contractor shall meet requirements of all regulatory agencies for handling such wastes. The Contractor shall provide all disposal tickets with each invoice related to blasting prior to the District approving payment.

Blast cleaned surfaces shall be cleaned prior to the application of specified coatings through a combination of blowing with clean dry air, brushing/brooming and/or vacuuming as directed by the District. Air hose for blowing shall be at least 1/2" in diameter and shall be equipped with a shut-off device.

The surfaces of any non-carbon steel substrates, or specialty items (i.e. galvanized, anodized, etc.) shall be properly treated and prepared prior to any coating operations in accordance with the coating manufacturer's written recommendations, subject to approval of the Engineer.

- 3.5 Surface Preparation (Specific) - All interior surfaces shall be abrasively blast cleaned to "**Near-White Blast Cleaning**" in conformance to SSPC's **Surface Preparation Specification No. 10** (SSPC-SP10) and surface profile or anchor pattern of 2 to 3 mils (0.002" - 0.003").

The center vent hood shall be removed and all accessible surfaces of the interior surfaces shall be properly cleaned and coated.

Special care shall be made to only prepare the interior surfaces of internal piping that can be properly recoated. Special care to not damage surfaces that cannot be coated shall be a priority.

- 3.6 Inspection Blasting - Inspection Blasting by the Contractor must be performed in areas identified by the District or their representative. Inspection blasting must be performed with the intent to determine the overall structural condition as well as to identify any areas which require repair or replacement. Special attention must be focused on the areas where heavy corrosion is visible. This may be limited to the vapor space area if directed by the District or their representative. Inspection Blasting shall be performed in accordance with SSPC-SP6/NACE NO.3 "Commercial Blast Cleaning".

- 3.7 Wedging - All interior rafter/roof interface areas are to be wedged. Wedging will be performed for the purpose of removing all existing coatings, corrosion, and other foreign related materials via abrasive blasting. The surface preparation requirements shall be that of the vapor space and shall be verified for compliance by the District or their representative. If, during the wedging process the contractor identifies any areas as inaccessible, the locations must be brought to the attention of and agreed upon by the District or their designated Representative. Wedging is required to be utilized throughout all phases of work, i.e., surface preparation, coating application, and verification of all phases prior to final acceptance.

- 3.8 Application (General) - Coating application shall conform to the requirements of the SSPC's Paint Application Specification No. 1 (SSPC-

PA1), latest revision, for "Shop, Field and Maintenance Painting," the manufacturer of the coating materials printed literature, and as specified herein.

Thinning shall only be permitted as recommended by the manufacturer and approved by the Engineer and shall not exceed the limits set by applicable regulatory agencies.

- A. If the Contractor applies any coatings which have been modified or thinned to such a degree as to cause them to exceed established maximum VOC levels, Contractor shall be responsible for any fines, costs, remedies, or legal action and costs which may result.

Application of the first coat shall follow immediately after surface preparation and cleaning within an eight-hour working day. Any cleaned areas not receiving prime coat within an eight-hour period shall be re-cleaned prior to application of first coat.

- A. If dehumidification equipment is used, cleaned areas may have the first coat applied during the last shift of the week, provided dehumidification equipment has run continuously during the complete week and surface meets all requirements of the specification.
- B. If heating equipment is used, cleaned areas may have the first coat applied during the last shift of the week, provided heating equipment has and will run continuously during the complete week and surface meets all requirements of the specification.

Because of the presence of moisture and possible contaminants in the working atmosphere, care shall be taken to ensure previously coated surfaces are protected or re-cleaned prior to application of subsequent coat(s). The Engineer shall approve methods of protection and re-cleaning.

- A. The project is subject to intermittent shutdown if, in the opinion of the Engineer, cleaning, coating operations are creating a localized condition detrimental to ongoing facility activities, personnel, or adjacent property.

In the event of emergency shutdown by the District, Contractor shall immediately correct deficiencies. All additional costs created by shutdown shall be borne by Contractor.

Each application of coating shall be applied evenly with a uniform appearance. The system shall be free of brush marks, unfeathered edges, sags, runs, and evidence of poor workmanship, or any aesthetic defects, as

defined by SSPC. Care should be exercised to avoid lapping on glass or hardware. Coating shall be sharply cut to clean, defined lines. Finish surfaces shall be uniform in appearance and shall be free from defects or blemishes.

Protective coverings or drop cloths shall be used to protect floors, concrete, fixtures, equipment, prepared surface and applied coatings. Personnel entering tank shall take precautions to prevent damage or contamination of coated surfaces. Care shall be exercised to prevent coating from being spattered onto surfaces, which are not to be coated. Surfaces from which such material cannot be removed satisfactorily shall be replaced or recoated as required to produce a finish satisfactory to the Engineer.

All welds and irregular surfaces, as defined by the Engineer shall receive a brush coat of the specified product prior to application of each complete coat. Coating shall be brushed in multiple directions to insure penetration and coverage, as directed by the Engineer. These areas include, but are not limited to welds, roof lap seams, nuts, bolts, ends, and flanges of rafters, etc.

At the conclusion of daily abrasive blasting and coating operations, a 6" wide strip of blast cleaned substrate shall remain uncoated to facilitate locating the point of origin for successive blast cleaning/priming operations.

Coating which has endured an excessive time element beyond manufacturer's recommended recoat cycle, shall be scarified by Brush-off Blast Cleaning (SSPC-SP7) or methods approved by the Engineer, prior to application of additional coating. Scarified coating shall have sufficient depth to assure a mechanical bond of subsequent coat.

All attachments, accessories, and appurtenances to be coated shall be prepared and finished in the same manner as specified for adjacent tank sections.

- A. The Contractor shall adhere to general application requirements as follows:
1. Obtain Inspector's evaluation and approval of steel surface preparation immediately prior to application of first coat.
 2. Obtain Inspector's evaluation and approval of cleanliness of previous coat immediately prior to application of a subsequent coat.
 3. Contractor shall provide ratio testing at the beginning of each application.

4. Scaffolding or other support system shall be free of abrasive blast media, dirt, and other foreign matter prior to coating application.
5. Finish coat shall be uniform in color and gloss over the entire surface. Finish coat shall be smooth to touch with no sags, runs, dry spray, over-spray, cracks, pinholes or other surface defects and must be even in color and appearance. When coating is applied, the previously coated area will be masked off to prevent overspray onto newly painted surfaces.
7. Coating should not be applied closer than 6 inches from an unprepared surface.

B. The Contractor shall provide coating repairs as follows:

1. Re-coating or touch-up of areas that have cured beyond the maximum time recommended by the manufacturer require the following special preparation.
 - a. Sweep blast area and 3-inches into the surrounding area. Sweep blast under low pressure to uniformly abrade surface and feather edges. Feather edges by sanding or other means acceptable to the Inspector. Alternatively, the Contractor may power tool (SP-3) or hand tool (SP-2) once abrasive blast is complete to the acceptance of the Inspector.
 - b. Remove abrasive blast residue from blasted area with special attention to marginal areas of intact coating.
 - c. All repairs will be masked off.
 - d. Clean area with a bond solvent recommend by the manufacturer.

3.9 Application (Specific) - After completion of surface preparation as specified, surfaces shall receive the coating systems specified under 2.3 "Coating System." Topcoats shall be white. When two or more coats are specified, where possible, each coat shall be of contrasting color. The lining system applied, shall include a total system from one of the following:

A. Vapor Area:

Sherwin-Williams Company

1. 3-4 mils Corothane I Galvapak 2K-100 Prime Coat
2. 4-6 mils Macropoxy 646 PW Intermediate Coat
3. 4-6 mils Macropoxy 646 PW Topcoat
4. 13 mils (0.013") shall be the minimum DFT of the system.

Tnemec Company

1. 3-4 mils Prime Coat 94 H2O Hydro-Zinc
2. 4-6 mils Series L140F PotaPox Intermediate Coat
3. 4-6 mils Series L140F PotaPox Topcoat
4. 13 mils (0.013") shall be the minimum DFT of the system.

Or approved equal

B. Immersion Area:

Sherwin-Williams Company

1. 25-35 mils DFT Sherplate PW Epoxy – one or two coats
2. 25 mils (0.020") shall be the minimum total DFT of the system.

Tnemec Company

1. 25-35 mils DFT Tnemec 22 or FC22 – one or two coats
2. 25 mils (0.020") shall be the minimum total DFT of the system.

Or approved equal

C. Shell/roof junction, roof plate lap seams, and designated void areas:

After completion of coating application, as specified, all void areas shall be filled with a joint sealant as specified under 2.3 "Coating System". Joint sealant may be applied by caulking gun, trowel or other approved method. Sealant shall be pressed firmly into voids to insure 100% filling/sealing. Sealant shall be a material as specified under 2. "Coating System" and shall include Sikaflex 1A or approved equal.

- 3.10 Ambient Conditions - No coating shall be applied when the surrounding air temperature or the temperature of the surface to be coated is below 50 degrees F. No coatings shall be applied at temperatures above 110 degrees F. No coatings shall be applied to wet or damp surfaces or in rain, snow, fog or mist, when the temperature is less than 5 degrees F above the dewpoint, or when it is expected the air temperature will drop below 50 degrees F prior to the coating drying. Dewpoint shall be measured by the use of an instrument such as a Sling Psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychrometer Tables or equivalent in accordance with ASTM E337. If unacceptable conditions are prevalent coating application shall be delayed or postponed until conditions are favorable. The day's coating application shall be completed in time to permit the film sufficient drying time prior to damage from atmospheric conditions.
- 3.11 Dehumidification - The Dehumidification (DH) shall be used to control the environment within the tank space 24 hours a day during blast cleaning and coating application. The system shall be similar or equal to the following requirements. In order for a payment to the contractor to be made for the use of this equipment, a written authorization must be received from the Engineer. The District shall not provide a time extension for weather delay. The Contractor shall bear all cost and liability for work resulting from dehumidification equipment failure, breakdown, power failure, or down time. The Contractor is responsible for operating within County, local and home owner's association sound ordinances.

Operation Criteria:

1. The tank shall be continuously dehumidified 24 hours per day, 7 days per week during blasting, coating, between applications of coating, unless approved in writing by the Engineer.
2. Maintain the dehumidification system at all times. Only ventilation equipment, not dehumidification equipment is required throughout final cure period.
3. Dehumidification equipment shall also provide the necessary ventilation for the removal of solvent vapors during the coating and final cure phase. At all times, maintain the concentration of solvent vapors in all parts of the tank at 10-percent below the lower explosive limit (LEL).
4. Ducting shall be a minimum of 18 inches in diameter, airtight and reinforced with spirally-wound wire to prevent collapse. Size of ducting shall be larger if deemed necessary by the

Contractor in order to comply with these specifications or any local, state, or federal safety regulations. Sizing of the ducting, ventilation, and dehumidification equipment shall be the sole responsibility of the Contractor. Provide an appropriate connecting device between the 18-inch duct and designated opening. All bends in duct work shall have a minimum radius of 2 X ID of the ducting (i.e. 18" ID = 36" minimum radius).

5. The Contractor shall design and submit for review a dehumidification and ventilation plan, which provides for a minimum cross-draft velocity of 100 feet per minute in the vicinity of the work area. The cross-draft velocities shall be obtained with the use of a portable blower or fans.
6. The areas adjacent to the surface that are to be blasted and coated shall not be exposed to a relative humidity over thirty-five percent (35%). Furthermore, these areas shall not have a surface temperature that is less than 15 degrees F above dew point at any time during cleaning and coating phases.
7. The Contractor shall provide and maintain 24-hour strip chart recorder for humidity and temperature and place humidity and temperature measuring devices inside tank at the start of abrasive blasting operations.

Equipment:

1. The dehumidification equipment shall be a solid desiccant (not liquid, granular, or loose lithium chloride) design having a single rotary desiccant bed capable of continuous operation, fully automatic, with drip-proof automatic electrical controller.
2. The equipment shall be capable of making two complete air changes every sixty minutes unless the 100 feet per minute cross-draft velocity requirement requires a larger volume.
3. The processed air from the dehumidification unit must maintain a relative humidity of eleven percent or less.
4. During the coating phase, dehumidification units shall have auxiliary heaters capable of maintaining a constant air temperature inside the tank.
5. Air heaters are not acceptable as substitutes for dehumidification units.

6. Air chillers, heaters, or air conditioners may be used downstream of the dehumidifiers if they are approved for use by the manufacturer of the dehumidification equipment and the Engineer.

Dehumidification equipment shall be operating continuously, 24 hours a day, seven days per week from the time abrasive blasting begins, through to completion of all lining application. Equipment shall be turned off only for regular servicing or fueling of climate control equipment or generator(s). Equipment can be turned off during periods when there is no demand for dehumidification only if automatic controls are installed that perform the following:

- A. Activates and deactivates the equipment by determining the difference between the coldest surface temperature and the dew point temperature in the tank.
- B. Measures and logs surface temperature, inside air temperature, inside dew point temperature and equipment run time at 1-minute intervals. Copies of this data will be delivered to the owner's representative.
- C. Climate control equipment equipped with a monitoring and control device, including complete control module, sensor module, and web-based support such as ExactAire supplied by Munters Corporation that notifies a capable technician of any failure of the equipment or power source, by cellular phone or pager.

The zinc primer requires a minimum level of humidity to cure. Should dehumidification be used, special care shall be made to assure that the relative humidity within the work space reaches a level required for the proper cure of the coatings. This may require turning off the DH equipment to raise the relative humidity. The DH may be turned-off for cure of the zinc when there are no prepared bare metal steel surfaces.

- 3.12 Final Curing for Zinc Primer and Epoxy - Special care shall be made to assure that the zinc primer is properly cured before applying any epoxy overcoats. This testing shall determine if the primer is cured in accordance with the coating manufacture's written recommendations and testing procedures.

Upon completion and acceptance of the total applied lining system, Contractor shall furnish an approved exhaust fan or blower of sufficient capacity to insure removal of solvent vapors during curing process. The fan or blower, after approval by Engineer, shall be installed as directed by the

Engineer and shall remain in continuous operation until coating is completely cured as determined by the manufacturer of the coating system.

After completion of curing cycle as noted above, the Contractor shall test the applied epoxy coating with a solvent rub test performed in accordance with ASTM D 5402 to verify adequate curing has been attained.

- A. If final cure has not been attained, ventilation shall be continued until applied lining passes the solvent wipe test.

After final cure is approved by the Engineer, Contractor shall remove blower.

3.13 Manway Gasket Replacement - The Contractor shall supply new manway gaskets for tank manways that is NSF approved.

3.14 Disposal Of Existing Coatings And Spent Abrasive Blast Media

- A. The Contractor shall dispose of spent abrasive blast media and removed coating materials in accordance with a District approved disposal plan.

- B. The Contractor shall coordinate and pay all costs for sampling and testing of spent abrasive blast media in order to document waste class. Minimum sampling and testing requirements are listed previously in this Section.

- C. Prior to removal of hazardous wastes off-site, the Contractor shall allow adequate time for District to review laboratory test results, as well as the time required to obtain a Hazardous Waste Generator's U.S. EPA ID Number, if required the District will provide the Contractor with written notice to dispose of all or a portion of the spent abrasive blast media and/or removal coating materials as hazardous waste, if so determined by the District that such disposal is required.

- D. The Contractor shall be responsible for all costs associated with accumulating, transporting, and disposing of spent abrasive blast media and removed coating materials.

3.15 Clean-Up - Upon completion of the work, the Contractor shall make a detailed inspection of all work. The Contractor shall be solely responsible for all paint over-spray or fugitive dust fallout claims. The Contractor shall remove all spattering, spits, and blemishes. Upon completion, of work, the Contractor shall remove all staging, tarps, scaffolding, and containers from the site, including but not limited to: paint and thinner containers and excess

paint and thinner (to be disposed of in conformance to all current regulations); paint spots removed and the entire job site cleaned; all damage to surfaces resulting from the work from this section to be cleaned, repaired or refinished to the complete satisfaction of the District. All clean up shall be completed within 7 calendar days starting at the last day of holiday testing of the tank. The Contractor shall bear all costs associated with site cleanup.

3.16 Mechanical Repairs - There are areas of corrosion in the tank that may require mechanical repairs. Excessive metal loss, as determined by the Engineer, shall be repaired using the following procedure:

A. After removing the lining, examine all surfaces for the presence of rust scale, excessive metal loss, and corrosion pitting. Report all locations observed to the Engineer.

B. Grind all sharp edges in accordance with NACE SP 0178.

3.17 Omissions – Care has been taken to delineate herein those surfaces to be coated. However, if coating requirements have been inadvertently omitted from this section or any other section of the specifications, it is intended that all metal surfaces, unless specifically exempted herein, shall receive a first-class protective coating equal to that given the same type surface pursuant to these specifications.

4.0 TESTING

4.1 Tank Disinfection

A. Upon complete curing, the Contractor shall submit in writing to the District certification that the coating is cured and ready to be placed into service for disinfection and testing. Tank cleaning and disinfection shall not commence without written certification.

B. After all other work has been completed, the Contractor shall ensure that the interior of the tank is thoroughly cleaned and disinfected in accordance with the most current edition of AWWA C652, Disinfection of Water Storage Facilities. The Contractor shall ensure the tank is disinfected in accordance with Chlorination Method 2, which requires spray wash of the tank interior with a 200-mg/ml chlorine solution. The District will assist the Contractor in filling the tank and the Contractor shall allow three (3) consecutive working days for the District to fill the tank.

- C. The Contractor shall furnish all cleaning and disinfection materials and all equipment and labor necessary for the cleaning and disinfecting operations.
- D. The Contractor shall ensure that any water used in cleaning and in disinfection of the tank, is discharged in a manner acceptable to the District and the appropriate water pollution control agency. The Contractor shall ensure all water discharged is de-chlorinated.
- E. The Contractor shall take special care to not develop discoloration, staining, or embedment (i.e. defects) into newly installed coatings by subsequent abrasive blasting or coating operations. Phasing and dry times shall be closely coordinated to avoiding these defects. The engineer may require the removal of these defects prior to accepting the work.

4.2 Soak Period And Testing For Volatile Organic Compounds

- A. The Contractor shall ensure that water in the tank is allowed to soak for five (5) days after the tank has been filled to the over-flow level and disinfected.
- B. After the five-day soak period the District will sample and submit a single sample to a certified laboratory to test the water for presence of organic chemical contaminants (e.g. TCE, PCE, etc.) possibly having leached from the new paint system. The sample is to be tested in accordance with EPA Method 524.2. The water sample will be collected by the District in the presence of the Contractor and should be a true representation of the water in the tank at the time.
- C. The Contractor shall be liable for all cost associated with re-testing the water if tank draining and refilling is necessary.
- D. The District shall evaluate and determine acceptability of the aesthetic quality of the water as a condition of final acceptance of the work. Constituent levels found from sample results which are at or below regulated maximum contaminant levels specified by state and federal standards shall not be the sole basis for tank acceptance.
- E. The District may reject all work or a portion thereof based on any adverse taste, odor or visual defect detected or other conditions affecting the aesthetic quality of the water.

5.0 INSPECTION

5.1 Quality Assurance

- A. The District has retained a coating inspection firm to oversee all quality control related to coating operations. The inspector will report directly to the District and shall act with the District's authority in all matters related to construction. The Inspector will be a N.A.C.E. Certified Coating Inspector, who will inspect any or all phases of work to be performed as outlined herein. The inspector shall be in addition to the District Inspector; authority shall be limited to coating related work only. The District Inspector shall remain the primary observer for all work on the project. The inspector shall work for and report to the District. The Contractor shall not rely upon the coating inspector for documentation of environmental conditions and assuring compliance with plans and specifications.
- B. The Contractor shall notify the District in advance (48 hours minimum) of all surface preparation or paint application in order to perform a preliminary examination and provide acceptance of the surface preparation and each coat prior to application of the next coat.
- C. The Coating Inspector shall examine all materials, tools, and equipment to be used in the blasting and coating operations and shall have the authority to direct the Contractor to remove, replace, or repair any materials, tools, or equipment found not to be in conformance with the Contract Documents including the approved shop drawings and manufacturer's recommendations. The Contractor shall be fully responsible for compliance with all safety measures, hazardous and toxic materials regulations, and site security. Observation of or failure to observe any safety efforts of the Contractor by the Inspector shall not relieve the Contractor of this responsibility nor shall any liability transfer from the Contractor to the District or the Inspector. The Contractor shall indemnify, defend, and save harmless the District and the coating Inspector from all liability associated therewith.
- D. All coating components shall be mixed in exact proportions specified by the manufacturer. Care shall be exercised to insure all material is removed from containers during mixing and metering operations. All coatings shall be thoroughly mixed utilizing an approved slow-speed power mixer until all components are thoroughly combined and are of a smooth consistency. Catalyzed coatings shall not be applied beyond pot-life limits specified by manufacturer. Any required induction requirements shall be strictly followed. Thinners shall be added to coating materials only as required in accordance with

manufacturer's printed literature and in the presence of the Engineer. Quantities of thinner shall not exceed limits set by applicable regulatory agencies. Application shall be by airless spray method except as otherwise specified, or approved by the Engineer. Drying time between coats shall be strictly observed as stated in the manufacturer's printed instructions. When two or more coats are specified, where possible, each coat shall be of contrasting color. Care shall be exercised during spray operations to hold the spray nozzle perpendicular and sufficiently close to surfaces being coated to avoid excessive evaporation of volatile constituents and loss of material into the air or the bridging of cracks and crevices. Reaching beyond limits of scaffold perimeter will not be permitted. All dryspray or overspray shall be removed as directed by Engineer and the area recoated.

- E. Upon completion of the interior coating operations and after the required drying intervals, holiday detection shall be accomplished on all coated surfaces below the overflow. Holiday detection within the vapor area shall be completed at the discretion of the Engineer. The instrument shall be set at a high-voltage in accordance with NACE SP 0188, include a wire brush electrode, and be properly grounded. Repairs shall be retested. All holiday detection of coatings shall be performed in the presence of the Engineer. A time element equivalent required by the coating manufacturer and approved by Engineer, shall be required before placing the epoxy coating system into service, as determined in 3.10 "Final Curing of Zinc Primer and Epoxy."
- F. The District may use any testing method deemed necessary by the District Coating Inspector to verify quality of work. The District may, but is not required to, monitor the quality of work pursuant to this section.
- G. The Contractor shall ensure proper materials handling and use, including: all coating materials are labeled and used in accordance with SSPC-PA 1, Paragraphs 5.1.1 thru 5.1.5, except all coating system materials without a stated shelf life shall be delivered and used within six months of the date of manufacture; and certification, from any source, that the coating system materials are still suitable for use beyond the stated shelf life or beyond the six month period specified above will not be accepted. All equipment and materials shall be stored in a secured ventilated container.
- H. The Contractor shall perform the necessary quality assurance in accordance with an approved plan. The Contractor will supply all

inspection equipment. The District reserves the right to use their equipment at any time.

- I. Contractor shall furnish, until final acceptance of coating, inspection devices in good working condition for detection of holidays and measurement of dry-film thickness of coatings. They shall also furnish National Institute of Standards and Technology/National Bureau of Standards (NIST/NBS) certified thickness calibration plates to test accuracy of thickness gauges. Dry film thickness gauges and holiday detectors shall be available at all times until final acceptance of application. Inspection devices shall be operated by, or in the presence of the Engineer with location and frequency basis determined by the Engineer. The Engineer is not precluded from furnishing his own inspection devices and rendering decisions based solely upon these quality assurance tests. Should in the opinion of the Engineer a 24-hour, continuous reading surface temperature gauge be required to assure that maximum recoat windows are observed, the contractor shall provide a working calibrated instrument to meet this need. The gauge shall be digital and capable of providing instantaneous average measurements of the temperatures recorded.
- J. Acceptable devices for ferrous metal surfaces include, but are not limited to Tinker-Razor Models AP and AP-W holiday detectors and SSPC, Type II units for dry film thickness gauging. Inspection devices shall be calibrated and operated in accordance with specified requirements. Any high-voltage testing shall require the contractor to obtain written acceptance from the lining manufacturer for detection within the Vapor Area. Should the manufacturer not approve of the use of a high-voltage testing device for the Vapor Area, a 67.5-volt device Tinker and Razor M-1 device shall be used.
- K. The Contractor shall comply with the following conditions in collection and analysis of wastes:
 1. All testing of spent abrasive blast media and removed coating materials to classify these wastes as hazardous or non-hazardous shall be performed by a laboratory that complies with and is certified under the Environmental Laboratory Accreditation Program (ELAP) of the California Department of Public Health.
 2. Any Laboratory performing analysis shall provide for comparison to TTLC, STLC, TCLP limits, and RCA limits, and to all other applicable regulatory limits. Laboratory shall retain

samples at least ninety (90) calendar days after all analyses are complete.

3. The Contractor shall ensure collection of as many representative samples as required by the representative of the disposal facility, but not less than 4 total.
4. The Contractor shall ensure the following: each sample shall have an identifying sample number assigned when the sample is taken; each sample number shall be included on the sampling chain of custody and in all reports, correspondence, and other documentation related to the sample; each sample shall have a sampling chain of custody; and, each chain of custody show the name and organization of each person having custody of the sample, and also show the sample number, job name and location, time of day and date sample was taken, material sampled, and tests to be performed.
5. The Contractor shall notify the District at least 24 hours prior to sampling collection for the purpose of District verification of samples collected.

5.2 Quality Control

- A. The Contractor shall provide adequate lighting, without shadows, during all phases of work to insure that work is performed as specified and that the entire work area is illuminated.
- B. The Contractor shall provide ground supported scaffolding and lighting (SSPC Guide12), as determined by the Inspector, to facilitate visual and instrument inspection by the Inspector of each phase of the work and of the completed work, as so placed as directed to minimize glare and shadows. Work will be rejected if proper lighting is not achieved for a proper inspection. All scaffolding shall be equipped with internal stairways, no exterior ladders.
- C. The Contractor shall provide personnel to move scaffolding and furnish other assistance to District Inspectors as required.
- D. The District Coating Inspector will examine surfaces after abrasive blast cleaning to verify that all deposits of contaminants have been removed as per surface clean as per ISO 8502 (Class 0). The Contractor shall blow down, and vacuum all surfaces prior to District inspection. Tank floors shall be vacuumed.

- E. The Contractor shall verify at a minimum of two times daily that air supply is free of oil and moisture contamination (ASTM D-4285). The Contractor shall use effective oil and water separators in all main compressor airlines and shall be placed as close as practicable to the equipment. Prior to using compressed air, the Contractor shall test the quality of air downstream of the separators at suitable outlets by blowing the air on clean white blotter for 2 minutes to check for any contamination, oil, or moisture.
- F. The Contractor shall perform the following daily: measure air temperature, humidity, relative humidity, and metal surface temperature, and determine dew point and relative humidity prior to abrasive blasting or painting. The Contractor shall provide portable temperature & humidity recorders to provide continuous permanent hard copy of the tank conditions and, repeat measurements and determination of dew point as often as the District Inspector deems necessary but not less often than every four hours at the start of preparation operations and run constantly until final cure.
- G. The Contractor shall maintain a written record of measurements and dew points, and time that measurements were taken, keep such record on-site, and make records available to District Inspector on request.
- H. The Contractor shall furnish 1 roll of Testex tape 1.5 to 4.5 mils X-course prior to the start of abrasive blasting. The District Coating Inspector may evaluate surface preparation using field abrasive blasting standards, and Testex tape. Evaluation may include inspection of blasted surfaces for dust and abrasive residue, using clear adhesive coated tape. Evaluation will be made immediately prior to coating application.
- I. The Contractor shall verify cleanliness of all spray application equipment prior to, or no later than, time of mixing coating material.
- J. The Contractor shall measure wet film thickness during coating application of coating to ensure adequate coating thickness, taking at least one measurement for each 100 square feet of application area. The Contractor shall measure dry film thickness after each coat using a non-destructive magnetic dry film thickness gauges.
- K. The District Coating Inspector may, but is not required to, also measure coating thickness, at random locations, after each coat. Thickness of coatings shall be checked with a non-destructive film thickness gauge in accordance with ASTM D7091. An instrument such as Tooke Gage should be used in accordance with ASTM

D4138 if a destructive tester is deemed necessary. The sampling of film thickness of flat (e.g. plate) surfaces shall be tested in accordance with SSPC-PA2. The sampling of structural members or irregular surfaces shall be tested in frequency and locations, as directed by the engineer using the Appendix of SSPC-PA2 as a guide.

- L. The District Coating Inspector will evaluate cleanliness of coated surface immediately prior to application of a subsequent coat.
- M. The Contractor shall test all coated surfaces for pinholes. Coating integrity of all interior coated surfaces shall be tested with an approved inspection device in accordance with NACE SP 0188. All pinholes shall be repaired in accordance with the manufacturer's printed recommendations and retested. No pinholes or other irregularities will be permitted in the final coating.
- N. Perform testing in the presence of the District Coating Inspector.
- O. Perform testing after coating has cured as recommended by the manufacturer.
- P. Use an appropriate detector, such as Elcometer #236 or as approved by the District representative.
- Q. Re-test after coating repairs.
- R. The District may hire a third party inspector to inspect Contractor's work, but the ultimate responsibility for the quality of the Contractor's work and the performance of contractual obligations remains with the Contractor.
- S. Manufacturer's Representative: The Contractor shall, at no cost to the District, provide a qualified technical representative of the coating system manufacturer at the job-site as required by the District to resolve problems related to the coating system or the application of the system.

5.3 Coating Inspector and Authority

- A. The Contractor shall notify the Coating Inspector in advance (48 hours minimum) of all surface preparation or paint application in order to perform a preliminary examination and provide acceptance of the surface preparation and each coat prior to application of the next coat.

- B. The Contractor shall afford the coating inspector all reasonable facilities and assistance in monitoring the coating and priming operations.
- C. To facilitate adequate inspection of all surfaces, the Contractor shall provide scaffolding or rigging necessary for the Coating Inspector to perform dry film thickness readings, and visual holiday inspection as required by these specifications and reference standards. The Contractor shall provide personnel to move scaffolding or rigging at the instructions of the District.
- D. The coating inspector shall have authority to direct the Contractor to suspend operations when environmental conditions fall outside the manufacturer's recommended parameters. The Contractor shall comply with these directions and shall not proceed until the coating inspector determines environmental conditions are sufficient to proceed. Failure to suspend coating operations as directed or restarting work without the direction of the coating inspector shall be cause for rejection of work so performed.
- E. The Contractor shall immediately remove and replace all such work in accordance with these Project Special Provisions and directions of the coating inspector. No additional compensation will be allowed for work resulting from failure to comply with the coating inspector or for surfaces not otherwise conforming to the provisions of these Project Special Provisions.

5.4 Inspector Assistance - To facilitate adequate inspection of all surfaces, the Contractor shall provide scaffolding or rigging necessary for the Coating Inspector to perform dry film thickness readings, and visual holiday inspection as required by these specifications and reference standards. The Contractor shall provide personnel to move scaffolding or rigging at the instructions of the Coating Inspector.

5.5 Acceptability for Paint Application - The SSPC-Vis1 pictorial surface standards along with dry film and wet film thickness gauges will be used by the Coating Inspector to determine acceptability of the paint application. The Contractor shall provide necessary testing equipment to perform the above-mentioned tests.

5.6 Reporting - The Contractor shall provide weekly copies of daily work reports to the coating inspector. Such reports shall include, but not be limited to, the day and date of work performed, the type and amount of work performed,

all work related to the safety of the operation, and personnel assigned to work actually performed.

5.7 Safety

- A. The Contractor shall provide a safe work environment at all times. In the event the Coating Inspector notes any safety deficiencies, the Contractor shall immediately rectify noted deficiencies.
- B. The Contractor shall be fully responsible for compliance with all safety measures, hazardous and toxic materials regulations, and site security. Observation of or failure to observe any safety deficiencies of the Contractor by the Coating Inspector shall not relieve the Contractor of this responsibility nor shall any liability transfer from the Contractor to the District or the Coating Inspector.
- C. The Contractor shall save harmless the District and the Coating Inspector from all liability associated therewith.

5.8 Warranty

- A. Anniversary inspection requirements and failure criteria shall be in accordance with AWWA D-102, Section 9, except as modified herein. The total warranty period shall be two years from the final acceptance date.
- B. The District will conduct a first anniversary warranty inspection approximately one year following final acceptance of the work, including inspection of the interior of the tank. The District will establish the date of the inspection and will notify the Contractor at least thirty (30) calendar days in advance of the inspection.
- C. The Contractor shall furnish ventilation, scaffolding, and lighting equipment as necessary for any warranty inspections, and shall be present for such inspections. The District will provide an inspection report to the Contractor detailing the number and types of failures observed, the percentage of surface area where failures have occurred, and the names of the persons making the inspections.
- D. All surfaces of the coating systems shall be visually inspected. All defective coatings, as well as damage or rusting spots of the tank, shall be satisfactorily repaired by and at the sole expense of the Contractor. Defective coating shall be any of those defined by SSPC's Visual Comparison Manual. In addition, the District shall consider photographs or reports of the coating imperfections or failures as acceptable evidence of failure.

- E. Any location where coating is defined as defective shall be considered to be a failure of the system at that location. The Contractor shall make repairs at all points where failures are observed by removing the deteriorated coating, cleaning the surface, and recoating with the same system specified herein. Any spot repairs to defective areas will require feathering at least 3 inches into sound adjacent coating. Repaired spots shall be demarcated by masking. If an area of failure exceeds 25 percent of a specific coated surface, the entire coating system from that specific area may be required to be removed and recoated in accordance with the original specification.
1. Specific coated surfaces are defined as follows:
 - a. Roof - interior
 - b. Shell - interior
 - c. Floor - interior
 - d. Attachments, accessories and appurtenances

Upon completion of remedial work, the Contractor shall disinfect the tank and piping as specified herein.

- E. The Contractor shall be liable for all remedial work including repair of all failures by removing the deteriorated coating, cleaning the surface, and recoating with the same system in accordance with this Section. The District may allow surface preparation of small failures (areas less than 1 sq/ft.) by cleaning to bare metal in accordance with appropriate SSPC-SP standards, however, the method of repair is at the sole discretion of the District.
- F. The District will prepare a schedule for remedial work completion, to be no more than thirty (30) calendar days after the submittal of the inspection report to the Contractor. Upon failure of the Contractor to commence remedial work within ten calendar days after the starting date established by the District, the District may at its option, retain another Contractor to perform the remedial work. The Contractor shall be liable for actual cost of all such remedial work plus a 20 percent District administrative cost.
- G. The Contractor shall bear the expense of all warranty inspections of the remedial work required by the District. The Contractor shall disinfect the tank after the inspection and repairs.

- H. Any repairs that are completed based on the warranty inspection are subject to be inspected one year after the repair work is complete. The Contractor shall bear all expenses as part of the repair work and providing all necessary access for the District to review the warranty repairs.

END OF SECTION

EXTERIOR TANK COATING

1.0 GENERAL

- 1.1 Scope -The work includes the surface preparation and application of protective coatings to all specified surfaces of the exterior, including all attachments, appurtenances, and accessories. The Contractor shall provide all labor, materials, equipment and incidentals required to complete the exterior tank coating.

The work to be accomplished includes the complete removal of all existing exterior paint and the replacement with an industrial system that includes an epoxy primer and urethane finish coat. The contractor shall apply caulking to the gaps between the ring wall and tank.

The Contractor shall dispose 100% of all wastes from abrasive blasting and any other wastes or debris generated during work. The Contractor shall sample and test wastes as required by applicable regulatory agencies, and as necessary for classification of wastes prior to disposal. The Contractor shall bear all costs for waste sampling, testing, accumulation, transport, and disposal, including the cost for wastes classified as hazardous and non-hazardous.

The District shall conduct a one-year warranty inspection and the Contractor shall provide scaffolding during the inspection. The Contractor shall be present at the inspection.

At least two days prior to start of work, the Contractor shall arrange with the District for a pre-construction conference at the job site to ensure that all parties are familiar with the entire project, including specifications and the manufacturer's printed application instructions.

- 1.2 Submittals – The Contractor must submit the following plans and programs for the District's review and acceptance prior to the pre-construction meeting. The Contractor shall provide a separate submittal for each material to be used in the work.

- A. The Contractor shall submit Manufacturers' Product Data Sheets and Safety Data Sheets on all materials to be used including, but not limited to coatings, thinners, solvents, inhibitors, and abrasive media.

Acceptance of the submittal does not relieve the Contractor from the responsibility to conduct the work in strict accordance with the requirements of this Specification, or to adequately protect the

environment, health and safety of all workers involved in the project including any members of the public who may be affected by the project.

Contractor shall maintain copies of submittal data at the jobsite at all times and shall furnish a complete set of submittal data for use by the Inspector.

- B. Containment Design: A description of the containment proposed for use during both surface preparation and paint application to prevent emission of dust and other particulate.
- C. Heater equipment and containment: All heating equipment shall be proposed on and approved showing secondary containment for all fuels. Additionally, the contractor shall have all necessary fire prevention equipment on site in accordance with all OSHA rules and regulations.
- D. The Contractor shall include the following data in the submittal:
 - 1. Weight in pounds/gallon – ASTM D-2196
 - 2. % solids by volume – ASTM D-2369
 - 3. Percent solids by weight – ASTM D-2369
 - 4. Air cure dry time to re-coat – ASTM D-1640
 - 5. Minimum adhesion to steel substrate – ASTM D-4541 using a type II instrument (Minimum acceptable adhesion shall be 800 psi).
 - 6. Adhesion between coats – ASTM D-4541
 - 7. Manufacturer's batch numbers and dates of manufacture for materials to be furnished as part of this project.
 - 8. Letter from dehumidification manufacture that the equipment has been properly sized as per the specification requirements.
- E. The Contractor shall include technical data documenting that the material to be provided complies with these specifications. Submittals will not be accepted until all requirements of this specification have been confirmed.

- F. The Contractor shall include the following data in the manufacturer's recommended handling and installation instructions for the proposed paint system submittal:
1. Storage – including maximum and minimum storage temperatures
 2. Surface preparation
 3. Coating repair
 4. Application equipment
 5. Mixing and application of coating system – including a table of minimum and maximum time to re-coat as a function of temperature
 6. Curing – including curing time required before holiday testing, and curing time required before immersion as function of temperature and coating thickness. Minimum and maximum re-coat times.
 7. Ventilation and Containment System
 8. Acceptable temperatures at the time of application
- G. The Contractor shall include the following data in the equipment submittal:
1. Details of vacuum system for removing dust and abrasive from abrasive blast cleaned surfaces.
 2. The manufacturer's latest written operation instructions including recommendations for air filter maintenance and change interval for air compressors used for work.
- H. The Contractor shall include the following data in the report submittal:
1. Actual weight of blast cleaning abrasive used for field abrasive blast cleaning, submitted within 24 hours after blasting is completed.
 2. Quantity of coating material used for each coat, submitted within 24 hours after completion of each coat.

3. Name of laboratories proposed to be used to test wastes and tank water prior to testing any materials.
 4. Laboratory test results for representative waste samples prior to removing any waste materials from the job site. At a minimum, the samples shall be tested for total concentrations of the 17 metals identified in Title 22, for comparison to Total Threshold Limit Concentrations (TTLC) values. The California Waste Extraction Test (WET) shall be performed for each analyte of each sample for which the total concentration exceeds 10 times the STLC value, if any, as specified in Title 22. Toxic Characteristic Leaching Procedure (TCLP) testing shall be performed for each analyte of each sample for which the total concentration exceeds 20 times the TCLP values, if any, specified in the Federal Resource Conservation and Recovery Act. Reactivity, corrosively, and Ignitability testing shall be performed as required by Title 22 and/or the District or representative of the disposal facility.
 5. Receipts from disposal site for all wastes. Receipts shall identify disposed material and source, show quantity of disposed material in tons or cubic yards, and show method used for final disposition as buried, incinerated, and chemically treated and/or other means.
- I. The Contractor shall include the following data in the disposal plan submittal:
1. Certification that the materials disposal plan complies with all applicable requirements of: The Federal Resource Conservation and Recovery Act; Title 22 and Title 26 of the California Administrative Code; and other applicable regulations of local, state and federal agencies having jurisdiction over the disposal of spent abrasive blast media, removed coating materials, and other waste, whether hazardous or non-hazardous.
 2. The name and Environmental Laboratory Accreditation Program Certificate number of laboratory that will sample and test spent abrasive blast media and removed coating materials. Include statement of the laboratory's certified testing areas and analyses that the laboratory is qualified to perform.

3. Written permission to dispose of material from disposal site representative. Include name, address, and telephone number of disposal site and of representative.
4. The District shall provide written acceptance of the disposal plan prior to disposal of any wastes.

1.3 Contractor - The contractor shall be a licensed Painting and Decorating Contractor in the State of California (C-33 Classification) and SSPC certified. They shall have a minimum of five (5) years practical experience and successful history in the application of specified products to surfaces of steel water storage tanks.

All coating and surface preparation work shall be performed by skilled personnel demonstrating experience, as listed above. Resumes of personnel shall be submitted to the District for approval prior to the pre-construction meeting. Continuity of personnel shall be maintained throughout the duration of the cleaning and coating work and any changes in key personnel shall be subject to the approval of the District.

Applicator Training: Application of coating is considered specialized work. Personnel performing this work shall be trained in proper methods of application.

1.4 Governing Standards - The following standards (including the most recent update or version) shall govern the work unless specified otherwise in these specifications.

SSPC-Vol.1,	Steel Structures Painting Manual, Good Painting Practice.
SSPC-Vol.2,	Steel Structures Painting Manual, Systems and Specifications.
SSPC-SP 1	Solvent Cleaning
SSPC-SP 2	Hand Tool Cleaning
SSPC-SP 3	Power Tool Cleaning
SSPC-SP 5	White Metal Blast Cleaning
SSPC-SP 6	Commercial Blast Cleaning
SSPC-SP 7	Brush-Off Blast Cleaning
SSPC-SP 10	Near White Blast Cleaning
SSPC-SP 11	Power Tool Cleaning to Bare Metal
SSPC-SP 15	Power Tool Cleaning to Commercial Grade
SSPC-SP Guide 11	Stripe Coating
SSPC-AB 1	Mineral and Slag Abrasives
SSPC-AB 2	Specification for Cleanliness of Recycled Ferrous Metallic Abrasives

SSPC-PA 1	Shop, Field and Maintenance Painting
SSPC-PA 2	Measurement of Dry Film Thickness with Magnetic Gages
SSPS-PA Guide 3	Guide to Safety in Paint Application
SSPS-PA Guide 12	Lighting
SSPC-Guide to Vis 1	Visual Standard for Abrasive Blast Cleaned Steel
SSPC-Guide to Vis 3	Visual Standard for Hand and Power Tool Cleaned Steel
SSPC-V15 (3-93)	Visual Standard for Power & Hand-Tool Cleaned Steel
SSPC Publication No. 91-12	Coating and Lining Inspection Manual
SSPC	Visual Comparison Manual
ASTM D4138	Standard Test Method for Measurement of Dry Paint Thickness of Protective Coating Systems by Destructive Means
ASTM D4285	Standard Test Method for Indicating Oil or Water in Compressed Air
Guide 6	Guide for Containing Debris Generated During Paint Removal Operations
SSPC Technology	Guide No. 12 for Illumination of Industrial Painting Projects
ASTM D4414	Standard Practice for Measurement of Wet Film Thickness by Notch Gages
ASTM D4417	Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
ASTM D5402	Standard Test Methods for Assessing the Solvent Resistance of Organic Coatings Using Solvent Rubs
ASTM D7091	Standard Test Method for Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals
ASTM E337	Standard Test Method for Measuring Humidity with a Psychrometer
AWWA D102	Standard for Painting Steel Water-Storage Tanks
AWWA M42	Manual of Water Supply Practices, Steel Water Storage Tanks
29 CFR 1910	Occupational Safety and Health Regulations for General Industry
29 CFR 1926	Occupational Safety and Health Regulations for the Construction Industry
Health and Safety Code, Div. 20, Chapter 6.5, 6.67, 6.7, 6.95	Hazardous Waste Control Law, Health and Safety Code
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste

40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 302	Designation, Reportable Quantities and Notification
49 CFR 171-179	Hazardous Materials Regulations
ISO 8502-3	Preparation of Steel Substrates before Application of Paints and Related Products
NACE SP0188-06	Standard Practice for Discontinuity (Holiday) Testing of Protective Coatings
NACE SP0178-89	Standard Recommended Practice for Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to be Lined for Immersion Service
EPA - SW 846	Test Methods for Evaluating Solid Waste - Physical/Chemical Methods
EPA - Method 1311	Toxicity Characteristic Leaching Procedure (TCLP)
EPA - Method 3050	Acid Digestion of Sediment, Sludge, and Soils
All applicable State and Federal OSHA safety standards.	

- 1.4 – Safety - The Contractor shall comply with all Federal, State, and Local applicable safety regulations and requirements. All scaffolding shall be equipped with interior stairways. No exterior ladders will be allowed.

Ventilation, electrical grounding, and care in handling coatings, paints, solvents and equipment are important safety precautions during coating projects. Contractor shall conform with safety requirements set forth by regulatory agencies applicable to the construction industry and manufacturer's printed instructions and appropriate technical bulletins and manuals. The Contractor shall provide and require use of personal protective life saving equipment for all persons working in or about the project site.

Access Facilities: all ladders, scaffolding and rigging shall be designed for their intended uses. Ladders and scaffolding shall be erected where requested by Engineer to facilitate inspection and be moved by the Contractor to locations requested by the Engineer.

- 1.5 – Definitions - "Paint" refers to protective materials used or applied to exterior surfaces.

"Coating" refers to protective materials used or applied on exterior surfaces, or any protective material in general.

"Engineer" refers to the District Director of Engineering or his/her designated representative.

- 1.6 – Quality Assurance - Quality assurance procedures and practices shall be used to monitor all phases of surface preparation, application and inspection throughout the duration of the project. Procedures or practices not specifically defined herein may be used provided they meet recognized and acceptable professional standards and are approved by the Engineer.

All materials furnished, and all work accomplished shall be subject to inspection by the Engineer. The Contractor shall be held strictly to the true intent of the Specifications in regard to quality of materials, workmanship, and diligent execution of the specification.

The District will assign a fulltime coating inspector to verify the level of quality of the coating work. Work accomplished in the absence of prescribed inspection may be required to be removed and replaced under the proper inspection. The entire cost of removal and replacement, including the cost of all materials used in the work thus removed, shall be borne by the Contractor regardless of whether the work removed is found to be defective or not. Work covered up without the authority of the Engineer, shall, upon order of the Engineer, be uncovered to the extent required. The Contractor shall similarly bear the entire cost of performing all the work and furnishing all the materials necessary for the removal of the covering and its subsequent replacement, as directed and approved by the Engineer.

The Engineer will make, or have made, such tests as deemed necessary to assure the work is being accomplished in accordance with the requirements of these specifications. Unless otherwise specified, the cost of such testing will be borne by the District. In the event such tests reveal non-compliance with the requirements of the specifications, the Contractor shall bear the cost of such corrective measures deemed necessary by the Engineer, as well as the cost of subsequent retesting. It is understood and agreed the making of tests shall not constitute an acceptance of any portion of the work, nor relieve the Contractor from compliance with the terms of these specifications.

2.0 MATERIALS

- 2.1 – General - Materials specified are those which have been evaluated for the specific service. Products are listed to establish a standard of quality. Standard products of manufacturers other than those specified will be accepted when proven to the satisfaction of the District they are equal in composition, durability, usefulness and convenience for the purpose intended. Substitutions will be considered provided the following minimum conditions are met:

- A. The proposed coating system shall have a dry film thickness equal to or greater than that of the specified system.
- B. The proposed coating system shall employ an equal or greater number of separate coats.
- C. The proposed coating system shall employ coatings of the same generic type.
- D. All requests for substitution shall carry full descriptive literature and directions for application, along with complete information on generic type, non-volatile content by volume and a list of 10 similar projects, all at least five years old, where the coatings have been applied to similar exposure. Substitutions shall be endorsed in writing from the materials manufacturer that these substituted materials will provide equivalent performance as those specified.
- E. If the above-mentioned data appears to be in order, the Engineer may require that the Contractor provide certified laboratory data sheets showing the results of complete spectrographic and durability tests accomplished on the proposed substitute. An independent testing laboratory satisfactory to the Engineer shall accomplish tests and all costs incurred in the testing program shall be borne by the Contractor. In any case, the Engineer shall be sole and final judge of the acceptability of any proposed substitution. Requests for substitution must be approved in writing.

All materials shall be brought to the jobsite in the original sealed containers. They shall not be opened or used until the Engineer has physically inspected containers and obtained necessary data from information printed on containers or labels. Materials exceeding storage life recommended by the manufacturer shall be rejected.

Flammability, toxicity, allergenic properties, and any other characteristic requiring field precautions shall be identified, and specific safety practices shall be stipulated.

All coating materials shall be stored in enclosed structures to protect them from weather and excessive heat or cold. Flammable coatings must be stored to conform with local, county, state and federal safety codes for flammable coating materials. At all times coatings shall be protected from freezing.

Contractor shall use products of the same manufacturer for all coats.

2.2– Abrasives - Surface preparation will be based upon comparison with: "Pictorial Surface Preparation Standards for Painting Steel Surfaces," SSPC-Vis 1 and/or SSPC-Vis 3 as described herein. Anchor profile for prepared surfaces shall be measured by using a nondestructive instrument such as a Testex Press-0-Film System in accordance with ASTM D4417. Temperature and dewpoint requirements noted above and herein shall apply to all surface preparation operations, except low and high temperature limits. The Contractor shall use abrasive grit for field blast cleaning conforming to the following:

- A. Produce a surface profile of 3 to 4 mils for the shell and all appurtenances.
- B. New, clean and free of contaminants, and containing no hazardous materials.
- C. Certified by California Air Resources Board, Executive Order G-565.
- D. Conform to all applicable requirements of the Local Air Quality District.
- E. Kleen Blast or approved equal. No sand abrasives are allowed.

2.3 Coating System – Exterior paint materials shall consist of an epoxy primer and urethane finish coat system and conform to the regulations and applicable requirements of applicable local, State and Federal air pollution regulatory agencies.

- A. Prime coat shall be similar or equal to that defined in AWWA Standard D102-17, Outside Coating No. 6. Materials listed herein as standards of quality.
- B. Finish coat shall be equal or similar to that defined in AWWA Standard D102-17, Outside Paint System No. 6. Materials listed herein as standards of quality.
- C. Joint sealant shall be a flexible polyurethane or polysulfide product, similar or equal to Federal Specification TT-S-00230C, Type II, Class A (non-sag). Materials listed herein as standards of quality.

3.0 EXECUTION

3.1 – General - All surface preparation and coating application shall conform to applicable standards of SSPC and the manufacturer's printed instructions. Material applied prior to approval of the surface by the Engineer shall be removed and reapplied to the satisfaction of the Engineer at the expense of the Contractor.

All work shall be performed by skilled craftsmen qualified to accomplish the required work in a manner comparable with the best standards of practice. Continuity of personnel shall be maintained, and transfer of key personnel shall be coordinated with the District.

The Contractor shall provide a supervisor to be at the work site during cleaning and application operations. The supervisor shall have the authority to sign any change orders, coordinate work and make other decisions pertaining to the fulfillment of their contract.

Contractor shall provide approved sanitary facilities for all project personnel, as no existing facilities will be available to the Contractor. Facilities shall be maintained during the project to complete standards established by the District and shall be removed prior to Contractor's departure from the site at completion of the project.

The Contractor shall provide, at his own expense, all necessary power for his operations.

Dust, dirt, oil, grease or any foreign matter which will affect the adhesion or durability of the finish must be removed by washing with clean rags dipped in an approved commercial cleaning solvent, rinsed with clean water and wiped dry with clean rags.

The Contractor's coating equipment shall be designed for application of materials specified and shall be maintained in first class working condition. Compressors shall have suitable traps and filters to remove water and oils from the air. Blotter test shall be accomplished at each start-up period and as deemed necessary by the Engineer. Contractor's equipment shall be subject to approval of the Engineer.

A. Cleanliness of compressed air supply shall be verified daily, and as deemed necessary by the Engineer, by directing a stream of air, without abrasive, from the blast nozzle or approved opening downstream from separator onto a white blotter or cloth for twenty seconds in accordance with ASTM D4285. If air contamination is evident, change filters, clean traps, add moisture separators or filters, or make adjustments as necessary to achieve clean, dry air.

3.2 – Delivery, Storage, and Hauling

- A. The Contractor shall deliver materials as follows:
 - 1. Delivery of abrasive grit shall be in original labeled moisture-proof bags or airtight bulk containers. Abrasives shall not be reused.
 - 2. Delivery of coating system materials shall be in original, unopened containers with seals unbroken and labels intact. Labels shall identify type of material, color, and batch number. No material shall exceed six months from the original batch manufacturing date.
- B. The Contractor shall store materials as follows:
 - 1. Store materials in a single, approved location.
 - 2. Store coating system materials in enclosed, secure, and ventilated structures, and maintain temperature inside the structure within the temperature range recommended by the manufacturer.
 - 3. Keep storage location clean, neat, and free of fire hazards.
 - 4. All operating equipment shall be placed into secondary containment to prevent accidental spills.
- C. The Contractor shall handle materials as follows:
 - 1. Avoid spilling thinners, solvents, paint products or other materials that contain toxic substances. All compressors and operating equipment shall be placed in secondary containment. All sewer or site drains shall be covered.
- D. Remove discarded thinners, solvents, and paint products from the job-site daily.

- 3.3 – Control of Visible Emissions - Visible emissions from dust producing operations or equipment are restricted to no greater than Level 1 (1% of workday) as defined in SSPC Guide 6 from the full containment (regulated) area. Assess visible emissions in accordance with 40 CFR 60, App A, Method 22.

Do not permit any visible emissions to extend beyond containment or the regulated area(s). Visible emissions extending beyond the regulated area

are cause for immediate project shut down until the cause of the emissions is corrected.

Immediately cleanup and properly dispose of visible dust and debris that extends beyond the regulated or protected areas.

The Contractor shall conduct all operations so as to confine abrasive blasting debris and coating overspray to within the bounds of the containment (site). The Contractor shall take all precautions necessary to prevent adverse off-site consequences of coating operations. Any complaints received by the District relating to any such potential offsite problems will be immediately delivered to the Contractor. The Contractor shall immediately halt work and shall take whatever corrective action is required to mitigate any such problems. All costs associated with protection of off-site properties and/or correction of damage to property as a result of coating operations shall be borne directly by the Contractor at no additional expense to the District.

3.4 – Surface Preparation (General) – The latest revision of the following surface preparation specifications of SSPC shall form a part of this specification. (Note: an element of surface area is defined as any given 9 square inches of surface).

- A. Solvent Cleaning (SSPC-SP1): Removal of oil, grease, soil and other contaminants by use of solvents, emulsions, cleaning compounds, steam cleaning or similar materials and methods, which involve a solvent or cleaning action.
- B. Brush-off Blast Cleaning (SSPC-SP7): Blast cleaning to remove loose rust, loose mill scale, and other detrimental foreign matter present to the degree specified.
- C. Commercial Blast Cleaning (SSPC-SP6): Blast cleaning to commercial grade cleanliness, until at least thirty-three percent of each element of surface area is free of all visible residues.
- D. Near-White Blast Cleaning (SSPC-SP10): Blast cleaning to near-white metal cleanliness, until at least ninety-five percent of each element of surface area is free of all visible residues.
- E. Powertool Cleaning to Bare Metal (SSPC-SP11): Powertool cleaning to bare metal cleanliness, until each element of surface area is free of all visible residues and has a minimum of 1 mil profile.
- F. Powertool Cleaning to Commercial Grade (SSPC-SP15): Powertool cleaning to commercial cleanliness, until at least thirty-three percent

of each element of surface area is free of all visible residues and has a minimum of 1 mil profile.

Slag, weld spatter, or sharp edges such as those created by flame cutting and shearing not previously removed by the tank fabricator, erector or installer shall be removed by chipping and grinding. All sharp edges shall be peened, ground or otherwise blunted as required by the Engineer in accordance with NACE SP0178. The rolled edges of angles, channels, and wide flange beams do not normally require further rounding unless specifically directed by the Engineer.

Abrasive blasting nozzles shall be equipped with "deadman" emergency shut-off nozzles. Blast nozzle pressure shall be a minimum of 95 P.S.I. and shall be verified by using an approved nozzle pressure gage at each start-up period or as directed by the Engineer. Number of nozzles used during all blast cleaning operations must be sufficient to insure timely completion of project as approved and directed by the Engineer.

All blast hose connections shall be connected with external couplings. These connections shall be taped with duct tape prior to pressurizing. All taped connections shall be visually inspected for leaks within five minutes after start of blast cleaning operations and at the end of blast cleaning operations. Leaking connections shall be immediately repaired to prevent further damage.

Particle size of abrasives used in blast cleaning shall be that which will produce a surface profile or anchor pattern specified herein, or in accordance with recommendations of the manufacturer of the specified coating system to be applied, subject to approval of the Engineer.

Abrasive used in blast cleaning operations shall be new, washed, graded and free of contaminants, which would interfere with adhesion of coatings and shall not be reused unless specifically approved by the District. Abrasives shall be certified for unconfined dry blasting pursuant to the California Administrative Code, Section 92520 of Subchapter 6, title 17, and shall appear on the current listing of approved abrasives.

The Contractor shall select an abrasive media that is proper for the quality of surface preparation specified. Should it be determined that the production rate and quality of the surface preparation is less than required, it shall be the Contractor's responsibility to use other types and/or sizes of abrasive to meet the requirements of this contract. At no time shall considerations of extra-effort be considered by the Engineer unless, in the opinion of the Engineer the Contractor has explored all alternative means of abrasive blasting during their operations.

Blast cleaning from rolling scaffolds shall only be performed within the confines of the interior perimeter of the scaffold. Reaching beyond the limits of the perimeter will be allowed only if blast nozzle is maintained in a position, which will produce a profile acceptable to the Engineer.

The Contractor shall keep the area of work in a clean condition and shall not permit blasting materials to accumulate as to constitute a nuisance or hazard to the prosecution of the work or the operation of the existing facilities. Spent abrasives and other debris shall be removed at the Contractor's expense as directed by the Engineer. If waste is determined to be hazardous, disposal by Contractor shall meet requirements of all regulatory agencies for handling such wastes. The Contractor shall provide all disposal tickets with each invoice related to blasting prior to the District approving payment.

Blast cleaned surfaces shall be cleaned prior to the application of specified coatings through a combination of blowing with clean dry air, brushing/brooming and/or vacuuming as directed by the District. Air hose for blowing shall be at least 1/2" in diameter and shall be equipped with a shut-off device.

The surfaces of any non-carbon steel substrates, or specialty items (i.e. galvanized, anodized, etc.) shall be properly treated and prepared prior to any coating operations in accordance with the coating manufacturer's written recommendations, subject to approval of the Engineer.

- 3.5 – Surface Preparation (Specific) - All exterior surfaces of the tanks and external, above grade piping shall be abrasively blast cleaned to **"Commercial Blast Cleaning"** in conformance to SSPC's **"Surface Preparation Specification No. 6** (SSPC-SP6) with a surface profile or anchor pattern of 2 to 3 mils (0.002" - 0.003").
- 3.6 – Application (General) - Coating application shall conform to the requirements of the SSPC's Paint Application Specification No. 1 (SSPC-PA1), latest revision, for "Shop, Field and Maintenance Painting," the manufacturer of the coating materials printed literature, and as specified herein.

Thinning shall only be permitted as recommended by the manufacturer and approved by the Engineer and shall not exceed the limits set by applicable regulatory agencies.

- A. If the Contractor applies any coatings which have been modified or thinned to such a degree as to cause them to exceed established maximum VOC levels, Contractor shall be responsible for any fines, costs, remedies, or legal action and costs which may result.

Application of the first coat shall follow immediately after surface preparation and cleaning within an eight-hour working day. Any cleaned areas not receiving prime coat within an eight-hour period shall be re-cleaned prior to application of first coat.

- A. If dehumidification equipment is used, cleaned areas may have the first coat applied during the last shift of the week, provided dehumidification equipment has run continuously during the complete week and surface meets all requirements of the specification.
- B. If heating equipment is used, cleaned areas may have the first coat applied during the last shift of the week, provided heating equipment has and will run continuously during the complete week and surface meets all requirements of the specification.

Because of the presence of moisture and possible contaminants in the working atmosphere, care shall be taken to ensure previously coated surfaces are protected or re-cleaned prior to application of subsequent coat(s). The Engineer shall approve methods of protection and re-cleaning.

- A. The project is subject to intermittent shutdown if, in the opinion of the Engineer, cleaning, coating operations are creating a localized condition detrimental to ongoing facility activities, personnel, or adjacent property.

In the event of emergency shutdown by the District, Contractor shall immediately correct deficiencies. All additional costs created by shutdown shall be borne by Contractor.

Each application of coating shall be applied evenly with a uniform appearance. The system shall be free of brush marks, unfeathered edges, sags, runs, and evidence of poor workmanship, or any aesthetic defects, as defined by SSPC. Care should be exercised to avoid lapping on glass or hardware. Coating shall be sharply cut to clean, defined lines. Finish surfaces shall be uniform in appearance and shall be free from defects or blemishes.

Protective coverings or drop cloths shall be used to protect concrete, asphalt, fixtures, equipment, prepared surface and applied coatings. Personnel walking on exterior roof of tanks shall take precautions to prevent damage or contamination of coated surfaces. Care shall be exercised to prevent coating from being spattered onto surfaces, which are not to be coated. Surfaces from which such material cannot be removed satisfactorily shall be replaced or recoated as required to produce a finish satisfactory to the Engineer.

All welds and irregular surfaces, as defined by the Engineer shall receive a brush coat of the specified product prior to application of each complete coat. Coating shall be brushed in multiple directions to insure penetration and coverage, as directed by the Engineer. These areas include, but are not limited to welds, roof lap seams, nuts, bolts, ends, and flanges of rafters, etc.

At the conclusion of daily abrasive blasting and coating operations, a 6" wide strip of blast cleaned substrate shall remain uncoated to facilitate locating the point of origin for successive blast cleaning/priming operations.

Coating which has endured an excessive time element beyond manufacturer's recommended recoat cycle, shall be scarified by Brush-off Blast Cleaning (SSPC-SP7) or methods approved by the Engineer, prior to application of additional coating. Scarified coating shall have sufficient depth to assure a mechanical bond of subsequent coat.

All attachments, accessories, and appurtenances to be coated shall be prepared and finished in the same manner as specified for adjacent tank sections.

- A. The Contractor shall adhere to general application requirements as follows:
1. Obtain Inspector's evaluation and approval of steel surface preparation immediately prior to application of first coat.
 2. Obtain Inspector's evaluation and approval of cleanliness of previous coat immediately prior to application of a subsequent coat.
 3. Contractor shall provide ratio testing at the beginning of each application.
 4. Scaffolding or other support system shall be free of abrasive blast media, dirt, and other foreign matter prior to coating application.
 5. Finish coat shall be uniform in color and gloss over the entire surface. Finish coat shall be smooth to touch with no sags, runs, dry spray, over-spray, cracks, pinholes or other surface defects and must be even in color and appearance. When coating is applied, the previously coated area will be masked off to prevent overspray onto newly painted surfaces.

7. Coating should not be applied closer than 6 inches from an unprepared surface.

B. The Contractor shall provide coating repairs as follows:

1. Re-coating or touch-up of areas that have cured beyond the maximum time recommended by the manufacturer require the following special preparation.
 - a. Sweep blast area and 3-inches into the surrounding area. Sweep blast under low pressure to uniformly abrade surface and feather edges. Feather edges by sanding or other means acceptable to the Inspector. Alternatively, the Contractor may power tool (SP-3) or hand tool (SP-2) once abrasive blast is complete to the acceptance of the Inspector.
 - b. Remove abrasive blast residue from blasted area with special attention to marginal areas of intact coating.
 - c. All repairs will be masked off.
 - d. Clean area with a bond solvent recommend by the manufacturer.

3.7 – Application (Specific) - After completion of surface preparation as specified, all exterior surfaces shall receive two complete coats of one of the coating systems specified under 2.3 "Coating System." The total system shall include one of the following:

A. Exterior Surfaces:

Sherwin-Williams Company

1. 4-6 mils DFT Macropoxy 646 FC – Prime Coat
2. 2-5 mils DFT High Solids Polyurethane 250 – Finish Coat
3. 8 mils (0.008") shall be the nominal dry film thickness of the completed system

Tnemec Company

1. 4-6 mils DFT Series L140 or L69 Epoxoline – Prime Coat
2. 2-4 mils DFT Endura-Shield Series 1095 – Finish Coat

3. 8 mils (0.008") DFT shall be the minimum dry film thickness of the completed new system

Or approved equal

- B. Following all paint work, apply caulking to the gap between the exterior floor plate and concrete ring wall in accordance with the manufacturer's written recommendations, using backing rod as required to provide suitable seal. Exterior caulking shall have a smooth clean finish that is applied to clean, sharp lines. Sealant color shall be selected and approved by the District.
- C. Sealant shall be a material as specified under 2.3 "Coating System" and shall include Sikaflex 2C, Vulkem 921, Sonolastic NP1, or approved equal.
- D. Color Scheme: the District shall select exterior finish coat colors for the project. The Contractor shall submit a current chart of the manufacturer's available colors to the District's representative twenty days prior to start of painting operations.
- E. Coating System Identification: unless otherwise directed by the Engineer, stencil the following information on the completed exterior system. Location will be selected by the Engineer. Use a black urethane coating and provide lettering that is 2 to 3 inches in height.
 1. Month and Year of Completion
 2. Identification of Cleaning Method
 3. Identification of Coating System

3.8 – Ambient Conditions - No coating shall be applied when the surrounding air temperature or the temperature of the surface to be coated is below 50 degrees F. No coatings shall be applied at temperatures above 110 degrees F. No coatings shall be applied to wet or damp surfaces or in rain, snow, fog or mist, when the temperature is less than 5 degrees F above the dewpoint, or when it is expected the air temperature will drop below 50 degrees F prior to the coating drying. Dewpoint shall be measured by the use of an instrument such as a Sling Psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychrometer Tables or equivalent in accordance with ASTM E337. If unacceptable conditions are prevalent coating application shall be delayed or postponed until conditions are favorable. The day's coating application shall be completed in time to permit the film sufficient drying time prior to damage from atmospheric conditions.

3.9 – Dehumidification - The Dehumidification (DH) shall be used to control the environment within the tank space 24 hours a day during blast cleaning and coating application. The system shall be similar or equal to the following requirements. In order for a payment to the contractor to be made for the use of this equipment, a written authorization must be received from the Engineer. The District shall not provide a time extension for weather delay. The Contractor shall bear all cost and liability for work resulting from dehumidification equipment failure, breakdown, power failure, or down time. The Contractor is responsible for operating within County, local and home owner's association sound ordinances.

Operation Criteria:

1. The tank shall be continuously dehumidified 24 hours per day, 7 days per week during blasting, coating, between applications of coating, unless approved in writing by the Engineer.
2. Maintain the dehumidification system at all times. Only ventilation equipment, not dehumidification equipment is required throughout final cure period.
3. Dehumidification equipment shall also provide the necessary ventilation for the removal of solvent vapors during the coating and final cure phase. At all times, maintain the concentration of solvent vapors in all parts of the containment at 10-percent below the lower explosive limit (LEL).
4. Ducting shall be a minimum of 18 inches in diameter, airtight and reinforced with spirally-wound wire to prevent collapse. Size of ducting shall be larger if deemed necessary by the Contractor in order to comply with these specifications or any local, state, or federal safety regulations. Sizing of the ducting, ventilation, and dehumidification equipment shall be the sole responsibility of the Contractor. Provide an appropriate connecting device between the 18-inch duct and designated opening. All bends in duct work shall have a minimum radius of 2 X ID of the ducting (i.e. 18" ID = 36" minimum radius).
5. The Contractor shall design and submit for review a dehumidification and ventilation plan, which provides for a minimum cross-draft velocity of 100 feet per minute in the vicinity of the work area. The cross-draft velocities shall be obtained with the use of a portable blower or fans.

6. The areas adjacent to the surface that are to be blasted and coated shall not be exposed to a relative humidity over thirty-five percent (35%). Furthermore, these areas shall not have a surface temperature that is less than 15 degrees F above dew point at any time during cleaning and coating phases.
7. The Contractor shall provide and maintain 24-hour strip chart recorder for humidity and temperature and place humidity and temperature measuring devices at the start of abrasive blasting operations.

Equipment:

1. The dehumidification equipment shall be a solid desiccant (not liquid, granular, or loose lithium chloride) design having a single rotary desiccant bed capable of continuous operation, fully automatic, with drip-proof automatic electrical controller.
2. The equipment shall be capable of making two complete air changes every sixty minutes unless the 100 feet per minute cross-draft velocity requirement requires a larger volume.
3. The processed air from the dehumidification unit must maintain a relative humidity of eleven percent or less.
4. During the coating phase, dehumidification units shall have auxiliary heaters capable of maintaining a constant air temperature inside the containment.
5. Air heaters are not acceptable as substitutes for dehumidification units.
6. Air chillers, heaters, or air conditioners may be used downstream of the dehumidifiers if they are approved for use by the manufacturer of the dehumidification equipment and the Engineer.

Dehumidification equipment shall be operating continuously, 24 hours a day, seven days per week from the time abrasive blasting begins, through to completion of all coating application. Equipment shall be turned off only for regular servicing or fueling of climate control equipment or generator(s). Equipment can be turned off during periods when there is no demand for dehumidification only if automatic controls are installed that perform the following:

- A. Activates and deactivates the equipment by determining the difference between the coldest surface temperature and the dew point temperature in the tank.
- B. Measures and logs surface temperature, inside air temperature, inside dew point temperature and equipment run time at 1-minute intervals. Copies of this data will be delivered to the owner's representative.
- C. Climate control equipment equipped with a monitoring and control device, including complete control module, sensor module, and web-based support such as ExactAire supplied by Munters Corporation that notifies a capable technician of any failure of the equipment or power source, by cellular phone or pager.

3.10 – Disposal Of Existing Coatings And Spent Abrasive Blast Media

- A. The Contractor shall dispose of spent abrasive blast media and removed coating materials in accordance with a District approved disposal plan.
- B. The Contractor shall coordinate and pay all costs for sampling and testing of spent abrasive blast media in order to document waste class. Minimum sampling and testing requirements are listed previously in this Section.
- C. Prior to removal of hazardous wastes off-site, the Contractor shall allow adequate time for District to review laboratory test results, as well as the time required to obtain a Hazardous Waste Generator's U.S. EPA ID Number, if required the District will provide the Contractor with written notice to dispose of all or a portion of the spent abrasive blast media and/or removal coating materials as hazardous waste, if so determined by the District that such disposal is required.
- D. The Contractor shall be responsible for all costs associated with accumulating, transporting, and disposing of spent abrasive blast media and removed coating materials.

3.11 – Clean-Up - Upon completion of the work, the Contractor shall make a detailed inspection of all work. The Contractor shall be solely responsible for all paint over-spray or fugitive dust fallout claims. The Contractor shall remove all spattering, spits, and blemishes. Upon completion, of work, the Contractor shall remove all staging, tarps, scaffolding, and containers from the site, including but not limited to: paint and thinner containers and excess paint and thinner (to be disposed of in conformance to all current

regulations); paint spots removed and the entire job site cleaned; all damage to surfaces resulting from the work from this section to be cleaned, repaired or refinished to the complete satisfaction of the District. All clean up shall be completed within 7 calendar days starting at the last day of holiday testing of the tank. The Contractor shall bear all costs associated with site cleanup.

3.12 Mechanical Repairs - There are areas of corrosion on the tank that may require mechanical repairs. Excessive metal loss, as determined by the Engineer, shall be repaired using the following procedure:

A. After removing the coating, examine all surfaces for the presence of rust scale, excessive metal loss, and corrosion pitting. Report all locations observed to the Engineer.

B. Grind all sharp edges in accordance with NACE SP 0178.

3.13 Omissions – Care has been taken to delineate herein those surfaces to be coated. However, if coating requirements have been inadvertently omitted from this section or any other section of the specifications, it is intended that all metal surfaces, unless specifically exempted herein, shall receive a first-class protective coating equal to that given the same type surface pursuant to these specifications.

4.0 INSPECTION

4.1 Quality Assurance

A. The District has retained a coating inspection firm to oversee all quality control related to coating operations. The inspector will report directly to the District and shall act with the District's authority in all matters related to construction. The Inspector will be a N.A.C.E. Certified Coating Inspector, who will inspect any or all phases of work to be performed as outlined herein. The inspector shall be in addition to the District Inspector; authority shall be limited to coating related work only. The District Inspector shall remain the primary observer for all work on the project. The inspector shall work for and report to the District. The Contractor shall not rely upon the coating inspector for documentation of environmental conditions and assuring compliance with plans and specifications.

B. The Contractor shall notify the District in advance (48 hours minimum) of all surface preparation or paint application in order to perform a preliminary examination and provide acceptance of the surface preparation and each coat prior to application of the next coat.

- C. The Coating Inspector shall examine all materials, tools, and equipment to be used in the blasting and coating operations and shall have the authority to direct the Contractor to remove, replace, or repair any materials, tools, or equipment found not to be in conformance with the Contract Documents including the approved shop drawings and manufacturer's recommendations. The Contractor shall be fully responsible for compliance with all safety measures, hazardous and toxic materials regulations, and site security. Observation of or failure to observe any safety efforts of the Contractor by the Inspector shall not relieve the Contractor of this responsibility nor shall any liability transfer from the Contractor to the District or the Inspector. The Contractor shall indemnify, defend, and save harmless the District and the coating Inspector from all liability associated therewith.
- D. All coating components shall be mixed in exact proportions specified by the manufacturer. Care shall be exercised to insure all material is removed from containers during mixing and metering operations. All coatings shall be thoroughly mixed utilizing an approved slow-speed power mixer until all components are thoroughly combined and are of a smooth consistency. Catalyzed coatings shall not be applied beyond pot-life limits specified by manufacturer. Any required induction requirements shall be strictly followed. Thinners shall be added to coating materials only as required in accordance with manufacturer's printed literature and in the presence of the Engineer. Quantities of thinner shall not exceed limits set by applicable regulatory agencies. Application shall be by airless spray method except as otherwise specified, or approved by the Engineer. Drying time between coats shall be strictly observed as stated in the manufacturer's printed instructions. When two or more coats are specified, where possible, each coat shall be of contrasting color. Care shall be exercised during spray operations to hold the spray nozzle perpendicular and sufficiently close to surfaces being coated to avoid excessive evaporation of volatile constituents and loss of material into the air or the bridging of cracks and crevices. Reaching beyond limits of scaffold perimeter will not be permitted. All dryspray or overspray shall be removed as directed by Engineer and the area recoated.
- E. Upon completion of the exterior coating operations and after the required drying intervals, holiday detection shall be accomplished on all coated surfaces below the overflow. The instrument shall be set at a high-voltage in accordance with NACE SP 0188, include a wire brush electrode, and be properly grounded. Repairs shall be retested. All holiday detection of coatings shall be performed in the presence of the Engineer.

- F. The District may use any testing method deemed necessary by the District Coating Inspector to verify quality of work. The District may, but is not required to, monitor the quality of work pursuant to this section.
- G. The Contractor shall ensure proper materials handling and use, including: all coating materials are labeled and used in accordance with SSPC-PA 1, Paragraphs 5.1.1 thru 5.1.5, except all coating system materials without a stated shelf life shall be delivered and used within six months of the date of manufacture; and certification, from any source, that the coating system materials are still suitable for use beyond the stated shelf life or beyond the six month period specified above will not be accepted. All equipment and materials shall be stored in a secured ventilated container.
- H. The Contractor shall perform the necessary quality assurance in accordance with an approved plan. The Contractor will supply all inspection equipment. The District reserves the right to use their equipment at any time.
- I. Contractor shall furnish, until final acceptance of coating, inspection devices in good working condition for detection of holidays and measurement of dry-film thickness of coatings. They shall also furnish National Institute of Standards and Technology/National Bureau of Standards (NIST/NBS) certified thickness calibration plates to test accuracy of thickness gauges. Dry film thickness gauges and holiday detectors shall be available at all times until final acceptance of application. Inspection devices shall be operated by, or in the presence of the Engineer with location and frequency basis determined by the Engineer. The Engineer is not precluded from furnishing his own inspection devices and rendering decisions based solely upon these quality assurance tests. Should in the opinion of the Engineer a 24-hour, continuous reading surface temperature gauge be required to assure that maximum recoat windows are observed, the contractor shall provide a working calibrated instrument to meet this need. The gauge shall be digital and capable of providing instantaneous average measurements of the temperatures recorded.
- J. Acceptable devices for ferrous metal surfaces include, but are not limited to Tinker-Razor Models AP and AP-W holiday detectors and SSPC, Type II units for dry film thickness gauging. Inspection devices shall be calibrated and operated in accordance with specified requirements.

- K. The Contractor shall comply with the following conditions in collection and analysis of wastes:
1. All testing of spent abrasive blast media and removed coating materials to classify these wastes as hazardous or non-hazardous shall be performed by a laboratory that complies with and is certified under the Environmental Laboratory Accreditation Program (ELAP) of the California Department of Public Health.
 2. Any Laboratory performing analysis shall provide for comparison to TTLC, STLC, TCLP limits, and RCA limits, and to all other applicable regulatory limits. Laboratory shall retain samples at least ninety (90) calendar days after all analyses are complete.
 3. The Contractor shall ensure collection of as many representative samples as required by the representative of the disposal facility, but not less than 4 total.
 4. The Contractor shall ensure the following: each sample shall have an identifying sample number assigned when the sample is taken; each sample number shall be included on the sampling chain of custody and in all reports, correspondence, and other documentation related to the sample; each sample shall have a sampling chain of custody; and, each chain of custody show the name and organization of each person having custody of the sample, and also show the sample number, job name and location, time of day and date sample was taken, material sampled, and tests to be performed.
 5. The Contractor shall notify the District at least 24 hours prior to sampling collection for the purpose of District verification of samples collected.

4.2 – Quality Control

- A. The Contractor shall provide adequate lighting, without shadows, during all phases of work to insure that work is performed as specified and that the entire work area is illuminated.
- B. The Contractor shall provide ground supported scaffolding and lighting (SSPC Guide12), as determined by the Inspector, to facilitate visual and instrument inspection by the Inspector of each phase of the work and of the completed work, as so placed as directed to

minimize glare and shadows. Work will be rejected if proper lighting is not achieved for a proper inspection. All scaffolding shall be equipped with internal stairways, no exterior ladders.

- C. The Contractor shall provide personnel to move scaffolding and furnish other assistance to District Inspectors as required.
- D. The District Coating Inspector will examine surfaces after abrasive blast cleaning to verify that all deposits of contaminants have been removed as per surface clean as per ISO 8502 (Class 0). The Contractor shall blow down, and vacuum all surfaces prior to District inspection. Tank floors shall be vacuumed.
- E. The Contractor shall verify at a minimum of two times daily that air supply is free of oil and moisture contamination (ASTM D-4285). The Contractor shall use effective oil and water separators in all main compressor airlines and shall be placed as close as practicable to the equipment. Prior to using compressed air, the Contractor shall test the quality of air downstream of the separators at suitable outlets by blowing the air on clean white blotter for 2 minutes to check for any contamination, oil, or moisture.
- F. The Contractor shall perform the following daily: measure air temperature, humidity, relative humidity, and metal surface temperature, and determine dew point and relative humidity prior to abrasive blasting or painting. The Contractor shall provide portable temperature & humidity recorders to provide continuous permanent hard copy of the tank conditions and, repeat measurements and determination of dew point as often as the District Inspector deems necessary but not less often than every four hours at the start of preparation operations and run constantly until final cure.
- G. The Contractor shall maintain a written record of measurements and dew points, and time that measurements were taken, keep such record on-site, and make records available to District Inspector on request.
- H. The Contractor shall furnish 1 roll of Testex tape 1.5 to 4.5 mils X-course prior to the start of abrasive blasting. The District Coating Inspector may evaluate surface preparation using field abrasive blasting standards, and Testex tape. Evaluation may include inspection of blasted surfaces for dust and abrasive residue, using clear adhesive coated tape. Evaluation will be made immediately prior to coating application.

- I. The Contractor shall verify cleanliness of all spray application equipment prior to, or no later than, time of mixing coating material.
- J. The Contractor shall measure wet film thickness during coating application of coating to ensure adequate coating thickness, taking at least one measurement for each 100 square feet of application area. The Contractor shall measure dry film thickness after each coat using a non-destructive magnetic dry film thickness gauges.
- K. The District Coating Inspector may, but is not required to, also measure coating thickness, at random locations, after each coat. Thickness of coatings shall be checked with a non-destructive film thickness gauge in accordance with ASTM D7091. An instrument such as Tooke Gage should be used in accordance with ASTM D4138 if a destructive tester is deemed necessary. The sampling of film thickness of flat (e.g. plate) surfaces shall be tested in accordance with SSPC-PA2. The sampling of structural members or irregular surfaces shall be tested in frequency and locations, as directed by the engineer using the Appendix of SSPC-PA2 as a guide.
- L. The District Coating Inspector will evaluate cleanliness of coated surface immediately prior to application of a subsequent coat.
- M. The Contractor shall test all coated surfaces for pinholes. Coating integrity of all exterior coated surfaces shall be tested with an approved inspection device in accordance with NACE SP 0188. All pinholes shall be repaired in accordance with the manufacturer's printed recommendations and retested. No pinholes or other irregularities will be permitted in the final coating.
- N. Perform testing in the presence of the District Coating Inspector.
- O. Perform testing after coating has cured as recommended by the manufacturer.
- P. Use an appropriate detector, such as Elcometer #236 or as approved by the District representative.
- Q. Re-test after coating repairs.
- R. The District may hire a third party inspector to inspect Contractor's work, but the ultimate responsibility for the quality of the Contractor's work and the performance of contractual obligations remains with the Contractor.

- S. Manufacturer's Representative: The Contractor shall, at no cost to the District, provide a qualified technical representative of the coating system manufacturer at the job-site as required by the District to resolve problems related to the coating system or the application of the system.

4.3 – Coating Inspector and Authority

- A. The Contractor shall notify the Coating Inspector in advance (48 hours minimum) of all surface preparation or paint application in order to perform a preliminary examination and provide acceptance of the surface preparation and each coat prior to application of the next coat.
- B. The Contractor shall afford the coating inspector all reasonable facilities and assistance in monitoring the coating and priming operations.
- C. To facilitate adequate inspection of all surfaces, the Contractor shall provide scaffolding or rigging necessary for the Coating Inspector to perform dry film thickness readings, and visual holiday inspection as required by these specifications and reference standards. The Contractor shall provide personnel to move scaffolding or rigging at the instructions of the District.
- D. The coating inspector shall have authority to direct the Contractor to suspend operations when environmental conditions fall outside the manufacturer's recommended parameters. The Contractor shall comply with these directions and shall not proceed until the coating inspector determines environmental conditions are sufficient to proceed. Failure to suspend coating operations as directed or restarting work without the direction of the coating inspector shall be cause for rejection of work so performed.
- E. The Contractor shall immediately remove and replace all such work in accordance with these Project Special Provisions and directions of the coating inspector. No additional compensation will be allowed for work resulting from failure to comply with the coating inspector or for surfaces not otherwise conforming to the provisions of these Project Special Provisions.

- 4.4 – Inspector Assistance - To facilitate adequate inspection of all surfaces, the Contractor shall provide scaffolding or rigging necessary for the Coating Inspector to perform dry film thickness readings, and visual holiday inspection as required by these specifications and reference standards.

The Contractor shall provide personnel to move scaffolding or rigging at the instructions of the Coating Inspector.

4.5 – Acceptability for Paint Application - The SSPC-Vis1 pictorial surface standards along with dry film and wet film thickness gauges will be used by the Coating Inspector to determine acceptability of the paint application. The Contractor shall provide necessary testing equipment to perform the above-mentioned tests.

4.6 – Reporting - The Contractor shall provide weekly copies of daily work reports to the coating inspector. Such reports shall include, but not be limited to, the day and date of work performed, the type and amount of work performed, all work related to the safety of the operation, and personnel assigned to work actually performed.

4.7 – Safety

- A. The Contractor shall provide a safe work environment at all times. In the event the Coating Inspector notes any safety deficiencies, the Contractor shall immediately rectify noted deficiencies.
- B. The Contractor shall be fully responsible for compliance with all safety measures, hazardous and toxic materials regulations, and site security. Observation of or failure to observe any safety deficiencies of the Contractor by the Coating Inspector shall not relieve the Contractor of this responsibility nor shall any liability transfer from the Contractor to the District or the Coating Inspector.
- C. The Contractor shall save harmless the District and the Coating Inspector from all liability associated therewith.

4.8 – Warranty

- A. Anniversary inspection requirements and failure criteria shall be in accordance with AWWA D-102, Section 9, except as modified herein. The total warranty period shall be two years from the final acceptance date.
- B. The District will conduct a first anniversary warranty inspection approximately one year following final acceptance of the work, including inspection of the exterior of the tank. The District will establish the date of the inspection and will notify the Contractor at least thirty (30) calendar days in advance of the inspection.
- C. The Contractor shall furnish scaffolding and equipment as necessary for any warranty inspections, and shall be present for such

inspections. The District will provide an inspection report to the Contractor detailing the number and types of failures observed, the percentage of surface area where failures have occurred, and the names of the persons making the inspections.

- D. All surfaces of the coating systems shall be visually inspected. All defective coatings, as well as damage or rusting spots of the tank, shall be satisfactorily repaired by and at the sole expense of the Contractor. Defective coating shall be any of those defined by SSPC's Visual Comparison Manual. In addition, the District shall consider photographs or reports of the coating imperfections or failures as acceptable evidence of failure.
- E. Any location where coating is defined as defective shall be considered to be a failure of the system at that location. The Contractor shall make repairs at all points where failures are observed by removing the deteriorated coating, cleaning the surface, and recoating with the same system specified herein. Any spot repairs to defective areas will require feathering at least 3 inches into sound adjacent coating. Repaired spots shall be demarcated by masking. If an area of failure exceeds 25 percent of a specific coated surface, the entire coating system from that specific area may be required to be removed and recoated in accordance with the original specification.
 - 1. Specific coated surfaces are defined as follows:
 - a. Roof - exterior
 - b. Shell - exterior
 - c. Attachments, accessories and appurtenances
- E. The Contractor shall be liable for all remedial work including repair of all failures by removing the deteriorated coating, cleaning the surface, and recoating with the same system in accordance with this Section. The District may allow surface preparation of small failures (areas less than 1 sq/ft.) by cleaning to bare metal in accordance with appropriate SSPC-SP standards, however, the method of repair is at the sole discretion of the District.
- F. The District will prepare a schedule for remedial work completion, to be no more than thirty (30) calendar days after the submittal of the inspection report to the Contractor. Upon failure of the Contractor to commence remedial work within ten calendar days after the starting date established by the District, the District may at its option, retain

another Contractor to perform the remedial work. The Contractor shall be liable for actual cost of all such remedial work plus a 20 percent District administrative cost.

- G. The Contractor shall bear the expense of all warranty inspections of the remedial work required by the District.
- H. Any repairs that are completed based on the warranty inspection are subject to be inspected one year after the repair work is complete. The Contractor shall bear all expenses as part of the repair work and providing all necessary access for the District to review the warranty repairs.

END OF SECTION

STRUCTURE EXCAVATION AND BACKFILL

1.0 GENERAL

- 1.1 Scope - This section shall govern the work for structure excavation and backfill. Structure excavation shall consist of the removal of material for the construction of foundations for vaults, manholes, or other structures, and other excavation designated on the Plans or in the Specifications as structure excavation. Trenching and backfill shall be in accordance with Section 31 23 33.

Structure excavation and structure backfill shall include the furnishing of all materials and equipment; the construction or installation of all facilities which may be necessary to perform the excavations and to place and compact the backfill; and the subsequent removal of such facilities, except where they are required or permitted by the Plans or Specifications to remain in place.

- 1.2 Submittals - Upon request, the following items shall be submitted and approved by the District.
- A. Test results showing gradation, durability and sand equivalent of import material.
 - B. Permit and notification form for excavations five feet or more in depth as required by Cal-OSHA, including any trench excavation or shoring plans.

2.0 MATERIALS

- 2.1 Excavation - Excavation is unclassified. The contractor shall complete all excavations regardless of the type of materials encountered. The contractor shall make his own estimate of the kind and extent of the various materials which will be encountered in the excavation.
- 2.2 Backfill - Native earth backfill and imported backfill material shall conform to the requirements of Section 31 23 33.

3.0 EXECUTION

- 3.1 Pavement - Bituminous or concrete pavements regardless of their thickness, and curbs and sidewalks shall be cut prior to excavation for the structure in accordance with the requirements of the encroachment permit or the District.

Pavement and concrete materials shall be removed from the site. These materials may be used as backfill if approved by the District.

- 3.2 Excavation - The sides of excavations for structures shall be sufficient to leave at least 1.5 feet clear as measured from the extreme outside of form work on the structure as the case may be. Where excavation is inadvertently carried below designated elevations, suitable provision shall be made at the expense of the contractor for adjustment of construction, as directed by the engineer to meet requirements incurred by the deeper excavation. No earth backfill will be permitted to correct overdepth excavation beneath structures, and overdepth excavation in such locations shall be rectified by backfilling with sand, graded gravel, or concrete as directed by the District.

- 3.3 Bracing - The contractor's design and installation of bracing and sheeting shall take the necessary precautions to be consistent with the rules, orders, and regulations of the State of California Construction Safety Orders.

Excavations shall be so braced, sheeted, and supported that they will be safe, such that the walls of the excavation will not slide or settle and all existing improvements of any kind, either on public or private property, will be fully protected from damage.

The sheeting, shoring, and bracing shall be arranged so as not to place any stress on portions of the completed work.

The contractor shall carefully remove sheeting, shoring, bracing, and timbering to prevent the caving or collapse of the excavation faces being supported.

- 3.4 Dewatering - The contractor shall provide and maintain means and devices to continuously remove and dispose of all water entering the excavation during construction of the structure and during backfill operations.

Water shall be disposed of in a manner that will prevent damage to adjacent property and pipe trenches.

The contractor shall not allow water to rise in the excavation until backfilling around and above the structure is completed.

- 3.5 Backfill - After structures and foundations are in place, backfill shall be placed to the original groundline or to the limits designated on the plans.

No material shall be deposited against cast-in-place concrete structures until the concrete has reached a compressive strength of at least 2,500 pounds per square inch.

Backfill material shall be placed in horizontal layers not exceeding 8 inches in depth.

3.6 Compaction - Compaction requirements shall be as follows:

Backfill within 5 feet of structure: 95% relative compaction.

Structural Backfill beyond 5 feet of structure: 90% relative compaction.

Gravel Base: 95% relative compaction.

Each layer of backfill material shall be moistened and thoroughly tamped, rolled, or otherwise compacted to the specified relative density.

Compaction equipment shall be carefully operated near structures to prevent their displacement or damage. Structural fill is to be placed and compacted in uniform layers around all sides of the structure.

3.7 Excess Excavated Material - The contractor shall make the necessary arrangements for, and shall remove and dispose of all excess excavated material.

All surplus material shall become the property of and be disposed of offsite by the contractor.

No excavated material shall be deposited on private property unless written permission from the owner thereof is secured by the contractor. Before the District will accept the work as being completed, the contractor shall file a written release signed by all property owners with whom he has entered into agreements for disposal of excess excavated material absolving the District from any liability connected therewith.

3.8 Restoration of Damaged Surfaces and Property - If any existing improvements, facilities, or vegetation not designated to be removed have been damaged, removed, or disturbed by the contractor, for whatever reason, such improvements, facilities and vegetation shall be replaced or repaired at the expense of the contractor.

3.9 Final Clean-up - After backfill has been completed, the right-of-way shall be dressed smooth and left in a neat and presentable condition to the satisfaction of the District.

END OF SECTION

TRENCH EXCAVATION, BACKFILL AND COMPACTION

1.0 GENERAL

- 1.1 Scope - This section governs the work for trench excavation, backfill and compaction for underground pipeline work.
- 1.2 Submittals - Upon request, the following items shall be submitted and approved by the District.
 - A. Permit and notification form for excavations five feet or more in depth as required by Cal-OSHA, including any trench excavation or shoring plans.
- 1.3 Testing - Testing frequency and location shall be approved by the District.

2.0 MATERIALS

- 2.1 Trench Excavation - Excavation is unclassified. The contractor shall complete all excavations regardless of the type of materials encountered. The contractor shall make his own estimate of the kind and extent of the various materials, which will be encountered in the excavation.
- 2.2 Pipe Zone - Material for the pipe zone shall conform to one of the following:
 - A. Aggregate Base - Shall be 3/4-inch and minus aggregate base with a sand equivalent of 30 minimum and durability index of not less than 35. All material shall generally conform to the following gradation:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/4"	90-100
#4	35-60
#30	10-30
#200	2-9

- B. 3/8 Minus - Shall be 3/8 inch and minus fine aggregate material with a sand equivalent of 25 minimum and durability index of not less than 50. All material shall generally conform to the following gradation:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/8"	100
#4	90-100
#30	45-70
#200	0-10

- C. Plug and Drain Material - When a plug and drain system has been approved by EID and the County DOT, pipe zone material shall be Caltrans Standard Class 2 permeable material designed for the specific condition.

2.3 Subsequent Backfill – 12 inches above the top of the pipe to subgrade.

Backfill where in unpaved section shall be free from organic matter, debris, and rocks larger than 6 inches in diameter or length. The District shall be the sole judge of conformance of backfill material to this specification.

<u>Sieve Size</u>	<u>Percent Passing</u>
6"	100
3"	50
#4	35-50
#30	20-50
#200	0-9

Backfill in paved roadway sections shall be 3/4-inch and minus aggregate base or approved alternative material with a sand equivalent of 30 minimum and durability index of not less than 35. All material shall generally conform to the following gradation:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/4"	90-100
#4	35-60
#30	20-30
#200	2-9

- 2.4 Initial Material Testing – The District requires that all material shall be tested prior to use. After the material has been approved by the Engineer one truckload of material shall be delivered to the site. Under the direction of the Engineer, the Contractor is required to have the onsite material tested and results provided to the District. The material shall be tested in accordance with American Society for Testing and Materials (ASTM) D1557.

3.0 EXECUTION

- 3.1 Excavation - Excavation for pipelines, fittings, and appurtenances shall be open trench to the depth and in the direction necessary for the proper installation of the same as shown on the contract drawings or as otherwise approved by the Engineer. Excavation shall only proceed when the necessary materials have been delivered to the site.

The contractor shall bear all costs of disposing of roots and all other waste materials from the excavation. Material shall be disposed of in such a manner as to meet all requirements of the state, county, and local regulations regarding health, safety, and public welfare. Non-flammable material and flammable material, when burning is not permitted, shall be disposed of off the construction site in an approved location at the contractor's expense.

The contractor shall remove obstructions within the trench area or adjacent thereto, such as abandoned concrete structures, logs, and debris of all types, without additional compensation. The Engineer may, if requested, make changes in the trench alignment to avoid major obstructions, if such alignment can be made without adversely affecting the intended function of the facility.

- A. Existing Pavement Removal - Pavement to be removed shall be removed and replaced in the manner prescribed by the agency issuing the encroachment permit or by approved industry standard where there is no permit.

Existing pavement, curbs, gutters, sidewalks and driveways to be removed in connection with construction shall be neatly saw cut prior to removal. Saw cuts shall have a minimum depth of one inch in concrete sidewalk. Concrete sidewalks or driveways shall be removed so that a minimum 30-inch square is replaced. If the saw cut in a sidewalk or driveway would fall within 30 inches of a construction joint, expansion joint, or edge, the concrete shall be removed and replaced to the joint or edge. If the saw cut would fall within 12 inches of a score mark, the concrete shall be removed and replaced to the score mark. Concrete shall be removed by jackhammer or other approved method.

- B. Grading - The contractor shall control grading in a manner to prevent water running into excavations. Obstructions of surface drainage shall be avoided and means shall be provided whereby storm and wastewater can be uninterrupted in existing gutters, other surface drains or temporary drains. Material for backfill or for protection of excavation in public roads from surface drainage shall be neatly

placed and kept shaped so as to cause the least possible interference with public travel and covered if precipitation is predicted. Free access must be provided to all water facilities, private drives, sewer facilities, gates, and mail boxes.

- C. Line and Grade - The contractor shall excavate the trench to the lines and grades shown on the plans and as staked. Any deviations shall first be approved by the Engineer.

The trench shall be excavated to a minimum depth of 6 inches below the bottom of the pipe. The sides of the trench shall be excavated and maintained as nearly vertical as practical within the pipe zone.

- D. Stockpiling of Backfill Materials – Stockpile of backfill materials shall be kept in a centralized location to allow for efficient transportation and management. Backfill materials shall be controlled. Backfill must not be spread in the roadway. In paved roadways, materials shall be stockpiled so as to keep the pavement clean and clear at all times. If backfill materials are accidentally scattered in the roadway they shall be cleaned immediately to the satisfaction of the District and/or El Dorado County Department of Transportation.

- E. Trench Support - The trench shall be adequately supported and the safety of workers provided for as required by the standard of the appropriate regulatory agency California OSHA and Federal OSHA.

All shoring for open excavations shall conform to the State of California, Department of Industrial Relations and Division of Industrial Safety "Construction Safety Orders." Contractor must provide engineer stamped tabulated data for any shoring system prior to use. All costs for the necessary drawings shall be borne by the Contractor.

The contractor shall be responsible for adequately shored and braced excavations so that the earth will not slide, move or settle, and so that all existing improvements of any kind will be fully protected from damage.

No shoring once installed, shall be removed until the trench is at legal depth per Cal OSHA and Fed OSHA. Removal of shoring shall only be accomplished during backfill operations once legal depth is attained and in such a manner as to prevent any movement of the ground or damage to the pipe or other structures.

The contractor shall obtain all permits for any excavations over five feet in depth into which a person is required to descend or any

excavation less than five feet in depth in soils where hazardous ground movement may be expected and into which a person is required to descend.

Excavated material shall not be placed closer than two feet from the top edge of the trench. Heavy equipment should not be used or placed near the sides of the trench unless the trench is adequately braced.

- F. Use of Explosives - Blasting for excavation will be permitted only after securing the approval of the Engineer, all necessary blasting permits, and only when precautions are taken to eliminate danger to life or property. Explosives are to be stored in accordance with the provisions of DIVISION XI of the Health and Safety Code of the State of California. The contractor is responsible to secure any required permits for use and storage of explosives. The contractor shall notify the proper representatives of any public service corporation, or any individual at least 24 hours in advance of any blasting which may damage his or their property, along or adjacent to the construction zone.

Blasting mats shall be used at all times where flying rock might cause damage to any person, building, power line or other installation.

All traffic shall be stopped a safe distance from the blasting operation and all persons shall be removed from the area prior to blasting.

The contractor shall designate, in writing, a single responsible individual as Powder Foreman. Carelessness or incompetency by the powder foreman is grounds for immediate removal from said position or responsibility and the powder foreman shall not be permitted to handle or use explosives on the remainder of the project. Priming of all explosives shall be with electric detonators of sufficient size to ensure efficient and complete detonation of the explosive charge. All charges consisting of more than one hole shall be wired either as series or series-parallel. Straight parallel hookups are not be permitted.

The contractor is responsible to provide a power source adequate for detonation of the explosive charges consistent with accepted standard practices involving electric detonation of explosives. Excessive blasting is not permitted and any material outside the authorized cross section, which may be loosened or shattered by blasting, shall be removed. The blasting contractor assumes all liability for work performed.

The Engineer will have authority to require the contractor to discontinue any method of blasting which leads to overshooting, is dangerous to the public, or is destructive to property or natural features. The contractor shall notify the District a minimum of two hours in advance of any blasting operations.

- G. Preservation of Trees - Excavation within the dripline of any tree shall conform to the following and to encroachment permits. Trees shall not be removed outside of fill or excavated areas, except as authorized by the District.

Tree roots larger than two inches in diameter shall not be cut and shall be kept moist during exposure. For damaged or severed root systems, trees shall be trimmed to compensate for the decreased root system. Trimming shall be done to the satisfaction of the inspector or arborists at the Contractor's expense. All roots shall be neatly cut with saw or sharp cutter.

- H. Dewatering - The contractor shall provide and maintain, at all times during construction, ample means and devices with which to promptly remove and properly dispose of all water from any source entering the excavations or other parts of the work. Dewatering shall be accomplished by methods which will ensure a dry excavation and preservation of the final lines and grades of the bottoms of excavations. Methods may include well points, sump pumps, suitable rock or gravel placed below the required bedding for drainage and pumping purposes, temporary pipelines and other means, all subject to the approval of the Engineer.

Dewatering for the structures and pipelines shall commence when groundwater is first encountered and shall continue until the backfill at the pipe zone has been completed.

The contractor shall dispose of the water from the work in a suitable manner without damage to adjacent property. No water shall be drained into work built or under construction without prior consent of the Engineer. Water shall be disposed in such a manner as not to be a menace to public health, violate the SWPPP, or cause ground disturbance, rilling, or landslide.

The contractor is responsible for obtaining all required Local and State Permits.

- I. Correction of Faulty Grades - Any over-excavation carried below the grade as specified or shown, shall be rectified by backfilling with approved pipe zone material and/or aggregate base, and shall be

compacted to provide a firm and unyielding subgrade and/or foundation, as directed by the Engineer.

- J. Structure Protection - Temporary support, adequate protection and maintenance of all underground and surface structures, drains, sewers and other obstructions encountered in the progress of the work shall be furnished by the contractor at his expense and subject to the approval of the Engineer. Any structure that has been disturbed shall be restored upon completion of the work.
- K. Protection of Property and Surface Structures - Trees, shrubbery, fences, poles, monuments and all other property and surface structures shall be protected then restored to as good or better condition unless their removal is shown on the drawings or authorized by the Engineer.
- L. Trench Width and Grade - The width of the trench within the pipe zone shall be such that the clear space between the barrel of the pipe and the trench wall shall not exceed the amount shown in the standard details. In general, the following shall be adhered to:

<u>Pipe Size</u>	<u>Total Trench Width</u>	
	<u>Minimum</u>	<u>Maximum</u>
6"	18"	24"
8"	20"	26"
12"	24"	30"
16"	40"	52"
20"	44"	56"
24"	48"	60"
30"	54"	66"
36"	60"	72"
42"	66"	78"
48"	72"	84"

Trench widths in excess of those specified must have prior written approval.

- M. Maximum Length of Open Trench - Unless otherwise specified or directed by the District, the maximum length of open trench is 500 feet, or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is greater. The distance is the collective length of any location including open excavation, pipe laying, appurtenant construction and backfill, which has not been

temporarily resurfaced. Failure by the contractor to comply with the limitations specified herein may result in an order to halt progress of the work until compliance has been achieved. The contractor shall provide proper barricades for excavated areas. All pipe installed each day shall (at a minimum) be covered by the compacted 12-inch pipe zone backfill.

3.2 Trench Foundation - The trench bottom shall be graded to provide a smooth, firm and stable foundation at every point throughout the length of the pipe. Should large gravel and cobbles be encountered at the trench bottom or pipe subgrade, they shall be removed from beneath the pipe and replaced with clean imported aggregate base, which shall be compacted to provide uniform support and a firm foundation.

A. Foundations in Poor Soil - If excessively wet, soft, spongy, unstable or similarly unsuitable material is encountered at the surface upon which the bedding material is to be placed; the unsuitable material shall be removed to a depth as determined in the field by the Engineer. The contractor's attention is called to Section 3.1 G, regarding his responsibilities in maintaining adequate dewatering procedures to ensure that an otherwise stable foundation will not be rendered unfit due to accumulation of water.

3.3 Backfill and Compaction - Backfill shall be completed within the shortest possible time so that the construction area or street can be opened to traffic. If for any reason construction of the pipeline or appurtenances thereto is delayed, the District may require that the trench be backfilled and such areas or streets opened to traffic.

A. Pipe Zone - After completion of the trench excavation and proper preparation of the foundation, six inches of bedding material shall be placed on the trench bottom for support under the pipe. Bell holes shall be dug to provide adequate clearance between the pipe bell and the bedding material. All pipe shall be installed in such a manner as to insure full support of the pipe barrel over its entire length. After the pipe is adjusted for line and grade and the joint is made, the remainder of the pipe bedding shall be placed to the limits as shown on the drawings. All bedding material shall be compacted 90% as measured by ASTM Method D6938, prior to placement of subsequent backfill.

When bedding material is placed, the pipe bedding backfill shall be brought to optimum moisture content and shall be placed by hand in layers not exceeding three inches in thickness to the centerline (springline) of the pipe and each layer shall be solidly tamped with the proper tools so as not to injure, damage, or disturb the pipe.

Backfilling shall be carried on simultaneously on each side of the pipe to assure proper protection of the pipe.

Each lift shall be "walked in" and supplemented by slicing with a shovel to ensure that all voids around the pipe have been completely filled. Mechanical compaction such as "pogo sticks" or "wackers", as approved, shall be used for compaction of pipe zone.

- B. Initial Backfill - The remaining portion of the trench shall be backfilled, compacted and/or consolidated by approved methods to obtain a 90% compaction as measured by ASTM D6938. Backfill shall be good sound earth. Bituminous pavement, concrete, rock, or other lumpy material shall not be used in the backfill unless these materials are scattered and do not exceed 6 inches in any dimension and are not placed within 1 ½ feet of the surface. Material of perishable, organic matter, spongy or otherwise improper nature, shall not be used.

When backfill is placed mechanically, the backfill material shall be pushed onto the slope of the backfill previously placed and allowed to slide down into the trench. The contractor shall not push backfill into the trench in such a way as to permit free fall of the material until at least 24 inches of compacted cover is provided over the top of the pipe. Under no circumstances shall sharp, heavy pieces of materials be allowed to be dropped directly onto the pipe or the tamped material around the pipe. Backfill shall be placed in layers not exceeding eight inches and compacted by an approved method.

Compacting equipment including wackers and turtles shall be used until backfill has been completed to a depth of 2 (two) compacted feet over the top of the pipe.

If hydro-hammer is used for compaction of overlying materials, at least four feet of backfill must be placed over the top of pipe prior to its use. This is required to insure that the pipe is not damaged.

- C. Final Backfill - Final backfill placed in trenches below roadways or below shoulders of roadways, shall be compacted to a density of not less than 95% or as directed by the encroachment permit. Backfill outside of roadways shall be compacted to 90%.

Backfill shall be placed in layers not exceeding eight inches, compacted and brought up to the sub grade of the roadway.

- 3.4 Excess Excavated Material - The contractor shall make the necessary arrangements for, and shall remove and dispose of all excess excavated

material. It is the intent of these specifications that all surplus material not required for backfill or fill shall be disposed of by the contractor offsite from the project outside the limits of the public right-of-way and/ or easements at no liability to the District.

Excavated material shall not be deposited on private property unless written permission from the owner thereof is secured by the contractor. Before the District will accept the work as being completed, the contractor shall file a written release signed by all property owners with whom he has entered into agreements for disposal of excess excavated material absolving the District from any liability connected therewith.

- 3.5 Restoration of Damaged Surfaces and Property - If any pavement, trees, shrubbery, fences, poles or other property and surface structures have been damaged, removed, or disturbed by the contractor, whether deliberately or through failure to carry out the requirements of the contract documents, state laws, municipal ordinances, or the specific direction of the District, or through failure to employ usual and reasonable safeguards, such property and surface structures shall be replaced or repaired equal to or better than original at the expense of the contractor.

- 3.6 Final Clean-Up - After backfill has been completed, the right-of-way shall be dressed smooth and left in a neat and presentable condition to the satisfaction of the District.

END OF SECTION

STEEL PIPE CASING AND BORING

1.0 GENERAL

- 1.1 Scope - This specification governs the furnishing and installing of carrier pipe and casing to a true line and grade as shown on the plans to be bored and jacked by auger without disturbing the surface. All incidentals and appurtenant operations necessary for the construction of the casing and pipe shall be done in strict accordance with the drawings, applicable permits, and other terms and conditions of the contract. Should there be conflicts between this specification and the governing agency, the more restrictive condition shall apply.

The contractor shall furnish all equipment, tools, labor and materials required for the construction as shown and specified.

All standard specifications, i.e., AWWA, ASTM, etc., made a portion of these specifications by reference, shall be the latest edition and revision thereof.

The contractor shall be responsible for all material furnished by him and shall replace at his own expense, should the material be defective in manufacture or damaged in delivery. This shall include the furnishing of all material and labor required to replace defective material discovered prior to final acceptance of the work.

- 1.2 Submittals - Submittals shall be provided for the following items:

- Casing, size, thickness, and material
- Construction method
- Skid configuration
- Pit bracing
- Carrier pipe type

- 1.3 Permits - All work shall conform to the specifications and requirements of the agency having jurisdiction. The contractor shall secure all required permits for construction of casing pipe installation.

- 1.4 Safety - It shall be the contractor's responsibility to see that the work is done in conformance with Cal-OSHA and all other applicable laws and regulations.

2.0 MATERIALS

- 2.1 Casing - Steel casing pipe shall conform, as a minimum, to ASTM A283, Grade C. All casing is required to be either straight seam or seamless steel. Used pipe for casing shall be allowed if it meets the same specifications as new pipe that is used for casing.

Minimum wall thickness for steel pipe casing shall be as shown on the table that follows the casing specifications. However, in no case shall wall thickness be less than 1/4-inch.

Lap weld or corrugated pipe, shall not be used for boring.

All casing length shall be equal to the auger length.

- 2.2 A. Tolerances for Casing - The outside diameter (O.D.) shall be as follows:

- 4 1/2 inches O.D. through 18 inches O.D. ±0.75%
- 20 inches O.D. and larger ±1.00%

For casing used in any one bore, maximum variation within above tolerances between maximum and minimum outside diameter shall not exceed 1/4-inch from 6 inches to 48 inches and 1/2-inch over 54 inches.

The wall thickness at any and all places on steel casing shall be as follows:

- 4 inches through 18 inches +15.0% -12.0%
- 20 inches and larger +17.5% -10.0%

- B. Lengths and Ends - Unless otherwise agreed, the casing shall be square cut by mechanical methods. Torches held by machinery shall be considered to meet this requirement. The lengths shall be even multiples of 10 feet (i.e. 10 feet, 20 feet, 30 feet, 40 feet, etc.) unless otherwise specified by the boring contractor. This does not apply to field cutting.

- C. Straightness - Casing shall be measured by the cord method with either string or wire stretched taut to take out all visible sag. Maximum cord measured along the casing shall be true length x0.02%. This shall be measured on actual lengths before loading for delivery to the jobsite.

D. Minimum Wall Thickness for Casing - If not shown on the plans, the minimum wall thickness shall be as follows:

<u>Casing Size</u>	<u>0 to 100' Length</u>	<u>100' to 200' Length</u>
16"-18"	1/4"	3/8"
20"-26"	5/16"	5/16"
28"-32"	3/8"	3/8"

E. Lead Joint - The lead joint, where called for, shall be 10 feet long and 1 ½ times the wall thickness of the casing being used.

F. Grout Ports - For casing sizes 30 inches and larger, inside grout ports shall be provided. Location and frequency of the ports shall be approved by the engineer.

2.3 Grout - Grout shall consist of one part Portland cement, water, and four parts sand. Sand shall be of a fineness that 100% passes a standard 8-mesh sieve and at least 45%, by weight, passes the 40-mesh sieve.

2.4 Carrier Pipe - Carrier pipe shall be either ductile iron pipe or polyvinyl chloride (PVC) conforming to the applicable pipe technical specification.

2.5 Skids - Skids shall be pressure treated fir, heart redwood, or polyurethane. Skid straps shall be stainless steel.

2.6 Backfill - The void between the earner pipe and casing shall be filled with blown sand or grout as shown on the plans.

3.0 EXECUTION

3.1 Bore and Receiving Pits - The trench for boring operations shall be adequately shored to safeguard existing substructures and surface improvements and to ensure against ground movement in the vicinity of the casing portal.

The foundation of the approach pit shall be prepared to provide firm support for the guide rails and boring machinery. Pits shall be of sufficient size to allow free insert of the lengths of casing pipe. All rails and support members shall be anchored to ensure that the action of the jacks is in line with the axis of the casing.

All pits shall be fenced and/or a type "K" barrier placed for protection. Pits to be left open overnight shall have a six-foot high fence, in panel sections, securely fastened together for predesign safety. Reflectors shall be secured to the side of the fence that faces traffic.

- 3.2 Alignment and Grade - Where tolerances are not shown on the plans, the horizontal tolerance for pressure and gravity pipeline shall be 1% left or right, from the survey line.

Vertical tolerance for pressure pipelines shall be 1% up or down from the grade line. No vertical tolerance is allowed for gravity flow pipelines.

- 3.3 Boring - Casing sections shall be joined by full-circumference butt welding in the field. The contractor shall prepare ends of casings for welding by providing a ¼-inch x 45 degree chamfer on the ends to be welded.

The end of the steel casing pipe shall be kept immediately behind the cutterhead of the boring machine. The bored hole shall have a diameter no greater than 1 inch larger than the steel casing pipe.

- 3.4 Grouting - Immediately after completion of the jacking or boring operation, lean grout shall be injected through the grout connections of casings 30 inches and larger in a manner that will completely fill all voids outside the casing pipe resulting from the boring operation. Grout pressure is to be controlled so as to avoid deformation of the casing and/or movement of the surrounding ground. After completion of grouting, the grout connections shall be closed with cast-iron threaded plugs.

Voids, created by casings smaller than 30 inches, shall be grouted from ground surface.

- 3.5 Carrier Pipe Installation - The carrier pipe shall be pushed into the casing pipe using skids in accordance with the detail.

It shall be the responsibility of the contractor to secure the carrier pipe in a manner satisfactory to the District Representative to prevent "floating" and subsequent loss of grade when the annular space between the casing pipe and the carrier pipe is filled.

Before backfilling the annular space, the carrier pipe shall pass an initial pressure or leakage test.

- 3.6 Backfill - The annular space between the carrier pipe and the jacked casing shall be filled with air blown sand.

- 3.7 Sealing Ends of the Casing - The annular spaces at the ends of the casing shall be sealed with Class B concrete a minimum of six inches thick or brick and mortar.

- 3.8 Closing the Jacking Pit - After jacking equipment and muck from the tunnel have been removed from the approach trench of the jacking pit, the

contractor shall prepare the bottom of the jacking pit as a pipe foundation. Loose and disturbed material below pipe grade to undisturbed earth shall be removed and then replaced and compacted in eight-inch lifts.

END OF SECTION

ASPHALT PAVING NON-COUNTY ROADS

1.0 GENERAL

1.1 Scope - This specification governs materials and installation for hot mix asphalt on prepared subgrade or aggregate base course to lines, grades and compacted thickness as indicated on the Drawings for non-county roads only. This specification also includes all temporary cold mix asphalt as approved by the District for non-county roads.

1.2 Submittals

Hot Mix Design:

- A. Contractor shall submit the proposed asphalt concrete mix design and test results which conform to these specifications. The proposed mix design shall be reviewed and approved by the Engineer prior to commencing work.
- B. Contractor shall provide a hot mix design that conforms to the applicable requirements as part of this specification and complies with the following design requirements set forth in Section 39-1.03B of the CALTRANS Standard Specifications.

Quality Characteristic	Test Method	HMA Type		
		A	B	RHMA-G
Air Voids Content (%)	CT 367 ^a	4.0	4.0	Special Provisions
Voids in mineral aggregate (% min)	LP-2			
No. 4 grading		17.0	17.0	--
3/8" grading		15.0	15.0	--
1/2" grading		14.0	14.0	18.0-23.0 ^b
3/4" grading	13.0	13.0	18.0-23.0 ^b	
Voids filled with asphalt (%)	LP-3			
No. 4 grading		76.0-80.0	76.0-80.0	Noted
3/8" grading		73.0-76.0	73.0-76.0	
1/2" grading		65.0-75.0	65.0-75.0	
3/4" grading	65.0-75.0	65.0-75.0		
Dust proportion	LP-4			
No. 4 and 3/8" gradings		0.9-2.0	0.9-2.0	Noted
1/2" and 3/4" gradings	0.6-1.3	0.6-1.3		
Stabilometer value (min.) ^c	CT 366			
No. 4 and 3/8" gradings		30	30	--
1/2" and 3/4" gradings	37	35	23	

Notes:

- Calculate the air voids content of each specimen using California Test 309 and Lab Procedure LP-1. Modify California Test 367, Paragraph C5, to use the exact air voids content specified in the selection of OBC.
- Voids in mineral aggregate for RHMA-G must be within this range.
- Modify California Test 304, Part 2.B.2.c: "After compaction in the compactor, cool to 140° ± 5°F by allowing the briquettes to cool at room temperature for 1/2-hour, then place the briquettes in the oven at 140°F for a minimum of 2 hours and not more than 3 hours.
- Report this value in the job mix formula submittal.

C. Mix shall have a tensile strength ratio of at least 70, as determined by California Test 371.

Cold Mix Design:

A. The aggregate and asphalt shall be thoroughly mixed so that the asphalt material is uniformly distributed throughout and a minimum of 90% of the aggregate particles are uniformly coated when placed on the roadway. Prior to commencing work, it shall be the responsibility of the contractor to submit to the Director one of the following mix designs.

Sieve Size	Stabilize Base	Dense Binder	Dense T&L	Dense Top	Open Binder	Open Top
2"	100					
1.5"		100			100	
1"		95-100				
3/4"			100		90-100	
1/2"		60-90	90-100	100	30-100	100
3/8"				85-100	10-60	85-100
#4	25-65	30-70	30-75	50-90	0-25	10-50
#8		20-60	20-65	25-65	0-10	0-15
#30		8-35	8-35	8-35		
#50		3-20	3-20	3-20		
#200	0-100	0-3	0-3	0-3	0-2	0-2
% Bitumen						
	2.5-4	3-4.7	3.3-5	4-5.8	2.8-4	3-4.4
Gal/Ton Cutback						
	7-14	8-13	9-14	11-16		

2.0 MATERIALS

2.1 Hot Mix Asphalt

- A. Asphalt Binder: Steam-refined paving asphalt conforming to Section 92-1.02B "Grades" of the CALTRANS Standard Specifications. Contractor shall furnish asphalt in conformance with the CALTRANS "Certification Program for Suppliers of Asphalt".
- B. Tack Coat: Grade SC-70, conforming to Section 93-1.01 of the CALTRANS Standard Specifications.
- C. Hot mix asphalt shall be produced in a batch mixing plant or a continuous mixing plant in accordance with Section 39-1.08 of the CALTRANS Standard Specifications.

2.2 Slurry Seal

- A. Slurry seal, Type II, shall be applied in conformance with the provisions in Section 37-2, and all applicable referenced sections of the CALTRANS Standard Specifications, where indicated on the drawings.

2.3 Hot Mix Asphalt Equipment

- A. Spreading and Compacting Equipment:
 - 1. Spreading equipment shall conform to Section 39-1.10 and all applicable referenced sections, of the CALTRANS Standard Specifications. Only in areas inaccessible to the machine, by approval of the Engineer, will hand spreading be permitted.
 - 2. Compaction equipment shall conform to Section 39-1.10 and all applicable referenced sections, of the CALTRANS Standard Specifications.

3.0 EXECUTION

3.1 Examination

- A. Verification of Conditions - Verify surfaces and site conditions are ready to receive work. If unsatisfactory conditions exist, Engineer reserves the right to stop installation until such conditions have been corrected. Beginning application means acceptance of existing conditions.

3.2 Hot Mix Asphalt Project Conditions

- A. Placement of hot mix asphalt shall be performed only when surface is dry and when atmospheric temperature is above 50°F.
- B. Do not place hot mix asphalt when weather is foggy, rainy nor when base on which material is to be placed is in wet or frozen conditions nor when, in the opinion of the Engineer, weather conditions will prevent proper handling, finishing, and/or compaction of the mixtures.

3.3 Hot Mix Asphalt Preparation

- A. All asphalt shall be saw cut prior to placement of new asphalt. Any trench crossing a driveway shall be saw cut in such a way to not cause any detriment to the existing driveway. Any saw cutting to private driveways or roads shall be marked prior to any work for review and approval by the Engineer. No saw cut shall take place without prior approval of the Engineer.
- B. Protect concrete pavements and walks, curbs and bases, and other improvements adjacent to the operations with suitable materials.
- C. Building and other surfaces shall be covered with paper or other protection, when required.
- D. Contractor shall be responsible for any damage caused by Contractor's employees. All damage caused by the contractor's operations shall be repaired to the satisfaction of the Engineer at no additional cost to the property owner.
- E. Immediately prior to applying tack coat the subgrade to receive hot mix asphalt shall conform to the compaction requirement and elevation tolerances specified for the material involved and shall be cleaned to remove any loose or extraneous material.

3.4 Tack Coat

- A. A tack coat of asphaltic emulsion shall be applied to all vertical surfaces of existing pavement, curbs, gutters, and construction joints in the surfacing against which additional material is to be placed, or as otherwise specified herein. A tack coat shall only be applied in advance of hot mix asphalt.
- B. Tack coat shall be applied in one application at a rate of 0.1 gallons per square yard of surface covered.

- C. If the hot mix asphalt is to be placed on an existing base or pavement which was not constructed as part of the contract, the contractor shall clean the surface by sweeping, flushing, or other means to remove all loose particles of paving, all dirt and all other extraneous material immediately before applying the tack coat.

3.5 Hot Mix Asphalt

- A. Hot mix asphalt shall be handled in such a way that the temperature is controlled to the best of the contractor's ability. The asphalt shall remain in the delivery truck until placement and shall not be temporarily placed in staging or storage area. Transport the mixture from the mixing plant to the point of use in vehicles having tight bodies previously cleaned of all foreign materials. Cover each load with canvas or other suitable material of sufficient size and thickness to protect the asphalt mixture from the weather.
- B. Placing materials in a windrow, then picking it up and placing it in the asphalt paver with loading equipment will be permitted provided that:

- 1. Hot mix temperatures:

Asphalt Arrives On Site	275-325°F
Asphalt Is Rolled Above	185°F

- 2. The asphalt paver is of such design that the material will fall into a hopper which has a movable bottom conveyor to feed and screed.
- 3. The loader is constructed and operated so that substantially all of the material deposited into windrows is picked up and deposited into the paving machine.
- 4. The windrow is deposited only so far in advance of the paver to provide for continuous operation of the paver and not so far as to allow the temperature of the Hot mix asphalt in the windrow to fall below 185°F.
- 5. Asphalt mixtures shall not be handled, spread or windrowed in a manner that will stain the finished surface of any pavement or other improvements.
- 6. The completed mixture shall be deposited on the prepared subgrade at a uniform quantity per linear foot, as necessary

to provide the required compacted thickness without resorting to spotting, picking-up or otherwise shifting the mixture.

- C. Spreading - All layers of hot mix asphalt shall be spread with an asphalt paver and shall conform to Section 39-1.11 and all applicable referenced sections of the CALTRANS Standard Specifications. At locations where the hot mix asphalt is to be placed over areas inaccessible to spreading and rolling equipment, all layers of hot mix asphalt shall be distributed directly out of the back of the dump truck and spread by hand. hot mix asphalt spread by hand shall be compacted thoroughly to the required lines, grades and cross-sections by means of pneumatic tampers, or by other methods that will produce the same degree of compaction as pneumatic tampers.
- D. Compaction - A pass shall be on movement of a roller in either direction. A coverage shall be as many passes as are necessary to cover the entire width being paved. Overlap between passes during any coverage, made to ensure compaction without displacement of material in accordance with good rolling practice, shall be considered to be part of the coverage being made and not part of a subsequent coverage. Each coverage shall be completed before subsequent coverages are started.

Rolling shall commence at the lower edge and shall progress toward the highest portion, except that when compacting layers which exceed 0.25-foot in compacted thickness, and if directed by the Engineer, rolling shall commence at the center and shall progress outwards.

Compacting of open graded asphalt concrete shall consist of two coverages. If necessary, only one coverage of the open graded asphalt concrete may be ordered by the Engineer to prevent a break in the bond of asphalt between the aggregate particles.

All other asphalt concrete and asphalt concrete base shall be compacted as follows:

Initial or breakdown compaction shall consist of three coverages of a layer of asphalt mixture and shall be performed with a 2-axle or 3-axle tandem or a 3-wheel roller weighting not less than 12-tons. Where the thickness of the layer of asphalt mixture is less than 0.15-foot, fewer coverages than specified above may be ordered by the Engineer if necessary to prevent damage to the layer being compacted. The initial or breakdown compaction shall be followed

immediately by additional rolling consisting of three coverages with a steel-tired roller weighing not less than 8-tons at a temperature above 185° F. Each layer of asphalt concrete and asphalt concrete base shall be compacted additionally without delay by a final rolling consisting of not less than one coverage with a steel-tired roller weighing not less than 8-tons. Except as otherwise provided for low rates of production, a separate finish roller will be required.

Rolling shall be performed so that cracking, shoving, or displacement will be avoided. Rolling where 3-axle tandem rollers may be used shall be under the control of the Engineer, but in general, no 3-axle tandem roller shall be used in rolling over a crown or a warped section when the center axle is in the locked position.

Provided it is demonstrated to the satisfaction of the Engineer that one roller can performed the work, the required minimum rolling equipment specified may be reduced to a 2-axle tandem roller, weighing at least 8-tons for each paver under any of the following conditions.

1. When asphalt concrete or asphalt concrete base is placed at a rate of 50-tons, or less, per hour at any location.
2. When asphalt concrete or asphalt concrete base is placed at a rate of 100-tons, or less, per hour and at the locations or under the conditions as follows:
 - Placed on miscellaneous areas as approved by the Engineer; or
 - When the width to be placed is less than 8-feet.

When rolling equipment is reduced as provided in this section the rolling requirements may be reduced to at least three complete coverages with the tandem roller.

Upon completion of rolling operations, if ordered by the Engineer, the asphalt concrete or asphalt concrete base shall be cooled by applying water.

The completed surfacing shall be thoroughly compacted, smooth, and free from ruts, humps, depressions, or irregularities. Any ridges, indentations, or other objectionable marks left in the surface of the asphalt concrete by blading or other equipment shall be eliminated by rolling or other means. The use of any equipment that leaves ridges, indentations or other objectionable marks in the

asphalt concrete shall be discontinued, and acceptable equipment shall be furnished by the contractor.

- E. Segregation shall be avoided and the surfacing shall be free of pockets of coarse or fine material. hot mix asphalt containing hardened lumps shall not be used. In areas inaccessible to paving and compacting equipment where spreading is done by hand, minimize the amount of segregation.
- F. At all locations, or as directed by the Engineer, the asphalt concrete shall be square and at least 2 inches thick when conforming to existing surfacing.
- G. Upon completion of final rolling, traffic shall not be permitted on the finished pavement for at least 4 hours, or until the Hot mix asphalt has cooled sufficiently to withstand traffic without being deformed as determined by the Engineer.

3.6 Cold Mix Asphalt

- A. Cold mix asphalt shall be placed before the end of each work day (where approved by the District) for newly installed pipeline trenches.
- B. Compact the cold mix asphalt material with a smooth drum roller, vibratory plate, or approved compaction equipment. Equipment to be used for compaction is subject to review and rejection by the Engineer. Contractor is responsible for adequately grading and compacting cold mix to the satisfaction of District and the Engineer.
- C. Contractor is responsible for all maintenance of cold mix up to the installation of the final pavement. Contractor is required to make repairs to cold mix as necessary and/or directed by the Engineer.

3.7 Hot Mix Field Quality Control

- A. All hot mix asphalt shall match the grades indicated on the Drawings and shall be completely free from unintended hollows and high spots.
- B. Cracks, settling of surface, improper drainage, improper compaction, and sloppy connection to previously laid surfaces will be construed as improper workmanship and will not be accepted.

3.8 Striping

- A. All striping removed or damaged during hot mix installation shall be corrected within one week of final pavement. If damage occurs before final pavement is scheduled the contractor in the interim can temporarily use marking paint for the stop bar until the final striping is scheduled.
- B. Standard striping is required at elevations above 2,500 feet and thermoplastic is required where previously used below 2,500 feet. The contractor is responsible to use either product that matches the existing striping.

3.9 Workmanship and Warranty

- A. Contractor shall provide written warranty against defects in materials or workmanship for a period of not less than one year upon acceptance of work.

END OF SECTION

CURBS, GUTTERS, SIDEWALKS, AND DRIVEWAYS

1.0 GENERAL

- 1.1 Scope - Section Includes: Concrete curbs, gutters, sidewalks, driveways, access ramps, and alley intersections.

All work in the right of way shall conform to El Dorado County's Standard Specifications.

2.0 MATERIALS

- 2.1 Concrete – Shall consist of Caltrans Class B mix containing no less than 564 pounds of cement per cubic yard, no more than 15 percent of which may be substituted with Fly Ash. Maximum coarse aggregate size shall not exceed 3/4 of an inch.

- A. Curb Finishing Mortar: One part portland cement to two parts sand.
- B. Form Release Material: Light oil or other releasing agent of type that does not discolor concrete or interfere with the application of finishing mortar to curb tops and faces.
- C. Joint Construction: Steel dividers or plastic inserts.

3.0 EXECUTION

- 3.1 Examination - Verify field conditions, including subgrade condition and interferences, before beginning construction.

- 3.2 Preparation - Surface Preparation:

- A. Construct and compact true to grades and lines indicated on the Drawings and requirements as specified.
- B. Remove soft or unsuitable material to depth of not less than 6 inches below subgrade elevation and replace with satisfactory material.
- C. Forms And Subgrade: Water immediately in advance of placing concrete.

- 3.3 Installation: Construct concrete curbs and gutters by conventional use of forms, or by means of curb and gutter machine when acceptable to the

Engineer. When use of machines designed specifically for work of this Section are accepted by the Engineer, results must be equal to or better than those produced by use of forms. Applicable requirements of construction that apply to use of forms also apply to use of machines. Discontinue use of machines when results are not satisfactory to the Engineer. Concrete shall not be poured on grade that is flooded, saturated, frozen, un-compacted, or unsuitable in any way as determined by the District, El Dorado County, and/or the City of Placerville.

- A. Thickness: Minimum thickness shall be 3-1/2 inches with a cross slope of 1/4 inch per foot towards the curb line. When completing a sidewalk repair the thickness and/or slope shall match the existing sidewalk.
- B. Forms: Carefully set to line and grade and securely stake in position forms conforming to dimensions of items to be constructed. Thoroughly clean each form prior to each use and coat with form releasing material.
- B. Expansion Joints: Construct vertically, and at right angles to centerline of street and match joints in adjacent pavement or sidewalks. Expansion joints shall be constructed at radius points, driveways, alley entrances, and at adjoining structures. Spacing between joints shall not be less than one joint every 20 feet with score lines every 4 feet. Fill joints with expansion joint filler material.
- C. Construction Joints: Construction joints shall not be constructed more than 15 feet apart. Construction joints shall be made of construction joint material, scoring or saw cutting to depth of not less than 1-1/2 inches and matching joints in adjacent pavement or sidewalk.
- D. Concrete Placing: Thoroughly spade concrete away from forms so that no rock pockets exist next to forms and so that no coarse aggregate will show when forms are removed.
- E. Concrete Compacting: Compact by mechanical vibrators and continue tamping or vibrating until mortar flushes to surface and coarse aggregate is below concrete surface.
- F. Form Removal: Front Form Faces: Do not remove before concrete has taken initial set and has sufficient strength to carry its own weight. Gutter and Rear Forms: Do not remove until concrete has hardened sufficiently to prevent damage to edges. Take special care to prevent damage.

- G. Finishing and Curing: As soon as curb face forms are stripped, apply finishing mortar to the top and face of curb and trowel to a smooth, even finish. Finish with a light, transverse broom finish in direction of work. In the case of specialty finishes such as stamped or colored concrete the finish shall match the adjacent concrete. Where curb is installed without integral gutter, extend finish 2 inches below grade. Flow lines of gutters shall be troweled smooth 4 inches out from curb face for integral curb and gutter and 4 inches on both sides of flowline for gutters without curbs.
- H. Backfill: Unless otherwise specified, backfill behind curbs, gutters, or sidewalks with soil native to area and to lines and grades indicated on the Drawings.
- I. Site Cleanup: The Contractor performing the sidewalk shall complete all backfill, form removal, and site cleanup no more than 48 hours after the concrete has been poured. It shall be the responsibility of the Contractor to remove and properly dispose of all forms, broken concrete, and materials used for the job including any trash, spoils, etc., that may be generated during the course of work.

3.4 Field Quality Control:

- A. The final product shall be subject to approval of the El Dorado Irrigation District, and where any agency such as El Dorado County or City of Placerville has jurisdiction, approval of that agency as well. New concrete shall be constructed in such a fashion so as to provide a smooth, unbroken transition from the new concrete to the adjacent existing concrete.
- B. Any concrete that shows evidence of drying, shrinking, checking, cracking, or spalling prior to cure, or that is damaged or vandalized in any way shall be removed and replaced as directed by the District, County, and/or the City.

- 3.5 Adjusting: Repair portions of concrete damaged while stripping forms or, when damage is severe, replace such work at no additional cost to the Contract. Evidence of repairs shall not be noticeable in the finished product. Remove and replace sections of work deficient in depth or not conforming to requirements indicated on the Drawings and specified in the Specifications at no additional cost to the Contract. Removal and replacement shall be the complete section between two joints.

END OF SECTION

ADJUSTING MANHOLES AND VALVE BOXES TO FINISH GRADE

1.0 GENERAL

1.1 Scope - This specification governs adjusting the elevation of existing manholes and valve boxes to new grades.

2.0 MATERIALS

2.1 All materials used in the adjusting of manholes and valve boxes shall conform to the requirements of Section 33 93 13 Manholes, 40 05 61 Gate Valves, 40 05 64 Butterfly Valves, 33 23 33 Trench Excavation, Backfill and Compaction, and the District standard details.

3.0 EXECUTION

3.1 Examination

A. Examine existing structure, valve box, frame, cover, and riser piping for damage or defects that would affect adjustment to grade.

3.2 Establishing Grade

A. Coordinate grade related items with existing grade and finished grade or paving, and relate to established bench mark or reference line.

3.3 Adjusting Manholes

A. Elevation of manhole shall be raised as necessary using precast concrete rings (grade rings) or metal adjusting rings (on a case by case basis). Use of brick for adjustment is not allowed. Elevation of manhole can be lowered by removing frame and cover, grade rings, cone, and then barrel section. A shorter section shall be installed, then the cone, grade rings, frame, and cover to rebuild or raise the elevation to the proper height.

B. Grout inside adjusting ring joints (grade rings) and any other affected joints.

C. Replacement frame and cover shall be new, submitted, and approved.

- D. Protect by using a false bottom or block off manhole using forms so that no debris or soil falls to the bottom during adjustment.
- E. Adjust frame to elevation to match grade and when finished grade is sloped pour in a monolithic spacer with the new collar.
- F. Verify that manholes and inlets are free of visible defects, damage, and leaks as a result of reconstruction. Repair deficiencies in a manner that is to the approval of the District.

3.4 Adjusting Valve Boxes

- A. Replace with new valve box.
- B. Remove and replace 8" PVC C-900 riser pipe as determined by the District in accordance with the District's standard details. Replace with suitable length to extend a minimum of 4" into the new valve box adjusted to accommodate final finish grade.
- C. After valve box has been set, aligned, and adjusted level with the final finish grade, place concrete collar per the District's standard details.

3.5 Backfill and Grading

- A. Concrete collars in paved areas shall be left down to accommodate finish asphalt but no more than 2" from finished grade.
- B. Backfill the area of excavation surrounding each adjusted manhole and valve box by compaction per the District's standard specifications.
- C. Grade the ground surface to drain away from each manhole and valve box. Backfill to concrete collar around manhole frame or to collar around valve box.
- D. In unpaved areas, grade surface at a uniform slope of 1 to 5 from the concrete collars frame to natural grade.

3.6 Adjusting Valves and Manhole Timing

- A. Valves and manholes shall be GPS'ed with sub meter accuracy prior to being lowered. This data shall be provided to the District a minimum of one week prior to lowering below grade. Once the District has given approval to lower the contractor shall mark each manhole and valve location with matching USA paint colors. The

contractor shall keep these marks visible until final paving or final road compaction for aggregate base roads.

- B. At the completion of final road compaction for aggregate base roads, final lift in paving, overlay or slurry seal projects, the manholes and valves shall be raised within three days of completion to the satisfaction of the District.

END OF SECTION

SEWER SYSTEM TESTING

1.0 GENERAL

- 1.1 Scope - This section governs the testing requirements and procedures for acceptance of all completed gravity sewer lines, manholes, and sewer force mains.

It is the intent of the plans and specifications that the completed sewer pipes along with manholes and other appurtenances shall be watertight.

All gravity sewer pipes and services shall be air tested for leakage. Gravity sewer mains, including services, shall also be visually inspected by video camera and tested for deflection by a mandrel. Manholes shall be hydrostatically tested for infiltration.

Leakage test for sewer force mains shall follow the procedures set forth in Technical Specification 33 13 10 "Water Piping System Testing" Subsection 3.2. See Section 3.5 of this specification.

All tests shall be made in the presence of the District.

Even though a section may have previously passed the leakage test, each section of sewer shall be tested subsequent to the last backfill compacting operation if, in the opinion of the District heavy compaction equipment or any of the operations of the contractor or others may have damaged or affected the structural integrity or water tightness of the pipe, structure, and appurtenances.

OFFICIAL DISTRICT TESTING WILL NOT BE PERMITTED UNTIL AFTER ALL OTHER UNDERGROUND FACILITIES HAVE BEEN INSTALLED AND THEIR TRENCH COMPACTION VERIFIED AND CERTIFICATION OF SUBGRADE PROVIDE BY THE COUNTY.

When lines to be tested are in areas that will be paved, testing shall be done after the sub grade is placed, compacted, and accepted by the County.

- 1.2 Acceptance - The gravity sewer will not be considered acceptable until the leakage or infiltration rate, as determined by test, is less than the maximum allowable.

If the leakage or infiltration rate is greater than the amount specified, the pipe joints shall be repaired or, if necessary, the pipe shall be removed and relayed by the contractors, and retested.

- 1.3 Submittals - The contractor shall notify the District a minimum of 3 business days in advance of its proposed testing schedule for review and concurrence.

2.0 MATERIALS

- 2.1 General - All test equipment, valves, plugs, or other control equipment and materials shall be determined and furnished by the contractor, subject to District review. No materials shall be used which would be injurious to the construction or its future function.

3.0 EXECUTION

- 3.1 Mandrel Test for Gravity Sewers - After completion of the sewer line, the line shall be ball flushed just prior to pulling the mandrel through.

A commercially manufactured, rigid, odd-numbered leg (9 legs minimum) mandrel, with a circular cross section having a diameter of at least 95% of the specified average inside diameter of the gravity sewer, shall be pulled through the pipe by hand. The minimum length of the mandrel shall be equal to the base inside diameter of the pipe. Obstructions encountered by the mandrel shall be corrected by the contractor.

- 3.2 Air Test for Gravity Sewers - After the mandrel test, each section of sewer between successive manholes shall be air tested as follows:

- A. With all outlets plugged, air shall be slowly added until the internal pressure is raised to 4.0 pounds per square inch gage (psig). The compressor used to add air to the pipe shall have a relief valve set at 5 psig to ensure that at no time the internal pressure in the pipe exceeds 5 psig.
- B. The internal pressure of 4 psig shall be maintained for at least two minutes to allow the air temperature to stabilize, after which the air supply shall be disconnected and the pressure allowed to decrease to 3.5 psig.
- C. The time in minutes that is required for the internal air pressure to drop from 3.5 psig to 3.0 psig shall be measured. The results shall not be less than the minimum permissible duration for the air test pressure drop shown in Table I. A pressure gauge with a scale no greater than 0 to 10 PSIG shall be used for the testing.

TABLE I
 MINIMUM TIME FOR
 AIR PRESSURE DROP OF 0.5 PSIG (3.5 to 3.0 PSIG)

Pipe Diameter (in.)	Time for Length Shown (in Minutes/Seconds)				
	0-200'	201-250'	251-300'	301-350'	351-400'
6	2:50	2:50	2:50	2:50	2:50
8	3:50	3:50	3:50	4:30	5:00
10	4:40	5:00	6:00	7:00	7:50
12	5:40	7:10	8:30	10:00	11:20

- D. Should groundwater be present above the flowline of the pipe, the air pressure added to the 3.5 psig criteria shall be calculated by dividing the vertical height, in feet of groundwater above the flowline, by 2.31. The starting test pressure shall not exceed 9.0 psig.
- E. If the time shown in Table I for the designated pipe size and length elapses before the air pressure drops 0.5 psig; the section being tested shall have passed and the test discontinued.

3.3 Manhole Test - Water tightness of manholes may be tested after all iron is raised and before the manhole is lined. The test shall be as follows:

- A. The contractor shall plug all inlets and outlets with approved stoppers or plugs.
- B. The manhole shall be filled with water to the top of the frame.
- C. The water shall stand in the manhole for a minimum of one hour to allow the manhole material to reach maximum absorption.
- D. The contractor shall refill the manhole to the original depth.
- E. The time of the test will be determined by the District to fit the various field conditions. The minimum test time shall be one hour.
- F. The manhole shall be refilled to the original depth and the amount of water required to fill the manhole shall be recorded.
- G. If the amount of water added does not exceed the limits shown in Table II, then the manhole has passed the test.

TABLE II

<u>Depth of Manhole (ft.)</u>	<u>Allowable Amount of water added (gal.)</u>
0-5	1
6-7	1-1/2
8-10	2
11-12	2-1/2
13-15	3
16-18	3-1/2
19-20	4

- H. Even if the leakage is less than the specified amount in Table II, the contractor shall stop any leaks that may be observed to the satisfaction of the District.
- I. For manholes that require lining, the manholes shall be tested prior to lining the manholes. The inlet(s) and outlet of the manhole shall be mandrel tested after the lining is applied to verify flowline has not been compromised.

3.4 Video Test- All sewer collectors and service laterals shall be T.V. inspected prior to pavement placement in accordance to the following:

- A. The complete job is ready for television inspection when the following work has been completed and approved by the District:
 1. All sewer pipelines are installed, backfilled, and compacted.
 2. All manholes are in place, all channeling is complete, and pipelines are accessible from manholes, and testing completed.
 3. All other underground facilities, utility piping and conduits are installed.
 4. Final sub grade is complete and accepted by the County.
 5. Pipelines to be inspected have been cleaned and flushed per Section 3.1.
 6. Final air test has been completed per Section 3.2.
 7. Mandrel testing has been successfully completed per Section 3.1.

- B. After the above work is complete, the contractor shall schedule the video inspection. The video test shall be done in the presence of the District's Inspector. Water shall be introduced into the new pipe prior to inspection. During the video for service, some water must be flowing for camera orientation. The camera shall have a device to measure water depths.
- C. The following observations from television inspections will be considered defects in the construction of sewer pipelines and will require correction prior to retesting:
1. Low spots, 1/2-inch and greater
 2. Joint separations
 3. Cocked joints present in straight runs or on the wrong side of pipe curves
 4. Cracked or damaged pipe
 5. Dropped joints
 6. Infiltration
 7. Debris or other foreign objects
 8. Other obvious deficiencies
 9. Irregular condition without logical explanation
 10. Standing water in service laterals

If no deficiencies are observed, the work will be considered satisfactory.

- D. The inspection shall be recorded and a Flash drive with the video given to the District. Any defects to require correction will be determined by the District.
- E. The District reserves the right to require another test of any repair after corrective work is complete.
- F. Those portions of the pipeline system that have been corrected will be re-inspected and retested per Sections 3.1 and 3.2.

- 3.5 Sewer Force Main Test - Leakage test for sewer force mains shall follow the procedures set forth in Technical Specification 33 13 10 "Water Piping System Testing" Subsection 3.2.

All defective elements shall be repaired, or removed and replaced, and then retested until all leakage has been stopped and the allowable leakage requirements have been met.

- 3.6 Final Video Inspection – After iron is raised, testing successfully complete, and any required interior lining has been applied, a final video inspection must be performed to confirm cleanliness of the system. The inspection is to be witnessed by EID personnel. Service laterals do not need to be re-inspected unless there is evidence of an issue.

END OF SECTION

ABANDONMENT OF FACILITIES

1.0 GENERAL

- 1.1 Scope - This section governs abandonment of pipelines, manholes, vaults, and other existing structures.
- 1.2 Submittals - Schedules and method of abandonment shall be submitted to the District for approval. Contractor shall submit for review and coordination their facilities abandonment and system shutdown plan a minimum of 3-weeks before performing any facility abandonments or needing a system shutdown.

2.0 MATERIALS

- 2.1 General - Concrete, fittings, backfill material and other material used for abandonment shall comply with District Technical Specifications.

3.0 EXECUTION

- 3.1 Pipelines - Pipelines to be abandoned in place by either plugging the ends or filling the entire pipeline with 1-sack light weight sand slurry. The abandonment shall be clearly indicated on the plan sheets for the project. No pipeline shall be abandoned until the new pipeline and all services are installed, tested, and in service. An abandonment plan must be prepared by the Contractor and approved by the District prior to abandonment of any facilities.

Pipelines to be abandoned, shall be securely closed at all pipe ends by an approved cap, blind flange, or, at manhole entries, by a watertight plug of concrete, or brick and cement mortar, not less than 2-feet thick. When laterals are abandoned, they shall be capped with an approved fitting at the property line. Thrust blocks shall be placed behind all mechanical caps and blind flanges in accordance with District Standards.

For pipelines to be completely filled the pumping pressure within the pipe shall not exceed 20 PSI. The Contractor's equipment shall be capable of pumping between 0-20 psi. In the event pump pressures are exceeded and the pipe fails, the Contractor shall be responsible for providing all labor, material, and equipment to clean up any slurry. Contractor is made aware that where necessary multiple slurry insertion and monitoring locations will be required to ensure adequate abandonment.

The Contractor shall be responsible for the cutting, removal, and the legal disposal of all materials including asbestos cement pipe, and for the dismantling of any fittings and valves necessary to perform the abandonment. The Contractor shall anticipate the need for removal of sections of the existing pipeline during tie-ins to the existing system and abandonment of the existing pipelines where indicated on the plans. All Asbestos Concrete Pipe shall be handled and disposed of according to California Code of Regulations (CCR) Title 8, Section 1529; or most current regulations. Contractor shall provide a plan for disposal of the Asbestos Cement pipe and provide evidence of proper disposal to the District Engineer.

- 3.2 Structures - Structures to be abandoned shall have all openings, inlets and outlets sealed off and the structure shall be removed to a point 3 feet below the proposed street grade or ground surface and filled with backfill (compacted as directed) or concrete.
- 3.3 Salvaged Materials - Salvaged castings such as fire hydrants, frames and covers and other appurtenances, unless otherwise specified, shall be delivered to a District facility prearranged with the Maintenance' Supervisor.

END OF SECTION

DUCTILE IRON PIPE AND FITTINGS
(PRESSURE FLOW) (UNDERGROUND)

1.0 GENERAL

- 1.1 Scope - This specification governs the furnishing and installation of ductile iron pipe material and main line fittings including laying, joining, bedding and approvals. All incidentals and appurtenant operations necessary for the construction of pipelines shall be accomplished in strict accordance with the drawings and other terms and conditions of the contract.

Fitting types covered under this section include bends, tees, crosses, reducers, couplings, caps, plugs, adapters and all other fittings necessary for a complete pipeline installation.

The contractor shall also furnish all equipment, tools, labor and materials required to relocate sewers, conduits, ducts, pipes, or other structures as may be necessary to complete the installation as shown and specified.

All standard specifications, i.e., AWWA, ASTM, etc., made a portion of these specifications by reference, shall be the latest edition and revision thereof.

The contractor shall be responsible for all material furnished by him, and shall replace, at his own expense, all material found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishings of all material and labor required to replace defective material discovered prior to final acceptance of the work.

The contractor shall be responsible for the safe storage of material until it has been incorporated into the completed project. The interior of all pipe and fittings shall be kept free from dirt and foreign matter at all times.

Pipe surfaces shall be free from nicks, scratches and other blemishes. The joining surfaces of pipe spigots and bell sockets shall be free from gouges or other imperfections that might cause leakage.

- 1.2 Submittals - Submittals shall be provided for the following items plus all additional items required in the specifications for the particular type of pipe:

- Pipe and joint material
- Fittings
- Specialties

2.0 MATERIALS

2.1 Ductile Iron Pipe (DI) - Ductile iron pipe shall conform to the quality and strength requirements of AWWA C-151.

A. Markings - Each standard or random length of pipe shall be clearly marked with the following:

- The letters "DI" or "Ductile"
- Nominal size and class
- Year produced
- Manufacturer's trade name and country where cast
- Seal (mark) of testing agency

B. Pressure Class - Where the class is not indicated on the plans, the pipe shall be Class 350.

C. Laying Length - Standard laying lengths of 18- or 20-foot is acceptable.

D. Joint Type - Unless otherwise shown or specified, pipe joints shall be rubber gasket push-on type joint conforming to AWWA C-111.

1. Flanged Joint - Where flanged joints are specified, pipe barrel shall be threaded and fitted with flanges in accordance to AWWA C-115 "Flanged Ductile Iron Pipe with Threaded Flanges."

E. Physical Test Requirements - Hydrostatic, tension test, and impact test shall be conducted at the factory in accordance with ASTM A746. All testing shall be performed by a recognized testing laboratory with such testing available for inspection by the District. If required, the manufacturer shall supply a letter of certification attesting to their pipe meeting these specifications.

F. Lining and Coating - The inside surfaces shall be cement mortar lined in accordance with ANSI/AWWA C-104/A21.4. The outside coating shall be an asphaltic coating per AWWA C-151.

G. Polyethylene Encasement - Pipe and fittings shall be wrapped in polyethylene. Polyethylene wrapping shall be in accordance to AWWA C-105, latest revision. Minimum thickness shall be 0.008 inch (8 mils).

H. Warning Tape - Two-inch-wide non-metallic tape marked "waterline."

2.2 Fittings - All cast and ductile iron fittings shall be manufactured in accordance with the following AWWA Standards: C-104, "Cement-Mortar Lining for Ductile-Iron Pipe and Gray-Iron and Fittings for Water", C-110, "Gray-Iron and Ductile-Iron Fittings, 3 inches through 48 inches for Water and Other Liquids", C-111, "Rubber Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings", with the following additional requirements or exceptions. All fittings shall be furnished with a cement-mortar lining of standard thickness as defined in referenced specifications.

All fittings shall be rated equally to the class of pipe. End connections may be push-on, mechanical, or flanged joints.

Ductile iron compact fittings, per AWWA C-153, are allowed.

A. Flanges. Bolts and Gaskets - Flanges shall be flat-faced and meet either the requirements of AWWA C-207 for steel hub flange fittings, or AWWA C-110 Section 10-18 for ductile iron fittings. The flanges shall be marked with the size, name or trademark of manufacturer and with the AWWA Class; i.e., "E", or pressure rating.

Bolts and nuts shall be cadmium plated, A307, Grade B of domestic origin. Cadmium plating shall conform to Federal Specification QQ-P-415-1956, Type 1, Class 1.

Gaskets shall be 1/8-inch thick and be of the full-face self-centered cloth impregnated type. The following table shows the bolt pattern for ASME/ANSI 16.1 Class 125 cast iron flange. This pattern is rated at 275 psi for Class E steel pipe flanges and 250 psi for ductile iron pipe fittings.

<u>Pipe Size</u>	<u>Bolt Hole Diameter (Inches)</u>	<u>Bolt Diameter & Length (Inches)</u>	<u>Number of Bolts</u>
6"	7/8	3/4 x 3 1/2	8
8"	7/8	3/4 x 3 1/2	8
10"	1	7/8 x 4	12
12"	1	7/8 x 4	12
14"	1 1/8	1 x 4 1/2	12
16"	1 1/8	1 x 4 1/2	16
18"	1 1/4	1 1/8 x 5	16

The contractor shall uniformly tighten the bolts and prevent bending or torsional strains. Proper anchorage shall be provided.

- B. Mechanical Joint Fittings - The mechanical joints shall meet AWWA C111. That standard covers the joint as well as gaskets and bolts. T-bolts and nuts shall be manufactured of corrosion-resistant high-strength low-alloy Cor-Ten steel or equal. Number and length of bolts shall be as follows:

<u>Pipe Size</u>	<u>Number of Bolts</u>	<u>Bolt Diameter & Length (Inches)</u>
6"	6	3/4 x 3 1/2
8"	6	3/4 x 4
10"	8	3/4 x 4
12"	8	3/4 x 4
14"	10	3/4 x 4
16"	12	3/4 x 4 1/2
18"	12	3/4 x 4 1/2

- C. Restrained Joints - Restrained joint pipe and fittings shall be U.S. Pipe TR FLEX or approved equal.

- D. Coatings and Linings - Cast iron fittings shall be cement mortar lined per AWWA C-104 and receive a bituminous coating per AWWA C110.

Threaded holes and mating surfaces shall not be coated. Flange faces shall be coated with asphaltic varnish only. There shall be no coating of materials, or mortar on gasket grooves.

- E. Mechanical Couplings - Couplings include transition couplings, flanged coupling adapters, flexible and insulated couplings.

1. Coupling Sleeves and Flanges - Coupling sleeves and flanges may be of gray iron or carbon steel.
2. Bolts and Nuts for Flanges - Bolts and nuts for buried and submerged flanges, flanges in underground vaults and structures, and flanges located outdoors above ground shall be cadmium plated, A307, Grade B. Provide one washer for each nut. Each washer shall be of the same material as the nut.

3.0 EXECUTION

- 3.1 Handling and Transportation - Handling and transportation of pipe shall be in accordance with the pipe manufacturer's published instructions.

Heavy canvas or nylon slings of suitable strength shall be used for lifting and supporting materials. Chains or cables shall not be used.

Pipe and fittings shall not be stored on rocks or gravel, or other hard material which might damage the pipe.

A. Rubber Gasket Storage - All rubber gaskets shall be stored in a cool, well ventilated place and not exposed to the direct rays of the sun. Gaskets shall not be allowed in contact with oils, fuels, petroleum, or solvents.

3.2 Pipe Laying - Pipe shall be laid in accordance with the pipe manufacturer's published instructions, as complimented and modified herein.

A. Cleanliness - The interior of pipes shall be clean of foreign materials before sections of pipe are installed and shall be protected to prevent entry of foreign materials after installation.

Open ends of installed pipe shall be sealed with watertight plugs or other approved means at times when pipe installation is not in progress.

Ground water shall not be allowed to enter the pipe.

B. Inspection Before Installation - All pipe and fittings shall be carefully examined for cracks and other defects while suspended and before installation. Spigot ends shall be examined with particular care as this area is the most vulnerable to damage from handling. Defective pipe or fittings shall be laid aside for inspection by the District, who will prescribe corrective repairs or rejection.

C. Lowering of Pipe Material into Trench - Proper implements, tools, and equipment, satisfactory to the District, shall be provided and used by the contractor for the safe and convenient performance of the work. All pipe, fittings, valves, and hydrants shall be carefully lowered into the trench piece by piece in such a manner as to prevent damage to the water main materials and protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench.

If damage occurs to any pipe, fittings, valves, hydrants or water main accessories in handling, the damage shall be immediately brought to the District's attention.

D. Laying of Pipe - Pipe shall be laid in trenches to the line and grade indicated on the plans and as specified.

Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the trench. If the pipe laying crew cannot install the pipe into the trench without getting earth into it, the District's Inspector may require a heavy tightly woven canvas bag of suitable size, or plastic caps, be placed over each end of the pipe prior to installation and left there until the connection is made to the adjacent pipe. During laying operations, no debris, tools, clothing or other material shall be placed in the pipe.

As each length of pipe is placed in the trench, the spigot end shall be centered in the bell or coupling, and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it, except at the bells or couplings. Precautions shall be taken to prevent dirt from entering the joint space.

Joints shall be assembled in accordance with the manufacturer's instructions. Each joint shall be checked with a feeler gauge to assure proper seating of the gasket.

- E. Cutting of Pipe - Field cuts and connections shall be in accordance with the pipe manufacturer's published instructions.

The cutting of pipe for inserting valves, fittings, or closure pieces, shall be done in a neat and workmanlike manner without damage to the pipe so as to leave a smooth end at right angles to the axis of the pipe.

- F. Allowable Deflection - The maximum allowable angular deflection at the joints shall be 80% of manufacturer's recommendation for push-on and mechanical joints.

3.3 Fittings - Fittings shall be installed in the manner specified herein.

- A. Anchorage for Fittings - All fittings shall be provided with a thrust block constructed against undisturbed soil as shown on the Standard Drawings.

- B. Thrust Blocks - Thrust blocks shall be constructed of Class B concrete. Care shall be taken not to obstruct the outlets of tees or crosses, which are intended for future connections. A waterproof paper or plastic bond-breaker shall be placed between plugs and caps and the concrete thrust block to facilitate their removal in the future. Thrust blocks shall be poured against undisturbed earth and

shall have at least the minimum dimensions shown in the details on the Standard Drawings.

- C. Mechanical Couplings - Oil, scale, rust, and dirt shall be cleaned from pipe ends. The contractor shall clean gaskets in couplings prior to installing the coupling in accordance with the manufacturer's recommendations.

Bolt threads shall be lubricated with graphite and oil prior to installation.

1. Painting and Coating

- a. The contractor shall coat buried flexible pipe couplings, transition couplings, and flanged coupling adapters per Section 09 90 00 and then wrap the couplings with polyethylene wrap per AWWA C-105.
- b. The contractor shall coat flexible pipe couplings (including joint harness assemblies), transition couplings, and flanged coupling adapters located indoors, in vaults and structures, and above-ground with the same coating system as specified for the adjacent pipe. A prime coat shall be applied at the factory.

- 3.4 Polyethylene Encasement - The polyethylene encasement shall prevent contact between the pipe and the surrounding backfill and bedding materials, but is not intended to be a completely airtight or watertight enclosure. All lumps of clay, mud, cinders, etc. on the pipe surface shall be removed prior to installation of the polyethylene encasement. During installation, care shall be exercised to prevent soil or embedment material from becoming trapped between the pipe and the polyethylene.

The polyethylene film shall be fitted to the contour of the pipe to effect a snug, but not tight, encasement with a minimum space between the polyethylene and the pipe. Sufficient slack shall be provided in contouring to prevent stretching the polyethylene where it bridges irregular surfaces, such as bell-spigot interfaces, bolted joints, or fittings, and to prevent damage to the polyethylene due to backfilling operations. Overlaps and ends shall be secured with adhesive tape.

For installations below the water table, both ends of the polyethylene tube shall be sealed as thoroughly as possible with adhesive tape at the joint overlap.

Installation of polyethylene encasement shall be in accordance with the Standard Drawings and AWWA C-105, Method A. The following summarizes this method.

- A. Installation of Polyethylene Encasement for Pipe - Cut polyethylene tube to a length approximately two feet longer than the pipe section. Slip the tube around the pipe, centering it to provide a one-foot overlap on each adjacent pipe section, and bunching it accordion fashion lengthwise until it clears the pipe ends.

Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at the joints to facilitate installation of the polyethylene tube.

After assembling the pipe joint, make the overlap of the polyethylene tube. Pull the bunched polyethylene from the preceding length of pipe, slip it over the end of the new length of pipe, and secure it in place. Then slip the end of the polyethylene from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Secure the overlap in place. Take up the slack width at the top of the pipe to make a snug, but not tight, fit along the barrel of the pipe, securing the fold at quarter points.

Any cuts, tears, punctures, or other damage to the polyethylene, shall be repaired as described below. Proceed with installation of the next section of pipe in the same manner.

- B. Installation of Polyethylene Encasement for Appurtenances - Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in the same manner as the pipe. When it is not practical to wrap tees, crosses, and other odd-shaped pieces in a tube, the items shall be wrapped with a flat sheet or split length of polyethylene tube by passing the sheet under the appurtenance and bringing it up around the body. Seams shall be made by bringing the edges together, folding over twice, and taping down. Polyethylene shall be taped securely in place.
- C. Repairs of Polyethylene Encasement - Repair any cuts, tears, punctures, or damage to polyethylene with adhesive tape, or with a short length of polyethylene sheet or a tube cut open, wrapped around the pipe to cover the damaged area, and secured in place.
- D. Openings in Polyethylene Encasement - Provide openings for branches, service taps, blowoffs, air valves, and similar appurtenances by making an X-shaped cut in the polyethylene and

temporarily folding back the fill. After the appurtenance is installed, tape the slack securely to the appurtenance and repair the cut, as well as, any other damaged areas in the polyethylene, with any resulting damaged areas being repaired, as described above.

- E. Junctions with Unwrapped Pipe - Where polyethylene-wrapped pipe joins an adjacent pipe that is not wrapped, extend the polyethylene wrap, to cover the adjacent pipe for a distance of at least three feet away from the ductile iron pipe. Service lines of dissimilar metals shall be wrapped with polyethylene or a suitable dielectric tape for a minimum clear distance of three feet away from the ductile iron pipe.

- 3.5 Testing and Disinfection - Testing and disinfection shall be performed on all pipelines, in accordance with Section 33 13 00.

END OF SECTION

POLYVINYL CHLORIDE PIPE AND FITTINGS (PVC)
(PRESSURE FLOW)

1.0 GENERAL

- 1.1 Scope - This specification governs the furnishing and installation of PVC pipe material and main line fittings including laying, jointing, bedding, and approvals. All incidentals and appurtenant operations necessary for the construction of water mains shall be done in strict accordance with the drawings and other terms and conditions of the contract. Fitting types covered under this section include bends, tees, crosses, reducers, couplings, caps, plugs, adapters and all other fittings necessary for a complete pipeline installation.

The contractor shall also furnish all equipment, tools, labor and materials required to relocate sewers, conduits, ducts, pipes, or other structures as may be necessary to complete the installation as shown and specified.

All standard specifications; i.e., AWWA, ASTM, etc., made a portion of these specifications by reference shall be the latest edition and revision thereof.

The contractor shall be responsible for all material furnished by him and shall replace at his own expense, all material found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishings of all material and labor required to replace defective material discovered prior to final acceptance of the work.

Pipe surfaces shall be free from nicks, scratches and other blemishes. The joining surfaces of pipe spigots and of integral bell and sleeve reinforced bell sockets shall be free from gouges or other imperfections that might cause leakage.

- 1.2 Storage and Care - The contractor shall be responsible for the safe storage of material until it has been incorporated into the completed project. The interior of all pipe and fittings shall be kept, free from dirt and foreign matter at all times.

Pipe shall be stored at the job site in unit packages provided by the manufacturer. Caution shall be exercised to avoid compression, damage or deformation to bell ends of the pipe. If pipe is to be exposed to direct sunlight for more than 14 days, pipe must be covered with an opaque material while permitting adequate air circulation above and around the pipe to prevent excessive heat accumulation. Gaskets shall be protected

from excessive exposure to heat, direct sunlight, ozone, oil and grease. Solvent cement when used shall be stored in tightly sealed containers from excessive heat.

1.3 Submittals - Submittals shall be provided for the following items plus all additional items required in the specifications for the particular type of pipe:

1. Pipe and jointing material
2. Fittings
3. Specialties

2.0 MATERIALS

2.1 Polyvinyl Chloride Pipe (PVC) - PVC pipe shall conform to AWWA C-900, titled "Polyvinyl Chloride Pipe (PVC) Pressure Pipe 4 Inches through 12 Inches for Water" and shall have the same outside diameter (O.D.) as that of cast iron pipe (C.I.P.O.D.) in the sizes furnished.

A. Markings - Each standard or random length of pipe shall be clearly marked with the following:

- Nominal size and O.D. base; i.e., six-inch cast iron pipe size
- Material code "PVC 1120"
- Dimensional ratio; i.e., DR 18 where DR is equal to thickness "divided by" diameter
- AWWA pressure class; i.e., PC 150
- AWWA designation "AWWA C-900"
- Manufacturer's trade name and production record code
- Seal (mark) of testing agency

B. Pressure Class - Where the class is not indicated on the plans, the pipe shall be Class 150.

C. Laying Length - The standard laying length shall be 20 feet (plus or minus 1 inch) in all classes. A maximum of 15% may be furnished in random lengths of not less than 10 feet each.

D. Joint Type - Pipe joints shall be made using an integral bell with an elastomeric gasket push-on type joint or using machined couplings of a sleeve type with rubber ring gaskets and machined pipe ends to form a push-on type joint.

Solvent cement joints are strictly prohibited.

One coupling complete with one gasket each shall be factory assembled to each length of standard length pipe furnished. The companion gasket for each coupling will be packaged separately for shipment. Couplings shall be the same class as the pipe. Manufacturer shall furnish gasket lubricant for each quantity of pipe furnished. When additional couplings are furnished as separate items, two gaskets shall be furnished and installed in the gasket recess of each coupling.

1. Couplings - Where couplings are used, they shall meet the requirements of AWWA C-900. Couplings shall be as furnished by the manufacturer. Couplings shall be marked with same information as the pipe.

E. Physical Test Requirements - Hydrostatic burst and sustained pressure and crushing tests shall be conducted at the factory in accordance with AWWA C-900. All testing shall be subject to inspection by the District. If required, the manufacturer shall supply a letter of certification attesting to their pipe meeting these specifications.

F. Locating Wire - Locating wire shall be single strand, 10-gauge copper wire, with solid thermoplastic insulation.

G. Warning Tape - Warning tape shall be two-inch-wide non-metallic tape marked "waterline."

2.2 Fittings - All cast and ductile iron fittings shall be manufactured in accordance with the following AWWA Standards: C104, "Cement-Mortar Lining for Ductile-Iron Pipe and Gray-Iron and Fittings for Water," C110, "Gray-Iron and Ductile-Iron Fittings, 3 Inches through 48 Inches for Water and Other Liquids". C111, "Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings," with the following additional requirements or exceptions. All fittings shall be furnished with a cement-mortar lining of standard thickness as defined in referenced specifications.

All fittings shall be rated equally to the class of pipe. End connections may be push-on, mechanical, or flanged joints except where specifically shown otherwise on the plans or Standard Drawings.

Ductile iron compact fittings, per AWWA C153, are allowed.

A. Flanges, Bolts and Gaskets - Flanges shall be flat-faced and meet either the requirements of AWWA C-207 for steel hub type flange fittings, or AWWA C-110 Section 10-18 for ductile iron fittings. The flanges shall be marked with the size, name or trademark of the

manufacturer and with the AWWA Class; i.e., "E", or pressure rating.

Bolts and nuts shall be cadmium plated, A307, Grade B of domestic origin.

Cadmium plating shall conform to Federal Specification QQ-P-415-1956, Type 1, Class 1.

Gaskets shall be 1/8-inch thick and be of the full face self centered cloth impregnated type. The following table shows the bolt pattern for ASME/ANSI 16.1 Class 125 cast iron flange. This pattern is rated at 275 psi for Class E steel pipe flanges and 250 psi for ductile iron pipe fittings.

<u>Bolt Hole Pipe Size</u>	<u>Diameter (Inches)</u>	<u>Bolt Diameter & Length (Inches)</u>	<u>Number of Bolts</u>
6"	7/8	3/4 x 3 1/2	8
8"	7/8	3/4 x 3 1/2	8
10"	1	7/8 x 4	12
12"	1	7/8 x 4	12
14"	1 1/8	1 x 4 1/2	12
16"	1 1/8	1 x 4 1/2	16
18"	1 1/4	1 1/8 x 5	16

The contractor shall uniformly tighten the bolts and prevent bending or torsional strains. Proper anchorage shall be provided.

- B. Mechanical Joint Fittings - The mechanical joints shall meet AWWA C111. That standard covers the joint as well as gaskets and bolts.

T-bolts and nuts shall be manufactured of corrosion-resistant high-strength low-alloy Cor-Ten steel or equal. Number and length of bolts shall be as follows:

<u>Pipe Size</u>	<u>Number of Bolts</u>	<u>Bolt Diameter & Length (Inches)</u>
6"	6	3/4 x 3 1/2
8"	6	3/4 x 4
10"	8	3/4 x 4
12"	8	3/4 x 4
14"	10	3/4 x 4
16"	12	3/4 x 4 1/2
18"	12	3/4 x 4 1/2

- C. Coatings and Linings - Cast iron fittings shall be cement mortar lined per AWWA C-104 and receive a bituminous coating per AWWA C110.

Threaded holes and mating surfaces shall not be coated. Flange faces shall be coated with asphaltic varnish only. There shall be no coating materials or mortar in gasket grooves.

- D. Mechanical Couplings - Couplings include transition couplings, flanged coupling adapters, flexible and insulated couplings.
1. Coupling Sleeves and Flanges - Coupling sleeves and flanges may be of gray iron or carbon steel.
 2. Bolts and Nuts for Flanges - Bolts and nuts for buried and submerged flanges, flanges in underground vaults and structures, and flanges located outdoors above ground shall be cadmium plated, A307, Grade B. Provide one washer for each nut. Each washer shall be of the same material as the nut.

3.0 EXECUTION

- 3.1 Handling and Transportation - Handling and transportation of pipe shall be in accordance with the pipe manufacturer's published instructions.

Heavy canvas, or nylon slings of suitable strength shall be used for lifting and supporting materials. Chains or cables shall not be used.

Pipe and fittings shall not be stored on rocks or gravel, or other hard material which might damage the pipe.

- A. Rubber Gasket Storage - All rubber gaskets shall be stored in a cool, well ventilated place and should not be exposed to the direct rays of the sun. Gaskets shall not be allowed in contact with oils, fuels, petroleum, or solvents.
- 3.2 Pipe Laying - Pipe shall be laid in accordance with the pipe manufacturer's published instructions, as complimented and modified herein and in the plans.
- A. Cleanliness - The interior of pipes shall be clean of foreign materials before sections of pipe are installed and shall be protected to prevent entry of foreign materials after installation.

Open ends of installed pipe shall be sealed with watertight plugs or other approved means at times when pipe installation is not in progress.

Ground water shall not be allowed to enter the pipe.

- B. Inspection Before Installation - All pipe and fittings shall be carefully examined for cracks and other defects just prior to installation. Spigot ends shall be examined with particular care as this area is the most vulnerable to damage from handling. Defective pipe or fittings shall be laid aside for inspection by the District, who will prescribe corrective repairs or rejection.

- C. Lowering of Pipe Material into Trench - Proper implements, tools, and equipment, satisfactory to the District, shall be provided and used by the contractor, for the safe and convenient performance of the work. All pipe, fittings, valves, and hydrants shall be carefully lowered into the trench piece by piece in such a manner as to prevent damage to the water main materials and protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench.

If damage occurs to any pipe, fittings, valves, hydrants or water main accessories in handling, the damage shall be immediately brought to the District's attention.

- D. Laying of Pipe - Pipe shall be laid in trenches to the line and grade indicated on the plans and as specified.

Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the trench. If the pipe laying crew cannot install the pipe into the trench without getting earth into it, the District Inspector may require a heavy tightly woven canvas bag of suitable size, or plastic caps to be placed over each end of the pipe prior to installation and left there until the connection is made to the adjacent pipe. During laying operations, no debris, tools, clothing or other material shall be placed in the pipe.

As each length of pipe is placed in the trench, the spigot end shall be centered in the bell or coupling, and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it, except at the bells or couplings. Precautions shall be taken to prevent dirt from entering the joint space.

Joints shall be assembled in, accordance with the manufacturer's instructions. Rubber rings and ring grooves shall not be lubricated. Each joint shall be checked with a feeler gauge to assure proper seating of the gasket.

- E. Cutting of Pipe - Field cuts and connections shall be in accordance with the pipe manufacturer's published instructions.

The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe so as to leave a smooth end at right angles to the axis of the pipe. The pipe shall be marked around its entire circumference prior to cutting to assure a square cut. A factory-finished beveled end shall be used as a guide for proper bevel angle (15°) and depth of bevel plus the distance to the insertion reference mark. The end shall be beveled using a PVC pipe beveling tool. Round off any sharp edges on the leading edge of the bevel with a pocket knife or a file.

When installing 8-, 10- and 12-inch PVC pipe, mechanical joint or push-on type fittings designed for ductile iron pipe shall be used. When connecting PVC pipe into the bell end of cast iron pipe or into push-on type fittings, the end should be rebeveled, similar to the bevel on ductile iron pipe. When connecting to mechanical joint fittings, the end of the PVC pipe should not be beveled.

- F. Allowable Deflection - No deflection shall be allowed at the joints.

The maximum allowable angular deflection at twin-gasketed couplings shall be 5 degrees.

The pipe shall not be bent to a lesser radius than the minimum shown below:

<u>Size (Inches)</u>	<u>Minimum Radius of Curvature (Feet)</u>
4	190
6	200
8	250
10	Fittings Required
12	Fittings Required

- G. Locating Wire - Locating wire shall be installed with non-metallic water pipe as indicated on the Standard Drawings.

H. Warning Tape - Warning tape shall be placed on top of pipe zone backfill centered over pipe as shown on the Standard Drawings.

3.3 Fittings - Fittings shall be installed in the manner specified herein for cleaning, laying and joining pipe.

A. Anchorage for Fittings - All fittings, unless otherwise specified, shall be provided with a thrust block constructed against undisturbed soil as shown on the Standard Drawings.

B. Thrust Blocks - Thrust blocks shall be constructed of Class B Concrete. Care shall be taken not to obstruct the outlets of tees or crosses which are intended for future connections. A waterproof paper or plastic bond-breaker shall be placed between plugs and caps and the concrete thrust block to facilitate their removal of the concrete in the future. Thrust blocks shall be poured against undisturbed earth and shall have at least the minimum dimensions shown on the Standard Drawings.

C. Mechanical Couplings - Oil, scale, rust, and dirt shall be cleaned from pipe ends. The contractor shall clean gaskets in couplings prior to installing the coupling in accordance with the manufacturer's recommendations.

Bolt threads shall be lubricated with graphite and oil prior to installation.

1. Painting and Coating -

a. The contractor shall coat buried flexible pipe couplings, transition couplings, and flanged coupling adapters per Section 09 90 00 and then wrap the couplings with polyethylene wrap per AWWA C-105.

b. The contractor shall coat flexible pipe couplings (including joint harness assemblies), transition couplings, and flanged coupling adapters located indoors, in vaults and structures, and above ground with the same coating system as specified for the adjacent pipe. A prime coat shall be applied at the factory.

D. Polyethylene Wrap - All ferrous metal shall be protected with polyethylene wrap. When it is not practical to wrap tees, crosses, and other odd-shaped pieces in a tube the item shall be wrapped with a flat sheet or split length of polyethylene tube by passing the

sheet under the appurtenance and bringing it up around the body. Seams shall be made by bringing the edges together, folding over twice, and taping down. Polyethylene shall be taped securely in place.

Cuts, tears, punctures, or damage to polyethylene shall be repaired with adhesive tape, or with polyethylene sheet secured in place with adhesive tape.

- 3.4 Testing and Disinfection - Testing and disinfection shall be performed on all pipelines in accordance with Section 33 13 00.

END OF SECTION

DOMESTIC SERVICE LINES AND APPURTENANCES

1.0 GENERAL

1.1 Scope - This section governs materials and installation of the following:

- A. Service line materials and fittings
- B. Meter Boxes

1.2 Submittals - The following items shall be submitted for approval by the District.

- A. Manufacturer's catalog data showing model, part number, pressure ratings and materials of construction.

2.0 MATERIALS

2.1 Service Line Materials and Fittings - Service line materials and fittings include service line tubing, service saddles, service fittings, meter stops, corporation stops, curb stops, and ball valves. All service line materials and fittings shall be NSF 61 approved and documentation must be provided in all required submittals.

A. Service Line Tubing (2-inch In Diameter And Smaller):

All service tubing shall be color coded as follows:

<u>Service Type</u>	<u>Color Indicator</u>
Potable	Blue
Recycled	Purple
Sewer	Green

i. Copper Tubing (CT) – CT shall be in accordance with AWWA C800 and ASTM B88 Standard Specification for Seamless Copper Water Tube Type K. Additionally, two #4 copper service line anodes with insulated solid copper wire 10 feet long, and a brass cable to pipe clamp shall be installed in each meter box.

B. Service Saddles - Service saddles shall be constructed of bronze, have AWWA iron pipe thread outlet taps, comply with AWWA C-800 "Underground Service Line Valves and Fittings" and have suitable

means for attachment and sealing to a water main. The body shall be made to conform to outside configuration of the main. The service saddle shall be designed to provide a drip-tight connection when used as a service connection to the main. Saddles for ductile iron pipe shall be double strap. Straps for PVC pipe may also be stainless and shall provide full support around the circumference of the pipe and have a bearing area of sufficient width so that the pipe will not be distorted when the saddle is tightened.

- C. Corporation Stops - Corporation stops shall be constructed of bronze, have AWWA iron pipe inlet threads, and shall comply with the requirements of AWWA C800, "Underground Service Line Valves and Fittings." Outlets connecting to either CT or PE 1-inch and 2-inch corporation stops shall have compression connections.
- D. Fittings - Fittings including CT or PE couplings, bends, unions, and adapters shall be constructed of bronze and shall be designed to join via a compression connection for 1-inch and 2-inch sizes. Fittings shall also have male or female iron pipe-size-threaded ends and/or meter coupling nut or meter flange as required.
- E. Angle Meter Stops - Angle meter stops shall be constructed of bronze, have lock wings and be suitable for joining to either CT or PE via a compression connection for 1-inch and 2-inch angle meter stops. Outlets for 1-inch angle meter stops shall consist of a meter coupling nut. 2-inch angle meter stops shall have meter flange outlets.

2.2 Meter Boxes - The meter boxes for 1-inch and 2-inch meters shall be concrete with steel lids in traffic areas. Plastic boxes and lids may be used in non-traffic areas with prior approval, according to the following:

<u>Meter Size</u>	<u>Box Inside Dimensions (Min.)</u>
3/4 inch, 1 inch	10 x 17 inches
1½ inch, 2 inch	13 x 24 inches

3.0 EXECUTION

3.1 Service Tubing:

Tubing and fittings should be stored in a way that prevents damage due to crushing or piercing, excessive heat, harmful chemicals, or exposure to sunlight for prolonged periods. The manufacturer's recommendations regarding storage should be followed.

Handling operations and trench installation and backfill shall be performed with reasonable care to prevent scratches, nicks, and gouges in the conduit.

Pipe excessively cut or kinked shall not be used.

Tubing shall be installed in trench bottoms with six-inches of bedding material to provide continuous and uniform support. The initial backfill shall be six inches above the tubing and material shall be free from rock, stones, and debris. Material above the tubing needs to be the same approved import as the bedding.

Bends in service tubing shall not occur closer than 10 diameters from any fitting or valve. The minimum radius of curvature is 30 diameters or the coil radius when bending with the coil. Bending of coiled tubing against the coil shall not go beyond straight. Service tubing that becomes kinked during handling or installation shall not be used, and care should be taken to ensure that kinking does not develop after installation. Service line from the main line tap to the angle meter stop shall be one continuous length of tubing.

- 3.2 Service Saddles - The service saddle shall be no closer than 36 inches to a valve, other saddle, coupling, joint, or fitting.

The surface of the pipe shall be free of all loose material and have a hard, clean surface before placing the service saddle.

The service saddle shall be tightened firmly and uniformly to ensure a tight seal, however, care shall be used to prevent damage or distortion of either the pipe, corporation stop or service saddle by overtightening.

The drilling of the pipe shall be performed in accordance with the pipe manufacturer's recommendation.

- 3.3 Fittings, Angle Meter Stops, and Boxes - Installation of fittings, meter stops, and boxes shall be as per the requirements of the manufacturer. Pipe or fittings made of nonferrous metals (bronze) shall be isolated from ferrous metals with insulating unions or couplings.

- 3.4 Hydrostatic Testing - The contractor shall hydrostatic test all appurtenances in place with the pipe being tested.

END OF SECTION

DOMESTIC IN-TRACT SERVICE LINES

1.0 GENERAL

1.1 Scope - This section governs materials and installation of the following:

A. In-tract service line materials and fittings from the meter box to the house connection

1.2 Submittals - The following items shall be submitted for approval by the District.

A. Manufacturer's catalog data showing model, part number, pressure ratings and materials of construction.

B. National Sanitation Foundation (NSF) 61 for all fittings, tubing, glue, and other material that have direct contact with water.

2.0 MATERIALS

2.1 In-Tract Service Line Materials and Fittings - Service line materials and fittings shall be new including all service tubing and service fittings. All service line materials and fittings shall be NSF 61 approved and documentation must be provided in all required submittals.

A. Polyvinyl Chloride (PVC) Schedule 80 – Pipe shall be furnished in minimum standard lengths of twenty feet. All in-tract lines shall be buried a minimum of 24” below finish grade. The piping shall be marked with the following:

- Nominal size
- Material code
- NSF 61
- Manufacturer's name or trademark
- Seal of testing agency

B. Polyethylene Tubing (PE) - PE tubing shall be in accordance with AWWA C901 and correspond to copper tubing size (CTS). Pipe shall be furnished in continuous lengths as to avoid unnecessary fittings and multiple pieces. PE tubing can only be used with approval from the Engineer only. The use of PE will be determined on a case by case basis only. The tubing shall be marked with the following:

- Nominal size
- Material code; i.e., PE 4710
- The word "Tubing" and dimension ratio (DR-9) minimum
- AWWA pressure class; i.e., PC 200
- AWWA designation AWWA C901
- Manufacturer's name or trademark
- Seal of testing agency

The polyethylene material shall be type "4710" conforming to ASTM D3350 and ASTM D2737. The pressure class shall be a minimum of 200 psi. Stainless steel liners or inserts shall be used with PE tubing when compression type connections are specified or shown.

- C. Fittings - Fittings including PE couplings, bends, unions, nipples, and adapters shall be constructed of brass or bronze. PVC fittings include adapters, couplings, and bends shall be schedule 80 PVC.

3.0 EXECUTION

3.1 General:

- A. Installation of all in-tract pipelines shall conform to the latest UPC and county plumbing code requirements. Contractor shall notify property owner a minimum of 48 hours prior to entering private property.
- B. The Contractor shall provide a qualified representative to approach landowners with District personnel to discuss meter location. Meeting shall take place a minimum of 48 hours prior to commencing work.
- C. Water meter location shall be selected based on the following:
- Option 1 Reconnect from the new meter location to a hose bib on the front or side of the house facing the nearest new water main. Option 1 cannot be used if any of the following apply: the house is plumbed with a water softener or instant hot water heater, or field conditions are not practical.
- Option 2 Reconnect to the existing service location in the back yard or side yard.

3.2 Locating Existing Services:

The Contractor shall be responsible for excavating to expose the existing service line to make the tie-in and abandonment. The Contractor shall locate the service lines at their cost.

3.2 Service Connections:

- A. Pipe and fittings should be stored in a way that prevents damage due to crushing or piercing, excessive heat, harmful chemicals, or exposure to sunlight for prolonged periods. Pipe and fittings shall be kept clean and free from dirt, dust, debris, and deleterious material. The manufacturer's recommendations regarding storage should be followed. Handling operations and trench installation and backfill shall be performed with reasonable care to prevent scratches, nicks, and gouges in the pipe.

- B. Diameters of new in-tract service lines shall be determined according to the size of the service and the length of the new line to be installed. Length shall be measured from the water meter box to the point of connection at the existing water service line or hose bib. Water service lines are to be sized as follows:

Length Of In-Tract Service Line (FT)	Diameter Of In-Tract Service Line		
	1" Service (IN)	1.5" Service (IN)	2" Service (IN)
<100	2	2.5	2.5
100-150	2	2.5	3
151-200	2	2.5	3
201-300	2.5	3	3
301-400	2.5	3	4

END OF SECTION

DISINFECTING WATER MAINS

1.0 GENERAL

- 1.1 Scope - The interior of all water mains and appurtenances shall be disinfected in accordance with the most current AWWA C651 specifications and these specifications. Disinfections requirements shall include preventive and corrective measures during construction, forms of chlorine and methods of application, final flushing, and bacteriological tests. This specification describes the requirements for disinfecting of water mains and appurtenances, including but not limited to, air release valve assemblies, blow off valve assemblies, fire hydrant assemblies, service assemblies, pressure reducing and pump stations, altitude valve stations, and all other appurtenances.

The methods and techniques described in these specifications are minimum requirements only. The Contractor shall be solely responsible for adherence to these requirements and the methods and techniques used to successfully disinfect the water mains and appurtenances and for dechlorinating/disposing of the highly chlorinated water during flushing operations.

All completed waterlines, as well as the service assemblies and appurtenant structures, shall be tested by the Contractor in the inspector's presence prior to field acceptance of the work. In compliance with the California Code of Regulations, Title 22, only certified Distribution Operators are allowed to make decisions addressing the following:

1. Install, tap, re-line, disinfect, test and connect water mains and appurtenances.
2. Shutdown, repair, disinfect and test broken water mains.
3. Oversee the flushing, cleaning, and pigging of existing water mains.
4. Pull, reset, rehabilitate, disinfect, and test domestic water wells.
5. Drain, clean, disinfect, and maintain distribution reservoirs.

The Contractor shall correct all defects in workmanship or materials which become evident by inspection or testing at any time during the work. Unless otherwise stated in this standard, all material utilized in the installation of new water mains shall comply with the California Waterworks Standard as

currently amended and meet all AWWA standards that are hereby incorporated by reference.

Testing shall be done after the complete installation and compaction of all underground utilities. The pipeline must be hydrostatically tested, per the District's Standard Specification 33 13 10 prior to disinfection except as modified below:

The Contractor shall furnish all pipe and fittings for connection to the main, pumps, pressure regulator, a calibrated water storage tank, disinfectant, and all other materials, fittings and pipelines required to perform the tests and make the necessary repairs. All equipment required for testing purposes that comes into contact with drinking water must be NSF 61 approved. All chemicals used for the construction, testing and disinfection of water mains shall be NSF/ANSI 60 approved.

When lines to be tested are in areas that will be paved, testing shall be done after subgrade is placed and compacted. At the District project engineer's discretion, testing may be performed after subgrade has been accepted. No lines (eligible for final testing) shall be accepted as passing until all underground construction that may disturb the waterline is completed.

1.2 Procedure - All waterlines shall follow the procedure outlined below:

- A. Prevent contaminating materials from entering the water main during storage, construction, or repair. All materials that are stored shall have covered ends prior to being installed. All pipelines shall be swabbed to remove any debris that may have come into contact with the pipe during transportation. The swab shall be a dry or damp cloth, and shall not under any circumstances be saturated with a chlorine mix. The purpose for the swab is solely to remove debris and is in no way a form of disinfection.
- B. Fill the new waterline slowly to remove all air pockets followed by flushing at a minimum of 3 feet per second, or an approved velocity or volume, to remove any material that may have entered the water main during construction.
- C. Pressure test the new waterline to the District's Standard Specification 33 13 10 and conforming (at a minimum) to the applicable AWWA standard for the pipe material being installed as required by the California Code of Regulations, Title 22. Testing shall not commence until the water main and all appurtenances have been completely installed and are set to final grade. The Contractor may, at any time and at his expense, perform his own pressure and leak

test; however these tests will in no way offset the requirement for a final pressure and leak test.

- D. Prior to disinfection, a sampling plan for the bacteria and standard heterotrophic plate count (HPC) must be created by a licensed Distribution Operator and submitted to District staff for review. The samples can be collected at the approved representative locations.
- E. The new pipeline shall be chlorinated utilizing a District approved method only. After chlorination residuals have been verified the super-chlorinated water shall be flushed from the main following all District procedures.
- F. After the new pipeline has been qualified by District staff, the Contractor can schedule a tie-in to the District's system. The Contractor shall provide a written or e-mail notice to the District project engineer a minimum of 5 working days before the proposed scheduled tie-in. District approved tie-in days are Tuesday-Thursday. Requests for exceptions shall be provided to the District for review. The District reserves the right to adjust tie-in days based on system operation.

- 1.3 Submittals - The Contractor shall notify the District a minimum of three business days in advance of its proposed testing schedule for review and concurrence. The Contractor's proposed plans for water conveyance, disinfection, control, and disposal, shall also be submitted in writing.

2.0 MATERIALS

2.1 Equipment - All test equipment, chemicals for chlorination, temporary valves, bulkheads, or other water control equipment and materials shall be determined and furnished by the Contractor, subject to the District's review. Chemical pump for injection of chlorine shall be an NSF 61 approved diaphragm metering pump similar to the M series made by CHEM PRO or approved equal. Any alternative equipment proposed for disinfection must be submitted and approved by the District a minimum of 48 hours in advance of the proposed disinfection date. No materials shall be used which would be injurious to the construction or its future function. The Contractor shall install a 2" valve and applicable piping to hydrants to provide control for sampling and flushing operations.

- 2.2 Chlorine - Chlorine used for disinfection shall be liquid Chlorine (sodium hypochlorite 12.5%) in accordance with AWWA B300, AWWA B301 and NSF/ANSI 60 approved for the treatment of drinking water. The product shall also be a registered product with Cal-EPA for use in potable water lines in the state of California. Liquid chlorine shall be used only:

1. Under the direct supervision of a licensed Distribution Operator.
 2. When appropriate safety practices are observed.
- 2.3 Dechlorinating Agent - Chemical agents acceptable for use in dechlorinating super chlorinated disinfection waters are Calcium Thiosulfate, Sodium Thiosulfate or Ascorbic Acid. All Dechlorinating agents must be NSF/ANSI 60 approved and in accordance with AWWA C655 and AWWA C651. The contractor shall provide written procedures and methods for use of the dechlorinating chemical chosen along with manufacturers mix ratios for effective neutralization of the chlorine concentration in use.

3.0 EXECUTION

- 3.1 General - The Contractor shall make all necessary provisions for conveying the water from the District designated source to the points of use.

Only District personnel shall operate valves and appurtenances that are a part of the existing treated water system in active service.

After successful continuity testing of the tracer wire and hydrostatic testing of the water system, including all appurtenances, the entire water system shall be flushed and disinfected per the most current AWWA C651 standard. Disinfection shall be accomplished by chlorination and shall be completed by the Contractor. All chlorinating and testing operations shall be performed in the presence of the District. Per California Title 22, water systems shall utilize only certified Distribution Operators to make decisions addressing the disinfection, testing, and tie-in of new water mains and appurtenances to existing systems.

All materials, equipment and parts required to perform the disinfection of water systems shall be provided by the contractor. Testing equipment must have current calibration and test strips and chemicals must be within their current shelf life (not expired).

Disinfection operations shall be scheduled by the Contractor as late as possible during the contract time period so as to assure the maximum degree of sterility of the facilities before the work is accepted by the District. A bacteriological test and a standard heterotrophic plate count shall be performed by the District.

Release of water from pipelines, after testing and disinfecting have been completed, shall be in accordance with a written disposal plan reviewed by the District project engineer. All dechlorination equipment shall be capable of handling high flows with high levels of chlorine as required for adequate flushing of the new pipeline. The Contractor shall provide all documentation

for acceptable reagents that will be used during the dechlorination process for review a minimum of 4 days prior. Discharges of highly chlorinated water that can make it to waters of the state or waters of the US are not allowed. Chlorinated water may only be discharged from a sampling apparatus (service line sample point, blow off sample point, fire hydrant sample point, air release valve sample point, etc.) of less than five gallons during disinfection verification only as approved by the licensed Distribution Operator.

3.2 Disinfecting - After completion of pressure testing operations, the Contractor shall flush and then sterilize all water mains, services, and appurtenances. All sterilization shall follow the procedures as described in AWWA C651. The following exceptions shall be incorporated into the testing procedure as outlined below:

A. Preliminary Flushing – A preliminary flush of the entire system is performed to remove particulates using a 3.0 ft./sec velocity flush per AWWA C651. Where flow rates are not possible, flushing at the maximum expected flow rate for the pipeline for 4 volumes can be approved by the District project engineer.

B. Chlorination Methods - Two methods of chlorination are accepted: continuous feed (25ppm for 24 hours, 10ppm minimum residual) and modified continuous feed (100ppm for 3 hours, 50ppm minimum residual). The tablet or granule method described in AWWA C651 is not allowed by the District. The slug method as described in AWWA C651 may only be used with prior approval from the District project engineer.

1. Continuous feed 24 hour Chlorination Method: This method shall consist of filling the completed water main system, including appurtenances, to remove all air pockets, flushing to remove particulates, and refilling the entire system with potable water chlorinated to a minimum solution of 25ppm so that after a 24 hour holding period a minimum residual of 10ppm free chlorine is retained.

2. Modified Continuous Feed Method: This method shall consist of filling the completed water main system including appurtenances to remove all air pockets, flushing to remove particulates, and refilling the entire system with potable water chlorinated to a minimum solution of 100ppm so that after a 3 hour holding period a minimum residual of 50ppm free chlorine is retained.

- C. Filling and Contact - Potable water shall be supplied from a temporary backflow connection to the existing system. The Contractor has two options when connecting to fill the new pipeline. Option one the Contractor can check out a District owned temporary water use meter and backflow device that will be tested and placed into service by the District. Option two the Contractor can provide a backflow for the temporary connection to be tested by District staff before the device can be placed into service. The water main and all appurtenances are then filled with potable water to eliminate air pockets after making all connections to the water main for testing equipment; application of disinfectant, performing the test, visually inspecting all appurtenances for compliance and final flushing operations. Materials furnished for this work shall include, but not be limited to, pipe and fittings for connections to the main, diaphragm metering pump, pressure regulator, disinfectant, dechlorinating chemicals and all other materials, fittings and piping required to perform the tests.

Contractor shall locate an injection point within 10' of the treated source water downstream of an EID approved backflow device.

Following the preliminary flush the water system shall receive a dose of chlorine injected at a constant rate throughout the entire system. All appurtenances and taps left open and tested for the desired free chlorine concentration per Chlorination method chosen. The water shall be tested for the free chlorine using Hach high range/low range test strips, high range drops and Colorimeter.

Once the system has reached the target concentration all outlets valves and source water valve shall be closed. The pump shall be turned off and disconnected the system shall be locked down for the prescribed period of time corresponding to chlorination method chosen. Valves shall be exercised to allow full contact with the chlorine solution during the required holding period.

Contractor shall install sampling risers at all service connections and appurtenances to allow clean safe collection of samples for testing per EID Standard Drawings W34.

At the end of the required holding time the chlorine residual shall be measured at all taps and appurtenances and shall meet the minimum requirements for free chlorine residual per chlorination method chosen. These samples include but are not limited to all service lines, hydrants, blow offs, and air releases. Sampling small diameter lines including services and air releases shall be completed within 10-15 seconds under a pencil sized flow. The service shall not be flushed

as to take a sample from the main, but rather verify that the service line is completely disinfected. Fire hydrants and blow offs shall be sampled within 20 seconds of initializing a low flow. All water discharged shall be adequately de-chlorinated or control land applied as to not have any run off. Control land applies to less than five gallons at one location during testing verification only.

If all tests have met the minimum free chlorine residual standards the contractor may begin flushing the system with treated source water.

If any test in the system fails to meet the minimum required free chlorine residual, the system shall be flushed and rechlorinated per AWWA C651 and AWWA C655.

- D. Final Flushing - When the disinfection efforts are successful the contractor shall set up provisions to flush and dechlorinate the heavily chlorinated water from the main and all appurtenances. The main and appurtenances shall be flushed until the level of the original background system water is reached (not more than 1.0 mg/L).

The heavily chlorinated water shall be flushed from the mains and appurtenances and shall not remain in the mains more than 24 hours beyond the times required in this section.

Per the District's statewide National Pollutant Discharge Elimination System (NPDES) permit, no super-chlorinated water shall be discharged without proper notification and an appropriate neutralizing agent. The environment to which the chlorinated water is to be discharged shall be inspected then a reducing agent shall be applied to the water to be wasted to thoroughly neutralize the chlorine residual remaining in the water. The concentrations of chlorine in the water being discharged from the mains and appurtenances shall be neutralized to 0ppm but no higher than 0.01 mg/L chlorine. The NPDES permit requires that the District notification for planned large discharges be submitted a minimum of 72 hours prior. The Contractor is required to provide the District a minimum of 4 days notification for any planned large water discharges. For any development projects related to final flushing all work shall be completed under the project specific NPDES permit. The Contractor is made aware to refer to the project specific NPDES permit prior to commencing flushing activities.

Contractor shall be solely responsible for any damage caused by any discharge.

Contractor shall request EID to obtain a background sample of the treated system source water for reference during the final flush.

- E. Bacteriological Tests – Bacteriological testing shall consist of collecting two rounds of samples. The first round bacteriological samples including presence/absence for bacteria/coliforms and the Heterotrophic Plate Count (HPC), the second round samples shall be a presence/absence for bacteria/coliforms. All samples shall be tested for bacteriological quality in accordance with AWWA “Standard Methods for the Examination of Water and Wastewater”. Bacteriological and Heterotrophic Plate Count samples shall show the absence of bacteria/coliform organisms and have a total HPC equal to or less than system background. The number and location of samples shall be determined by the District. Should any of the samples prove positive, the Contractor shall repeat the disinfection process and the District shall collect another two rounds of samples for testing. These procedures shall continue until negative/passing samples are obtained and disinfection approved by the District. The Contractor is responsible for all costs associated with additional flushing and/or re-chlorination of the new pipeline. Upon completion of the disinfection process and system final flush to clear heavily chlorinated disinfection water, the system water shall be tested for free chlorine residual. The free chlorine residual shall be logged as a background for the system and the first round of bacteriological samples shall be taken.

When the first round sample tests absent of coliforms the next day a District water distribution operator will arrive and test the system for free chlorine residual at the same sample ports. If the free chlorine residual is 40% or less than measured during the first round of sampling then testing shall be terminated and the entire system shall be considered to have failed disinfection. The entire chlorination process shall start over.

If the free chlorine residual degradation between the first day and the second day is less than 40% the distribution operator shall take a second water sample for presence/absence of coliforms as a confirmation sample.

On the third day the final bacteriological testing will be considered as passing if the final results are:

1. First round samples P/A = Absent
2. Second round samples P/A = Absent
3. Heterotrophic plate count = <1

Successfully passing bacteriological testing shall qualify the contractor to submit a tie in request.

NOTE: High velocities in the existing system, resulting from flushing the new main, may disturb sediment that has accumulated in the existing mains. When check samples are taken, it is well advised to also sample water entering the new main.

END OF SECTION

WATER PIPING SYSTEM TESTING

1.0 GENERAL

- 1.1 Scope - All completed waterlines, as well as the service assemblies and appurtenant structures, shall be tested by the Contractor in the inspector's presence prior to field acceptance of the work. The Contractor shall correct all defects in workmanship or materials which become evident by inspection or testing at any time during the work. Unless otherwise stated in this standard, all material utilized in the installation of new water mains shall comply with the California Waterworks Standard as currently amended and meet all AWWA standards that are hereby incorporated by reference.

Testing shall be done after the complete installation and compaction of all underground utilities, except as modified below:

The Contractor shall furnish all pipe and fittings for connection to the main, pumps, pressure regulator, a calibrated water storage tank, disinfectant, and all other materials, fittings and pipelines required to perform the tests and make the necessary repairs. All equipment required for testing purposes that comes into contact with drinking water must be NSF 61 approved. All chemicals used for the construction, testing and disinfection of water mains shall be NSF/ANSI 60 approved.

When lines to be tested are in areas that will be paved, testing shall be done after subgrade is placed and compacted. At Engineer's discretion, testing may be performed after subgrade has been accepted. No lines eligible for final testing shall be accepted as passing until all underground construction that may disturb the waterline is compacted.

Pressure testing the new waterline shall conform (at a minimum) to the applicable AWWA standard for the pipe material being installed as required by the California Code of Regulations, Title 22. Testing shall not commence until the water main and all appurtenances have been completely installed. The Contractor may, at any time and at his expense, perform his own pressure and leak test; however these tests will in no way offset the requirement for a final pressure and leak test.

District Standard Specification 33 13 00, Disinfecting Water Mains, covers the disinfection process. All pressure pipelines shall be hydrostatically tested prior to introducing chlorine to the new pipeline.

2.0 MATERIALS

- 2.1 General - All test equipment, temporary valves, bulkheads, or other water control equipment and materials shall be determined and furnished by the Contractor, subject to the District's review. No materials shall be used which would be injurious to the construction or its future function.
- 2.2 Hydrostatic Testing Equipment - The Contractor shall be responsible for supplying and operating all testing equipment. In general, the testing equipment configuration shall consist of a pump receiving water from a calibrated storage tank. The pump discharge shall enter the water main through a tap or appurtenance. A pressure sustaining valve shall be placed on a tee located in the pump discharge line. Discharge from the pressure sustaining valve shall return to the calibrated storage tank. Other types or configurations of testing equipment shall be subject to District approval. The pressure pump shall operate continuous throughout the testing period. If the pump is stopped, the pressure shall not be allowed to drop more than two psi below test pressure before starting the pump.

3.0 EXECUTION

- 3.1 General - The Contractor shall make all necessary provisions for conveying the water from the District designated source to the points of use at the Contractor's own cost.

Release of water from pipelines, after testing and disinfecting have been completed, shall be in accordance with a written disposal plan reviewed by the Engineer.

- 3.2 Hydrostatic Testing - The purpose of the hydrostatic test is both to test the ability of the pipeline to withstand pressure and test for allowable leakage. All hydrostatic testing shall follow the test setup and pressurization procedures as described in AWWA C600, C604, and C605. The following exceptions shall be incorporated into the testing procedure as outlined below:

- A. Preparation - The line shall be filled with water at least 24 hours prior to testing when the pipeline has a mortar lining, thus allowing the lining material to become saturated. Water for testing shall be introduced at the low end of the section being tested to facilitate the elimination of air in the pipeline prior to testing. All pressure gauges used for determining hydrostatic testing shall be liquid filled and shall be capable of operating above the prescribed line test pressure. Gauges shall provide adequate visible ranges to allow accurate measurement for allowable leakage calculation. The

Engineer reserves the right to reject provided gauge that does not meet this specification.

- B. Test Section Length - The length of pipe being tested at any one time shall not exceed 2,000 linear feet unless otherwise approved by the District.
- C. Test Pressure – The test pressure shall be 200 PSI or as outlined in C600, C604, or C605, whichever is greater, measured at the lowest point of the section of the pressure zone being tested.
- D. Test Duration - Pressure in the water main shall be maintained within two psi of the calculated test pressure for a minimum of 2 hours.
- E. Allowable Leakage - The allowable leakage per test section shall be calculated from the formula contained in this subsection. Different sized water mains that might be contained within the same test section shall be calculated separately and then added together.

$$L = \left(SD \frac{\sqrt{P}}{148,000} \right) \times 2$$

WHERE:

L = Testing allowance in Gallons (For a 2 Hour Test).

S = Length of pipeline tested in Feet.

D = Nominal diameter in Inches.

P = Average test pressure during the hydrostatic test in PSI.

- F. Repairs - During the pressure and leakage test, all accessible appurtenances shall be inspected for visual signs of leakage. All visual leaks shall be corrected immediately, regardless of the amount of leakage, and the test shall be run again for its full duration. All leaks detected shall be repaired to a water tight condition. All repairs made shall be retested in accordance with the specifications. All repairs shall be made and a successful test accomplished prior to taking base bacteriological samples for the Disinfection Process.

END OF SECTION

DUCTILE IRON PIPE AND FITTINGS
(GRAVITY SEWER FLOW)

1.0 GENERAL

- 1.1 Scope - This specification governs the furnishing and installation of ductile iron pipe material, including laying, joining, bedding and approvals. All incidentals and appurtenant operations necessary for the construction of pipelines shall be accomplished in strict accordance with the drawings and other terms and conditions of the contract.

The contractor shall also furnish all equipment, tools, labor and materials required to relocate sewers, conduits, ducts, pipes, or other structures as may be necessary to complete the installation as shown and specified.

All standard specifications, i.e., AWWA, ASTM, etc., made a portion of these specifications by reference shall be the latest edition and revision thereof.

The contractor shall be responsible for all material furnished by him, and shall replace at his own expense, all material found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishings of all material and labor required to replace defective material discovered prior to final acceptance of the work.

The contractor shall be responsible for the safe storage of material until it has been incorporated into the completed project. The interior of all pipe shall be kept free from dirt and foreign matter at all times.

Pipe surfaces shall be free from nicks, scratches and other blemishes. The joining surfaces of pipe spigots and bell sockets shall be free from gouges or other imperfections that might cause leakage.

- 1.2 Submittals - Submittals shall be provided for the following items plus all additional items required in the specifications for the particular type of pipe:

- Pipe and joint material

2.0 MATERIALS

- 2.1 Ductile Iron Pipe (DI) - Ductile iron pipe shall conform to the quality and strength requirements of AWWA C-151.

- A. Markings - Each standard or random length of pipe shall be clearly marked with the following:
- The letters "DI" or "Ductile"
 - Nominal size and class
 - Year produced
 - Manufacturer's trade name and country where cast
 - Seal (mark) of testing agency
- B. Pressure Class - Where the class is not indicated on the plans, the pipe shall be Class 350.
- C. Laying Length - Standard laying lengths of 18 or 20 feet are acceptable.
- D. Joint Type - Unless otherwise shown or specified, pipe joints shall be rubber gasket push-on type joint conforming to AWWA C-111.
- E. Physical Test Requirements - Hydrostatic, tension test, and impact test shall be conducted at the factory in accordance with ASTM A746. All testing shall be performed by a recognized testing laboratory with such testing available for inspection by the District. If required, the manufacturer shall supply a letter of certification attesting to their pipe meeting these specifications.
- F. Lining and Coating - Lining and Coating shall be as specified on the plans or Special Conditions.
- G. Polyethylene Encasement - Pipe and fittings shall be wrapped in polyethylene. Polyethylene wrapping shall be in accordance to with AWWA C-105 latest revision. Minimum thickness shall be 0.008 inch (8 mils).
- H. Warning Tape - Two-inch-wide green non-metallic tape marked "sewerline" shall be used.

3.0 EXECUTION

- 3.1 Handling and Transportation - Handling and transportation of pipe shall be in accordance with the pipe manufacturer's published instructions.

Heavy canvas or nylon slings of suitable strength shall be used for lifting and supporting materials. Chains or cables shall not be used.

Pipe and fittings shall not be stored on rocks or gravel, or other hard material which might damage the pipe.

- A. Rubber Gasket Storage - All rubber gaskets shall be stored in a cool, well ventilated place and not exposed to the direct rays of the sun. Gaskets shall not be allowed in contact with oils, fuels, petroleum, or solvents.

3.2 Pipe Laying - Pipe shall be laid in accordance with the pipe manufacturer's published instructions, as complimented and modified herein.

- A. Cleanliness - The interior of pipes shall be clean of foreign materials before sections of pipe are installed and shall be protected to prevent entry of foreign materials after installation.

Open ends of installed pipe shall be sealed with watertight plugs or other approved means at times when pipe installation is not in progress.

Ground water shall not be allowed to enter the pipe.

- B. Inspection Before Installation - All pipe and fittings shall be carefully examined for cracks and other defects while suspended and before installation. Spigot ends shall be examined with particular care as this area is the most vulnerable to damage from handling. Defective pipe or fittings shall be laid aside for inspection by the District, who will prescribe corrective repairs or rejection.

- C. Lowering of Pipe Material into Trench - Proper implements, tools, and equipment, satisfactory to the District, shall be provided and used by the contractor for the safe and convenient performance of the work. Under no circumstances shall sewer main materials be dropped or dumped into the trench.

If damage occurs to any pipe or accessories in handling, the damage shall be immediately brought to the District's attention.

- D. Laying of Pipe - Pipe shall be laid in trenches to the line and grade indicated on the plans and as specified.

Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the trench. If the pipe laying crew cannot install the pipe into the trench without getting earth into it, the District's Inspector may require a heavy tightly woven canvas bag of suitable size, or plastic caps, be placed over each end of the pipe prior to installation and left there until the connection is made to the adjacent pipe. During laying operations, no debris, tools, clothing or other material shall be placed in the pipe.

As each length of pipe is placed in the trench, the spigot end shall be centered in the bell or coupling, and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it, except at the bells or couplings. Precautions shall be taken to prevent dirt from entering the joint space.

Joints shall be assembled in accordance with the manufacturer's instructions. Each joint shall be checked with a feeler gauge to assure proper seating of the gasket.

- E. Cutting of Pipe - Field cuts and connections shall be in accordance with the pipe manufacturer's published instructions.

The cutting of pipe for inserting valves, fittings, or closure pieces, shall be done in a neat and workmanlike manner without damage to the pipe so as to leave a smooth end at right angles to the axis of the pipe.

- F. Allowable Deflection - The maximum allowable angular deflection at the joints shall be 80% of manufacturer's recommendation for push-on and mechanical joints. Changes in direction greater than the allowable deflection shall be accomplished with manholes.

- 3.3 Polyethylene Encasement - The polyethylene encasement shall prevent contact between the pipe and the surrounding backfill and bedding materials, but is not intended to be a completely airtight or watertight enclosure. All lumps of clay, mud, cinders, etc., on the pipe surface shall be removed prior to installation of the polyethylene encasement. During installation, care shall be exercised to prevent soil or embedment material from becoming trapped between the pipe and the polyethylene.

The polyethylene film shall be fitted to the contour of the pipe to effect a snug, but not tight, encasement with a minimum space between the polyethylene and the pipe. Sufficient slack shall be provided in contouring to prevent stretching the polyethylene where it bridges irregular surfaces, such as bell-spigot interfaces, bolted joints, or fittings, and to prevent damage to the polyethylene due to backfilling operations. Overlaps and ends shall be secured with adhesive tape.

For installations below the water table, both ends of the polyethylene tube shall be sealed as thoroughly as possible with adhesive tape at the joint overlap.

Installation of polyethylene encasement shall be in accordance with the Standard Drawings and AWWA C-105, Method A. The following summarizes this method.

- A. Installation of Polyethylene Encasement for Pipe - Cut polyethylene tube to a length approximately two feet longer than the pipe section. Slip the tube around the pipe, centering it to provide a one-foot overlap on each adjacent pipe section, and bunching it accordion-fashion lengthwise until it clears the pipe ends.

Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at the joints to facilitate installation of the polyethylene tube.

After assembling the pipe joint, make the overlap of the polyethylene tube. Pull the bunched polyethylene from the preceding length of pipe, slip it over the end of the new length of pipe, and secure it in place. Then slip the end of the polyethylene from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Secure the overlap in place. Take up the slack width at the top of the pipe to make a snug, but not tight, fit along the barrel of the pipe, securing the fold at quarter points.

Any cuts, tears, punctures, or other damage to the polyethylene, shall be repaired as described below. Proceed with installation of the next section of pipe in the same manner.

- B. Installation of Polyethylene Encasement for Appurtenances - Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in the same manner as the pipe. When it is not practical to wrap tees, crosses, and other odd-shaped pieces in a tube, the items shall be wrapped with a flat sheet or split length of polyethylene tube by passing the sheet under the appurtenance and bringing it up around the body. Seams shall be made by bringing the edges together, folding over twice, and taping down. Polyethylene shall be taped securely in place.
- C. Repairs of Polyethylene Encasement - Repair any cuts, tears, punctures, or damage to polyethylene with adhesive tape, or with a short length of polyethylene sheet or a tube cut open, wrapped around the pipe to cover the damaged area, and secured in place.

- 3.4 Testing and Disinfection - Testing and disinfection shall be performed on all pipelines, in accordance with Section 33 01 30.13.

END OF SECTION

POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS
(GRAVITY SEWER FLOW)

1.0 GENERAL

- 1.1 Scope - This Section of the specifications will govern the furnishing and installation of PVC pipe material and fittings; including laying, jointing, bedding, testing and approvals. All incidentals and appurtenant operations necessary for the construction of pipelines shall be done in strict accordance with the drawings and other terms and conditions of the contract.

The contractor shall also furnish all equipment, tools, labor and materials required to rearrange sewers, conduits, ducts, pipes, or other structures as may be necessary to provide installation as shown and specified.

All standard specifications, i.e., ASTM, etc., made a portion of these specifications by reference shall be the latest edition and revision thereof.

The contractor shall be responsible for all material furnished by him and shall replace it at his own expense, should the material be defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all material and labor required to replace defective material discovered prior to final acceptance of the work.

Pipe surfaces shall be free from nicks, scratches and other blemishes. The joining surfaces of pipe spigots and of integral bell and sleeve reinforced bell sockets shall be free from gouges or other imperfections that might cause leakage.

- 1.2 Storage and Care - The contractor shall be responsible for the safe storage of material furnished by or to him and accepted by him, and intended for the work, until it has been incorporated in the completed project. The interior of all pipe and fittings shall be kept free from dirt and foreign matter at all times.

Pipe shall be stored at the job site in unit packages provided by the manufacturer. Caution shall be exercised to avoid compression, damage or deformation to bell ends of the pipe. If pipe is to be exposed to direct sunlight for more than 14 days, pipe must be covered with an opaque material while permitting adequate air circulation above and around the pipe to prevent excessive heat accumulation.

Gaskets shall be protected from excessive exposure to heat, direct sunlight, ozone, oil and grease. Solvent cement when used shall be stored in tightly sealed containers away from excessive heat.

1.3 Submittals - Submittals shall be provided for the following items plus all additional items required in the specifications for the particular type of pipe:

1. Pipe and jointing material
2. Fittings
3. Specialties

2.0 MATERIALS

2.1 Polyvinyl Chloride Pipe (PVC) and Fittings - PVC pipe and fittings shall be made in accordance to ASTM D-3034 or ASTM F679, and ASTM D1784 in both physical, dimensional and chemical requirements. Pipe shall be green unless otherwise approved.

A. Markings - Each standard or random length of pipe shall be clearly marked with the following:

- Manufacturer's name
- Nominal pipe size, i.e. six-inch
- Cell classification or material code; i.e. 12454-B
- Dimension ratio; i.e. SDR35
- Product type; i.e. Type PSM
- Standard specification designation; i.e. 03034
- Production code

B. Pipe Class - The SDR or wall thickness shall be as shown on the plans.

C. Laying Length - The standard laying length shall be 20 feet (plus/minus) 1 inch. A maximum of 15% may be furnished in random lengths of not less than 10 feet each.

D. Joint Type - Pipe joints shall be constructed with an integral bell and spigot with an elastomeric gasket push-on-type joint. Each spigot shall have a reference mark to facilitate pipe assembly. The gasket shall be contained in a machined groove on the pipe spigot such that when compressed the gasket will not displace and will form a positive seal. The gasket shall meet all requirements of ASTM F-477; pipe lubricant shall be listed with NSF (National Sanitation Foundation).

Solvent cement joints are strictly prohibited.

E. Physical Test Requirements -

1. Material - Material samples shall be taken at the beginning of production and tested for compliance to ASTM D-3034 or ASTM F794.
2. Product Quality - The following tests shall be performed on a sample of pipe.

Flattening - Three specimens of pipe per pipe size furnished, minimum of six inches long, shall be flattened between parallel plates in a suitable press until the distance between the plates is 40% of the outside diameter of the pipe. The rate of loading shall be uniform and such that the compression is completed within two to five minutes. Remove the load, and examine the specimens for splitting, cracking, or breaking.

Pipe Stiffness - The pipe stiffness shall be determined utilizing procedures similar to those outlined in ASTM D2412. The stiffness of pipe shall be determined at a 5% deflection datum. Test specimens shall be a minimum of two pipe diameters or four feet in length, whichever is less.

Joint Tightness - Joint tightness shall be tested in accordance with ASTM D3212.

The manufacturer shall provide a certificate of conformance for the above tests. Tests shall be performed on materials and products from the same lot of those furnished to the project.

Plant Inspection - The District may require inspection of production of the pipe. When requested, the manufacturer shall provide advance notice of when and where production of materials will begin.

- F. Struts - All pipe, 24 inches in diameter and greater, shall be strutted prior to placement in the trench. Each strut shall consist of two 2x4's placed in a perpendicular cross. A minimum of four struts equally spaced shall be placed per pipe length. Struts are to be removed prior to backfill above the pipe zone.

- 2.2 Warning Tape - Warning tape shall be two-inch wide green non-metallic tape marked "sewerline."
- 2.3 Fittings - All fittings shall be as manufactured and furnished by the pipe supplier or approved equal and have bell and/or spigot configurations compatible with the pipe.

3.0 EXECUTION

- 3.1 Handling and Transportation - Handling and transportation of pipe shall be in accordance with the pipe manufacturer's published instructions.

Heavy canvas or nylon slings of suitable strength shall be used for lifting and supporting materials. Chains or cables shall not be used.

Pipe and fittings shall not be stored on rocks or gravel, or other hard material which might damage the pipe.

- A. Rubber Gasket Storage - Store all rubber gaskets in a cool, well ventilated place and do not expose to the direct rays of the sun. Do not allow contact with oils, fuels, petroleum, or solvents.

3.2 Pipe Laying -

- A. General - Pipe shall be laid in accordance with the pipe manufacturer's published instructions, as complimented and modified herein.
- B. Cleanliness - The interior of pipes shall be clean of foreign materials before sections of pipe are installed and shall be protected to prevent entry of foreign materials after installation.

Open ends of installed pipe shall be sealed with watertight plugs or other approved means at times when pipe installation is not in progress.

Groundwater shall not be allowed to enter the pipe.

- C. Inspection Before Installation - All pipe and fittings shall be carefully examined for cracks and other defects while suspended and before installation. Spigot ends shall be examined with particular care as this area is the most vulnerable to damage from handling. Defective pipe or fittings shall be laid aside for inspection by the District, who will prescribe corrective repairs or rejection.

- D. Lowering of Pipe Material into Trench - Proper implements, tools, and equipment, satisfactory to the District, shall be provided and used by the contractor, for the safe and convenient performance of the work. All pipe shall be carefully lowered into the trench piece by piece in such a manner as to prevent damage to the materials. Under no circumstances shall the pipe be dropped or dumped into the trench.

If damage occurs to any pipe or accessories in handling, the damage shall be immediately brought to the District's attention.

- E. Laying of Pipe - Pipe laying shall proceed upgrade with spigot ends pointing in the direction of flow. After a section of pipe has been lowered into the prepared trench, the contractor shall clean the end of the pipe to be joined, the inside of the joint, and the rubber ring immediately before joining the pipe. The assembly of the joint shall be made in accordance with the recommendations of the manufacturer of the type of joint used. The bell and spigot joint shall be pushed "home" in line with the installation band. If a piece has been cut, the usable end shall be clearly marked to show the proper amount of installation distance. All special tools and appliances required for jointing assembly shall be provided by the contractor.

After the joint has been made, the contractor shall check pipe for alignment and grade. The trench bottom shall form a continuous and uniform bearing and support along the length of the pipe between joints. Sufficient pressure in making the joint shall be applied to assure proper pipe alignment and joint makeup. Sufficient pipe zone material shall be placed to secure the pipe and prevent movement before the next joint is installed.

When pipe is laid within a movable trench shield, all necessary precautions shall be taken to prevent pipe joints from pulling apart when moving the shield ahead.

Precautions shall be taken to prevent excavated or other foreign material from getting into the pipe during the laying operation. At all times, when laying operations are not in progress, or whenever the workers are absent from the job, the contractor shall close and block the open end of the last laid section of pipe to prevent entry of foreign material or creep of the gasketed joints.

Pipes which are stubbed off for manhole construction or for connection by others shall be plugged or closed off with temporary plugs as specified in the manhole specifications.

The contractor shall take all precautions necessary to prevent the "uplift" or floating of the line prior to the completion of the backfilling operation.

Where pipe is connected to manholes or concrete structures without using a flexible connector, connections shall be made so that the standard pipe joint is located not more than 2 feet from the outside edge of the structure unless otherwise shown.

- F. Cutting of Pipe - Field cuts and connections shall be in accordance with the pipe manufacturer's published instructions.

The cutting of pipe for fittings or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe so as to leave a smooth end at right angles to the axis of the pipe. The pipe shall be marked around its entire circumference prior to cutting to assure a square cut. A factory finished beveled end shall be used as a guide for proper bevel angle and depth of bevel plus the distance to the insertion reference mark. The end shall be beveled using manufacturer recommendations. Sharp edges on the leading edge of the bevel shall be rounded off with a pocket knife or a file.

END OF SECTION

MANHOLES

1.0 GENERAL

- 1.1 Scope - The work covered by this section shall consist of furnishing all materials, accessories, equipment, tools, transportation, service, labor and performing all operations to furnish and install concrete manholes in accordance with this section of the specifications and applicable drawings. Testing of manholes shall be done in accordance with Section 33 01 30.13.

Precast concrete bases, wall sections, and covers shall be manufactured in a facility especially designed for that purpose and shall conform to the shapes and dimensions indicated on the plans.

- 1.2 Submittals - Prior to installation, the following information is to be submitted:
- A. Manufacturer's catalog data on precast items. Show dimensions, reinforcing thickness of walls, and top slab shall be shown. Show materials of construction by ASTM reference and grade.
 - B. Concrete mix design and reinforcing for cast-in-place concrete item.
- 1.3 Design Loads - Design loads shall consist of dead load, live load, impact, and, in addition, loads due to water table and any other loads which may be imposed upon the manhole.

2.0 MATERIALS

- 2.1 Concrete - Portland cement concrete shall conform to Class A as specified in the Caltrans Standard Specifications Section 90, "Portland Cement Concrete."
- 2.2 Reinforcement - Reinforcement shall be deformed reinforcement in accordance with ASTM A615 or ASTM A497 for welded deformed wire fabric.
- 2.3 Base Rock - Base Rock shall be 3/4-inch aggregate base conforming to Caltrans Specifications for Class 2 aggregate base.
- 2.4 Precast Manhole Wall Sections - Precast manhole sections shall be of the size indicated on the Drawings. The contractor shall provide the District with a Certificate of Compliance from the manhole manufacturer that the

manholes and concrete mix conform in all respects to these specifications and requirements of ASTM C478. Minimum wall thickness shall be 4 inches. Cones shall have the same wall thickness and reinforcement as manhole section. The top and bottom of all sections shall be parallel.

Joints shall be tongue-and-groove type.

- 2.5 Precast Base Sections and Adaptor Ring - Unless otherwise approved, all concrete manhole bases shall be precast. Connections to the base shall be made with elastomeric boots or an approved cast-in adaptor.
- 2.6 Manhole Extensions - Concrete grade rings for extensions shall be a maximum of six-inches high and shall be approved by the District before installation.
- 2.7 Mortar - Standard premixed mortar conforming to ASTM C387 or proportion 1 part Portland cement with 2 parts clean, well graded sand which will pass a 1/8-inch screen. Admixtures may be used provided they do not exceed the following percentages by weight of cement: Hydrated lime, 10%; diatomaceous earth or other inert materials, 5%. Consistency of mortar shall be such that it will readily adhere to the applied surface. Mortar mixed for longer than 30 minutes shall not be used.
- 2.8 Preformed Plastic Gaskets - Preformed plastic gaskets shall be used for the manhole assembly and shall be Kent-Seal No. 2 manufactured by Hamilton Kent Manufacturing Company, Box 178, Kent, OH 44240; Ram-Nek, manufactured by K.T. Snyder Company, Inc., Central National Bank Bldg., Houston, TX 77002; or equal, meeting all requirements of Federal Specifications SS-S00210.
- 2.9 Manhole Frames and Covers - Covers shall have the word SEWER in raised two-inch letters. Castings shall be tough, close-grained gray iron, sound, smooth, clean, free from blisters, blowholes, shrinkage, cold shuts, and all defects, and shall conform to ASTM A48, Class 30B. All bearing surfaces shall be machined to ensure true flat surfaces. Covers shall be true and seat within the ring at all points. Frames shall be water tight and be of the grooved gasketed type. Manhole frames and covers shall be as shown on the approved Materials List.
- 2.10 Backfill Material - Backfill material shall conform to Section 31 23 16. When material from the excavation is unsuitable for use in backfill, it shall be disposed of and suitable material, which is capable of attaining the required relative compaction, shall be arranged for and furnished.

3.0 EXECUTION

- 3.1 Excavation - The contractor shall prepare an excavation large enough to accommodate the structure and permit grouting of openings and backfilling operations. Excavations shall be made in accordance to Section 31 23 16. No earth backfill will be permitted to correct overdepth excavation. Over excavation shall be corrected as described in Section 31 23 16-3.2.
- 3.2 Precast Bases - Precast bases shall be placed on six-inches of pipe bedding material compacted to 95% and graded level. The top of the base, when installed, shall be level in all directions.
- 3.3 Cast-in-Place Bases - Manhole base shall be poured in accordance to the standard drawing against undisturbed soil. All vertical surfaces shall be poured against approved forms. The base shall extend to the lines shown on the details.

The manhole stubs and sewer main shall be set before the concrete is placed and shall be rechecked for alignment and grade before the concrete has set. The various sized inlets and outlets to the manhole shall be located as indicated on the plans and as detailed in the detail drawings. Invert elevations of connecting sewers may vary.

The invert of the manhole base shall be hand worked so as to provide channels conforming in size and shape to the lower portions of the inlets and outlets. The manhole invert channels shall be smooth and accurately shaped. Channels may be formed directly in the concrete base.

All transitions shall be smooth and of the proper radius to give an uninterrupted transition of flow.

The concrete base shall be shaped with a wood float and shall receive a hard steel trowel finish before the concrete sets.

In the event additional mortar is required after initial set has taken place, the surface to receive the mortar shall be primed, and the mortar mixed with a concrete adhesive in the amounts and proportions recommended by the manufacturer and as directed by the District in order to secure as chip-proof a result as possible.

The bases shall set a minimum of 24 hours before manhole construction is continued. In certain critical situations, the time of setting may be reduced upon approval of the District.

- 3.4 Manhole Assembly - Manhole assembly shall be as shown on the standard drawings. Each precast concrete unit shall be set plumb using preformed plastic gaskets at all joints.

It is the intent of these specifications that manholes and appurtenances be watertight and free from infiltrations. Manholes shall be free of any seeping or surface moisture prior to the application of a protective lining or coating. Adequate watertightness of manholes and appurtenances shall be determined by the District upon completion of testing by the contractor. All stubs shall be plugged with stoppers or brick wall plugs as shown on the plans for various sizes of pipe.

In order to prevent accidental use of the new sewer before completion and acceptance, the inlet to existing tie-in manholes shall be sealed. Installation of these plugs shall be approved by the District. Plugs shall be removed at the time of final inspection or as directed by the District.

- 3.5 New Connections to Existing Manholes - New connections to existing manholes, where stubs have not been provided, shall be made by core drilling through the wall and rebuilding the manhole bench as shown on the standard drawings.

- 3.6 Backfill - Backfill around manholes shall be placed and compacted in accordance to Section 31 23 16.

END OF SECTION

RECYCLED WATER SYSTEMS

1.0 GENERAL

- 1.1 Scope - This section governs the materials and installation of pipelines and fittings for recycled water systems. All components of recycled water systems shall conform to the specifications of the potable water system except as specified in this section.

2.0 MATERIALS

- 2.1 PVC Pipe - PVC recycled water piping shall be purple-colored. The pipe shall be identified as recycled water pipe by continuous marking. The markings shall include the following: CAUTION RECYCLED WATER - DO NOT DRINK. Nominal pipe size. PVC-1120. Pressure rating in pounds per square inch at 73 degrees Fahrenheit. ASTM designations such as 1785, 2241, 2672, 3139. Printing shall be placed continuous on two sides of the pipe.
- 2.2 Ductile Iron Pipe - Ductile iron pipe shall conform to Section 33 11 13.13 and shall be encased with purple plastic sleeve.
- 2.3 Plastic Wrap or Sleeve - The plastic warning wrap or sleeve shall be prepared with black printing on a purple field having the words, "CAUTION: RECYCLED WATER DO NOT DRINK".
- 2.4 Quick-coupling Valves - Quick-coupling valves shall be constructed of brass with a purple rubber or vinyl cover, and shall have a $\frac{3}{4}$ - or 1-inch inlet.
- 2.5 Valve Boxes
1. All gate valves, manual control valves, electrical control valves, pressure reducing valves for on-site recycled water systems shall be installed below grade in a valve box.
 2. Valve boxes should be the standard round-type concrete box with a special triangular, heavy-duty cover. All valve covers on the off-site nonpotable waterlines should be of non-interchangeable shape with potable water covers and with the recognition inscribed "Recycled Water" cast on the top surface.

2.6 Tags

Tags shall be weatherproof plastic, 3" x 4", purple in color with the words "WARNING RECYCLED WATER DO NOT DRINK". Imprinting shall be permanent and black in color. Use tags as manufactured by T. Christy Enterprises or approved equal.

2.7 Service Pipe - Service pipe shall be PE tubing per Technical Specification 33 12 13 encased in purple plastic sleeve.

3.0 EXECUTION

3.1 General - All buried PVC pipe in the recycled water system shall be purple colored with stenciling identifying it as recycled water in accordance with the AWWA Guidelines for the Distribution of Non-potable Water. Ductile iron pipe shall be wrapped with purple plastic wrap.

Standard PVC pipe completely wrapped with purple plastic wrap, as specified below, may be accepted as an alternative to stenciled purple colored PVC pipe only on a project-by-project basis with prior written approval from the District Engineer. The color of the wrap must be in accordance with the AWWA Guidelines for the Distribution of Non-potable Water.

Plastic Wrap shall be installed completely around the pipe. Plastic wrap shall be installed continuous for the entire length of the pipe and shall be fastened to each pipe length by plastic banded around the pipe with fasteners no more than five feet apart. Taping attached to the sections of pipe before laying in the trench shall have flaps sufficient for continuous coverage.

The District may require tags, as approved by the District, to be installed on designated facilities such as on valves and blowoffs. The tags will notify that the system contains recycled water that is unsafe to drink.

All recycled water facilities are to be clearly identified differently from potable water by being tagged or painted purple.

END OF SECTION

GATE VALVES

1.0 GENERAL

- 1.1 Scope - This specification governs materials and installation of gate valves. Valves shall be furnished and installed by the contractor at the locations shown on the approved plans, or as required by the District.
- 1.2 Submittals - Prior to the purchase of gate valves to be used in the District's system, the following items shall be submitted and approved by the District:
- Manufacturer's catalog data and detail construction sheets showing the size to be used, valve dimensions, pressure rating, and materials of construction.
 - Manufacturer's catalog data and NSF certification seal on the lining to be used.

2.0 MATERIALS

- 2.1 Gate Valves three inches and Larger - Gate valves three inches and larger, shall be resilient-seated suitable for buried service and meet the requirements of AWWA C-509, manually operated. All such valves shall be of the non-rising stem type, with double o-ring seal and shall turn to the left in a counter-clockwise direction to open the valve.

All valves shall be suitable for frequent operation as well as service involving long periods of inactivity. Valves shall be capable of operating satisfactorily with flows in either direction and shall provide zero leakage past the seat.

- A. Valve Body - Body, bonnet, operating nut, and stuffing box shall be of iron with internal working parts of solid bronze. Exposed capscrews, bolts and nuts shall be stainless steel type 304.

The word "open" and an arrow indicating the direction to open shall be cast on each valve body or operator.

- B. Valve Operator - Valve operators shall be equipped with a two-inch AWWA square operating nut. They shall be sealed and gasketed and lubricated for underground service. The operator shall be capable of withstanding an input torque of 450 ft. lbs. at extreme operator position without damage.

- C. Coating and Lining - Interior surfaces, excluding seating areas, bronze, and stainless steel pieces, shall be epoxy lined to a dry film thickness of 12 mils.

Liquid epoxy linings shall be applied in two coats. Liquid epoxy coating materials shall be listed in the NSF Listing for Drinking Water Additives, Standard 61, as certified for use in contact with potable water. Powder epoxy coating materials shall contain 100% solids. Surface preparation shall include White Metal Blast Cleaning.

Exterior surfaces shall be shop coated with two coats of asphalt varnish conforming to AWWA C-509. Flange faces shall be coated with a rust preventive compound.

- D. Marking - The manufacturer shall show on the valve the size, manufacturer, class and year.
- E. Gate - Gate shall be cast or ductile iron encapsulated in Buna-N rubber or nitrile elastomer.
- F. Types of End Connection - End connections may be either flanged, push-on, or mechanical joint type per Section 33 11 13.13 or Section 33 11 13.23.

2.2 Gate Valves three Inches and Smaller -

- A. Aboveground Valves - Aboveground threaded end gate valves, 1/4-inch through 3 inches for water service, shall be nonrising stem, screwed bonnet, solid wedge disc type having a minimum working pressure of 220 psi. The body, bonnet, and stem shall be of bronze, ASTM B 62. Handwheels shall be of brass. Packing shall be Teflon asbestos.
- B. Buried Valves - Buried gate valves for water service shall be iron body, bronze mounted, nonrising stem type, double disc, parallel seat, and shall have a working pressure of at least 200 psi.

Valves shall have flanged or threaded ends to match the pipe ends. Valves supplied with threaded ends shall not be in direct contact with the soil.

Valves shall have a two-inch AWWA operating nut.

Bonnet and stuffing box bolts shall be cadmium plated steel. Discs, disc nut, disc ring, and seat ring shall be bronze.

3.0 EXECUTION

3.1 Storage - Valves shall be delivered and stored in the field with the port openings covered with plastic, cardboard or wood. These covers shall remain in place until the valve is ready to be installed. Valves shall not be stored in contact with bare ground. Valves shall not be stacked on top of one another.

3.2 Installation - The weight of the valve shall be supported by firm ground or concrete blocking and not by the pipe. Buried valves having the top of the operating nut greater than three feet below the finished surface shall be provided with shaft extensions.

A. Flanged Connection - Boltholes of flanged valves shall straddle the horizontal and vertical axis of the pipe to which the valves are attached. Flanges, bolts and nuts shall be cleaned by wire brushing before installing flanged valves. Threads on nuts and bolts shall be lubricated with oil and graphite. Nuts and bolts shall be tightened uniformly and progressively. If flanges leak under pressure testing, the contractor shall loosen or remove the nuts and bolts, reseal or replace the gasket, reinstall or retighten the bolts, and retest the joints. Joints shall be watertight.

Bolts shall be tightened in an even manner by a series of steps until the torque required by the manufacturer is reached.

B. Threaded Connection - Threaded joints shall be cleaned by wire brushing or swabbing. Teflon joint compound or Teflon tape shall be applied to pipe threads before installing threaded valves. Joints shall be watertight.

C. Push-on Connection - Rubber ring grooves of joints shall be inspected before installation by the contractor for ridges or holes that would interfere with the rubber ring. Interferences with the rubber rings shall be corrected to a satisfactory condition or the valve replaced, as required by the District.

The pipe to be stabbed into the valve shall be beveled. Pipe shall be stabbed into the valve to the "Insertion Depth" as specified by the manufacturer.

D. Mechanical Joint - Valve socket, gland, and pipe plain end shall be wiped clean of all sand, dirt and other foreign material prior to valve installation. Bolts shall be tightened in a manner by a series of steps until the torque required by the manufacturer is reached.

- E. Polyethylene Encasement - Valves and all bolted connections shall be encased with 10 mil polyethylene plastic film wrap installed as follows: The valves shall be wrapped by passing the flat sheet of film under the valve bottom and bringing the ends up around the body to the stem and securing it in place with two-inch strips of the plastic adhesive tape. The polyethylene shall be secured around the valve stem in such a manner as to leave the stem free to operate. The film shall be brought completely around the flanges and secured to the pipe with a plastic adhesive tape on either side of the valve, flange or fitting.

- F. Operation - Immediately before installation, each valve shall be operated through one complete open-close cycle and visually checked for proper operation. Boxing of valves shall begin immediately after pipe sections containing the valve have been installed. All valve boxes, paving rings, and lids shall be brought to grade after pavement has been constructed.

END OF SECTION

BUTTERFLY VALVES

1.0 GENERAL

- 1.1 Scope - This specification governs materials and installation of butterfly valves. Valves greater than 12 inches shall be butterfly valves; unless specifically called out on plan sheets for pressure reducing stations.

Valves shall be furnished and installed by the contractor at the locations shown on the approved plans, or as required by the District.

- 1.2 Submittals - Prior to the purchase of butterfly valves to be used in the District system, the following items shall be submitted and approved by the District.

- A. Manufacturer's catalog data and detail construction sheets showing the size to be used, valve dimensions, pressure rating and materials of construction.
- B. Actuator manufacturer's catalog data and detail construction sheets showing the dimensions, materials, number of turns, and required torque input of the actuator to be used.
- C. Manufacturer's catalog data and NSF certification seal on the lining to be used.

2.0 MATERIALS

- 2.1 General: Buried Butterfly Valves - Shall be tightly closing, rubber seated valves conforming to AWWA C-504 suitable for buried service. Valves shall be Class 250-B designed for tight shut-off up to 250 psi in both directions. Valve disc shall rotate 90 degrees from fully open to tightly closed position.

- A. Valve body - Valve bodies shall be cast iron with integrally cast mechanical joints or flanged ends. Exposed capscrews, bolts, and nuts shall be stainless steel type 304.
- B. Valve operators - Shall be of the manual traveling nut type. Operators shall be equipped with a two-inch AWWA square operating nut. They shall be sealed and gasketed and lubricated for underground service. The operator shall be capable of withstanding an input torque of 450 ft. lbs. at extreme operator position without damage.

- C. Coating and Lining - Interior surfaces, excluding seating areas, bronze, and stainless steel pieces, shall be epoxy lined to a dry film thickness of 12 mils. Liquid epoxy linings shall be applied in two coats. Lining of interior valve surfaces shall be performed in a facility with qualified personnel and where the environment can be controlled. Epoxy lining of valves shall not be permitted in the field. Liquid epoxy coating materials shall be listed in the NSF Listing for Drinking Water Additives, Standard 61, as certified for use in contact with potable water. Powder epoxy coating materials shall contain 100% solids. Surface preparation shall include White Metal Blast Cleaning.

Exterior surfaces shall be shop coated with two coats of asphalt varnish conforming to AWWA C-504. Flange faces shall be coated with a rust preventive compound.

- D. Marking - The manufacturer shall show on the valve the valve size, manufacturer, class and year of manufacture.
- E. Valve Disc and Shaft - Discs shall be cast iron with a stainless steel edge. Shafts shall be type 304 stainless steel.
- F. Types of End Connections - End connections may be either flanged or mechanical joint type per Section 33 11 13.13 or Section 33 11 13.23.

2.1 General: Above Ground or Vault Butterfly Valves - Shall be tightly closing, triple offset metal seated valves. Valves shall be Class 250-B designed for tight shut-off up to 250 psi in both directions. Valve disc shall rotate 90 degrees from fully open to tightly closed position.

- A. Valve body - Valve bodies shall be stainless steel with integrally cast flanged ends or lug ends. Exposed capscrews, bolts, and nuts shall be stainless steel type 304. Valves installed in vault applications shall be coated per Specification 09 91 13.13.
- B. Valve operators - Gear operators shall have handwheels. The handwheel shall have a minimum diameter of 12 inches. The actuator shall contain a dial indicator which shows the position of the valve disc.
- C. Coating and Lining - Interior surfaces shall be uncoated stainless steel.
- D. Marking - The manufacturer shall show on the valve the valve size, manufacturer, class and year of manufacture.

- E. Valve Disc and Shaft - Discs shall be 316 stainless steel body seat with a duplex stainless steel and graphite seal ring. Shaft shall be 17-4 PH stainless steel.
- F. Types of End Connections - End connections may be either flanged or lug type per Section 33 11 13.13 or Section 33 11 13.23.

3.0 EXECUTION

- 3.1 Storage - Valves shall be delivered and stored in the field with the port openings covered with plastic, cardboard or wood. These covers shall remain in place until the valves are ready to be installed. Valves shall not be stored in contact with bare ground. Valves shall not be stacked on top of one another.
- 3.2 Installation: Buried Butterfly Valves – The weight of the valve shall be supported by firm ground or blocking and not the pipe. In vaults or above ground applications the valves shall have an individual pipe support.
 - A. Flanged Connection - Valves shall be installed with the operating nut in the vertical position. Flanges, bolts and nuts shall be cleaned by wire brushing before installing flanged valves. Threads of bolts and nuts shall be clean and threads shall be lubricated with NSF 61 anti-seize compound. Nuts and bolts shall be tightened uniformly and progressively. If flanges leak under pressure testing, the contractor shall loosen or remove the nuts and bolts, reseal or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.

Bolts shall be tightened in an even manner by a series of steps until the torque required by the manufacturer is reached.
 - B. Mechanical Joint - Valve socket, gland, and pipe plain end shall be wiped clean of all sand, dirt and foreign material prior to valve installation. Bolts shall be tightened in a manner by a series of steps until the torque required by the manufacturer is reached.
 - C. Polyethylene Encasement - Valves and all bolted connections shall be encased with 10 mil polyethylene plastic film wrap installed as follows: The valves shall be wrapped by passing the flat sheet of film under the valve bottom and bringing the ends around the body to the stem and securing it in place with two-inch strips of adhesive tape. The polyethylene shall be secured around the valve in such a manner as to leave the stem free to operate. The film shall be brought completely around the flanges and secured to the pipe with a plastic adhesive tape on either side of the valve flange.

D. Operation - Immediately before installation, each valve shall be operated through one complete open-close cycle and visually checked for proper operation. Boxing of valves shall begin immediately after pipe sections containing the valves have been installed. All valve boxes, paving rings, and lids shall be brought to grade after pavement has been constructed.

3.3 Installation: Above Ground or Vault Butterfly Valves - The weight of the valve shall be supported by an individual pipe support.

A. Flanged or Lug Connection - Valves shall be installed with the operating handwheel operator either in the vertical or horizontal position. Contractor shall verify with District Inspector prior to installation of the orientation of the handwheel. Flanges, bolts and nuts shall be cleaned by wire brushing before installing flanged valves. Threads of bolts and nuts shall be clean and threads shall be lubricated with NSF 61 anti-seize compound. Nuts and bolts shall be tightened uniformly and progressively. If flanges leak under pressure testing, the contractor shall loosen or remove the nuts and bolts, reseal or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.

Bolts shall be tightened in an even manner by a series of steps until the torque required by the manufacturer is reached.

END OF SECTION

TAPPING VALVES AND SLEEVES

1.0 GENERAL

- 1.1 Scope - This section governs materials and installation of tapping valves and sleeves. Valves shall be furnished and installed by the contractor at the locations shown on the Approved Plans, or as required by the District.
- 1.2 Submittals - Prior to the purchase of tapping valves and sleeves to be used in the District system, the following items shall be submitted to and approved by the District:
 - A. Manufacturer's catalog data and detail construction sheets showing the size to be used, valve and sleeve dimensions, pressure rating and materials of construction.
 - B. Manufacturer's catalog data and NSF certification seal on the lining to be used.

2.0 MATERIALS

- 2.1 Tapping Valves - Tapping valves shall be of the double disc or resilient seat type conforming to all requirements for gate valves in Section 40 05 61. Valves shall be furnished with a flanged end with centering ring on the tapping sleeve side. The outlet side of valve shall have a mechanical joint, except as otherwise approved. Seat rings shall be oversized to permit the use of full-size cutters.
- 2.2 Tapping Sleeves - Sleeves shall be 304 stainless steel or cast iron conforming to ASTM-A-126 Class B. Bolts, nuts, and washers shall be type 304 stainless steel. Gaskets shall be Buna-N rubber at each end of the sleeve. Sleeves shall have ¾-inch NPT plug for air test.
- 2.3 Coating and Linings - Valves shall be coated and lined per Section 40 05 61. Cast iron sleeves shall be coated with two coats of asphalt varnish conforming to AWWA C504, except for face of flanges, bolts and nuts. Face of flanges shall be shop coated with a rust preventive compound.

3.0 EXECUTION

- 3.1 Installation - Surface preparation, sleeve placement, and connection of valve shall be in accordance with manufacturer's recommendations. Method of installation may vary depending on type of pipe being tapped.

- 3.2 Testing - Valve and sleeve shall be air tested prior to pipe cutting. Valve and sleeve shall sustain an air pressure of 30 psi for 5 minutes. After acceptance of the air test the pipe can be tapped.
- 3.3 Tapping - Tapping shall only be done in the presence of the Inspector. The tapping mechanism shall be of the self-purging type so that cutting chips are removed from the tapping machine and do not enter the pipeline.
- 3.4 Size - The diameter of the tap shall be less than the diameter of the main being tapped.

END OF SECTION

AIR AND VACUUM VALVE ASSEMBLIES

1.0 GENERAL

- 1.1 Scope - This specification governs materials and installation for air release, air and vacuum, or combination air-vacuum and air release valve assemblies. The type of air valve to be installed shall be as indicated on the plans. Valve assemblies include all items from the main pipeline to the valve vent as shown on the Standard Drawings.
- 1.2 Submittals - Prior to the purchase of valves to be used in the District system, the following items shall be submitted and approved by the District:
- A. Manufacturer's catalog data showing valve type and size to be used, valve dimensions, pressure rating, NSF 61 certification, and materials of construction.

2.0 MATERIALS

- 2.1 Valves - Valve bodies shall be of high strength cast iron. The float, seal, and all moving parts shall be of Type 316 stainless steel. Seat washers and gaskets shall be of Buna-N, Nitrile Rubber. All valves shall be NSF 61 approved. Valves shall be designed for a minimum pressure of 150 psi unless otherwise shown on the plans. Valves shall be designed to perform the following function:
- A. Air Release Valve - Air release valves shall be designed to release small amounts of air that can accumulate at high points in systems once they are filled and under pressure.
 - B. Air and Vacuum Valves - Air and vacuum valves shall be designed to: (1) expel large amounts of air from a system when it is being filled, (2) remain closed when the system is in operation and under pressure, and (3) open to allow air to enter when the line begins to drain and the internal pressure reverts to atmosphere.
 - C. Combination Air-Vacuum and Air Release Valves - These valves combine the features of the air release, and the air and vacuum valves specified herein.
- 2.2 Appurtenances - Materials for gate valves, piping, boxes, and fittings shall conform to the requirements of the Standard Drawings.

3.0 EXECUTION

- 3.1 Installation - The tap for the air valves shall be made in a level section of pipe no closer than 36 inches to a bell, coupling, joint, or fitting.

Tapping mains shall conform to the standard procedures for house services.

Air valve assemblies shall be installed in accordance with the Standard Drawing.

Threaded joints shall be cleaned by wire brushing or swabbing. NSF approved Teflon joint compound or Teflon tape shall be applied to pipe threads before installing threaded valves. Joints shall be watertight.

The contractor shall also isolate nonferrous pipe from steel supports and pipe straps by means of insulating sleeves or tape wrapped around the pipe.

- 3.2 Testing - Air valve assemblies shall be tested at the same time that the connecting pipelines are pressure tested and disinfected.

END OF SECTION

FIRE HYDRANT ASSEMBLIES

1.0 GENERAL

- 1.1 Scope - This specification governs materials and installation for fire hydrant assemblies. Fire hydrant assembly includes all items from the main line tee to the fire hydrant as shown on the Standard Drawings.
- 1.2 Submittals - Prior to the purchase of fire hydrants to be used in the District's system, the following items shall be submitted and approved by the District:
- Manufacturer's catalog data showing model, size, dimensions, and materials of construction.

2.0 MATERIALS

- 2.1 Fire Hydrants - Fire hydrants shall be dry barrel type meeting AWWA C502 and have a 6-inch bell inlet with two 2 ½-inch hose outlets and one 4½-inch pumper connection. Threads on the pumper and hose connections shall conform to the requirements of the fire department equipment of the area which they are to serve or if no standards exist, they shall conform to the "National Standard Screw Threads for Fire Hose Couplings and Fittings" published by the National Board of Fire Underwriters. Hydrants shall be designed to operate at a minimum of 250 psi working pressure and shall be tested hydrostatically to 400 psi. Fire hydrants shall open to the left (counterclockwise). The hydrant shall be cast iron and bronze mounted. Hydrants shall have a main valve opening size of 5 ¼ inches. The outlets shall be protected with caps attached to the hydrant head with a chain. Other specific requirements are:
- Hydrant materials shall comply with AWWA C502.
 - Hydrant flanges shall contain six equally spaced bolt holes of 7/8-inch diameter on a 9 3/8-inch diameter.
 - All hydrants shall be permanently marked with the manufacturer's name and the year of the manufacture.
 - Caps shall be metal-type.
- 2.2 Hydrant Lateral – Laterals under 50-feet shall be 6-inch DI or PVC pipe DR-14, and laterals over 50-feet shall be 8-inch DI or PVC DR-14 pipe. All pipe used for fire hydrant laterals shall be fully restrained. Hydrant laterals shall be pressure rated appropriately. Thrust block sizes shall be as shown in the Standard Drawings.

- 2.3 Hydrant Lateral Valve - The lateral valve shall be a 6-inch gate valve in runs less than 50-feet, and 8-inch valve in runs greater than 50-feet with a reducer to 6-inch pipe at the end of the run to a 6-inch valve for the hydrant. The valve shall be stacked to the surface as shown on the Standard Drawings.
- 2.4 Spools and Bury - Hydrant burys shall be 6-inches inside the diameter and made of cast iron conforming to ASTM A-126. The burys shall be one piece with the top having a flange drilled with six holes to receive the extension spool or hydrant. The bury end shall be flange or mechanical joint fitting. All fire hydrant extensions shall be one piece only and installed in the presence of the Engineer. The Engineer reserves the right to have the extensions removed and re-installed in his presence. If the hydrant bury requires more than one extension the hydrant shall be installed with a vertical shoe only.
- 2.5 Bolts - Alloy steel break-off bolts shall be used to attach the fire hydrant to the extension spool. All break away parts shall be installed at the connection between the hydrant and the extension spool.

3.0 EXECUTION

- 3.1 Examination of Material - Prior to installation, all hydrants shall be inspected for direction of opening, nozzle threading, operating-nut and cap-nut dimensions, tightness of pressure-containing bolting, cleanliness of inlet elbow, handling damage, and cracks. Defective hydrants shall be corrected or held for inspection by the District.
- 3.2 Placement of Hydrant - All hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the curb, with pumper nozzle facing the curb. In locations where the hydrant is to be closer than 6 feet from the back of the curb, the curb shall be vertical for 6 feet in both directions.
- 3.3 Assembly Installation - Special attention is called to the following:
- The shoe of the fire hydrant bury must be anchored on a concrete thrust block.
 - The fire hydrant shall be positioned so that the bolts between the extension piece and the hydrant are accessible, both top and bottom, within the limits shown on the Standard Drawing. If the hydrant is either too low or too high, it shall be corrected.
 - Painting shall be per Section 09 90 00 with all metal surfaces above ground being painted. Extensions shall have a shop coat and be wrapped in 8-mil polyethylene encasement. Color of hydrant will be determined by the local fire department.

- All underground iron fittings and hydrant bury shall be wrapped with polyethylene.

3.4 Testing – Hydrants shall be tested after the main per AWWA M17. Hydrant foot valves shall be closed during the pressure test of the new main. With completion of the hydrostatic test on the new main the hydrant testing procedure can be completed. The new hydrants shall be pressure test at main normal operating pressure as follows:

- Remove the highest outlet nozzle cap and open the hydrant valve a few turns. Allow water to reach the bottom of the outlet nozzle.
- Replace the outlet nozzle cap and leave it loose to permit all air to escape.
- After all air has escaped, open the hydrant completely.
- Check for leakage at the flanges, outlet nozzles, and the packing around the stem. If leakage is noted, repair or replace the faulty components or the entire hydrant.

Hydrants shall have the drain valves tested in the following manner:

- Following the pressure test, open fire hydrant valve a few turns and allow hydrant to fill until water is at bottom of nozzle. Close hydrant valve and observe water level drop. If drop in water level is not visible, place palm of hand over open nozzle to feel a noticeable suction. If water level drop is not detectable, the hydrant has failed the drainage test.
- If the hydrant fails the drainage test, the drain valve may be clogged or backfill material does not permit free drainage. The contractor shall make the necessary corrections and repairs to correct improper drainage and re-test.

END OF SECTION