

date of notice of completion and acceptance of the work is filed, and to restore to full compliance with the requirements of these specifications including the test requirements, any part of the facilities or appurtenant works which during said guarantee period is found to be deficient with respect to any provision of this specification. Replacement of backfill where it has settled below the lines established by the Engineer shall be considered part of such repair work. The Contractor shall make all repairs and replacements promptly upon receipt of written orders for same from the Engineer. If the Contractor fails to make the repair and replacements promptly, the District may do the work, and the Contractor and his surety shall be liable to the District for the cost thereof.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

#### **A. Select Backfill Material, and Special Bedding and Backfill**

Select backfill material shall be selected from the excavated material or imported when not available from the excavated material. In either case, it shall be provided at the Contractor's expense, and shall be included in the costs proposed for pipeline installation on the bidding sheets.

Where called for on the plans or in these specifications, and not covered by a separate bid item, special bedding or backfill shall be included in pipeline construction costs on the bidding sheets.

Where required by the governing agency or by the District to meet compaction requirements of these specifications or requirements of these specifications for bedding or for select granular backfill, special bedding or imported backfill and disposal of excavated spoil shall be provided at the Contractor's expense.

The requirements for special bedding and backfill at the Contractor's expense as described herein as a part of the Special Conditions or as shown on the Contract Drawings shall supersede and take precedence over any and all other requirements for measurement and/or payment for special bedding or backfill found elsewhere in these specifications. Bedding is defined herein to include sand, rock or concrete base, cradle, or encasement. Backfill material is defined herein to include backfill for both trench backfill and pipe bedding (or pipe zone backfill).

Special bedding or backfill not called for on the plans or in these specifications, but required by the Engineer over and above the requirements of this specification shall be constructed at additional cost, at prices reflecting current material costs as evidenced by paid vouchers, plus 50% to cover all costs of installation and overhead.

The encounter of ground water not anticipated in engineering reports made available for this contract, and the required over-excavation and construction of a stable base as determined necessary by the Engineer shall be considered over and above the requirements of this specification, and the required base shall be paid for at the above stipulated prices.

### **PART 3 - EXECUTION**

#### **3.01 WEATHER LIMITATIONS**

Excavating and grading shall be performed only when the weather conditions do not adversely affect the quality of the finished product. Any graded or excavated areas that are damaged by the effect of rain, or other weather conditions, during any phase of the construction, shall be re-excavated, regraded, and recompact to conform to the herein specified requirements, without additional cost to the District.

#### **3.02 PREPARATION**

##### **A. Dust Abatement**

The Contractor shall furnish all labor, equipment and means required and shall carry out protective measures wherever and as often as necessary in the opinion of the Engineer to prevent his operations from producing dust in amounts damaging to property or causing nuisance. The Contractor shall be responsible for any damage resulting from dust originating from his operations. **The Contractor shall also make himself knowledgeable of Southern California Air Quality Management District's Rule 403-Fugitive Dust and comply with these requirements.** The dust abatement measures shall be continued until all required resurfacing is completed or until the Contractor has completed arrangements with the proper authorities whereby he is relieved of further responsibility. Such arrangements shall be approved by the Engineer prior to their completion. All compensation to be received for dust abatement shall be included in the prices named for appropriate items of the bidding sheet.

##### **B. Utilities and Substructures**

The indication of the type and approximate location of existing utilities and substructures in the Contract Documents represents a diligent search of known records, but the accuracy and completeness of such indications are not warranted by the District and utility structures and services not so indicated may exist. Before commencing any excavations, the Contractor shall investigate, determine the actual locations, and protect the indicated utilities and structures, shall determine the existence, position, and ownership of other utilities and substructures in the site or where the work is to be performed by communication with such owners, search of records, or otherwise, and shall protect all such utilities and substructures.

C. Control of Water

The Contractor shall acquire such permits and take such measures as may be required, and shall furnish, install, and operate such pumps or other devices as may be necessary to remove any seepage, storm water, or sewage that may be found or may accumulate in the excavations during the progress of the work. The Contractor shall keep all excavations entirely free from water at all times during the construction of the work and until the Engineer gives permission to cease pumping. He shall keep the complete work reasonably free from accumulations of water and sewage, and shall free it entirely at such times as may be required by the Engineer for inspection or other purposes. Any accumulated water or sewage thus pumped shall be disposed of in accordance with good practice and local ordinances.

The Contractor shall provide an adequate dewatering system for the control of surface and groundwater seepage into the excavations as may be required during the construction period. The proposed plan of this dewatering system shall be submitted to the Engineer for concept approval prior to the installation of the system.

3.03 CONSTRUCTION

A. Excavation

The Contractor shall perform all excavation necessary or required for the construction of the facilities covered by these specifications. Excavations may be performed by either hand or machine methods and shall be of sufficient size to provide adequate space for working in accordance with safety regulations and practice and the Contract Drawings. Excavations shall include the removal and disposal of all materials of whatever nature and quantity including water, rock, decomposed granite, or any other type of soil or material, subsurface obstructions and also overhead obstructions which may interfere with the operation of equipment used on the work. Excavation shall immediately precede subsequent construction, and shall not remain open longer than necessary for construction. Excavation for foundations shall be made only after construction of subgrade, as hereinafter described, has been completed. Over-excavation for foundations shall be filled with concrete.

1. Seismic Investigation. In suspected or known fault areas, Contractor shall make his trench or excavation available to the property owner or his geologist for seismic investigations as required under the Alquist-Priolo Geologic Hazard Zones Act. Such investigation shall involve no delay to the Contractor.

2. Trench Excavation. Unless otherwise specified in the Special Conditions or on the Contract Drawings, pipeline trenches shall have a minimum clear distance: pipe sizes up through 12" - 6" to 9" min., sizes larger than 12", 12" minimum on each side of the pipe barrel when the pipe is properly placed and aligned in conformity with the Contract Drawings. The sides of the trench shall be parallel to and at equal distance on each side of the centerline of the pipe.

The maximum length of trench which shall be opened or partially opened at any one time shall be limited to 500' for sewer lines and one-half mile for water pipelines, except where governed by other agencies or approved by the Engineer. See Section 3.04. J, "Clean-up During Construction" for maximum trench length without restoration. Bell holes or depressions shall be dug by hand at the proper locations of sufficient size to adequately work the joints, but no larger than is required.

When the trench is excavated to the line and grade as shown on the drawings, and the bedding material encountered is rock, the trench shall be excavated an additional depth of at least 4" below the grade for the bottom of the pipe, and the bottom of the trench shall be refilled with approved material, moistened and compacted by tamping or by other approved method to the satisfaction of the Engineer.

Where ground water is encountered and the native material does not afford a solid foundation for pipe subgrade as specified above, the Contractor shall excavate to such depth below subgrade as determined necessary by the Engineer and shall construct a stable base by placing crushed rock bedding upon which subgrade can be prepared. Crushed rock for bedding shall be one and one-half inch (1 1/2") maximum size.

When the trench has been inadvertently excavated below the designed grade, at the Contractor's expense, the bottom of the trench shall be refilled with approved material, well compacted into place in an approved manner and to the satisfaction of the Engineer.

3. New Subdivision Construction. Where pipelines are to be constructed in new subdivision developments, it is anticipated, unless otherwise stated, that sewers will be installed after grading is completed to subgrade in streets and proposed paved areas, and to final grade in other areas; then curbs will be constructed prior to water system construction. Only after water system construction will other utilities, roadway base, and paving be placed.

4. Excavated Materials. Shall be piled neatly along the side of the trench and adjacent to manhole excavations in such a manner as to be of as little inconvenience as possible to the public traffic or the occupants of the adjacent property, and be in compliance with safety standards and soils report recommendations.

Through all cultivated areas, topsoil removed from excavations shall be replaced as backfill in the uppermost part of the excavation to a depth as it existed previous to excavation, not exceeding 18". Where topsoil replacement is required, excavated topsoil shall be stored separately from other materials and in general shall be replaced as backfill in the same parcel of land from which it came.

5. Manhole Excavations. Shall be made to the depths as indicated on the drawings, with sufficient side clearances to provide adequate working space for the construction of the manhole structure.

When unsatisfactory soil bearing conditions, such as soft mud, quicksand, or other unstable materials are encountered at the elevation of the bottom of the manhole, the base shall be made firm and solid by removing said unstable material to sufficient depth and replacing same with crushed rock, gravel, or other approved material, well compacted into place in a manner approved by the Engineer.

6. Blasting. The use of explosives on the work shall be subject to the approval of the Engineer. All operations involving the handling and storage and use of explosives shall be conducted with every precaution prescribed by the Construction Safety Orders of the Division of Occupational Safety and Health of the State of California and by local laws and regulations. Only competent, reliable men working under experienced supervision shall be permitted to use explosives. The Contractor will be held responsible for and shall make good any damage caused by blasting or otherwise resulting from disposition or use of explosives on the work.
7. Cutting. In cutting or breaking up street surfacing, the Contractor shall use equipment acceptable to the authorities concerned. The pavement to remain in place shall be trimmed with an approved cutting device in such manner as to leave a vertical face with sound, unfractured pavement. All pieces of pavement resulting from cutting or breaking up street surfacing shall be removed from the trench area prior to trenching.

8. Disposal of Excavated Materials. Insofar as space is available in the right-of-way, such space may be used for temporary storage of excavated material, to be used for backfill, provided that no material shall be stored or deposited in violation of any ordinance or regulation prohibiting the filling or obstructing of water courses in drainage channels. Storage of excavated material in any street or highway shall conform to the regulations of the public authority having jurisdiction there over. All materials removed from the excavations in excess of that stored temporarily as above specified shall be immediately hauled away and used in backfilling elsewhere, or, if not used, shall be disposed of by the Contractor. The disposal area shall be acquired by the Contractor. No materials shall be disposed of either temporarily or permanently on privately or publicly owned property unless the Contractor shall first obtain permission therefore from the owner or agency concerned. The Contractor shall furnish satisfactory evidence to the Engineer that such consent has been obtained and shall be responsible for all damages and claims that may arise in connection therewith.
9. Bracing and Shoring. The Contractor shall furnish, place and maintain such bracing and shoring as may be required to support the side of the excavations for the proper protection of workmen, to facilitate the work and prevent damage to the pipes and manholes being constructed, and to prevent damage to adjacent structures or facilities. Upon completion of the work, all bracing and shoring shall be removed unless otherwise directed or permitted by the Engineer. Site conditions that alter shoring submittals such as blasting, groundwater, differing soils, etc., must be reviewed for adequate shoring by Contractor or his Engineer.
10. Bridges. Foot bridges of approved construction, not less than 4' in width, and provided with hand rails and uprights of dressed lumber, shall be installed over the trenches at all crosswalk intersections and at such other points where, in the opinion of the Engineer, traffic conditions make it advisable. Substantially constructed bridges, adequate for handling all vehicular traffic, shall be installed over any trench or other excavation in a street intersection whenever such excavation is in excess of half the width of the street crossing. Adequate bridges shall be provided to make possible the safe and full use of all driveways or roadways used to move vehicles from the public street onto private property.

All bridges required to be installed shall be maintained in place as long as the condition of the work requires their use for the safety or convenience of the public, except that when necessary for the proper prosecution of the work in the immediate vicinity of a bridge, said bridge shall be relocated to take care of the traffic requirements, or may be temporarily removed for such period or periods of time, at the Contractor's risk, as the Engineer may approve.

B. Installation

1. Pipe. The pipe manufacturer shall send a field representative to answer any questions on installation procedures, within 48 hours of request, as coordinated by and through the Engineer.
2. Concrete Encasement. Where required on the Contract Drawings, concrete cradles and encasements shall be constructed in accordance with the requirements stated thereon.

Whenever the maximum allowable width of trench as specified elsewhere in these specifications or in the construction plans or the standard drawings, is exceeded for any reason except as provided for in the plans or special conditions or by the written direction of the Engineer, and where the resulting effect of the exceeded trench width would place loads upon the pipeline exceeding the maximum loads recommended by the pipe manufacturer, the Engineer may require, at his discretion, that the Contractor, at his own expense for all labor and materials cradle the pipe in Class "C" concrete, as described in this specification.

C. Fill, Backfill and Grading

Fill, Backfill and Grading shall include all scarifying, moistening, compacting, and other manipulations of the soil necessary to obtain the required densities, cross sections, lines, grades and surface finish indicated or specified. Backfill shall not be placed in trenches or excavations until the pipelines and structures in the particular section involved have been inspected and approved for backfilling by the Engineer.

Backfill shall be placed, insofar as practical, as the work progresses, allowing time for concrete (if used) to attain sufficient strength.

All excavations outside the completed pipelines and structures shall be backfilled with compacted material to the level of the original ground surface unless otherwise shown on the drawings or ordered by the Engineer. The materials used for backfill shall be imported, selected material, or approved selected excavated materials and shall be placed as directed by the Engineer. All materials placed within 6" of the pipe or structure shall be free from rocks or boulders larger than 1 1/2" maximum dimension, and from unbroken masses of earthy materials which might lodge and thereby cause unfilled pockets in the excavation.

Unsuitable material encountered at the surface upon which the bedding material is to be placed shall be removed to a depth as determined in the field by the Engineer. Unsuitable material shall be as determined by the Engineer. If not otherwise specified, removal of material and additional bedding so ordered over and above the amount required will be paid for in accordance with the specifications unless, however, the necessity for such additional bedding materials has been occasioned by an act or failure to act on the part of the Contractor, in which event the Contractor shall bear the expense of the additional excavation and backfill to the required depth. The Contractor's attention is called "dewatering" procedures to ensure that an otherwise stable foundation will not be rendered unfit due to accumulation of water in the trench excavation. However, the Contractor has the responsibility to reasonably ascertain the soil conditions prior to bid. The cost of removing the unsuitable materials should have been known prior to bid and be included in the bid price.

Imported materials (if any) required for fill or backfill shall be provided by the Contractor from areas outside the site at his own expense. Such material shall be as herein specified and must be approved by the District before delivery to the site.

1. Structure Backfill. The Contractor shall place all backfill about structures to the original ground level, or to the lines shown on the drawings or prescribed by the Engineer. Fill materials shall be of earth only, and be free from debris, vegetation, alkali, or other deleterious substances.

All backfill about structures shall be placed in layers not more than 6" thick prior to compaction, which shall be obtained by moistening to optimum moisture content prior to placing and compacting to maximum compaction by use of suitable equipment approved by the Engineer.

The Contractor shall take all necessary precautions to protect the structure and underground facilities during the placement, compacting or consolidating, and grading of backfill.

2. Pipeline Backfill. Except as otherwise required by the construction plans or the standard drawings, the material used in backfilling to 1' above the pipe shall be granular material approved by the Engineer and in accordance with the manufacturers requirements, sandy, or sandy gravel material obtained from required excavation or from approved borrow areas, as shown on the Contract Drawings or as directed by the Engineer.



This material shall be carefully placed and compacted to provide a firm continuous bedding and encasement for the pipe. Pipe shall be shaded the same day it is laid to protect it from possible damage and/or thermal expansion. Pipe zone backfill may be consolidated by careful flooding to saturation only if the soil has a Sand Equivalent of 30 or better and no more than 10% fines (particles passing the no. 200 sieve), otherwise mechanical compaction will be required or as specified elsewhere in these specifications.

Variations to the foregoing pipeline backfill requirement, when recommended by the pipe manufacturer or requested by the Contractor, shall be submitted for approval by the District prior to the commencement of such pipe installation. The method of compaction shall then be proven before backfilling more than the footage of pipe allowed by the contract specification. In lieu of a specific contract requirement, not more than 1000' of pipe shall be laid and backfilled prior to proving the method of compaction.

The remaining trench backfill shall consist of select backfill material from the excavation, when available, free from stones or lumps exceeding 3" in greatest dimension, and free from vegetable matter or other unsatisfactory material. This select material as defined herein and elsewhere in these specifications shall be placed in layers not exceeding 2' in depth, unless otherwise directed by the Engineer. Excavated soils that have excessive moisture must be dried, mixed, or replaced with suitable material that will meet the compaction requirements at no additional cost to EMWD. Each lift shall be consolidated in such a manner that the backfill will meet the requirements of these specifications. Care shall be taken not to disturb the backfill previously placed, and the Contractor shall at all times protect the pipe against flotation. Material placed between successful test and failed test shall be tested at one-fifth (1/5) the distance intervals until a passing test is achieved. All material from failed test to successful test shall be removed, recompacted and retested.

3. Sewer Line Backfill. Backfill shall not be placed in trenches or excavations until the sewer lines and manholes in the particular section involved have been inspected and approved for backfilling by the Engineer.

For all sewer pipe, select granular backfill having a Sand Equivalent of 30 and less than 10% fines (particles passing the no. 200 sieve) shall be used up to an elevation 12" above the top of pipe, imported whenever the Engineer determines that native material is not satisfactory. Material for this purpose shall conform to the requirements as set forth herein. The pipe

zone backfill shall be carefully packed under the haunches of the pipe and brought up simultaneously on both sides, to the full specified depth, so as to prevent any displacement of the pipe from its true alignment. In compacting by flooding, no ponding of water above the surface of the sand will be permitted.

4. Water Line Backfill. Prior to backfilling, all pipe 30" in diameter and larger shall be either filled with water under pressure or braced with stulls sufficiently to prevent distortion while placing, consolidating and compacting back fill. Prior to backfilling, all trench supports shall be removed unless otherwise approved by the Engineer.
5. Gravel Fill. Gravel fill shall be placed where specified, indicated on the plans, or designated by the Engineer to meet special conditions encountered.

Where gravel fill is required, crushed rock may be substituted or added. Crushed rock for foundations shall be as defined for pipe bedding which is described elsewhere in this specification.

The percentage composition by weight of gravel fill shall conform to the following grading when determined by Test Method No. Calif. 202:

<u>Sieve Sizes</u>	<u>Percentage Passing Sieves</u>
1"	100
3/4"	85-100
No. 4	35-55
No. 30	10-30
No. 200	2-9

6. Compacting and Surfacing. Except as otherwise specifically required by the encroachment permit or elsewhere in these specifications, the following requirements will apply:

The upper portion of the final lift will be backfilled with selected material from the excavation, moistened to optimum moisture content and compacted by mechanical tamping to meet the requirements of the District standards. All backfill in public roads shall be consolidated and surfacing shall be placed to meet State of California and Riverside County requirements as stated in the respective permit, whether or not required by the inspector for that particular agency - unless otherwise approved by the Engineer.

Where backfill is in areas not within public roads, it shall be consolidated and tested to meet the requirements of these specifications, except as otherwise approved by the Engineer.

Minimum acceptable field densities specified in District standards shall be determined in accordance with the testing procedures set forth elsewhere in these specifications.

Where sand material of an approved grade is used for backfilling, mechanical compaction may be eliminated and compaction obtained by jetting.

Except as otherwise required by a specific permit, where pavement is being replaced, an approved plant mixed surfacing shall be placed to a minimum thickness of 3" when compacted. Surfacing in streets shall be maintained to original street grade after laying and any settlement filled with plant mix surfacing.

The edges of trenches which are broken down during the making of subgrade shall be removed and trimmed neatly before refilling or resurfacing. When the backfill is complete and excess material removed, the surface will be graded and a layer of approved decomposed granite will be placed with a minimum thickness of 4" when compacted at optimum moisture content by rolling and to a grade to conform to the original roadway section. All pavements outside the paylines damaged by the Contractor shall be trimmed and repaired.

If the edge of the excavated trench when trimmed is within 2' of the edge of the roadway pavement, then the pavement shall be completely removed to the edge of the roadway and replaced with the replacement of the trench pavement. Except as otherwise directed by the Engineer, after a period of not less than 30 days or more than 60 days, any settlement shall be filled with decomposed granite. The top 2½" shall then be road mixed where allowed, with a minimum of 1½ gallons liquid asphalt binder of grade SC3 or 4 (as directed) per square yard and compacted to the original roadway section. Each phase shall be approved by the Engineer before proceeding to the next operation. Where allowed, the road-mixed surfacing operation shall conform to the Standard Specifications of the State of California Department of Transportation.

Pavement, curbs, gutters and walks removed, cut or damaged during the construction of facilities shall be replaced or restored to their original condition, or as otherwise specified. Local ordinances governing such replacement shall be adhered to in all respects.

Removal and/or replacement of pavement where pavement now exists, as well as removal and/or replacement of any other obstructions, will be included in the item cost for the particular installation, unless specifically itemized separately on the bidding sheet.

D. Paving

Where not required otherwise by specific contract requirements or permit requirements incorporated in the contract, the Contractor shall construct new asphalt concrete paving as indicated on the Contract Drawings and as specified herein. All paving proposals and operations shall be subject to the approval of the Engineer.

Where this work is included in a lump sum bid item, it is the Contractor's responsibility to satisfy himself as to the exact lengths and/or dimensions of new roads and pavements. Terminals of all surfacing indicated on the Contract Drawings shall join any existing surfaces in a smooth juncture.

1. Sub-base

- a) Preparation. The upper 12" of sub-base in any area to be paved shall be compacted to not less than 95% of maximum compaction, as determined by currently adopted ASTM D-1557 and procedure C.
- b) Weed Killer. After the sub-base has been prepared, a weed killer shall be applied to the entire sub-base. Weed killer shall be OUST XP as manufactured by DUPONT, or approved equal. The weed killer shall be applied according to the manufacturer's published instructions.

2. Aggregate Base Course. Shall be Class II aggregate base. The aggregate base course shall be the thickness shown on the plans and shall be placed in maximum 4" lifts. Aggregate base course shall be compacted to 95% of maximum compaction, as specified by ASTM D-1557. Aggregate base course shall be furnished, spread and compacted, as specified for Class II Aggregate Base Course in the Standard Specifications, State of California,

Department of Transportation, latest edition. A spreader box will not be required but care shall be taken to prevent segregation during placement.

3. Asphalt Concrete

- a) Asphalt Concrete shall conform to the requirements of Caltrans Standard Specifications Section 39, for Type "B". Aggregate will conform to a grading for 1/2" maximum aggregate with paving grade asphalt PG 64-10 (Section 92) unless otherwise directed by the Engineer.

- b) Proportioning, Mixing, Spreading and Compacting. The proportioning and mixing of aggregates and asphalt, and the spreading and compacting of the asphalt concrete to make up the asphalt pavement, shall be in accordance with the Standard Specifications, State of California, Department of Transportation, latest edition. The paving machine shall have a self-screening spreader unless approved otherwise by the Engineer.
- c) Tack Coat. Tack coat shall be Type SS1H grade Anionic Asphaltic Emulsion as per Caltrans Standard Specification 94.
- d) Prime Coat. When indicated on the Plans or in the Special Provisions, a prime coat consisting of Grade SC-250 liquid asphalt shall be applied in accordance with Caltrans Standard Specification Sections 39 and 93.
- e) Paving. The asphalt concrete pavement shall be no less than the thickness as shown on the plans and shall be applied in two (2) lifts. The first lift shall be the leveling course and the second lift shall be the wearing course not less than 1" thick and shall bring the pavement to full thickness.

The finished surface shall be free from depressions exceeding 1/4" as measured with a 10-foot straightedge in any direction, except where the drawings show a grade break.

- f) Seal Coat. Seal coat shall be a Bituminous Fog Seal in accordance with Caltrans Standard Specification Section 37.
- g) Joining Existing Pavement. Existing paving which is to be joined by new paving shall be saw-cut to provide straight true neat joints.
- h) Paving Headers. Edges of paving shall be bounded by 2 x 6 net new rough cut redwood unless otherwise shown on the plans.
- i) Asphalt Curbs. Automatic curbing machines shall be used to construct asphalt curbs. The curb cross section used shall be as shown on the drawings or as approved by the District.
- j) Paving Removal. Where paving is shown to be removed on the drawings, it shall mean that all asphaltic concrete and aggregate base shall be removed.

4. Removal and Replacement

- a) General. Replacement of street, driveway, alley entrance, and other type pavements shall be of the same material as the existing pavement, constructed in accordance with the applicable drawings and specifications.

The Contractor shall install temporary asphalt pavement of the first course of permanent replacement immediately following backfilling and compaction of trenches that have been cut through pavement. Except as otherwise provided, this preliminary pavement shall be maintained in a safe and reasonably smooth condition until required backfill compaction is obtained and final pavement replacement is ordered by the Engineer. Temporary paving removed shall be hauled from the job site and disposed of at the Contractor's expense.

Where a longitudinal trench is partly in pavement, the pavement shall be replaced to the original pavement edge, on a straight line, parallel to the centerline of the roadway.

Where no part of a longitudinal trench is in the pavement, surfacing replacement will only be required where existing surfacing materials have been removed or damaged.

When the trench cut is in aggregate surfaced areas, the replacement shall be of aggregate base course material compacted to 95% of its maximum compaction.

- b) Asphalt Pavement Replacement. Asphalt pavement replacement shall be of the same thickness as the adjacent pavement and shall match as nearly as possible the adjacent pavement in texture.

Existing asphalt pavements to be removed for trenches or other underground construction or repair shall be cut by a wheel cutter, clay spade, or other device without damaging adjacent pavement that is not to be removed. The Engineer's decision as to the acceptability of the cutting device and its manner of operation shall be final.

The existing pavement shall be cut and trimmed after placement of required ABC and just prior to placement of asphalt concrete for pavement replacement, and the trimmed edges shall be painted with a light coating of asphalt cement or emulsified asphalt immediately prior to constructing the new abutting asphalt pavements. No extra payment shall be provided for these items, and all costs incurred in performing this work shall be incidental to pipe laying or pavement replacement.

Asphalt pavement replacement shall conform to the contour of the original pavement. A 10-foot straightedge shall be laid parallel to the centerline of the trench when the trench is running parallel to the street and across the pavement replacement when the trench crosses the street at an angle. Any deviation in the cut pavement replacement and the old pavement greater than 1/4" in 10 feet (10-foot straightedge) shall be removed and corrected.

- c) Portland Cement Concrete Pavement Replacement. Where trenches lie within the portland cement concrete section of streets, alleys, driveways, sidewalks, etc., such concrete shall be saw-cut (to a depth of not less than 1½") to neat, vertical, true lines in such a manner that the adjoining surfaces will not be damaged.

The pavement replacement shall be Class "A" concrete placed to the dimension as shown on the drawings. Expansion joints shall match the existing expansion joints in the old pavement.

The surface shall be wood float finish with no greater variance than 1/4" in a 10-foot straightedge either across the pavement replacement or longitudinal with the centerline of the ditch. Any greater variance than the above 1/4" shall be cause for rejection of the pavement replacement. Before placing the concrete replacement, the edges of the old pavement shall be thoroughly cleaned and given a wash of neat cement and water.

- d) Curb, Gutter, and Sidewalk Replacement. Where any concrete curb, gutter, or sidewalk has been removed or displaced, the same shall be replaced to the nearest construction joints with new asphalt or concrete to the same dimensions, material, and finish as the original construction that was removed.

Expansion joints shall be the same spacing and thickness as on the original construction.

- e) Expansion Joints. Expansion joints shall be constructed in curb, walk, and gutter as shown on the plans or as specified herein. Such joints shall be filled with premolded joint filler. No such joints shall be constructed in crossgutters, alley intersections or driveways except as may be approved by the Engineer.

One-half inch (13 mm) joints shall be constructed in curb and gutter at the end of all returns except where crossgutter transitions extend beyond the curb return, in which case they shall be placed at the ends of the crossgutter transition. No joints shall be constructed in returns.

Where monolithic curb and gutter is constructed adjacent to concrete pavement, no expansion joints will be required except at EC and BC of curb returns. Expansion joint filler 1/4" (6 mm) thick shall be placed in walk at the EC and BC of all walk returns, around all utility poles which may project into the concrete along the line of the work, and in walk returns between the walk and the back of curb returns when required by the Engineer. At the EC and BC and around utility poles, the joint filler strips shall extend the full depth of the concrete being placed. Joint filler strips between walk and curb shall be the depth of the walk plus 1" (25 mm) with the top set flush with the specified grade of the top of curb. All expansion joint filler strips shall be installed vertically, and shall extend to the full depth and width of the work in which they are installed, and be constructed perpendicular to straight curb or radially to the line of the curb constructed on a curve. Expansion joint filler materials shall completely fill these joints to within 1/4" (6 mm) of any surface of the concrete. Excess filler material shall be trimmed off to the specified dimension in a neat and workmanlike manner. During the placing and tamping of the concrete, the filler strip shall be held rigidly and securely in proper position.

f) Weakened Plane Joints.

- (i) General. Weakened plane joints shall be straight and constructed in accordance with Subsections "Control Joint" and "Plastic Control Joint" below, unless otherwise shown on the drawings.

In walk, joints shall be tranverse to the line of work and at regular intervals not exceeding 10' (3 m). At curves and walk returns, the joints shall be radial.

In gutter, including gutter integral with curb, joints shall be at regular intervals not exceeding 20' (6 m). Where integral curb and gutter is adjacent to concrete pavement, the joints shall be aligned with the pavement joints where practical.

- (ii) Control Joints. After preliminary troweling, the concrete shall be parted to a depth of 2" (50 mm) with a straightedge to create a division in the coarse aggregate. The concrete shall then be refloated to fill the parted joint with mortar. Headers shall be marked to locate the weakened plane for final joint finishing, which shall be accomplished with a jointer tool having a depth of 1/2" (13 mm) and a radius of 1/8" (3 mm). The finished joint opening shall not be wider than 1/8" (3 mm).



- (iii) Plastic Control Joints. The joint material shall be a T-shaped plastic strip at least 1" (25 mm) deep, having suitable anchorage to prevent vertical movement, and having a removable stiffener with a width of at least 3/4" (20 mm). After preliminary troweling, the concrete shall be parted to a depth of 2" (50 mm) with a straightedge. The plastic strip shall be inserted in the impression so that the upper surface of the removable stiffener is flush with the concrete. After floating the concrete to fill all adjacent voids, the removable stiffener shall be stripped. During final troweling, the edges shall be finished to a radius of 1/8" (3 mm) using a slit jointer tool.

### 3.04 FIELD QUALITY CONTROL

A. Contractor's Responsibility for Safety

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work. This requirement will apply continuously 24 hours a day every day until final acceptance of the work and shall not be limited to normal working hours.

B. Warnings and Barricades

The Contractor shall provide and maintain barricades, guards, temporary bridges and walkways, watchmen, night lights and danger signals illuminated from sunset to sunrise, and all other necessary appliances and safeguards to protect the work, life, property, the public, excavations, equipment, and materials. Barricades shall be of substantial construction and shall be painted such as to increase their visibility at night. Suitable warning signs shall be so placed and illuminated at night as to show in advance where construction, barricades, or detours exist. Guard rails shall be provided for bridges and walkways over or adjoining excavations, shafts, and other openings and locations where injury may occur.

C. Fire Prevention

The Contractor's Safety Officer shall inspect the entire work and site, including storage areas, at frequent intervals to verify that fire prevention measures are constantly enforced.

D. Fire Extinguishers and Hoses

The Contractor shall furnish and maintain fully charged fire extinguishers of the appropriate type, supplements with temporary fire hoses wherever an adequate water supply exists, at the places where burning, welding, or other operations that may cause a fire are being performed.

- E. Flammable or Toxic Materials  
Only a working supply of flammable or toxic materials shall be permitted on or on any of the permanent structures and improvements, and shall be removed therefrom at the end of each day's operations. The Contractor shall store flammable or toxic materials and waste separate from the work and stored materials for the work in a manner that prevents spontaneous combustion or dispersion, and none shall be placed in any sewer or drain piping nor buried on the site.
- F. Safety Helmets, Clothing, and Equipment  
The Contractor shall not permit any person for whom he is responsible or liable to enter or remain on the site of the work unless the person is equipped with and wearing a safety helmet and other protective clothing and safety equipment conforming to the requirements of the District or regulatory agencies, and shall discharge from the site all persons not so equipped. The Contractor shall post conspicuous signs at appropriate locations warning the public and persons engaged upon the work of this requirement. The Contractor shall furnish for their temporary use such safety helmets, protective clothing, and safety equipment as the Engineer may request of him.
- G. Hazardous Areas  
The Contractor shall not permit or allow any person or persons to enter any pipe or space containing hazardous or noxious substances or gases, or where there is an insufficient amount of oxygen to sustain life and consciousness, or any other hazardous area unless equipped with lawful and appropriate safety equipment and life-supporting apparatus, and unless those entering are continually monitored and guarded by and in communication with other persons outside the space or area who are equipped in the same way, can give an alarm to others for assistance, and initiate immediate rescue operations in the event of mishap.
- H. Work During an Emergency  
The Contractor shall perform any and all operations and shall furnish any materials and equipment necessary during an emergency endangering life or property and, in all cases, shall notify the District of the emergency as soon as practical, but shall not wait for instruction before proceeding to properly protect both life and property. Any additional compensation or extension of contract time claimed by the Contractor on account of an emergency shall be applied for as provided in the specifications.
- I. Compaction Tests  
All compaction tests required by either the governing agency having jurisdiction over the right-of-way or by the District shall be performed by the District or its agent at District expense. However, in the event these tests prove the compaction to be unacceptable to either the governing agency or the District, all subsequent tests required by the governing agency or the District shall be performed at the Contractor's expense.

Tests will be scheduled within 24 hours of the Contractor's request for tests, at locations to be selected by the District and/or the governing agency. However, tests shall not be scheduled until a minimum 4-hours work is available for the testing laboratory, as determined by the Engineer. Results of these tests shall then be available within 48 hours.

In-place soil densities shall be determined by the sand cone method of test in accordance with currently adopted ASTM Standard D-1556, or by the nuclear method of test in accordance with ASTM Standard D-2922.

Optimum soil moisture-compaction relations shall be determined by the method of test specified in ASTM Standard D-1557, except as otherwise specified in the Special Conditions.

Soils testing provided by EMWD to determine compliance with the requirements of this specification does not relieve the Contractor of his/her responsibility.

In accordance with provisions for guarantee of the work, the Contractor shall return at his expense to correct any backfill conditions subsequently found to be substandard by either failure or more extensive testing. The Contractor shall provide all labor and equipment necessary to prepare for all tests and to assist the soils engineer in taking the tests, as directed by the Engineer.

J. Clean-up During Construction

The Contractor shall keep the premises occupied by him in a neat and clean condition, and free from unsightly accumulation of rubbish. Upon completion of the work and before the final estimate is submitted, the Contractor shall, at his own cost and expense, satisfactorily dispose of or remove from the vicinity of the work all plants, buildings, rubbish, rock, unused and excavated materials belonging to him or used under his direction during the construction, and in the event of his failure to do so, the same may be removed and disposed of by the District at the Contractor's expense. Contractor's responsibility shall include satisfactory disposal of all debris or protective material resulting from material delivery such as plastic wrappings, pipe stulls, etc., whether or not the Contractor furnished such material.

The Contractor shall carry on his operations in such sequence and in such manner as to interfere as little as possible with other improvements. When the construction is adjacent to or on residential property or cultivated fields or orchards, disposal of material and backfill operations shall be performed in such manner as to restore the properties to their original condition as nearly as practical as determined by the Engineer. Topsoil shall be carefully removed, stockpiled, and replaced after the backfill is placed.

As a part of the clean-up operation on facilities in private right-of-way, the Contractor shall restore the soil the full width of the right-of-way to a mechanical condition equivalent to that which existed at the time of the construction operations on such areas, by thoroughly loosening the soil with subsoilers, or other acceptable means and by discing and leveling if necessary, any stones, gravel, or other deleterious material left in spoil banks. On such lands debris shall be removed by the Contractor before his final preparation of the soil and shall be disposed of as required for excavated materials.

In unimproved areas the finish surfaces over pipelines shall be graded to drain surface water away from the center line of the actual trench and provide drainage away from all the structures. No ponding of surface water will be allowed within the construction right-of-way.

Contractor shall complete total trench restoration (original condition or better) within 1,320 feet of trench heading or within 10 working days of construction, whichever represents the least amount of time. Failure of the contractor to comply with the Engineer's cleanup orders may result in an order to suspend work until the condition is corrected. No additional compensation will be allowed as a result of such suspension.

**END OF SECTION 02201**

Revised 02/95

**SPECIFICATIONS - DETAILED PROVISIONS**  
**Section 02221 - Trenching, Backfilling, and Compacting**

**C O N T E N T S**

<b>PART 1 - GENERAL .....</b>	<b>1</b>
1.01 SUMMARY .....	1
1.02 STRUCTURE PROTECTION .....	2
1.03 JOB CONDITIONS .....	2
1.04 GUARANTEE .....	3
<b>PART 2 - PRODUCTS.....</b>	<b>3</b>
2.01 MATERIALS .....	3
<b>PART 3 - EXECUTION.....</b>	<b>4</b>
3.01 WEATHER LIMITATIONS .....	4
3.02 PREPARATION.....	4
3.03 CONSTRUCTION.....	4
3.04 FIELD QUALITY CONTROL.....	9

**SECTION 02221**  
**TRENCHING, BACKFILLING, AND COMPACTING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Trench, backfill, and compact as specified herein and as needed for installation of underground utilities associated with the work.
- B. Verification of Existing Conditions. It shall be the responsibility of the Contractor to examine the site of the work and to make all investigation necessary, both surface and sub-surface, to determine the character of materials to be encountered and all other existing conditions affecting the work.
- C. Lines, Grades and Measures. All lines and grades will be established by the Engineer, and the Contractor shall provide him with such assistance and materials as may be required. The Contractor shall carefully preserve all survey stakes and reference points. SHOULD ANY STAKES OR POINTS BE REMOVED OR DESTROYED BY ANY ACT OF THE CONTRACTOR OR HIS EMPLOYEES THEY MAY BE RESET AT THE CONTRACTOR'S EXPENSE.
- D. Compliance with Regulations. The Contractor shall familiarize himself, and comply with all applicable federal, state, county and municipal rules and regulations pertaining to sanitation, fire protection, and safety.
- E. Contractor's Equipment. The Contractor shall provide such modern plant and equipment as may be necessary in the opinion of the Engineer to perform in a satisfactory and acceptable manner, and in accordance with the specifications, all the work required of the Contractor.
- F. Representatives for Emergencies. The Contractor shall file with the District a written list giving the names, addresses, and telephone numbers of at least two (2) of his representatives who can be contacted at any time in case of emergency. The representatives shall be fully authorized and equipped to correct unsafe or inconvenient conditions on short notice. The Contractor shall promptly notify the District of all changes in the listing.
- G. Water Supply. The Contractor may obtain water for work under this specification from the sources as stated in the Special Provisions and Requirements of this specification.

Trenching, Backfilling, and Compacting  
Section 02221 – 2

1.02 STRUCTURE PROTECTION

- A. Contract Drawings. The drawings identify the various pipes, conduits, and other existing utility structures as they are supposed to exist in construction areas, but no error or omission on said drawings shall be construed to relieve the Contractor from the responsibility of protecting any such pipe, conduit, or other existing utility structures.

When deemed necessary by the Engineer, revisions of the contract drawings and additional detailed drawings will be issued to the Contractor during the progress of the work.

- B. Notification of Underground Service Alert of Southern California. When performing underground work, the Contractor shall call Underground Service Alert (USA), the one-call underground facility locating service two (2) working days prior to making an excavation. Contractor shall be responsible for such notification of sub-contractor's work, or shall require sub-contractor to assume this responsibility.
- C. Operation of Utilities. No District valves, or appurtenances of other utility facilities shall be operated by the Contractor without approval and/or instruction from the District or the utility, as appropriate.

1.03 JOB CONDITIONS

- A. Safeguarding Excavations and Property. Excavations shall be adequately shored and braced so that the earth will not slide or settle and so that all existing improvements of any kind will be fully protected from damage. Any damage resulting from a lack of adequate shoring and bracing shall be the responsibility of the Contractor. The Contractor shall affect all necessary repairs or reconstructions at the Contractor's own expense as directed by the Engineer and shall bear all other expenses resulting from such damage.
- B. Safety Measures. Each bid proposal submitted under these specifications for the construction of a pipeline, sewer, sewage disposal system, boring and jacking pits, or similar trenches or open excavations, or the use of such a trench or open excavation, shall include in appropriate bid items for such work the costs necessary to provide adequate sheeting, shoring, and bracing, or equivalent method for the protection of life or limb, which shall conform to applicable safety orders, including the Construction Safety Orders of the California Division of Industrial Safety, in accordance with the requirements of the California Occupational Safety and Health Act.

#### 1.04 GUARANTEE

The Contractor hereby guarantees that the entire work constructed by him under the contract will fully meet all the requirements thereof as to quality of workmanship, and of materials furnished by him.

### **PART 2 - PRODUCTS**

#### 2.01 MATERIALS

- A. Select Backfill Material, and Special Bedding and Backfill. Select backfill material shall be selected from the excavated material or imported when not available from the excavated material. In either case, it shall be provided at the Contractor's expense, and shall be included in the costs proposed for pipeline installation on the bidding sheets.

Provide soil materials free from organic matter and deleterious substances, containing no rocks over 3" in greatest dimension, and with no more than 15% of the rocks over 2" in their greatest dimension.

Where called for on the plans or in these specifications, and not covered by a separate bid item, special bedding or backfill shall be included in pipeline construction costs on the bidding sheets.

Where required by the governing agency or by the District to meet compaction requirements of these specifications, or requirements of these specifications for bedding or for select granular backfill, special bedding or imported backfill and disposal of excavated spoil shall be provided at the Contractor's expense.

The requirements for special bedding and backfill at the Contractor's expense as described herein as a part of the Special Conditions or as shown on the Contract Drawings shall supersede and take precedence over any and all other requirements for measurement and/or payment for special bedding or backfill found elsewhere in these specifications. Bedding is defined herein to include sand, rock or concrete base, cradle, or encasement. Backfill material is defined herein to include backfill for both trench backfill and pipe bedding (or pipe zone backfill).

Special bedding or backfill not called for on the plans or in these specifications, but required by the Engineer over and above the requirements of this specification, shall be constructed at additional cost, at prices reflecting current material costs as evidenced by paid vouchers, plus 50% to cover all costs of installation and overhead.



Trenching, Backfilling, and Compacting  
Section 02221 – 4

The encounter of ground water not anticipated in engineering reports made available for this contract, and the required over-excavation and construction of a stable base as determined necessary by the Engineer shall be considered over and above the requirements of this specification, and the required base shall be paid for at the above stipulated prices.

**PART 3 - EXECUTION**

**3.01 WEATHER LIMITATIONS**

Excavating and grading shall be performed only when the weather conditions do not adversely affect the quality of the finished product. Any graded or excavated areas that are damaged by the effect of rain, or other weather conditions, during any phase of the construction, shall be re-excavated, regraded, and recompactd to conform to the herein specified requirements, without additional cost to the District.

**3.02 PREPARATION**

- A. Control of Water. The Contractor shall acquire such permits and take such measures as may be required, and shall furnish, install, and operate such pumps or other devices as may be necessary to remove any seepage, storm water, or sewage that may be found or may accumulate in the excavations during the progress of the work. The Contractor shall keep all excavations entirely free from water at all times during the construction of the work and until the Engineer gives permission to cease pumping.

He shall keep the complete work reasonably free from accumulations of water and sewage, and shall free it entirely at such times as may be required by the Engineer for inspection or other purposes. Any accumulated water or sewage thus pumped shall be disposed of in accordance with good practice and local ordinances.

The Contractor shall provide an adequate dewatering system for the control of surface and groundwater seepage into the excavations as may be required during the construction period. The proposed plan of this dewatering system shall be submitted to the Engineer for concept approval prior to the installation of the system.

**3.03 CONSTRUCTION**

- A. Excavation. The Contractor shall perform all excavation necessary or required for the construction of the facilities covered by these specifications. Excavations may be performed by either hand or machine methods and shall be of sufficient size to provide adequate space for working in accordance with safety regulations

and practice and the Contract Drawings. Excavations shall include the removal and disposal of all materials of whatever nature and quantity including water, rock, decomposed granite, or any other type of soil or material, subsurface obstructions and also overhead obstructions which may interfere with the operation of equipment used on the work. Excavation for foundations shall be made only after construction of subgrade, as hereinafter described, has been completed. Over excavation for foundations shall be filled with concrete.

1. Trench Excavation. Unless otherwise specified in the Special Conditions or on the Contract Drawings, pipeline trenches shall have a minimum clear distance of 6" and a maximum of 9" on each side of the pipe barrel when the pipe is properly placed and aligned in conformity with the Contract Drawings.

The maximum length of trench which shall be opened or partially opened at any one time shall be limited to 500' for sewer lines and one-half mile for water pipelines, except where governed by other agencies or approved by the Engineer. Bell holes or depressions shall be dug by hand at the proper locations of sufficient size to adequately work the joints, but no larger than is required.

When the trench is excavated to the line and grade as shown on the drawings, and the bedding material encountered is rock, the trench shall be excavated an additional depth of at least 4" below the grade for the bottom of the pipe, and the bottom of the trench shall be refilled with approved material, moistened and compacted by tamping or by other approved method to the satisfaction of the Engineer.

Where ground water is encountered and the native material does not afford a solid foundation for pipe subgrade as specified above, the Contractor shall excavate to such depth below subgrade as determined necessary by the Engineer and shall construct a stable base by placing crushed rock bedding upon which subgrade can be prepared. Crushed rock for bedding shall be one and one-half inch (1 1/2") maximum size.

When the trench has been inadvertently excavated below the designed grade, at the Contractor's expense, the bottom of the trench shall be refilled with approved material, well compacted into place in an approved manner and to the satisfaction of the Engineer.

Where it becomes necessary to excavate beyond the limits of normal excavation lines in order to remove boulders or other interfering objects, backfill the voids remaining, as directed by the engineer but not less than 90% of maximum compaction. This work is to be done at no extra cost to owner.

Where trenching occurs in existing turf areas, remove turf in sections and keep roots damp. Replace turf upon completion of backfilling.

Trenching, Backfilling, and Compacting  
Section 02221 – 6

2. Cover. Provide minimum trench depth indicated below to maintain a minimum cover over the top of each listed utility, unless otherwise indicated in specifications or on the drawings.

- |    |                      |     |
|----|----------------------|-----|
| a) | 1. Water lines:      | 48" |
| b) | 2. Gas lines:        | 24" |
| c) | 3. Electrical lines: | 36" |

3. Excavated Materials. Shall be piled neatly along the side of the trench and adjacent to manhole excavations in such a manner as to be of as little inconvenience as possible to the public traffic or the occupants of the adjacent property.

Through all cultivated areas, topsoil removed from excavations shall be replaced as backfill in the uppermost part of the excavation to a depth as it existed previous to excavation, not exceeding 18". Where topsoil replacement is required, excavated topsoil shall be stored separately from other materials and in general shall be replaced as backfill in the same parcel of land from which it came.

4. Disposal of Excavated Materials. Insofar as space is available in the right-of-way, such space may be used for temporary storage of excavated material, to be used for backfill, provided that no material shall be stored or deposited in violation of any ordinance or regulation prohibiting the filling or obstructing of water courses in drainage channels. All materials removed from the excavations in excess of that stored temporarily as above specified shall be immediately hauled away and used in backfilling elsewhere, or, if not used, shall be disposed of by the Contractor. The disposal area shall be acquired by the Contractor.

No materials shall be disposed of either temporarily or permanently on privately or publicly owned property unless the Contractor shall first obtain permission therefore from the owner or agency concerned. The Contractor shall furnish satisfactory evidence to the Engineer that such consent has been obtained and shall be responsible for all damages and claims that may arise in connection therewith.

5. Bracing and Shoring. The Contractor shall furnish, place and maintain such bracing and shoring as may be required to support the side of the excavations for the proper protection of workmen, to facilitate the work and prevent damage to the pipes and manholes being constructed, and to prevent damage to adjacent structures or facilities. Upon completion of the work, all bracing and shoring shall be removed unless otherwise directed or permitted by the Engineer.

Trenching, Backfilling, and Compacting  
Section 02221 - 7

- B. Fill, Backfill and Grading shall include all scarifying, moistening, compacting, and other manipulations of the soil necessary to obtain the required densities, cross sections, lines, grades and surface finish indicated or specified.

Backfill shall not be placed in trenches or excavations until the pipelines and structures in the particular section involved have been inspected and approved for backfilling by the Engineer.

All excavations outside the completed pipelines and structures shall be backfilled with compacted material to the level of the original ground surface unless otherwise shown on the drawings or ordered by the Engineer. The materials used for backfill shall be imported, selected material, or approved selected excavated materials and shall be placed as directed by the Engineer. All materials placed within 6" of the pipe or structure shall be free from rocks or boulders larger than 1 1/2" maximum dimension, and from unbroken masses of earthy materials which might lodge and thereby cause unfilled pockets in the excavation.

Unsuitable material encountered at the surface upon which the bedding material is to be placed shall be removed to a depth as determined in the field by the Engineer. Unsuitable material shall be as determined by the Engineer. If not otherwise specified, removal of material and additional bedding so ordered over and above the amount required will be paid for in accordance with the specifications unless, however, the necessity for such additional bedding materials has been occasioned by an act or failure to act on the part of the Contractor, in which event the Contractor shall bear the expense of the additional excavation and backfill to the required depth. The Contractor's attention is called to "dewatering" procedures to ensure that an otherwise stable foundation will not be rendered unfit due to accumulation of water in the trench excavation.

Imported materials (if any) required for fill or backfill shall be provided by the Contractor from areas outside the site at his own expense. Such material shall be as herein specified and must be approved by the District before delivery to the site.

1. Structure Backfill. The Contractor shall place all backfill about structures to the original ground level, or to the lines shown on the drawings or prescribed by the Engineer. Fill materials shall be of earth only, and be free from debris, vegetation, alkali, or other deleterious substances.

All backfill about structures shall be placed in layers not more than 6" thick prior to compaction, which shall be obtained by moistening to optimum moisture content prior to placing and compacting to maximum compaction by use of suitable equipment approved by the Engineer.

The Contractor shall take all necessary precautions to protect the structure and underground facilities during the placement, compacting or consolidating, and grading of backfill.

Trenching, Backfilling, and Compacting  
Section 02221 - 8

2. Pipeline Backfill. Except as otherwise required by the construction plans or the standard drawings, the material used in backfilling to 1' above the pipe shall be cohesionless, sandy, or sandy gravel material obtained from required excavation or from approved borrow areas, as shown on the Contract Drawings or as directed by the Engineer. This material shall be carefully placed and compacted to provide a firm continuous bedding and encasement for the pipe. Pipe shall be shaded the same day it is laid to protect it from possible damage and/or thermal expansion. Pipe zone backfill shall be consolidated by mechanical tamping.

Deposit approved backfill and bedding material, in the lower portion of the trench, in layers of 6" maximum thickness, and compact with suitable mechanical tampers to a density not less than 85%, or grade as specified in special conditions of contract, until there is a cover of not less than 24" for sewer lines and 12" over other utility lines. Care must be taken to not damage the pipe.

The remaining trench backfill shall consist of select backfill material from the excavation, when available, free from stones or lumps exceeding 3" in greatest dimension, and free from vegetable matter or other unsatisfactory material. This select material as defined herein and elsewhere in these specifications, shall be placed in layers not exceeding 9" in depth, unless otherwise directed by the Engineer. Each lift shall be consolidated in such a manner that the backfill will meet the requirements of 90% maximum compaction. Care shall be taken not to disturb the backfill previously placed, and the Contractor shall at all times protect the pipe against flotation. All material from failed test to successful test shall be removed, recompacted and retested.

3. Compacting and Surfacing. Except as otherwise specifically required by the encroachment permit or elsewhere in these specifications, the following requirements will apply:

The upper portion of the final lift will be backfilled with selected material from the excavation, moistened to optimum moisture content and compacted by mechanical tamping to meet the requirements of the District standards, of 95% maximum compaction. All backfill in public roads shall be consolidated and surfacing shall be placed to meet State of California and Riverside County requirements as stated in the respective permit, whether or not required by the inspector for that particular agency - unless otherwise approved by the Engineer.

Where backfill is in areas not within public roads, it shall be consolidated and tested to meet the requirements of these specifications, except as otherwise approved by the Engineer.

Minimum acceptable field densities specified in District standards shall be determined in accordance with the testing procedures set forth elsewhere in these specifications.

Where sand material of an approved grade is used for backfilling, mechanical compaction may be eliminated and compaction obtained by jetting.

Except as otherwise directed by the Engineer, after a period of not less than 30 days or more than 60 days, any settlement shall be filled with decomposed granite.

### 3.04 FIELD QUALITY CONTROL

- A. Contractor's Responsibility for Safety. The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work. This requirement will apply continuously 24 hours a day every day until final acceptance of the work and shall not be limited to normal working hours.
- B. Warnings and Barricades. The Contractor shall provide and maintain barricades, guards, temporary bridges and walkways, watchmen, night lights and danger signals illuminated from sunset to sunrise, and all other necessary appliances and safeguards to protect the work, life, property, the public, excavations, equipment, and materials. Barricades shall be of substantial construction and shall be painted such as to increase their visibility at night. Suitable warning signs shall be so placed and illuminated at night as to show in advance where construction, barricades, or detours exist. Guard rails shall be provided for bridges and walkways over or adjoining excavations, shafts, and other openings and locations where injury may occur.
- C. Compaction Tests. All compaction tests required by either the governing agency having jurisdiction over the right-of-way or by the District shall be performed by the District or its agent at District expense. However, in the event these tests prove the compaction to be unacceptable to either the governing agency or the District, all subsequent tests required by the governing agency or the District shall be performed at the Contractor's expense.

Tests will be scheduled within 24 hours of the Contractor's request for tests, at locations to be selected by the District and/or the governing agency. However, tests shall not be scheduled until a minimum 4-hours work is available for the testing laboratory, as determined by the Engineer. Results of these tests shall then be available within 48 hours.

In-place soil densities shall be determined by the sand cone method of test in accordance with ASTM Standard D-1556-64, or by the nuclear method of test in accordance with ASTM Standard D-2922-071.

Trenching, Backfilling, and Compacting  
Section 02221 – 10

In accordance with provisions for guarantee of the work, the Contractor shall return at his expense to correct any backfill conditions subsequently found to be substandard by either failure or more extensive testing. The Contractor shall provide all labor and equipment necessary to prepare for all tests and to assist the soils engineer in taking the tests, as directed by the Engineer.

In unimproved areas the finish surfaces over pipelines shall be graded to drain surface water away from the center line of the actual trench and provide drainage away from all the structures. No ponding of surface water will be allowed within the construction right-of-way.

Contractor shall complete total trench restoration (original condition or better) within 1,320 feet of trench heading or within 10 working days of construction, whichever represents the least amount of time. Failure of the contractor to comply with the Engineer's cleanup orders may result in an order to suspend work until the condition is corrected. No additional compensation will be allowed as a result of such suspension.

**END OF SECTION 02221**

Revised 02-95

**SPECIFICATIONS - DETAILED PROVISIONS**  
**Section 02242 - Cement Stabilized Sand Bedding/Backfill**

**C O N T E N T S**

<b>PART 1 - GENERAL</b> .....	<b>1</b>
1.01 DESCRIPTION.....	1
<b>PART 2 - PRODUCTS</b> .....	<b>1</b>
2.01 Cement.....	1
2.02 Sand.....	1
2.03 Water.....	2
2.04 Sand-Cement Mixture Product.....	2
2.05 Mix Design.....	2
<b>PART 3 - EXECUTION</b> .....	<b>2</b>
3.01 PLACEMENT.....	2
3.02 PERFORMANCE.....	2
3.03 TESTING.....	2
3.04 MEASUREMENT AND PAYMENT.....	2



**SECTION 02242**  
**CEMENT STABILIZED SAND BEDDING/BACKFILL**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

Cement stabilized sand shall be used for backfill and bedding as called for by the plans and specifications, or as directed by the Engineer. This section provides for the use of cement-sand as bedding material around gravity sewer pipes constructed in open cut installations; for backfilling material around sewer pipes constructed in open cut installations, manholes, inlets, and drainage structures (if required), and for backfill in pavement sections.

**PART 2 - PRODUCTS**

**2.01 CEMENT**

Cement shall consist of Type I, II or V Portland Cement conforming to ASTM C 150.

**2.02 SAND**

Clean, durable sand containing not more than the following:

**A. Deleterious Materials**

1. Clay lumps, ASTM C 142; less than 0.5 percent.
2. Lightweight pieces, ASTM C 123; less than 5.0 percent.
3. Organic impurities, ASTM C 40; shall not show a color darker than the standard color.

**B. Plasticity Index**

Plasticity index shall be six (6) or less when tested in accordance with ASTM D 4318.

**C. Gradation Requirements**

**ASTM C-33 Concrete Sand**

100% Passing - 3/8" Sieve  
Less than 5% Passing - No. 200 Sieve  
MINIMUM SAND EQUIVALENT OF 30

Cement Stabilized Sand Bedding/Backfill  
Section 02242 - 2

2.03 WATER

Water shall be free of oils, acids, alkalies, organic matter or other deleterious substances.

2.04 SAND-CEMENT MIXTURE PRODUCT

Sand-cement mixture shall consist of the proper percentage of cement per cubic yard or per ton of sand with sufficient water to hydrate the cement. A minimum of one and one-half (1.5) sacks of cement per ton of sand will be required.

2.05 MIX DESIGN

Contractor shall provide a sample of the proposed dry mix to the Engineer for testing and approval prior to construction. These tests will be used to derive the Proctor curve.

**PART 3 - EXECUTION**

3.01 PLACEMENT

Cement stabilized sand shall be placed around HDPE pipelines where depth of cover exceeds 20 feet in a manhole reach unless otherwise stated. The cement stabilized sand bedding shall surround 42" and smaller HDPE pipe by a minimum of 12" on top and both sides and by 6" on the bottom. The cement stabilized sand bedding shall surround HDPE pipe larger than 42" by a minimum of 18" on top and both sides and by 12" on the bottom. Bedding shall be placed in 6" to 8" lifts with 3% moisture or less, and compacted mechanically to achieve ninety-five (95%) Standard Proctor Test (ASTM D 698). Sand cement mixture shall be brought to the level required by the plans if different than the aforesaid minimums.

3.02 PERFORMANCE

Sand-cement mixture shall produce a minimum unconfined compressive strength of one hundred pounds per square inch (100 psi) in forty-eight (48) hours when compacted to ninety-five (95%) Standard Proctor Test (ASTM D 698) without additional moisture control, cured (ASTM C 31, Item 9), and tested in accordance with ASTM C 31.

3.03 TESTING

Random samples of the product will be taken in the field by the Engineer and tested.

3.04 MEASUREMENT AND PAYMENT

Cost of cement stabilized sand will not be paid directly, but shall be considered incidental to various bid items offered in the proposal.

**END OF SECTION 02242**

Revised 030907

**SPECIFICATIONS - DETAILED PROVISIONS**  
**Section 02252 - Control Density Fill**

**C O N T E N T S**

<b>PART 1 - GENERAL .....</b>	<b>1</b>
1.01 DESCRIPTION .....	1
1.02 UTILITY TRENCH CDF MIX DESIGN .....	1
<b>PART 2 - PRODUCT .....</b>	<b>1</b>
2.01 PORTLAND CEMENT .....	1
2.02 AGGREGATES .....	1
2.03 WATER .....	2
2.04 ADMIXTURES .....	2
2.05 FLY ASH .....	2
<b>PART 3 - EXECUTION .....</b>	<b>2</b>
3.01 MIXING .....	2
3.02 TESTING .....	2
3.03 PLACEMENT .....	2

**SECTION 02252  
CONTROL DENSITY FILL**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

Control Density Fill (CDF) is used as a low strength, self consolidating fill material for confined spaces which can be easily excavatable at a later time. CDF is characterized by a high maximum slump of 8 inches. CDF is not a structural concrete and should not be used in such applications.

CDF may be used as a trench backfill, structural backfill, pipe bedding, or pipe filling for abandonment in place. CDF shall consist of Portland cement, aggregates, water and fly ash. Chemical admixtures and other mineral admixtures may be used.

The actual mix proportions and flow characteristics shall be determined by the producer of the CDF to meet site conditions. Mix designs and performance tests shall be submitted to the Engineer for approval.

**1.02 UTILITY TRENCH CDF MIX DESIGN (PER CUBIC YARD)**

- |                       |                 |
|-----------------------|-----------------|
| A. Cement             | 50 – max lbs    |
| B. Fly Ash (Type F)   | 50 - 150 lbs    |
| C. Total Mix Water    | 35 gallons Max. |
| D. Stable Air Content | 20 - 30%        |

CDF shall be hand excavatable and shall contain aggregate no larger than 3/8 inch and the 3/8 inch aggregate shall comprise no more than 20 percent of the total aggregate content.

**PART 2 - PRODUCT**

**2.01 PORTLAND CEMENT**

Portland cement shall conform to the requirements of Section 03300, Part 2.01 A of the EMWD Specifications.

**2.02 AGGREGATES**

Aggregates shall conform to the requirements of Section 03300, Part 2.01 B of the EMWD Specifications, except as follows. Aggregates shall be pretested in CDF mixtures similar to those anticipated for the work, confirming their ability to perform as required for the specific application. Aggregates not in conformance with Section 03300 may be used when approved by the Engineer, providing the material has a minimum sand equivalent of 20, the percentage passing the No. 200 sieve does not exceed 12 percent, and the fines are non-plastic.

Control Density Fill  
Section 02252 – 2

**2.03 WATER**

Water shall be free of oils, acids, alkalies, organic matter or other deleterious substances.

**2.04 ADMIXTURES**

Admixtures shall conform to the requirements of Section 03300, Part 2.01 C of the EMWD Specifications.

**2.05 FLY ASH**

Fly ash shall conform to the requirements of ASTM C 618, Class F. Fly ash as a percent by weight of total cementitious material, shall not exceed 20 percent.

**PART 3 - EXECUTION**

**3.01 MIXING**

Mixing shall conform to the requirements of Section 03300, Part 2.03 of the EMWD Specifications, except for the one and one-half hour time limit specified in Paragraph B of Part 2.03. Unless otherwise specified, under conditions contributing to quick setting, the Engineer may specify a time limit, not to exceed two and one-half hours.

When CDF is used underneath a paved public right-of-way, the mixture shall contain a minimum of 25 pounds per cubic yard of cement when using washed concrete sand.

Adjustment of the mixture to achieve improved placement characteristics shall be through the use of chemical admixtures. No increase in water content or water to cement ratio will be allowed.

**3.02 TESTING**

CDF shall be tested for plastic unit weight. Plastic unit weight shall not deviate more than  $\pm 10$  percent of theoretical unit weight shown on the approved mix design. Unit weight shall be determined in accordance with ASTM C138.

CDF's consistency shall be tested by the slump method. The slump shall be measured in accordance with ASTM C143.

**3.03 PLACEMENT**

CDF may be placed by chutes, conveyors, buckets or pumps depending upon the application and accessibility.

For trench backfill, CDF shall be placed continuously. To contain CDF when filling long open trenches or open ended structures in stages, the end points shall be adequately bulkheaded to prevent movement. Methods may include bulkheading with sandbags, earth dams, forms or stiffer mixtures of CDF. CDF shall be placed from the centerline of mainline utilities to the bottom of the excavation.

For bedding, CDF shall be placed in a manner to prevent flotation or displacement of the embedded item. Methods of preventing flotation or displacement may include placement of CDF in lifts, faster setting CDF or lower slump CDF over the embedded item.

For backfilling of pipelines to be abandoned in place, CDF shall be pumped into the pipeline to be abandoned. It is intended that the disconnected ends of the pipeline shall be the primary means for injecting CDF into the pipeline. The Contractor may excavate for additional injection points along the pipeline. The pipeline shall be filled uniformly to within 90 percent of the pipe soffit. The lack of voids (other than the top 10 percent) shall be demonstrated to the Engineer by breaking out small sections of pipeline in various critical locations.

Pavement may be placed directly upon the CDF as soon as the surface will withstand the paving process without displacement or disruption. If the placement of the CDF is not completed in time to allow permanent paving to be completed the same day, the Contractor shall prevent traffic contact with the CDF until paving is completed.

**END OF SECTION 02252**

**SPECIFICATIONS - DETAILED PROVISIONS**  
**Section 02718 - Installation of Water Pipeline**

**C O N T E N T S**

<b>PART 1 - GENERAL .....</b>	<b>1</b>
1.01 DESCRIPTION .....	1
1.02 QUALITY ASSURANCE .....	1
1.03 SUBMITTALS .....	1
1.04 PRODUCT DELIVERY .....	2
1.05 JOB CONDITIONS .....	3
1.06 PAYMENT .....	3
1.07 GUARANTEE .....	6
<b>PART 2 - PRODUCTS &amp; MATERIALS .....</b>	<b>6</b>
2.01 SERVICE CONNECTIONS .....	6
2.02 FLANGE X HUB-END VALVES .....	6
2.03 PORTLAND CEMENT CONCRETE .....	6
2.04 CEMENT MORTAR PIPE JOINTS .....	7
2.05 LOCATOR WIRE .....	8
2.06 TELEMETRY CABLE .....	9
2.07 POLYETHYLENE ENCASEMENT .....	9
2.08 JOINT BONDS .....	9
<b>PART 3 - EXECUTION .....</b>	<b>9</b>
3.01 GENERAL .....	9
3.02 BEDDING PIPE .....	10
3.03 RUBBER GASKET PIPE JOINTS .....	11
3.04 CURVES, ANGLES, CLOSURES AND SHORT SECTIONS .....	12
3.05 WELDING .....	12
3.06 JOINT INSPECTION .....	13
3.07 FIRE HYDRANT RUNS .....	13
3.08 FLANGE, FITTING AND BOLT CORROSION PROTECTION .....	13
3.09 VALVE CAP AND RISER INSTALLATION .....	14
3.10 SERVICE CONNECTION METER BOX LOCATIONS AND METER INSTALLATION .....	14
3.11 SERVICE CONNECTIONS .....	14
3.12 ELECTROLYSIS FACILITIES .....	14
3.13 TEMPORARY BUMPHEADS .....	14
3.14 FIELD HYDROSTATIC TEST .....	15
3.15 CHLORINATION .....	17
3.16 PIPE ENTRY RESTRICTIONS .....	20

**SECTION 02718  
INSTALLATION OF WATER PIPELINE**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

Under these specifications, the Contractor shall furnish all labor, material, equipment and tools required for the complete installation and testing of pipe and pipeline appurtenances and allied structures as stated on the Bidding Sheets, shown on the contract drawings or specified herein, and all within the contract time. The Contractor shall be responsible for all work specified herein and the orderly progress and completion of the work in accordance with an approved schedule of construction.

The work includes, but is not limited to, all excavation, backfill, disposal, resurfacing of roads and driveways, verification of utilities, installation of all pipe and pipeline fittings/specials such as crosses, tees, elbows, bends, joint restrainers, couplings, tapers, butt straps and all necessary cuts and welds. All anchorage for pipe, such as at the ends of lines, at crosses, tees, elbows, bends, etc., shall be sufficient to withstand all unbalanced forces. Unless otherwise approved by the Engineer, anchorage shall be provided by means of double pass, full welds of all steel pipe joints, restraint fittings for plastic (PVC) pipe, or ductile iron pipe, as required by the Contract Drawings and these specifications. The use of concrete anchorage in lieu of restrained joints will be considered on a case by case basis. All welding and restraint shall be included in the bid price for the installation of pipe.

It shall be the responsibility of the Contractor to furnish the District with accurate tie dimensions to all valves installed in the course of constructing this project.

Refer to Section 02201 of the District's standard specifications for requirements relating to Construction Methods and Earthwork.

**1.02 QUALITY ASSURANCE**

Contractor shall be responsible for the quality of all work of his forces and that of his subcontractors, for adherence to all laws and regulations, and for all public relations regarding the contract work, as set forth elsewhere in the Contract Documents.

**1.03 SUBMITTALS**

Shop drawings for all pipe and appurtenances shall be submitted pursuant to the requirements of the Contract Documents for Submittals, and shall show the materials, dimensions, stations and all relevant details.



1.04 PRODUCT DELIVERY

- A. Materials Furnished by the Contractor. Except as otherwise stated on the Bidding Sheet, all materials, including water pipe and appurtenances and service connections and appurtenances, shall be furnished in place by the Contractor, excepting service connection meters will not be furnished or installed by the Contractor. Materials to be furnished by the Contractor shall include that necessary for replacement of all obstructions, road surfacing, etc.

The Contractor shall furnish the Engineer, as soon as issued, duplicate copies of all orders placed outside the Contractor's plant for articles or materials to be furnished by the Contractor for incorporation in the work. The Contractor shall also furnish the Engineer with such additional information as reasonably may be required respecting the character of the material and progress of their procurement.

- B. Materials Furnished by the District. ONLY WHERE SHOWN ON THE CONTRACT DRAWINGS OR ON THE BIDDING SHEETS, OR ORDERED BY THE ENGINEER, the District will furnish any or all of the following materials necessary for the completion of the work under these specifications:

1. Cement mortar lined pipe, asbestos-cement pipe, ductile iron pipe, or PVC pipe with rubber gasket joints and gasket rings. Pipe will be delivered to the job site by the Pipe Supplier. Pipe to be unloaded and strung along trench site by Installation Contractor. Approximately 5% of each size of pipe will be furnished in the standard short lengths manufactured by the pipe supplier, except as otherwise requested by the Contractor.
2. Valves, flanges, gaskets, valve risers and caps, bolts, crosses, tees, bends, elbows, tapers, fire hydrant assemblies complete with valve and pipe, or air valve assemblies complete with piping and valves, etc.
3. Joint materials except for cement mortar.
4. Locating wire required for asbestos-cement pipe and PVC pipe systems.
5. Telemetry wire where noted on the construction drawings.

The Contractor shall, within seven (7) days after execution of the contract, meet with the Engineer for approval of his proposed schedule of construction and shall furnish the Engineer a written statement of the Contractor's requirements for delivery of materials and equipment to be furnished by the District with the dates upon which delivery of each class of said materials and equipment will be necessary in order to conform to the Contractor's program of construction.

Materials to be furnished by the District, except for pipe, will be delivered to the Contractor f.o.b. the Contractor's trucks at the District yard or warehouse, and the Contractor will sign for these materials received. No direct payment will be made to the Contractor for hauling or handling materials or equipment furnished by the District, but payment for such handling and hauling will be included in the prices named for the contract items wherein the materials and equipment are used. The Contractor shall be responsible for coordinating the delivery and the actual placement of all pipe in accordance with his requirements and construction schedule, shall properly barricade the pipe and other materials, and shall be responsible for any damage to property as a result of the unloading or placement of the pipe or other materials.

If the delivery of any materials or equipment specified herein to be furnished by the District shall be delayed by strikes, acts of God, or other causes beyond the control or without the fault or negligence of the District, the Contractor shall have no claim against the District for such delay in delivery, but shall be entitled to so much additional time wherein to perform and complete the contract on his part as the Engineer shall certify in writing to be just.

- C. Hauling and Handling Pipe. The Contractor shall protect all pipe from damage during hauling and handling. Dropping or bumping of pipe will not be permitted. Pipe will be handled with a two point pick-up with a six foot minimum spread. Slings or padded cable will be used so as not to damage exterior coating.

Pipe shall not be strung prior to blasting in those areas where blasting is required. Damaged pipe shall be replaced or repaired by the Contractor at his expense, and subject to approval by the Engineer.

#### 1.05 JOB CONDITIONS

Water Furnished by District. The District will make water available for construction at the locations stated in the Special Provisions.

#### 1.06 PAYMENT

- A. Measurement for Payment. Quantities for installation of pipelines and appurtenances on District-administered projects shall be measured for payment as specified herein and described on the Bidding Sheet:

1. Pipelines. Will be measured in place along the horizontal axis of the pipe by the linear foot, on the basis of pipeline completely installed and tested including earthwork, special bedding included in the work, pipe, gaskets, fittings, polyethylene encasement, specials, welding, concrete and miscellaneous materials. The measurement will be continuous through all valves and fittings.

Installation of Water Pipeline  
Section 02718 – 4

2. Valves. Will be measured on the basis of each gate valve or butterfly valve completely installed and tested including valve, valve riser and cap, earthwork and miscellaneous materials.
3. Air Valves. Will be measured on the basis of each air valve assembly completely installed and tested including tap-to main, piping, all valves, fittings, valve box, earthwork, and miscellaneous materials.
4. Fire Hydrants. Will be measured on the basis of each fire hydrant assembly completely installed and tested including tap-to-main, piping, valve, valve riser and cap, fittings, hydrant, earthwork and miscellaneous materials.
5. Blow-offs. Will be measured on the basis of each blow-off assembly completely installed and tested including tap-to-main, piping, valve, valve riser and cap, fittings, earthwork and miscellaneous materials.
6. Special Bedding. Will be measured on the basis of the cubic yards of special bedding required to bring the bedding up to grade for the trench size excavated up to the maximum size of trench allowable under these specifications. Only that special bedding for which there are stipulated costs, or for which special bid items are listed in the bid sheet will be measured for payment.

No allowance will be made for over-excavation except as directed by the Engineer, or for special bedding required in the contract work under other bid items.

7. Bore Casing. Will be measured on the basis of horizontal centerline distance and shall include all excavation, furnishing and placement of casing, furnishing and placement of all required back-packing and grouting around casing, backfilling within casing, pipe bracing, restoration of surfaces, and all labor and material for a finished job. Furnishing and installation of pipe within casing shall be included in pipeline measurement.
  8. Paving. Will be measured as a part of project causing removal and/or replacement of paving, except as otherwise specified on the Bidding Sheet.
- B. Payment. Payment for quantities for installation of pipeline and appurtenances on District-administered contracts will be paid for in the following manner. Quantities of items listed herein, measured as stated above and accepted, will be paid for at the unit bid prices as stated herein, which prices and payments shall constitute full compensation for furnishing all labor, equipment and tools necessary to complete the described work in place. No additional compensation will be paid above the unit bid prices for changes in quantities.

1. Pipelines. Quantities of pipelines will be paid for at the respective unit bid prices per horizontal linear foot for the kinds and sizes of pipe stated in the bidding sheet. Work includes all earthwork, installation and testing of pipe, specials, fittings, welding, anchors, removal and restoration of pavement, curbs, gutters and sidewalks, and clean-up. Payment for pipe in place shall be further broken down based upon the Contractor's submittal under Section F-10 of the General Conditions, as concurred by the Engineer, but not to exceed in the ordinary project the following percentages of the linear foot price stated on the Bidding Sheet:  

Trench excavation .....	10%
Pipe laid in place and shaded .....	65%
Trench Backfilled and the Backfill Compacted .....	20%
Testing and Clean-up, Exclusive of Pavement Replacement .....	5%
2. Fittings and Specials. Payments for quantities of fittings and specials shall be included in the payment for installation of pipelines. Work includes installation of bends, tees, crosses, joint restrainers, couplings, saddles, outlets, tapers, butt straps and all necessary cuts and welding and all earthwork, and no additional compensation will be made therefore.
3. Valves. Quantities of gate valves or butterfly valves will be paid for at the respective unit bid prices for the size of valves stated in the bidding sheet. Work includes installation of valves, valve risers and caps, saddles, flanges, gaskets, bolts, and all earthwork.
4. Air Valves. Quantities of air valve assemblies will be paid for at the respective unit bid prices for the size of air valves stated in the bidding sheet. Work includes installation of tap-to-main, valves, service stops, elbows, bends, valve boxes, and all piping.
5. Fire Hydrants. Quantities of fire hydrant assemblies will be paid for at the respective unit bid prices for the sizes of fire hydrants stated in the bidding sheet. Work includes installation of tap-to-main, valves, valve risers and caps, saddles, bends, flanges, gaskets, bolts, hydrants, and all piping.
6. Blow-offs. Quantities of blow-off assemblies will be paid for at the respective unit bid prices for the sizes of blow-offs stated in the bidding sheet. Work includes installation of tap-to-main, valves, valve risers and caps, fittings, earthwork and miscellaneous materials.

Installation of Water Pipeline  
Section 02718 – 6

7. Special Bedding. Quantities of special bedding measured as stated above and accepted, will be paid for at the stipulated cost price, or the respective unit bid price for the quantities as stated in the bidding sheet, which price shall constitute full compensation for all labor, materials, and equipment necessary to complete the work in place, including the special bedding material.
8. Bore Casing. Payment for bore casing in place measured as stated above shall be made as specified on the bidding sheet.
9. Paving. Payment for quantities of paving measured as stated above and accepted shall be included in the unit bid for pipeline. Work includes removal and/or restoration of paving and all earthwork, and no additional compensation will be made therefore, except as otherwise provided on the bidding sheet.

1.07 GUARANTEE

All work, materials, and equipment shall be guaranteed for the periods of time set forth elsewhere in the contract documents for General Guaranty or Warranty.

**PART 2 - PRODUCTS & MATERIALS**

2.01 SERVICE CONNECTIONS

Service connections to asbestos-cement pipe main shall be by prefabricated heavy tapped couplings for 3/4", 1" & 1/2" Meter Service Connections. Service connections to ductile iron pipe and PVC pipe shall be made using service saddles.

2.02 FLANGE X HUB-END VALVES

Where valves do not connect to fittings, the fitting may be hub-end, or flange x hub-end. However, where valves connect to cast iron or welded steel fittings, fittings shall be flanged. Where flange x hub-end valves are not available for use with asbestos-cement pipe, flanged valves shall be used with flange x hub-end adaptors. All fittings and valves for ductile iron pipe and PVC pipe shall be bolted mechanical joint type.

All valves shall be hung plumb, with the stems vertical.

2.03 PORTLAND CEMENT CONCRETE

Cast-in-place structures of plain and reinforced concrete shall conform to the requirements of Chapter 26 of the Uniform Building Code and ACI 318, unless otherwise approved by the Engineer.

Classes of concrete used in the construction of cast-in-place structures shall be proportioned as specified in Section 03300 of the District standard specifications.

## 2.04 CEMENT MORTAR PIPE JOINTS

Mortared joints shall meet the following requirements:

### A. Joint Mortar

1. Composition of mortar for caulking, buttering, or coating of joints shall be composed of cement, sand and water, well mixed and of such consistency as to produce a dense, homogeneous mortar that will adhere firmly to the pipe surface. Sufficient hand plastering of the joint prior to placing of the mortar is to be encouraged, to enhance the bond between the pipe and mortar.
  - a) Cement shall be Type V Portland Cement (sulfate resistant)
  - b) Water for mixing mortar shall be clean and free from mud, oil, organic material, or other deleterious substances.
  - c) Aggregate sand shall be silica sand passing at No. 16 mesh screen; or "plaster" sand at least 80% passing a No. 16 mesh screen; or other well graded inert, granular material produced from hard rock, with strong, durable, uncoated grains, upon prior approval of the District.
2. Proportions of cement and sand in joint mortar shall be one part of Portland cement to one and one-half parts of sand by volume. The exact proportion shall be determined by the characteristics of the sand used, and approved by the Engineer.
3. Water content shall be kept to the minimum allowing workability, as approved by the District, recognizing that better flow characteristics are required for placement in diapers around the pipe than for placement by caulking or buttering.
4. Mixing of the mortar should be long enough (approximately 3 minutes in paddle-type mixers, or 1 minute in turbine mixers) to obtain maximum plasticity. The mortar shall be used before initial set; therefore, only enough mortar shall be mixed at a time for immediate use even to the extent of discarding mortar already mixed in the event of delay in the pipelaying operation.

### B. Diapers shall be impervious if available.

1. Width of diapers, where used, shall be sufficient to allow cupping of the diaper for increased thickness of the joint mortar. Recommended minimum diaper widths:

Installation of Water Pipeline  
Section 02718 – 8

20" dia. pipe and larger:.....	12"
12" - 18" dia. pipe: .....	10"
10" dia. pipe and smaller: .....	9"

2. Mortar placement shall be from one side of the diaper, to allow the mortar to flow around the bottom and up the opposite side of the pipe, to preclude the possibility of any voids inside the diaper.

C. Curing operations shall begin immediately after completion of joint mortaring.

1. Immediate backfill should follow the completion of the joint mortaring operation where possible. Care must be taken to immediately wet down and consolidate the backfill, to avoid draining the moisture from the mortar through porous diapers into dry backfill soil, or disturbing the mortar set by subsequent compaction of the backfill.
2. Completed-joint mortar to be exposed to the sunlight where backfill will not take place until after the mortar has hardened must be kept continually moist during the curing period to prevent cracking of the curing mortar.

2.05 LOCATOR WIRE

Locator wire shall be installed over all waterlines, reclaimed waterlines and forcemains whether or not telemetry wire is buried with pipe. Locator wire per Standard Drawing B-656 shall be 14-1 solid insulated copper wire (UF), in a continuous strand, placed on top of pipe and secured with tape. Locator wire shall be brought to the surface at the edge of the right of way at 660 feet maximum on centers in Brooks No. 1-SP, or equal, valve boxes.

The valve boxes shall be placed within two feet of fire hydrants when fire hydrants are available at 660' or less on center. Where no fire hydrants are available, EMWD marker posts shall be installed within two feet of the valve boxes.

For subdivision construction, instead of the marker post, mark the face of the curb in front of the box with the letters "LW". Loop 2 feet of wire in valve box. Provide the inspector survey stations at each valve box for as-built drawings.

After all trench backfill operations are complete, the District shall pay for and conduct the locatibility test to confirm that the wire is continuous. The Contractor shall be responsible for all costs to confirm, locate and repair any breaks in the location wire identified in the locatibility test. In addition, the Contractor shall reimburse the District for all costs to retest repaired sections of the wire. The Contractor is advised to use care in the installation and backfilling operations to prevent damage to the wire.

#### 2.06 TELEMETRY CABLE

On District-administered contracts, the District will supply the telemetry cable for installation in accordance with these specifications and contract drawings. The telemetry cable will be delivered to the Contractor at the District's warehouse. Prior to acceptance and delivery of the cable, a continuity test will be performed by District personnel or the Contractor's representative. Certification of the test results will be acknowledged by the Contractor or his representative in writing. The Contractor will be responsible for the safe handling, installation and retesting for total continuity of the cable installation prior to acceptance by the District.

#### 2.07 POLYETHYLENE ENCASEMENT

All underground installed valves, ductile iron pipe and fittings shall be polyethylene encased at the time of installation. Polyethylene encasement and installation shall be in accordance with ANSI/AWWA C105/A21.5.

#### 2.08 JOINT BONDS

All metallic pipes shall be electrically continuous except at insulating flanges. All joints that are not welded shall have bonds to ensure continuity.

Cathodic test stations and/or Insulated Test Connection 4-wire test stations shall be installed at every half mile or less except where otherwise indicated on the plans.

#### 2.09 DROPS AND SIPHONS

All waterline drops and siphons larger than 12" shall be CML&C. A soil corrosivity report with recommendations shall be prepared by a corrosion engineer and submitted to the District for approval prior to construction.

### **PART 3 - EXECUTION**

#### 3.01 GENERAL

It shall be the responsibility of the Contractor, prior to start of construction, to meet with the Engineer:

- A. For approval of schedule of construction for work and completion of pipelines or sections thereof.
- B. To submit the required forms listed in the General Conditions.
- C. To coordinate delivery of District-furnished materials.
  1. Determine location and placing of the pipe to be unloaded and direction of placing bells;
  2. Determine the quantity of pipe to be placed in a particular location;
  3. Coordinate delivery of pipe and other materials to meet his construction schedule.



Installation of Water Pipeline  
Section 02718 – 10

- D. To furnish such additional information as may be required from time to time as construction progresses, regarding the progress of the procurement and delivery of the required equipment and materials, and/or the scheduling of the work.

Any subsequent shuttling of pipe, turning of bells, etc., will be at the Contractor's expense and no additional compensation will be allowed above the unit bid price, unless authorized by the Engineer in writing. All quantities shown on the Bidding Sheet and the contract drawings indicate the estimated quantities of materials for the completed pipelines in place.

3.02 BEDDING PIPE

- A. General. Each section of pipe shall be lowered into the trench in a manner that will prevent injury to the pipe, coating, or joints and shall be carefully bedded to provide continuous bearing and prevent uneven settlement. The inside of the pipe shall be clean and free from foreign material of any kind before being installed.
- B. Steel Pipe. For bedding steel pipe without encasement, the trench bottom shall be given a final trim such that each pipe section first laid will be continuously in contact with the ground along the bottom as shown on the drawings, provided that in the event ground is encountered which, due to its instability or other properties, but through no fault of the Contractor, cannot be trimmed in the prescribed manner or made to retain the specified shape, a 2-inch bedding or other suitable modification of the method of bedding the pipe will be ordered by the Engineer. Bellholes will be provided to prevent bridging the pipe supported at the bells.

Wherever, due to over-excavation or inaccurate trimming by carelessness in the operation of the Contractor's equipment or by his workmen, the shaping is inadequate to afford uniform support for the normal bedding of the pipe, the Contractor at his own expense, shall refill with sand, consolidate, and then reshape the trench bottom to the required section.

Pipe zone bedding shall be completed in accordance with the requirements of the District standards and/or the manufacturer's trench section bid submittal.

- C. Asbestos-Cement Pipe. Asbestos-cement pipe without encasement shall be installed in accordance with AWWA Spec. C603, shall be bedded in accordance with Section 3.2 of that specification for pipe laid on earth mounds, and in accordance with the standard drawings.
- D. Ductile Iron Pipe. Ductile iron pipe without encasement shall be installed in accordance with AWWA Spec. C600.

- E. PVC Pipe. PVC pipe without encasement shall be installed in accordance with ASTM D-2774-82.

For PVC pipe and ductile iron pipe with mechanical joints, the gasket shall be placed in the groove of the bell. Lubricate the spigot lead of the pipe, keeping it clean and free of dirt or sand and then insert the spigot end into the bell and force into position per manufacturer's recommendation.

- F. Tolerance. The pipe shall be accurately laid to alignment and grade shown on the drawings or established by the Engineer. Where grade stakes are provided with which to establish the proper pipeline grade, pipe shall be laid to grade within a tolerance of 0.1', or 0.2' cumulative deviation from elevations set by adjacent grade stakes. As ordered by the Engineer, the allowed tolerance may be greater than herein indicated for lines on steep grades, or less than herein indicated for the larger lines or lines on flat grades, where necessary to avoid air pockets.

### 3.03 RUBBER GASKET PIPE JOINTS

After the subgrade has been prepared as specified, the rubber gasket shall be placed in the groove on the spigot ring, and the spigot end of the pipe then entered into the bell of the adjoining pipe and forced into position. Care shall be taken to avoid twisting or cutting the gasket when jointing the pipe. The inside surface of the bell shall be lubricated with a compound of Sherwin-Williams Fluxsoap or approved equal which will facilitate the telescoping of the joint.

- A. Lining. For steel pipe smaller than 21 inches, buttering of joints with cement mortar and drawing sewer ball or an approved swab or squeegee through the pipe may be substituted in place of caulking and troweling. Water shall not be turned into the pipe until the inside joints have been properly cured.
- B. Coating. In the case of wrapped steel pipe, the outside joints shall be completely primed with Primer 1170 and wrapped with Protecto-Wrap.

In case of cement mortar coated steel pipe, the outside joints shall be completely coated with cement mortar using diapers as set forth in Article 2.04, Cement Mortar Pipe Joints.

All field coatings other than joint mortar shall be shaded with pipe zone backfill after their initial set, but prior to four (4) hours following installation, and properly protected during the shading operation. Joint mortar shall be cured as set forth in Article 2.04, Cement Mortar Pipe Joints.

Installation of Water Pipeline  
Section 02718 – 12

3.04 CURVES, ANGLES, CLOSURES AND SHORT SECTIONS

The laying of pipe on curved alignment by means of unsymmetrical closure of spigot into bell rings will be permitted. The amount of pull permitted from normal closure on one side of the joint will be up to 1/2" for 8" pipe or smaller, up to 3/4" for 10" through 21" pipe, and up to 1" for pipe 24" and larger; provided that the maximum deflection shall not exceed the manufacturer's recommendation. Where smaller radius of curvature is required, sections of pipe with beveled ends may be fabricated for the purpose and laid on curved alignment, unless fabricated bends are shown on the drawings or ordered by the Engineer. Beveled pipe may have a maximum bevel of five degrees measured from a plane perpendicular to the pipe's axis. The center of the short side of the bevel shall be marked on the joint bands. For the purpose of reducing the angular deflections at pipe joints and for closure sections, the Contractor shall be permitted to install pipe sections of less than standard length. Where such installations are allowed, Contractor shall be responsible for anchorage of the necessary joints, as directed by the Engineer. Curved Sections of PVC pipe shall be in accordance with AWWA C-900 and manufacturer's recommendations.

Closing courses and short sections of straight pipe shall be fabricated and installed by the Contractor as found necessary in the field and approved. Where closing pieces are required, the Contractor shall make all necessary measurements and shall be responsible for the correctness. Other than closing courses and short sections approved by the Engineer for field fabrication, all pipe and special fittings shall be fabricated in a shop approved by the Engineer for that purpose.

Asbestos-cement pipe cutting or beveling operations shall utilize tools that do not produce concentrations of airborne asbestos dust exceeding levels permitted by regulatory agencies.

PVC pipe shall be cut square, deburred and beveled in accordance with pipe manufacturer's recommendations. The pipe shall be cut in a neat and workmanlike manner without damage to the pipe.

3.05 WELDING

The Contractor shall be responsible for the quality of work performed by his welding organization. All welding operators shall be qualified under the Standard Qualification procedure of the American Welding Society. All welds shall be made by an electric shielded arc method of welding. When continuous welded pipe is specified, the Contractor shall use filler rods made of the same material as the cans, per the manufacturer's recommendations. No bending of the pipe shall be allowed.

All pipe welds at joints and fittings shall be double pass full welds. Welding shall be performed only after any mortar within two (2) feet has a 24-hour set.

The Engineer shall have the right at any time to call for and witness the making of test specimens by any welder in accordance with these specifications, and the expense of such tests shall be borne by the Contractor.

Welds considered by the Engineer to be deficient in quality, or made contrary to any mandatory provision of these specifications, shall be removed by chipping or melting, and shall be remade. The weld-metal shall be removed throughout its depth to expose clean base metal, but in case of a strictly local deficiency, the weld need not be removed throughout its entire length, provided that a sufficient amount shall be removed to insure that sound weld metal only remains. A cracked weld shall be removed throughout its length.

### 3.06 JOINT INSPECTION

For sizes smaller than 30 inch, Contractor must provide closed circuit television inspection (CCTV) as a post-construction method to determine if the pipeline has been installed as required and all joints have been properly finished. CCTV system shall have a rotating lens camera with articulating head. Each joint will be scanned 360 degrees. The television camera shall be specifically designed and constructed for water pipe inspection. The camera shall be operative in 100% humidity conditions. Lighting for the camera shall minimize relative glare. Lighting and camera quality shall be suitable to provide a clear, in focus picture of the entire periphery of the water pipe for all conditions encountered during the work. Focal distance shall be adjustable through a range from 6" to infinity. The remote reading footage counter shall be accurate to one percent (1%) over the length of the particular section being inspected. The camera, television monitor and other components of the color video system shall be capable of producing a minimum of 350 line resolution. Documentation consisting of a color video tape and a written report detailing the condition of the mainline and joints shall be submitted to EMWD for approval prior to pressure testing.

Any defects in the pipe lining or joints, shall be repaired and another video taken of the repaired section and submitted for approval by EMWD prior to pressure testing. **For domestic water systems, all video equipment must be certified for DOMESTIC WATER LINE INSPECTION ONLY, and NEVER to have been utilized in a non-potable system.**

### 3.07 FIRE HYDRANT RUNS

In asbestos-cement pipe, ductile iron pipe, and PVC pipe systems where thrust blocks are required, trenches shall be trimmed neat to avoid encroachment of the thrust block into the area of future utility trench assignment.

### 3.08 FLANGE, FITTING AND BOLT CORROSION PROTECTION

All corporation stops, valves and other appurtenances and fittings at the pipeline shall be primed, and wrapped with Protecto-Wrap No. 200 or 300 Coal Tar Resin tape. Bolts and nuts shall be protected using zinc caps anodes in accordance with section 15089.

Fittings and valves on pipeline shall be encased in alkalized sandslurry envelope between 12" and 18" thick. Composition 50 lb. hydrated lime per cubic yard of sand.

All bare iron and steel shall be field coated with one of the following as directed by the Engineer:

- A. Protecto-Wrap #1170 primer and #200 or #300 Coal Tar Resin tape; or

Installation of Water Pipeline  
Section 02718 – 14

- B. two coats of Koppers Supertank solution; or
- C. cement mortar meeting the requirements of Article 2.04.

3.09 VALVE CAP AND RISER INSTALLATION

In new subdivision developments, Contractor shall leave valve cans 3" minimum below rough-graded subgrade street surface, properly covered, and shall return after paving of the streets is completed by others, to raise the valve slip can and cap to grade. Contractor shall coordinate his work with that of the paving contractor to place the slip can during placement of the road sub-base, if desirable.

3.10 SERVICE CONNECTION METER BOX LOCATIONS AND METER INSTALLATION

Service connections shall be installed by the Contractor of the size and at the locations shown on the standard drawings, with meter boxes located as shown on the standard drawing for the proper size meter service connection. Where meter installation is indicated on the standard drawings, spacers as shown on the standard drawings shall be furnished and installed by the Contractor for later installation of meters to be furnished and installed by the District.

Except as specifically stated otherwise, or as coordinated by the Engineer upon mutual agreement during construction, meter boxes shall be set after curbs have been constructed in those areas involving curb construction in the street improvement, and after grading of the parkway or road shoulders. The Contractor shall maintain the meter boxes within County road improvements until those improvements are accepted by the County.

3.11 SERVICE CONNECTIONS

Service connections to asbestos-cement pipe shall utilize heavy tapped couplings where service connections are made or locations are known at the time of main installation. Service connections to ductile iron pipe and PVC pipe shall utilize service saddles. Water Service Compression Couplings where required or permitted, shall utilize a stainless steel insert in accordance with the drawings. The stainless insert specified shall be a full circle insert; split or collapsible inserts will not be accepted.

3.12 ELECTROLYSIS FACILITIES

Such as insulating flanges, test connection stations, and bonding of pipe joints shall be installed to eliminate conductivity of electrical current or to ensure such conductivity, whichever is appropriate. Inasmuch as the testing of these installations requires specialized equipment, any tests required by the Engineer will be performed by the District or its agent at District expense on District-administered contracts. The electrical potential and current necessary to successfully test the installation shall be determined by the District or its agent for each individual facility, dependent upon such factors as the pipe-to-soil potentials available.

3.13 TEMPORARY BUMPHEADS

The Contractor shall furnish and install complete, all the necessary temporary bumpheads or skillets and appurtenances thereto in the pipeline used for backfilling or testing purposes and shall remove such bumpheads upon completion of the line.

The Contractor shall furnish, at his own expense, any openings in the pipeline or bumphead and any valves or by-pass arrangements which are for his convenience in filling, testing and/or emptying the pipeline.

At all times when the work of installing pipe is not in progress, all openings into the pipe and the ends of the pipe in the trench shall be tightly closed to prevent entrance of animals and foreign materials.

The Contractor shall take all necessary precautions to prevent the pipe from floating due to water entering the trench from any source, shall assume full responsibility for any damage due to this cause and shall at his own expense restore and replace the pipe to its specified condition and grade if it is displaced due to floating.

If the Contractor, upon approval by the Engineer, elects to test a system utilizing valves and connecting pipe installed by the District, the District will assume responsibility for any leaks occurring in any pipeline or valve furnished and installed by the District. In the event Contractor is unable to satisfactorily test his system because of leaks in the District-installed system, Contractor shall install temporary bumpheads in his construction to perform tests, as determined necessary by the Engineer. Full compensation for furnishing all labor, tools, materials, and equipment (except water when provided by the District), and for doing all work involved in testing, and for repairing any leaks shall be included in the price paid for installation of the pipe, and no additional compensation by the District will be allowed therefore.

### 3.14 FIELD HYDROSTATIC TEST

Upon completion of the laying, jointing, backfilling, and proper curing of the joints, and compaction of backfill, the pipeline or portions thereof shall be hydrostatically tested.

For convenience of testing, the pipeline may be divided into sections and each section tested separately. Main line valves may be used in lieu of special bumpheads, or if valves are not conveniently located, temporary bumpheads shall be constructed. Bumpheads shall be constructed to safely withstand the hydraulic pressures imposed upon them. No payment will be made expressly for the work and materials required for the bumpheads and any compensation desired by the Contractor for this work shall be included in the price quoted for the installation of pipe. The Contractor shall have no claim against the District by reason of required construction of bumpheads due to the omission of the installation of any or all main line valves.

After the section of pipeline has been bumpheaded and completely filled with water, it shall be allowed to stand under pressure a sufficient time to allow the pipe to obtain a maximum absorption of water and to allow the escape of air from any air pockets. The pressure shall then be increased to the specified test pressure as hereinafter described, and shall be maintained at this pressure for not less than four (4) hours.

All pipes shall be tested under a pressure  $1 \frac{1}{2}$  times the pressure rating of the pipe, but not less than 150 pounds per square inch. Maximum test pressure shall not exceed 225 pounds per square inch unless otherwise specified by the Engineer.

Installation of Water Pipeline  
Section 02718 – 16

As a matter of information, valves specified elsewhere for installation shall meet the following conditions:

Gate Valves

AWWA C-500 requires:

12" & smaller: 200 psig rated working pressure

16" & larger: 150 psig rated working pressure

At these pressures, allowable hydrostatic leakage rate is  
1 fl. oz./hour/inch of nominal valve size.

Butterfly Valves

AWWA C-504 requires:

3" - 72": 150 psi working pressure

Allowable leakage:

Drip-tight at 150 psi hydrostatic pressure differential

Dresser 450 [AWWA Class 150-B (150 psi)]

4" - 12": 200 psi rated working pressure

14" & larger: 150 psi rated working pressure

Allowable leakage:

Bottle tight at rated working pressure differential

If testing is against gate valves and leakage is detected through the valve, additional leakage over and above the allowable leakage for the pipeline may be allowed at the rate of 1 fl. oz./hour/inch of valve diameter. There will be no allowance for leakage through butterfly valve.

If any leakage is evidenced in the testing of the pipeline, the various sections of the pipeline shall be isolated for testing between available valves, or between bumpheads located as directed by the Engineer. The maximum allowable leakage for asbestos-cement pipe shall be ten (10) gallons per day per mile of pipe per inch of pipe inside diameter. The maximum allowable leakage for steel pipe shall be two (2) gallons per day per mile of pipe per inch of pipe inside diameter. The maximum allowable leakage for ductile iron pipe shall be seven (7) gallons per day per mile of pipe per inch of pipe inside diameter. The maximum allowable for PVC pipe shall be six (6) gallons per day per mile of pipe per inch of pipe inside diameter. If the leakage exceeds this amount, the section being tested will be considered defective. The Contractor shall determine the points of leakage, make the necessary repairs and perform another test. This procedure shall be continued until the leakage in each section falls below the allowable maximum for that section of pipeline.

Leakage shall be determined by metering the water injected into the pipeline while under the required pressure. The Contractor shall submit to the District before and after the test the gage and meter used so that these devices may be tested by this District.

The Contractor shall provide all calibrated meters for measurement of leakage, all bumpheads or skillets, piping, calibrated gages, pumps and other equipment, all water not furnished by the District, and all power and labor necessary for the performance of pressure tests satisfactory to the Engineer. The Contractor shall furnish all necessary equipment and labor to fill each section of pipeline tested and for pumping the water from one test section to another as may be necessary for obtaining and maintaining the required water pressure and for filling the entire pipeline with water after the conclusion of the testing, as hereinafter provided.

The Contractor, at his own expense, shall do any excavation necessary to locate and repair leaks or other defects which may develop under test, including removal of backfill already placed, shall replace such excavated material, and shall make all repairs necessary to meet the required water tightness after which the test shall be repeated until the pipe meets the test requirements. All tests shall be made in the presence of the Engineer. After the pipe has met successfully all test requirements specified herein, the entire pipeline shall be filled with water and so maintained until the completion of the contract unless otherwise ordered by the Engineer.

### 3.15 CHLORINATION

- A. Flushing. Sections of pipe to be disinfected shall first be flushed to remove any solids or contaminated material that may have become lodged in the pipe. If no hydrant is installed at the end of the main, then a tap should be provided large enough to develop a velocity of at least two and five-tenths (2.5) feet per second in the main. A two and one-half (2½) inch hydrant opening will, under normal pressures, provide this velocity in pipe sizes up to and including twelve (12) inch.

All taps required for chlorination, flushing purposes, or for temporary or permanent release of air shall be provided for by the CONTRACTOR as a part of the construction of water mains.

- B. Requirement of Chlorine. Before being placed into service, all new mains and repaired portions of, or extension to existing mains shall be chlorinated so that the initial chlorine residual is not less than 50 mg/l and that a chlorine residual of not less than twenty-five (25 mg/l) remains in the water after standing twenty-four (24) hours in the pipe.
- C. Form of Applied Chlorine. Chlorine shall be applied by one of the methods which follow subject to approval by the ENGINEER.
1. Liquid Chlorine. A Chlorine gas-water mixture shall be applied by means of a solution-feed chlorinating device, or the dry gas may be fed directly through proper devices for regulating the rate of flow and providing effective diffusion of the gas into the water within the pipe being treated. Chlorinating devices for feeding solutions of the chlorine gas, or the gas itself, must provide means for preventing the backflow of water into the chlorine.



2. Chlorine-Bearing Compounds in Water. A mixture of water and high-test calcium hypochlorite (65-70% Chlorine) may be substituted for the chlorine gas water mixture. The dry powder shall first be mixed as a paste and then thinned to a one (1) percent chlorine solution by adding water to give a total quantity of seven and five-tenths (7.5) gallons of water per pound of dry powder. This solution shall be injected in one end of the section of main to be disinfected while filling the main with water in the amounts as shown in the table which follows:

Chlorine Requirements to Produce 50 mg/l  
Concentration in 100 Foot of Pipe - By Diameter

<u>Pipe Size Inches</u>	<u>100% Chlorine Chlorine, LB.</u>	<u>1% Chlorine Solution, Gals.</u>
4	0.027	0.33
6	0.061	0.73
8	0.108	1.30
10	0.170	2.04
12	0.240	2.88

3. Tablet Disinfection. Tablet disinfection is best suited to short extensions (up to 2500 ft.) and smaller diameter mains (up to 12 inch). Since preliminary flushing must be eliminated in using this method, it should be utilized only when scrupulous cleanliness has been used in construction. It should not be used if trench water or foreign material has entered the main or if the water is below 41 F.

Tablets should be placed in each section of pipe, hydrants, hydrant branches, and other appurtenances. Tablets must be at the top of the main and shall be attached by an adhesive, such as Permatex No. 1 or any alternative approved by the ENGINEER. Tablets in joints between pipe sections, hydrants, hydrant branches, or appurtenances are to be crushed and placed inside the annular space, rubbed like chalk in butt ends of sections to coat them if the type of assembly does not permit crushing.

In filling a section of piping with water when using the tablet method, water velocity shall be less than one (1) foot per second.

Number of 5-Grain Hypochlorite Tablets Required  
for a Dosage of 50 MG/L per Length of Pipe Section

Pipe Size Inches	Length of Pipe Section -----Foot----->				
	<u>Up to 13</u>	<u>18</u>	<u>20</u>	<u>30</u>	<u>40</u>
2	1	1	1	1	1
4	1	1	2	2	2
6	2	2	3	3	4
10	3	5	7	7	9
12	5	6	10	10	14

- D. Point of Application. The preferred point of application of the chlorinating agent is at the beginning of the pipe line extension or any valved section of it, and through a corporation stop inserted in the pipe. The water injector for delivering the chlorine-bearing water into the pipe should be supplied from a tap made on the pressure side of the gate valve controlling the flow into the pipe line extension. Alternate points of application may be used when approved or directed by the ENGINEER.
- E. Preventing Reverse Flow. Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water. Check valves may be used if desired.
- F. Retention Period. Treated water shall be retained in the pipe at least twenty-four (24) hours. After this period, the chlorine residual at pipe extremities and at other representative points shall be at least twenty-five (25) mg/l.
- G. Chlorinating Valves and Hydrants. In the process of chlorinating newly laid pipe, all valves or other appurtenances shall be operated while the pipe line is filled with the chlorinating agent and under normal operating pressure.
- H. Final Flushing and Testing. Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipe at its extremity until the replacement water throughout its lengths shows upon test, a chlorine residual of less than one (1) mg/l. In the event chlorine is normally used in the source of supply, then the tests shall flow a residual of not in excess of that carried in the system.

After flushing, water samples collected on two (2) successive days from the treated piping system, as directed by the ENGINEER, shall show satisfactory bacteriological results.

Installation of Water Pipeline  
Section 02718 – 20

A minimum of one sample shall be taken from the end of the new main and one from each branch of the new main. If the new main is extremely long, then samples shall be collected along the length of the line as well as at its end. If trench water has entered the main during construction, or if excessive quantities of dirt or debris have entered the main, then bacteriological samples shall be taken every 200 feet at 24 hours after the final flush.

Each sample will be subjected to the MMO-MUG or approved method and Heterotrophic Plate Count.

If total and/or fecal coliform bacteria are present, then the sample fails and corrective action shall be performed, and a re-sample submitted.

If an HPC of greater than 500 colony forming units is found, then the sample fails State and Federal regulations.

For both the re-sample, and the replacement sample, it may be recommended that upstream and downstream samples are taken to eliminate the possibility of a poor sampling site. (Another way to eliminate a poor sampling site is to request that the contractor install a sampling station or a sampling spigot.) It may also be recommended that a source sample is obtained. This sample will be taken outside the influence of the main being tested, and labeled "source".

Bacteriological analysis must be performed by a laboratory certified by the California Department of Public Health.

- I. Repetition of Flushing and Testing. Should the initial treatment result in an unsatisfactory bacterial test, the original chlorination procedure shall be repeated by the CONTRACTOR until satisfactory results are obtained.

### 3.16 PIPE ENTRY RESTRICTIONS

No person shall enter a pipe that has not been checked for hazardous gases and oxygen concentration. Incapacitated persons in the pipe shall be practically accessible for rescue within five minutes.

The Contractor shall adhere to all the installation recommendations of the pipe manufacturer including any requirements for bedding and backfill before stull removal and joint mortar. The recommendations of the manufacturer shall be included in the prices bid for installation.

**END OF SECTION 02718**

Revised 05/92

**SPECIFICATIONS - DETAILED PROVISIONS**  
**Section 02725 - Installation of Copper Pipe and Tubing**

**C O N T E N T S**

<b>PART 1 - GENERAL</b> .....	<b>1</b>
1.01 DESCRIPTION .....	1
<b>PART 2 - EXECUTION</b> .....	<b>1</b>
2.01 EXECUTION.....	1

**SECTION 02725**  
**INSTALLATION OF COPPER PIPE AND TUBING**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

All copper tubing, exposed, buried, or in plastic conduit, shall conform to ASTM Specification B-88 and shall be Type K soft-annealed.

Fittings shall be solder type forged or wrought copper. Solder shall be ASTM B 32-70 alloy, Grade 5A.

Flange fitting connections up to 7/16" diameter may be used when approved by the Engineer. Such fittings shall be brass conforming to ANSI/ASME pressure rated pipe for maximum working pressure of 7,000 p.s.i.

Copper pipe connected to hydraulic cylinders, steel or iron valves, galvanized steel pipe, black steel pipe, stainless steel pipe, Venturi tubes, or other non-copper items shall be connected by means of dielectric insulating unions or fittings as manufactured by the Patrol Valve Company, Mueller Company, or equal.

When making connections to meters or other devices having female or male threaded fittings, special thread-to-tube adapters shall be used. Such adapters shall be equal to Crawford Fitting Company "Swagelok" brass tube fittings.

Copper pipe and tubing shall be manufactured by Anaconda, Phelps-Dodge or Revere.

**PART 2 - EXECUTION**

**2.01 EXECUTION**

All installations shall conform to the requirements of the Uniform Plumbing Code (latest edition). Copper tubing embedded in concrete shall be protected by double-coverage protective wrap with a minimum of 20 mil thickness material. In no case, shall piping be in direct contact with concrete or masonry walls or footings. Copper lines shall be neatly supported at such intervals as to prevent sagging. Tube shall be cut square with hacksaw or disc cutter and shall be reamed full size and burrs removed. If necessary, a sizing tool shall be used to correct any distortion. The outside surface of the end of the pipe and the inside surface of fittings shall be cleaned with steel wool until the metal is bright. Soldering flux shall be applied to the cleaned surfaces of pipe and fitting in a thin, uniform, complete coating. After the pipe has been inserted in the fitting as far as it will go, fitting shall be twisted on the pipe to help spread the flux uniformly. The fitting shall then be heated until it reaches the correct temperature to melt the solder.

Revised 08/85

**SPECIFICATIONS - DETAILED PROVISIONS**  
**Section 15059 - Welded Steel Fittings**

**C O N T E N T S**

<b>PART 1 - REQUIREMENT .....</b>	<b>1</b>
1.01 FITTINGS .....	1
1.02 FLANGES .....	1

**SECTION 15059  
WELDED STEEL FITTINGS**

**PART 1 - REQUIREMENT**

**1.01 FITTINGS**

Fittings shall be fabricated as shown on the contract drawings, and/or as specified in the Special Conditions.

**1.02 FLANGES**

- A. Steel flanges shall conform to the requirements of Drawing B-288 made a part hereof by reference.
- B. Ring flanges shall be for welding to the pipe unless otherwise noted on the plans.
- C. Screwed flanges, where required, shall be Crane No. 556 or approved equal.

**END OF SECTION 15059**

Revised 110706

**SPECIFICATIONS - DETAILED PROVISIONS**  
**Section 15061 - Steel Cylinder Water Pipe**

**C O N T E N T S**

<b>PART 1 - GENERAL .....</b>	<b>1</b>
1.01 DESCRIPTION .....	1
1.02 QUALITY ASSURANCE .....	1
1.03 SUBMITTALS .....	2
1.04 DELIVERY .....	4
1.05 JOB CONDITIONS .....	4
1.06 ALTERNATIVES .....	4
<b>PART 2 - PRODUCTS .....</b>	<b>5</b>
2.01 MATERIALS .....	5
2.02 MIXES .....	9
2.03 FABRICATION OF PIPE .....	9
<b>PART 3 - EXECUTION .....</b>	<b>11</b>
3.01 INSPECTION .....	11
3.02 INSTALLATION .....	12



**SECTION 15061  
STEEL CYLINDER WATER PIPE**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

Contractor to furnish steel pipe as hereinafter described.

**A. Types of Steel Pipe**

1. Cement mortar lined and cement mortar coated steel pipe (CML&C). This type of pipe is to be used in steel pipeline construction unless otherwise specified.
2. Pre-tensioned concrete cylinder pipe.
3. Cement mortar lined and coal-tar enamel coated and wrapped steel pipe.
4. Cement mortar lined and asphalt coated and wrapped steel pipe.

**B. Pipe Class or Working Pressure** shall be 150 psi unless otherwise specified. This specification includes all classes and specific tables for Class 100, 150, and 200 psi.

**C. Nominal Pipe Diameter** shall mean the approximate inside diameter of the cement mortar lining.

**D. Fabricated Steel Plate Specials**, defined as bends, wyes, reducers, outlets, and other pipe structures.

**1.02 QUALITY ASSURANCE**

Includes the requirements of this specification and the requirements of the latest revision of the following standards as applicable. Unless specifically stated otherwise, the most stringent requirement will govern when there is a conflict.

- A. AWWA C-200**. American Water Works Association (AWWA) C-200 standard for steel water pipe 6 inches and larger.
- B. AWWA C-203**. AWWA C-203 coal-tar protective coatings for hot applied enamel and tape.
- C. AWWA C-205**. AWWA C-205 cement mortar lining and coating. Section 5.5.4 wire mesh: When wire mesh is used as the reinforcement for the coating, it shall have a minimum of 1/2" coating over the wire mesh.

Steel Cylinder Water Pipe  
Section 15061 – 2

- D. AWWA C-208. Standard dimensions for steel water pipe fittings.
- E. AWWA C-303. Reinforced concrete pressure pipe – steel cylinder type, pre-tensioned.
- F. ASTM C-150. Portland Cement.
  - 1. Type II Cement.
  - 2. Type V Cement.
- G. ASTM A-234. Piping fittings of wrought carbon steel and alloy steel for moderate and elevated temperatures.
- H. ASTM A-615-GR40. Deformed and plain billet-steel bars for concrete reinforcement.
- I. AWWA Manual M-11. Design and installation of steel pipe.
- J. Standard Drawing B-288. EMWD standard drawing for steel plate flanges.
- K. ASTM D-2240. Rubber property - durometer hardness.

1.03 SUBMITTALS

- A. Pipe Layout Drawings. Pipe (36 inches and larger) shall be fabricated to adhere to the contract construction drawings. The Contractor shall submit pipe layout drawings for approval by the Engineer when the pipe layout varies from the alignment or grade shown on the contract drawings. These drawings shall be the same scale as the contract drawings. The District will allow the manufacturer to utilize a set of reproducible contract drawings to reflect the proposed deviations from the planned grades. Departures from line and grade within the following parameters will be permitted in the manufacture of the pipe to allow the use of joint pulls to effect changes of alignment:
  - 1. Horizontal alignment shall be within 4 inches of the alignment shown on the contract drawings.
  - 2. In vertical alignment, depth may be reduced 1 inch or increased 4 inches if the following minimum vertical clearances between outside diameters of other facilities are maintained and no additional highpoints are created :
    - a) 1 foot vertical clearance between sewer and water pipelines.
    - b) 0.5 foot vertical clearance between all other facilities except when specifically shown otherwise on the contract drawings.

3. Horizontal location of the vertical P.I. may deviate by 0.5 feet.

(Pipe smaller than 36 inch may be straight run pipe with horizontal and vertical bends fabricated to conform to construction drawings and welded to straight run pipe with butt straps per Standard Drawing B-304 or other approved full welded joint connections.)

Proposed departures in excess of these limits must be approved by the Engineer prior to initiation of layout drawings.

Computer printouts will be accepted in lieu of layout drawings except for such proposed departures.

- B. Fabricated Steel Plate Specials. Fabricated steel plate specials submittals shall be approved prior to fabrication. The dimensions shall conform to AWWA C-208 except as modified herein or as otherwise shown on the plans.

1. Pipe Outlets. The measurement from the outside of pipe to the face of flange shall be 12" unless otherwise shown. Outlets shall be designed per AWWA Manual M-11, and design of stiffener plates shall follow the nomograph method.

Pipe outlets shall also be provided for chlorination corp stops, air valve assemblies, services, and other appurtenances required by the contract drawings. Brass plugs shall be provided for installation upon later removal of the chlorination corp stops.

2. Bends

- a) The radius of bends shall be a minimum of 2½ times the pipe diameter unless specified otherwise.
- b) Bends may be welded to adjacent pipe sections.
- c) Bends shall conform to the following table:

2-piece	0° - 30°
3-piece	30° - 45°
4-piece	45° - 67½°
5-piece	67½° - 90°

- C. Rubber Gaskets. Test results showing the properties of the material used in the rubber gaskets shall be submitted by the Contractor if requested by the Engineer.

Steel Cylinder Water Pipe  
Section 15061 – 4

- D. Pipe Design. Pre-tensioned concrete cylinder pipe reinforcing steel shall be computed as follows:

$$A_s = \frac{6 P_w D_y}{f_s}$$

Where:

$A_s$  = Total cross-sectional area of circumferential steel (cylinder plus bar reinforcement) --- sq. in./ft. of pipe

$P_w$  = Pressure Rating (Class) --- psi

$D_y$  = Inside diameter of steel cylinder – inches

$f_s$  = Average circumferential stress in psi in the steel cylinder and bar reinforcement when the section is subjected to working pressure

and

$f_s$  = is not to exceed 16500 psi nor 50% of the specified minimum yield strength of the steel used in the cylinder. Bar reinforcement shall not be greater than 60% of the total area of circumferential reinforcement.

#### 1.04 DELIVERY

Pipe and material shall be furnished, delivered and strung along the trench site.

- A. Internal bracing adequate for handling and transportation shall be installed as soon as practical after the application of cement mortar lining. All bracing shall remain in the pipe until installation and backfilling are completed.
- B. Gasket material shall be furnished with the pipe for storage in a cool, well ventilated place and protected from direct sunlight.

#### 1.05 JOB CONDITIONS

Pipe and materials shall not be fabricated, stored, or installed in climatic conditions that will adversely affect the quality of the finished pipeline project.

#### 1.06 ALTERNATIVES

Pipe for projects that are federally funded, in part or whole, shall also meet or exceed federal requirements:

- A. Steel pipe shall conform to federal specification SS-P-385A for cement mortar lined and reinforced cement mortar coated pipe.

- B. Pre-tensioned concrete cylinder pipe shall conform to federal specification SS-P-381B.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

For all steel manufactures outside the United States, the Contractor shall submit to the District, for its approval, a certified letter stating that the steel meets or exceeds the following: all of the requirements of AWWA C-200, the applicable ASTM Standards, and this Specification, and provide certified physical and chemical test results. The manufacturer of the steel cylinder shall be responsible for all requirements of these specifications. Manufacturers must be per EMWD's "approved materials list" and are: Ameron, Continental Pipe Manufacturing Co., Mid America Pipe, Northwest Pipe Company and Rosco Moss.

#### **A. Cement Mortar Lined Steel Pipe Cylinder**

1. Steel thickness shall be at least 12 ga. (0.1046").
2. Steel thickness shall be determined from the pressures imposed (Class) and the design stress of the steel. Design stress is defined as one-half ( ) of the allowable minimum yield stress of the steel.
3. Steel pipe shall conform to the following table which includes minimum diameters and minimum thicknesses for various classes and nominal diameters. Note: Plate thickness is based on steel with a yield stress of 33,000 psi and a design stress equal to 50% of the yield stress (16,500 psi).

Nominal Pipe Diameter	Minimum Cylinder Diameter	Class 200 Min. Cylinder Plate Thickness	Class 150 Min. Cylinder Plate Thickness	Class 100 Min. Cylinder Plate Thickness
4"	4-1/2"O.D.	0.1046"	0.1046"	0.1046"
6"	6-5/8"O.D.	0.1046"	0.1046"	0.1046"
8"	8-5/8"O.D.	0.1046"	0.1046"	0.1046"
12"	12-3/4"O.D.	0.1046"	0.1046"	0.1046"
14"	15-1/4"O.D.	0.1046"	0.1046"	0.1046"
16"	17-3/8"O.D.	0.1046"	0.1046"	0.1046"
18"	19-3/8"O.D.	0.1160"	0.1046"	0.1046"
20"	21-3/8"O.D.	0.1280"	0.1046"	0.1046"
21"	22-3/8"O.D.	0.1340"	0.1046"	0.1046"
24"	25-3/8"O.D.	0.1519"	0.1143"	0.1046"
27"	28-3/8"O.D.	0.1699"	0.1278"	0.1046"
30"	31-3/8"O.D.	0.1879"	0.1413"	0.1046"
33"	34-3/8"O.D.	0.2058"	0.1548"	0.1046"
36"	37-3/8"O.D.	0.2238"	0.1684"	0.1126"
39"	40-3/8"O.D.	0.2418"	0.1819"	0.1216"
42"	43-3/8"O.D.	0.2597"	0.1954"	0.1306"

Steel Cylinder Water Pipe  
Section 15061 – 6

Nominal Pipe Diameter	Minimum Cylinder Diameter	Class 200 Min. Cylinder Plate Thickness	Class 150 Min. Cylinder Plate Thickness	Class 100 Min. Cylinder Plate Thickness
45"	46-7/8" O.D.	0.2807"	0.2111"	0.1412"
48"	49-7/8" O.D.	0.2987"	0.2247"	0.1502"
54"	55-7/8" O.D.	0.3346"	0.2517"	0.1683"

4. Cylinder shall conform to AWWA C-200.
5. Cement mortar lining shall conform to AWWA C-205.
6. Separate joint rings, if used, shall conform to Section 2.6, AWWA C-303.

B. Pre-tensioned Concrete Cylinder Pipe

1. Shall conform to the following table:

**PRE-TENSIONED CONCRETE CYLINDER PIPE  
WORKING PRESSURE**

Nominal Pipe Diameter	Cylinder Diameter	Class 200		Class 150		Class 100	
		Plate Thickness	Total Area (sq."/ft)	Plate Thickness	Total Area (sq."/ft)	Plate Thickness	Total Area (sq."/ft)
12"	12-3/4" O.D.	12ga.	1.485	12ga.	1.485	12ga.	1.485
14"	15-1/4" O.D.	12ga.	1.485	12ga.	1.485	12ga.	1.485
16"	17-3/8" O.D.	12ga.	1.485	12ga.	1.485	12ga.	1.485
18"	19-25/32" O.D.	12ga.	1.485	12ga.	1.485	12ga.	1.485
20"	21-25/32" O.D.	12ga.	1.584	12ga.	1.485	12ga.	1.485
21"	22-25/32" O.D.	12ga.	1.657	12ga.	1.485	12ga.	1.485
24"	25-3/4" O.D.	12ga.	1.873	12ga.	1.495	12ga.	1.495
27"	28-25/32" O.D.	12ga.	2.093	12ga.	1.570	12ga.	1.525
30"	31-7/8" O.D.	12ga.	2.318	12ga.	1.737	12ga.	1.555
33"	34-7/8" O.D.	12ga.	2.536	12ga.	1.902	12ga.	1.585
36"	37-7/8" O.D.	12ga.	2.755	12ga.	2.066	12ga.	1.615
39"	40-7/8" O.D.	12ga.	2.973	12ga.	2.230	12ga.	1.645
42"	43-7/8" O.D.	11ga.	3.191	12ga.	2.393	12ga.	1.675
45"	46-7/8" O.D.	11ga.	3.409	12ga.	2.557	12ga.	1.704
48"	49-7/8" O.D.	10ga.	3.628	11ga.	2.720	11ga.	1.915
54"	55-7/8" O.D.	9ga.	4.063	11ga.	3.048	11ga.	2.032

12 ga. = .1046 = 1.255 square inch/ft.  
11 ga. = .1196 = 1.435 square inch/ft.  
10 ga. = .1345 = 1.614 square inch/ft.  
9 ga. = .1495 = 1.794 square inch/ft.

2. Rod reinforcing shall conform to ASTM A615 GR40, and the minimum diameter shall be 7/32".
3. Shall conform to AWWA C-303.

C. Coatings

1. Pre-tensioned concrete cylinder pipe shall be coated per AWWA C-303 except the cement shall be Type II or Type V.
2. Cement mortar lined steel pipe shall be cement mortar coated unless specified otherwise.
  - a) Cement Mortar Coating
    - (i) Shall be a minimum of 3/4" thick.
    - (ii) Shall either be Type II or Type V cement, unless specifically stated on the plans or in the Special Conditions.
    - (iii) Shall be one type of cement; i.e., Type II & V shall not be mixed together.
    - (iv) Shall meet or exceed AWWA C-205 requirements.
    - (v) Shall be of adequate thickness to provide required rigidity and corrosion protection.
  - b) Coal-Tar Enamel Coated and Wrapped Coating shall conform to AWWA C-203
    - (i) Type B primer shall be used.
    - (ii) Coal-tar enamel may be Type I or Type II.
    - (iii) Wrapping shall be a single layer of glass mat or 15-pound coal tar saturated asbestos felt.
    - (iv) The coating shall be whitewash.
  - c) Asphalt Coated and Wrap Coating shall use
    - (i) Asphalt primer.
    - (ii) Asphalt (hot applied).
    - (iii) Mica surfaced 15-pound pipeline felt.
  - d) Field painting shall be used on above-ground installation as shown on the drawings
  - e) Bare metal shall be coated with a suitable primer for its intended use

Steel Cylinder Water Pipe  
Section 15061 – 8

D. Steel Plate Specials

1. Shall be constructed of steel plate, thickness computed from the greater of the following criteria, unless a still greater requirement is shown on the drawings or stated in the special conditions:

- a) Thickness not less than 3/16"; or
- b) Thickness as determined from the formula

$$T \geq \frac{D \times P}{2 \times 12,500}$$

Where:

T = wall thickness in inches

D = inside diameter of steel cylinder in inches

P = design pressure (class) in pounds per square inch

2. Schedule 30 or heavier steel pipe in standard diameters may be used in lieu of above paragraph "2.01, D1" for outlets that are 12" and smaller diameter (12.75", 10.75", 8.625", 6.625" and 4.5" outside diameters).
3. Steel welding fittings conforming to the requirements of ASTM Designation A-234 may be used when available in suitable sizes.
4. Cement mortar lining meeting AWWA C-205 except handwork reinforcement shall be 2"x 4" No. 12 welded wire fabric.
5. Coating meeting the requirements of straight pipe.
6. Stiffner plates, when required, designed per the nomograph method of AWWA Manual M-11.
7. Reinforced steel collar pads designed for the specified pressure where needed.
8. Materials meeting or exceeding AWWA C-200 requirements.

E. Rubber Ring Gaskets

1. Shore durometer hardness range shall be in the range of 50-55 in accordance with ASTM D-2240.
2. Compound shall conform to the requirements of Section 2.8 AWWA C-303.



## 2.02 MIXES

All mixes shall conform to the applicable reference sections.

## 2.03 FABRICATION OF PIPE

- A. Steel cylinder pipe shall be fabricated in accordance with:
  - 1. AWWA C-200 for cement mortar lined steel pipe.
  - 2. AWWA C-303 for pre-tensioned steel cylinder steel pipe.
- B. Cement mortar lining process shall be followed with sealing each pipe end with a waterproof cover prior to carefully moving the pipe section. The pipe sections shall be cured under sprinklers or by other processes approved by the Engineer.
- C. Coatings shall be applied after the exterior of the pipe is thoroughly cleaned and free from all loose mill scale and rust.
  - 1. Cement mortar coating shall be applied pneumatically or by impaction resulting in a dense uniform coating that adheres tightly to the pipe.
  - 2. Coal-tar enamel and wrapped coating shall be applied in accordance with AWWA C-203.
  - 3. Asphalt coating and wrapping.
    - a) Shall be applied after pipe is fabricated and hydrostatically tested.
    - b) Asphalt primer.
      - (i) Shall be applied to clean-dry surfaces to produce a suitable bond between the metal and subsequent coating of asphalt.
      - (ii) Shall be uniform and free from bare spots.
      - (iii) Shall be protected from rain and fog during and between applications.
    - c) Hot asphalt shall be applied after the primer has completely hardened and with, or immediately preceding, the wrapping material in sufficient quantity to form a bead on the exposed edge of wrap.
    - d) Wrapping material shall be spirally wrapped under tension to ensure complete coverage, 3/4" lap at edge, no wrinkles and buckles, and complete cementing to the pipe with hot asphalt.

Steel Cylinder Water Pipe  
Section 15061 – 10

- e) Coating and wrapping shall be omitted at each end for a sufficient distance to permit the making of field joints. All exposed bare metal shall be coated with a suitable primer.

D. Joints

1. All pipes shall have rubber gasket joints unless otherwise shown.
  - a) The steel area in the bell shall not be less than the area in an equivalent length of pipe barrel.
  - b) Rubber gasket ends formed integrally with the steel cylinder shall be formed either by sizing with a machined swage or die, or by rolling per AWWA C-200.
  - c) Separate rubber gasket joint rings shall be formed per requirements of Section 3.3 of AWWA C-303.
2. Ends that are not rubber gasket, including but not limited to weld bells, plain ends, grooved ends, and butt straps shall conform to AWWA C-200 where applicable, and to the construction drawings.
3. Flanges shall conform to Eastern Municipal Water District standard drawing B-288.

E. Steel Plate Specials shall conform to approved shop drawings and shall be fabricated in a shop approved for that purpose by the Engineer.

1. Each special shall have a mark on the top and bottom corresponding to the true vertical axis.
2. Outlets, including wyes, shall be built into the wall of the pipe.
3. Fabricated steel fittings of suitable design shall be welded to the cylinder before the exterior coating is placed around the fittings.
4. Cement mortar lining shall meet the requirements of straight pipe with the provisions that handwork lining reinforcement shall be positioned approximately in the center of the lining. The wires spaced 2" on center shall extend circumferentially around the pipe. The fabric shall be securely fastened to the pipe. Splices shall be lapped 4" and the free ends tied or looped to ensure continuity.

### **PART 3 - EXECUTION**

#### **3.01 INSPECTION**

- A. Notification of Manufacture. Unless specifically waived, EMWD Inspection Department shall be notified at least 48 hours prior to commencement of the manufacture of pipe.
- B. Hydrostatic Testing. Steel cylinders shall be hydrostatically tested to a stress equal to 75% of the minimum yield point of the steel. Certification of all cylinders is required by the District.
- C. Specials. Specials shall be bulkheaded and tested prior to lining and coating of weld seams at one-and-one-half (1½ ) times the design pressure (class). Dye penetrant process may be used on all untested welds in lieu of hydrostatic testing if the straight pipe used in fabricating the special has passed a hydrostatic test of 75% of the yield point. All defective welds including pinholes and porous welds shall be chipped out, rewelded, and retested.
- D. Soap and Compressed Air Test
  - 1. All double-welded lap joints, butt-strap joints, and other joints susceptible to this test shall be tested by the soap and compressed air method as hereinafter described. After completion of the shop hydrostatic test of the pipe sections the soap and compressed air test also may be used instead of hydrostatic testing of welded joints in the steel manhole outlets, which are attached to steel-plate sections.
  - 2. As soon as practicable after the welding of each joint to be tested by the soap and compressed air test has been completed, the Contractor shall subject each joint to a soap test by forcing compressed air, at approximately 40 pounds pressure per square inch, into each said joint and, while the joint is under pressure, every portion of every welded seam forming a part of the joint shall be swabbed with a heavy soap solution or an approved, commercial, bubble producing leak test fluid and shall be carefully examined for leakage. The Contractor shall repair any defects disclosed by the test by chipping out and rewelding the chipped section, after which the same test shall again be applied. The Contractor shall provide all apparatus and materials for making the tests, shall drill and tap the necessary holes and shall plug weld the holes after testing.
- E. Rubber Gaskets. Rubber gaskets shall be subject to inspection and/or testing by the Engineer. All unsatisfactory gaskets shall be immediately replaced at no expense to the District.
- F. Manways. All 30" diameter and larger pipe shall have 24" diameter or larger access manways within 750 feet of any interior point of the pipeline.

Steel Cylinder Water Pipe  
Section 15061 – 12

1. Manways shall consist of 24" diameter outlets with 24" blind flanges.
2. Manways shall have a maximum spacing of 1500 feet on center. At valve installations, manways shall be located on both sides of each valve a maximum of 35 feet.
3. Outlets or bumped heads that provide an equal or larger opening than a 24" manway may be used for pipe access.
4. Manway locations shall be selected to minimize impact to traffic, and shall be approved by EMWD prior to pipe fabrication.

3.02 INSTALLATION

- A. Preparation. Internal bracing, in addition to the bracing used for handling and transportation of the pipe, shall be installed when required to ensure maximum permissible deflections are not exceeded during laying, backfill, and compaction.
- B. Pipe Zone Density. Relative compaction in pipe zone III as shown on standard drawing B-286B shall be in accord with the manufacturer's recommendation. All pipe bid for this project shall meet EMWD's minimum standards as set forth in Section 15061 herein. The Contractor, in conjunction with the pipe manufacturer, will indicate in the space provided and attached hereto as part of the bid forms, the pipe zone compaction to be constructed, the mortar thickness - both lining and coating - and the trench slope construction.
- C. Diapers shall be impervious if available.
  1. Width of diapers, where used, shall be sufficient to allow cupping of the diaper for increased thickness of the joint mortar. Recommended minimum diaper widths:
    - a) 20" dia. pipe and larger: 12"
    - b) 12" - 18" dia. pipe: 10"
    - c) 10" dia. pipe and smaller: 9"
  2. Mortar placement shall be from one side of the diaper, to allow the mortar to flow around the bottom and up the opposite side of the pipe, to preclude the possibility of any voids inside the diaper.
- D. Curing operations shall begin immediately after completion of joint mortaring.

**Steel Cylinder Water Pipe  
Section 15061 – 13**

1. Immediate backfill should follow the completion of the joint mortaring operation where possible. Care must be taken to immediately wet down and consolidate the backfill, to avoid draining the moisture from the mortar through porous diapers into dry backfill soil, or disturbing the mortar set by subsequent compaction of the backfill.
2. Completed-joint mortar to be exposed to the sunlight where backfill will not take place until after the mortar has hardened must be kept continually moist during the curing period to prevent cracking of the curing mortar.

**END OF SECTION 15061**

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**SPECIFICATIONS - DETAILED PROVISIONS**  
**Section 15064 - Plastic (PVC) Pressure Water Pipe & Fittings**

**C O N T E N T S**

<b>PART 1 - GENERAL .....</b>	<b>1</b>
1.01 REQUIREMENT .....	1
1.02 DELIVERY .....	1
1.03 QUALITY ASSURANCE .....	1
1.04 MEASUREMENT AND PAYMENT .....	1
<b>PART 2 - PRODUCTS AND MATERIALS .....</b>	<b>2</b>
2.01 TYPE OF PVC PIPE .....	2
2.02 PIPE CLASS OR WORKING PRESSURE .....	2
2.03 TYPE OF FITTING .....	2
2.04 RESTRAINED SYSTEM .....	2
2.05 SERVICE CONNECTION OUTLETS .....	2
2.06 POLYETHYLENE ENCASEMENT .....	3
<b>PART 3 - EXECUTION .....</b>	<b>3</b>
3.01 FACTORY TESTING .....	3
3.02 INSTALLATION .....	3

**SECTION 15064**  
**PLASTIC (PVC) PRESSURE WATER PIPE & FITTINGS**

**PART 1 - GENERAL**

**1.01 REQUIREMENT**

It is required that the Contractor shall furnish, deliver, unload and string along the trench site, all pipe and material as hereinafter described in the specifications. All fabrication, workmanship, material and testing of pipe shall conform to the latest revision of the specifications.

**1.02 DELIVERY**

- A. Transport, deliver, unload, store and handle all materials in a manner to prevent damage to the materials or the work.
- B. All damaged, broken or otherwise defective materials will be rejected.
- C. Store all circular rubber gaskets and special lubricants in packaged materials with the manufacturer's name, brand and all other applicable data plainly marked thereon.

**1.03 QUALITY ASSURANCE**

Unless otherwise specified, all work specified herein and as shown on the drawings shall conform to the applicable requirements of the latest revision of the following standards. Unless specifically stated otherwise, the most stringent requirement will govern when there is a conflict.

- A. AWWA C-900. American Water Works Association (AWWA) C-900 standard for polyvinyl chloride (PVC) pressure pipe 4 inches through 12 inches for water.
- B. AWWA C-905. American Water Works Association (AWWA) C-905 standard for polyvinyl chloride (PVC) transmission pipe 14 inches through 36 inches.
- C. Any pipe showing discoloration, chaulking, checking or other visible damage due to ultraviolet light exposure shall not be accepted by the District.

**1.04 MEASUREMENT AND PAYMENT**

Payment for pipe shall be made on a unit price basis per lineal foot of pipe.

## **PART 2 - PRODUCTS AND MATERIALS**

### **2.01 TYPE OF PVC PIPE**

PVC pipe shall be extruded from 12454 A or B compound providing a hydrostatic design basis (HDB) of 4000 p.s.i. in accordance to AWWA C-900 and C-905. Pipe shall have cast iron outside diameters.

All rubber rings shall be furnished by the pipe manufacturer. These rubber rings (elastomeric gaskets) shall be manufactured to conform with the requirements of ASTM F-477.

### **2.02 PIPE CLASS OR WORKING PRESSURE**

AWWA C-900 PVC pipe shall be class 150 and AWWA C-905 PVC pipe shall be rated at 235 p.s.i. (DR-18) or as specified on approved drawings. PVC pipe shall not be installed for working pressures exceeding 150 p.s.i. unless specifically approved by the District.

### **2.03 TYPE OF FITTING**

Fittings for PVC pipe shall be flanged or bolted mechanical joint or push-on joint ductile or gray iron fittings and shall conform to ANSI/AWWA C110/A21.10 or C153/A21.53, and ANSI/AWWA C111/A21.11. All fittings shall be cement mortar lined and tar (seal) coated in accordance with ANSI/AWWA C104/A21.4.

### **2.04 RESTRAINED SYSTEM**

Restrained Joints shall be provided by a clamping ring and an additional ring designed to seat on the bell end of the pipe. The rings shall be connected with T-Head bolts or rods. Restraining devices shall provide full (360 degree) support around the circumference of the pipe. No point loading shall be permitted. Restraint of mechanical joint fittings shall be provided by a clamping ring installed on the PVC pipe and connected to the mechanical joint fitting with T-Head bolts or rods. Restraining devices shall meet or exceed the requirements of ASTM F-1674 or UNI-Bell B-13 "Recommended Standard Performance Specification for Joint Restrainers for Use with PVC Pipe." Restraining devices shall be UNI-Flange Series 1300 or 1350 or approved equal.

All buried steel parts shall be sand blasted in accordance with the coating manufacturer's technical data sheet for "submerged" service and coated with a two coat epoxy. Epoxy shall be Tnemac Series 66 or equal. All bolts and tie rod materials shall be either high strength cast iron containing a minimum of 0.5% copper or high-strength, low alloy steel, as specified in AWWA C-111 for buried mechanical joints.

### **2.05 SERVICE CONNECTION OUTLETS**

All service connections to PVC pressure pipe water main shall be constructed with bronze service saddles with CS threads for receiving a bronze corporation stop in accordance with standard drawings. Service saddle shall be Jones, Mueller, or approved equal.



**2.06 POLYETHYLENE ENCASEMENT**

All ductile or gray iron fittings shall be polyethylene encased at the time of installation. Polyethylene encasement and installation shall be in accordance with ANSI/AWWA C105.

**PART 3 - EXECUTION**

**3.01 FACTORY TESTING**

All pipe shall be tested in the United States in accordance with AWWA C900 and C-905 and certification of the testing shall be furnished to the engineer upon his request prior to delivery. The engineer may be present during physical testing of pipe.

**3.02 INSTALLATION**

PVC pipe shall be installed in accordance with Sections 02718 and 02201 of Eastern Municipal Water District Specifications.

**END OF SECTION 15064**

**SPECIFICATIONS - DETAILED PROVISIONS**  
**Section 15081 - Gaskets**

**C O N T E N T S**

<b>PART 1 - GENERAL .....</b>	<b>1</b>
1.01 REQUIREMENT .....	1
1.02 FLANGE INSULATING GASKET KITS .....	1

**SECTION 15081  
GASKETS**

**PART 1 - GENERAL**

**1.01 REQUIREMENT**

Gaskets for steel and cast iron flanges shall be of dimensions conforming to the requirements of Standard Drawing B-288, and shall be standard full face for pipe 27" diameter and larger.

Gaskets shall be 1/16", non-asbestos model # Garlock 3000 or Tripac 5000.

**1.02 FLANGE INSULATING GASKET KITS**

A. Pipe flange insulating kit materials shall be of the type designated by the manufacturer as suitable for appropriate service at the operating temperatures and pressures specified on the Plans.

B. Flange insulating kits shall consist of a one piece full-face, insulating gasket, an insulating sleeve for each bolt, two insulating washers for each bolt, and a steel washer between each insulating washer and nut.

1. Insulating gasket shall be a full faced NEMA Grade G-10 Glass Epoxy Laminated Retainer with a precision tapered groove to accommodate the compression of a BUNA-N or VITON sealing element. Minimum total thickness shall not be less than 1/8-inch. Dielectric strength shall be not less than 550 volts per mil, and compressive strength of not less than 50,000 psi. Use PSI Linebacker or equal.

a. Optional Materials:

1. Neoprene faced phenolic gasket

2. Insulating sleeves shall be full length, one piece, insulating flange bolt sleeves for the appropriate bolt size. Insulating sleeves shall be NEMA G-10 Glass Epoxy Laminated tubing (Pyrox). Dielectric strength shall be not less than 400 volts per mil.

a. Optional Materials:

1. Phenolic tubing
2. Nomex tubing
3. Mylar tubing
4. Polyethylene tubing

3. Insulating washers shall be NEMA Grade G-10 Glass Epoxy Laminated Washers with a minimum thickness of 1/8-inch. Dielectric strength shall not be less than 550 volts per mil, and compressive strength of not less than 50,000 psi.

Gaskets  
Section 15081 – 2

- a. Optional Materials:
  - 1. Phenolic Washers
  - 2. Nomex Washers

- 4. Provide cadmium plated steel flange bolt washers for placement over the insulating washers with a minimum thickness of 1/8 inch.

**END OF SECTION 15081**

Revised 101907

**SPECIFICATIONS - DETAILED PROVISIONS**  
**Section 15089 - Nuts & Bolts**

**C O N T E N T S**

<b>PART 1 - GENERAL .....</b>	<b>1</b>
1.01 REQUIREMENT .....	1
1.02 USE OF ZINC CAPS FOR BURIED PIPE .....	1

**SECTION 15089  
NUTS & BOLTS**

**PART 1 - GENERAL**

**1.01 REQUIREMENT**

Bolts and nuts for flanged fittings shall be bare steel conforming to SAE J429 Grade 5 or ASTM A449 medium carbon steel quenched and tempered meeting the following requirements, and shall have hex heads and lite-pattern hex nuts.

¼" Through 1" diameter

85,000 p.s.i. proof strength  
92,000 p.s.i. yield strength  
120,000 p.s.i. tensile strength

Over 1" to 1½" diameter

74,000 p.s.i. proof strength  
81,000 p.s.i. yield strength  
105,000 p.s.i. tensile strength

**1.02 USE OF ZINC CAPS FOR BURIED PIPE**

Each bolted fitting including couplings, flange adapters, restrained joints, etc. that have manufactured bolts and nuts shall have a minimum of 2 zinc caps anodes as specified below.

Bolt sizes and number of zinc caps:

through 1" diameter - 2 zinc caps  
over 1" diameter - 4 zinc caps

Weight of zinc caps:

Zinc caps to be 6 oz. weight.

Material reference:

Zinc caps shall be per ASTM B418-80 and Mil-A-18001J, and be manufactured by Mars, Reliance, or equal.

**END OF SECTION**

Revised 012006

**SPECIFICATIONS - DETAILED PROVISIONS**  
**Section 15102 - Resilient-Seated Gate Valves**

**C O N T E N T S**

<b>PART 1 - GENERAL .....</b>	<b>1</b>
1.01 DESCRIPTION .....	1
1.02 QUALITY ASSURANCE .....	1
1.03 SUBMITTALS .....	1
1.04 PRODUCT DELIVERY .....	1
1.05 JOB CONDITIONS .....	1
1.06 ALTERNATIVES .....	2
1.07 GUARANTEE .....	2
<b>PART 2 - PRODUCT .....</b>	<b>2</b>
2.01 MATERIALS .....	2
2.02 COATINGS .....	2
2.03 FABRICATION AND MANUFACTURE .....	3
<b>PART 3 - EXECUTION .....</b>	<b>3</b>
3.01 INSPECTION .....	3
3.02 PREPARATION .....	4

**SECTION 15102  
RESILIENT-SEATED GATE VALVES**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

The Contractor shall furnish, deliver, and unload within the time specified in the Special Conditions, the resilient-seated gate valves as hereinafter described.

**1.02 QUALITY ASSURANCE**

Quality Assurance includes the requirements of this specification and the requirements of the latest revision of the following standards, as applicable. Unless specifically stated otherwise, the most stringent requirement will govern when there is a conflict.

- A. AWWA C-509. American Water Works Association Standard for Resilient Seated Gate Valves, 3" through 30" NPS, for Water and Sewage Systems
- B. AWWA C-515. American Water Works Association Standard for Reduced-Wall, Resilient Seated Gate Valves, 3"-16" & 3"-36" NRS.
- C. AWWA C-550. American Water Works Association Standard for Protective Interior Coatings for Valves and Hydrants.

**1.03 SUBMITTALS**

The name of the manufacturer of the valves to be furnished by the bidder shall be stated on the bidding sheets. Proposed valves other than those listed on the EMWD approved Material List must be submitted for evaluation well in advance of the bid opening, for acceptance prior to the award of the contract. Generally, the specified 35-day period following issuance of the Notice-of-Acceptance-of-Proposal is not sufficient for approval of alternate valves.

**1.04 PRODUCT DELIVERY**

- A. Storage. Valves shall be stored in the closed position to protect seating surfaces.
- B. Handling. Valves shall be carefully lowered from the truck to the ground. Do not hook hoists or fasten chains around stem, gearing, motors, cylinders, or handwheels.

**1.05 JOB CONDITIONS**

Valves shall not be fabricated, stored, coated, or installed in climatic conditions that will adversely affect the quality of the finished project.



Resilient-Seated Gate Valves  
Section 15102 - 2

1.06 ALTERNATIVES

Valve ends shall be as specified on the bidding sheet, plans or specifications as applicable; these may be flanged both ends, hub-end both ends, or one flanged end and one hub-end, conforming to the following specifications:

- A. Flanged End. Flanged ends shall be designed for the water pressure as specified in AWWA C-509 and drilled to the American Standard for 125# Cast Iron Flanges, and flange face shall not be raised. Flange face shall have standard machine finish.
- B. Hub-End. Hub-ends shall be designed for the water pressure as specified in AWWA C-509 and shall be "Ring-tite", "Fluid-tite" or approved equal.

1.07 GUARANTEE

Contractor shall guarantee all materials and workmanship of items furnished under these specifications shall be free from defects for a period of one (1) year after final completion and acceptance of the entire contract work. The Contractor shall, at his own expense, repair or replace all defective materials or workmanship supplied by him that are found to be deficient with respect to any provisions of this specification.

**PART 2 - PRODUCT**

2.01 MATERIALS

Resilient Seated Gate Valves shall include the following materials:

- A. Non-Rising Stems. Clockwise to close, counterclockwise to open. Valve stems shall be of bronze, having a minimum tensile strength of 55,000 psi and a yield point of not less than 40,000 psi, with an elongation of not less than 10% in 2". Heat treatment will be permitted to develop these requirements. All bronze shall contain not more than 7% zinc nor more than 2% aluminum.
- B. 2" Square Nut with arrow cast in metal to indicate opening direction, except where specified otherwise.
- C. Resilient Seats may be bonded or mechanically attached to either the gate or valve body.

2.02 COATINGS

- A. All valves shall have internal and external ferrous parts epoxy coated. Wetted surfaces shall have an 8 mil minimum (dry film) thickness, unless otherwise specified. The epoxy shall be approved for potable water, and shall conform to AWWA C-550.
- B. All coated surfaces shall be visually and electrically examined for defects. The coating shall be holiday free as determined by a low voltage wet sponge test per AWWA C-550.

2.03 FABRICATION AND MANUFACTURE

- A. Interchangeability. All like parts of all valves of the same model number and size shall be interchangeable.
- B. Waterway. With the valve open, there shall be a smooth and unobstructed waterway at least equal to the nominal valve diameter. There shall be no sediment pockets in the valve.
- C. Valve Actuator. Resilient Seated Gate Valves 16-inches through 36 inches shall have a gear reduction actuator that meets the following maximum values for torque and number of turns:

Valve Size	Maximum Input Torque (ft. lbs.)	Maximum Number of Turns to Open/Close
16"	65	200
18"	80	225
20"	125	250
24"	150	310
30"	350	380
36"	385	450

- D. Cast Marking. Valves shall have the manufacturer's name, the size of the valve, and the working pressure cast on the side of the valves.
- E. Stem Sealing. Stems shall be sealed by the use of multiple stem seal o-rings.

**PART 3 - EXECUTION**

3.01 INSPECTION

- A. Hydrostatic Tests. All valves shall have hydrostatic shell test of 400 psi and a bubble tight shut-off test of 200 psi.
- B. Coating Tests. All coated surfaces shall be visually and electrically examined for defects. The coatings shall be holiday free with a low voltage wet sponge test per AWWA C-550.
- C. Operation Test. Each valve shall be operated through one complete cycle in the position for which it is designed, to ensure proper functioning of all parts.

Resilient-Seated Gate Valves  
Section 15102 – 4

D. Additional Testing (RSGVs 16-inch and Larger). Resilient Seated Gate Valves 16-inch and larger shall be hydrostatically tested and performance tested per AWWA C509 and C515. This test shall be conducted within 100 miles of the District office and shall be performed in the presence of a District Inspector. No valve shall be installed until this testing has been completed and approved by the District. Each valve shall be tested as detailed in AWWA and District Standard Specifications and as specified below:

1. Visually inspect each valve for obvious damage, substandard construction and compliance with specifications.
2. Each valve shall be operated through one complete cycle in the position for which it is designed, to ensure proper functioning of all parts.
3. Each valve shall be hydrostatically tested at its rated pressure. The testing medium shall be water (no air shall be used as the test medium under any circumstance). Both sides of the valve are to be tested.
4. The test duration on each side of the valve shall be 5 minutes. A passing test is one where there is no visible leakage and no decrease in the initial test pressure.
5. A valve that fails the hydrostatic test shall be either repaired or replaced. Repaired/replaced valves shall be retested using the same procedure.
6. Valves shall only be repaired by personnel authorized by the valve manufacturer. Unless specifically authorized by the valve manufacturer, supplier or contractor shall not be permitted to perform repairs.

3.02 PREPARATION

Valves shall be complete when shipped. They shall be drained and closed before shipment.

**END OF SECTION 15102**

Revised 03/95

**SPECIFICATIONS - DETAILED PROVISIONS**  
**Section 15136 - Air Valves**

**C O N T E N T S**

<b>PART 1 - GENERAL</b> .....	<b>1</b>
1.01 Requirement .....	1
1.02 Valve Manufacturer .....	1
1.03 Guarantee .....	1
<b>PART 2 - PRODUCT</b> .....	<b>1</b>
2.01 Materials .....	1
2.02 Operational Features .....	1
2.03 System Air Valves .....	2
2.04 Pump Air Valves .....	2

**SECTION 15136  
AIR VALVES**

**PART 1 - GENERAL**

**1.01 REQUIREMENT**

Under these specifications the Contractor shall be required to furnish, deliver and unload at the place stated, and within the time specified in the Special Provisions, the air valves for water systems as specified on the Bidding Sheet and hereinafter described in these specifications. Air valves for sewerage systems are not included in this specification, but will be specifically called out on the construction drawings.

**1.02 VALVE MANUFACTURER**

The name of the manufacturer of the valves to be furnished by the bidder shall be stated on the Bidding Sheet. If valves different than listed herein are proposed, the bidder shall submit drawings of the proposed valves to the District prior to the time of opening bids. Bidder's drawings need not be submitted if such drawings have previously been approved by the Engineer as to compliance with the specifications.

**1.03 GUARANTEE**

The Contractor shall guarantee all materials and workmanship of items furnished under these specifications shall be free from defects for a period of one (1) year after final completion and acceptance of the entire contract work. The Contractor shall, at his own expense, repair or replace all defective materials or workmanship supplied by him found to be deficient with respect to any provisions of this specification.

**PART 2 - PRODUCT**

**2.01 MATERIALS**

All valves shall have a body of high grade cast iron and have all internal parts of solid bronze or stainless steel. All valves shall be designed for a working pressure of not less than 150 p.s.i..

**2.02 OPERATIONAL FEATURES**

A. Air Valves. All valves shall be designed to automatically operate as specified herein:

1. Will positively open under atmospheric pressure to allow air to escape from the pipe through the valve.

Air Valves  
Section 15136 – 2

2. Will positively close as water under low head fills body of the valve.
  3. Will not blow shut under high velocity air discharge, to allow air to escape from pipe while pipe is being filled.
  4. Will permit the escape of accumulated air under pressure, while pipeline is in operation.
- B. Air-Vacuum Valves. Shall be designed to automatically permit the rapid egress of large amounts of air from the pipeline while the pipeline is being filled with water, and to permit the rapid ingress of large amounts of air into the pipeline while the pipeline is being emptied.
- C. Air Release Valves. Shall be designed to automatically permit the escape of small amounts of accumulated air from pipelines operating under pressure.
- D. Combination Air-Vacuum and Air Release Valves. Shall be designed to automatically operate as described above for air-vacuum valves and air release valves.

2.03 SYSTEM AIR VALVES

Air valves for use in distribution systems shall be the float and lever type of the makes listed herein, or equal as approved by the Engineer:

<u>Manufacturer</u>	<u>Sizes</u>
Air Release Valves	
Apco #65	3/4"
Air Release & Vacuum Valves	
Apco 143-C	1"
Apco 145-C	2"
Valmatic 201-C	1"
Valmatic 202-C	2"
Crispen U-10	1"
Crispen U-20	2"
Apco 149-C	4"
Apco 150-C	6"

2.04 PUMP AIR VALVES

All air release valves for use on pumps shall have 3/4" pipe connection and shall be Armstrong Machine Works No. 21 AR Air Relief Trap, or equal as approved by the Engineer.

END OF SECTION 15136

Revised 08/96

**SPECIFICATIONS - DETAILED PROVISIONS**  
**Section 16640 - Corrosion Monitoring System for Underground Piping**

**C O N T E N T S**

<b>PART 1 - GENERAL .....</b>	<b>1</b>
1.01 DESCRIPTION .....	1
1.02 SUBMITTAL .....	1
<b>PART 2 - PRODUCT .....</b>	<b>1</b>
2.01 TEST BOXES .....	1
2.02 WIRE .....	1
2.03 REFERENCE ELECTRODES .....	1
2.04 THERMITE WELDS .....	2
<b>PART 3 - INSTALLATION .....</b>	<b>2</b>
3.01 REFERENCE CELLS .....	2
3.02 THERMITE WELD .....	2
3.03 SPLICE .....	2
3.04 TESTING PROCEDURES FOR COMPLETED TEST STATIONS AND JOINT BONDS .....	2

**SECTION 16640**  
**CORROSION MONITORING SYSTEM FOR UNDERGROUND PIPING**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

Construct corrosion monitoring system for the pipeline by installing test stations as shown on the drawings and as specified herein.

**1.02 SUBMITTAL**

Submit catalog data on test boxes, wire, copper sulfate reference cells, thermite welds, and weld coating.

**PART 2 - PRODUCT**

**2.01 TEST BOXES**

Each test station enclosure shall be a concrete valve box with a cast iron cover marked "EMWD CP Test". Test stations shall be Brooks Products valve box 1-RT or approved equal through EISEL Enterprises or J & R Concrete Products.

**2.02 WIRE**

Copper-Copper Sulfate (CSE) reference electrodes lead wires are specified under "Reference Electrodes" below. Other wiring to be copper of the size shown and shall have THWN insulation of the color shown. Dyed insulation is not acceptable.

**2.03 REFERENCE ELECTRODES**

Reference electrodes shall be copper-copper sulfate (CSE) suitable for direct burial. They shall be designed to remain stable for at least twenty years. The reference cell shall be capable of maintaining a potential within 15 millivolts of a freshly made cell while draining 2 microamperes. Reference cells shall contain a barrier to inhibit migration of chloride ions from the soil into the reference cell. Reference cell lead wire shall be #14 AWG copper, with yellow RHW insulation and shall be silver soldered to the copper core of the reference cell with the connection epoxy sealed by the manufacturer. CSEs shall be Stelth 2 by Borin Manufacturing, Staperm Model CU-1-UGPC by GMC Corrosion, or equal.



Corrosion Monitoring System for Underground Piping  
Section 16640 – 2

**2.04 THERMITE WELDS**

Thermite weld shall be "Cadweld" by Erico Products, "Thermoweld" by Continental Industries, Inc., or equal. Mold shall be the type recommended by the manufacturer for the wire size, metal shape, and orientation. Weld alloy shall be formulated for use on steel or iron pipe as appropriate and shall be of the weight recommended by the manufacturer for the size cable and mold being used. Welds to be buried or submerged shall be primed with an elastomer resin based primer then be covered with a 100% solids mastic filled plastic cap or cement-mortar. Use the plastic cap on dielectric coated pipe following the manufacturer's instructions. Use cement-mortar on cement-mortar coated pipe. Primer and cap shall be Roybond Primer 747 and Handy Cap as manufactured by Royston Laboratories, or equal.

**PART 3 - INSTALLATION**

**3.01 REFERENCE CELLS**

Install reference cells as detailed on the drawings. Backfill around each reference cell and compact to the relative compaction specified in Section 02201 taking care not to damage the reference cell. Coil the reference cell wire in slack loops to compensate for settlement both near the cell and near the cathodic test station. Any damage to the insulation on the reference cell wire shall be wrapped with two layers of Scotch No. 88 vinyl electrical tape or equal. Wet the reference cell and backfill per the manufacturer's instructions.

**3.02 THERMITE WELD**

Clean pipe to bright metal. Weld according the manufacturer's instructions. Test completed weld by striking the side of the weld solidly with a 16 ounce or larger hammer. Remove flux and coat as specified above.

**3.03 SPLICE**

Splices shall be made only where shown or allowed. Splices shall be made using split bolt connectors or crimp connectors of the smallest size compatible with the cables being used. Connections shall be insulated with two half lapped layers of rubber tape and at least one half lapped layer of plastic tape, by encasing in resin (3M Scotchcast), heat shrink sleeve (Raychem ASE), or equal.

**3.04 TESTING PROCEDURES FOR COMPLETED TEST STATIONS AND JOINT BONDS**

After the pipeline is backfilled test each test station and joint bonds for effectiveness using the procedures described below. The testing and report shall be completed by or under the direction of a California licensed corrosion engineer or NACE International Certified Cathodic Protection Specialist.

Measure native pipe-to-soil potentials to a portable CSE using each wire at each test station and to the stationary CSE where installed. Repair or replace any wires or test stations that are not operating properly and remeasure to confirm proper operation. Record the data in clear tabular form.

**Corrosion Monitoring System for Underground Piping  
Section 16640 – 3**

Test to determine if the joint bonds are effective using a temporary cathodic protection system. Measure pipe-to-soil potentials at test stations at the ends of the pipe and other locations as necessary to confirm electrical continuity with cathodic current applied and immediately after turning the current off. Installer shall repair all discontinuities found. Repaired test station shall be retested until continuity is established throughout the installed piping. Record the potentials and currents.

During the corrosion monitoring system test described above, measure pipe-to-soil potentials on both sides of each insulated joint to determine its effectiveness. If defective insulated joints are found, repairs shall be made by the installer. Retests and measurements shall be reported until all insulated joints are proved effective.

Submit a written report with test data, conclusions, and any recommendations signed by licensed corrosion engineer or cathodic protection specialist.

**END OF SECTION**

# **APPENDIX A**

## **EMWD APPROVED MATERIAL LISTS**

**APPENDIX A**

**EMWD APPROVED MATERIALS LIST**

**Latest Revision:**  
**October 1, 2009**

# **EASTERN MUNICIPAL WATER DISTRICT APPROVED MATERIALS LIST**

## **C O N T E N T S**

1.	AIR VALVES .....	1
2.	CAST IRON FITTINGS C-110 .....	1
3.	DUCTILE IRON FITTINGS C-153 .....	2
4.	FIRE HYDRANTS .....	2
5.	FRAMES AND COVERS .....	2
6.	METERS .....	3
7.	METER BOXES .....	3
8.	MISCELLANEOUS BRASS .....	4
9.	PIPE .....	5
10.	PRECAST MANHOLES - Manhole Shafts, Cones, Flat Tops & Grade Rings 24" - 48" .....	6
11.	RESTRAINING JOINT DEVICES.....	7
12.	VALVES .....	7
13.	ZINC CAPS .....	11
14.	WIRING .....	11
15.	VFD's .....	11

Approved Materials

## APPENDIX "A"

### EASTERN MUNICIPAL WATER DISTRICT APPROVED MATERIALS LIST

If Contractor uses materials listed on this approved material list, no formal submittal will be required, except for pipe submittals. Contractor, however, must submit and identify that materials to be used on the project comply with the approved list.

#### 1. AIR VALVES

Air Release and Vacuum Valve - EMWD Standard Drawing B-598 and B-367, Sizes 1" & 2"

- APCO VALVE COMPANY - Model 143C and 145C
- CRISPIN VALVE COMPANY - Model UL-10 and UL-20
- EMPIRE VALVE COMPANY - Model 940
- VALVMATIC VALVE COMPANY - Model 201-C and 202C
- CLA-VAL COMPANY - Model #361-CAV564B and #362-CAV332

Air Release and Vacuum Valve - EMWD Standard Drawing B-578, Sizes 4" & 6"

- APCO VALVE COMPANY - Model APCO 149-C & APCO 150-C
- CRISPIN VALVE COMPANY - Model UL-41 (4") and Model AL-61/PL-10 (6")
- CLA-VAL COMPANY - Model #364-CAV332 and #366-CAV732-3

Pump Air Valve

- ARMSTRONG MACHINE WORKS - Model 21

#### 2. CAST IRON FITTINGS C-110

Cast Iron Flanged Fittings, Various Sizes -

- Shall conform to the latest revision of ASA Specification A21.10 (AWWA C110) Flanged Fittings. These fittings shall be cement lined in accordance with the latest revision of ASA Specification No. A21.4 and shall have standard machine finish.

Cast Iron Hub Fittings -

- Shall conform to the latest revision of AWWA C100.52 ASA 21-10250 PSI for Class 150 and 200 pipe, cement line in accordance with the latest revision of ASA Specification A21.4.
- Size, Joint size, and Pressure Rating shall be as specified on Purchase Orders, Construction plans, and Bid Sheets.

Cast Iron Fittings -

- Shall conform to latest revision of ASA Spec. A21.10 (AWWA C110) Flanged Fittings.

Fittings shall be cement lined, ASA Spec. A21.4, and shall have standard machine finish.

- SIGMA CORPORATION - Model Sigma/Nappco
- STAR PIPE PRODUCTS - Model Star Fittings
- TYLER PIPE - Model Tyler Fittings
- UNION FOUNDRY\* - Model Union Fittings \*(Domestic Fittings)
- SMITH COPPER - Model Flanged Fittings for 125# and 250#