



Monte Vista Water District

TECHNICAL SPECIFICATIONS

FOR
DEVELOPMENT PROJECTS

NOVEMBER 2018

TABLE OF CONTENTS

TECHNICAL SPECIFICATIONS

02223	Trenching, Backfilling, and Compacting
15041	Water Pipeline Testing and Disinfection
15050	Piping, Valves, and Accessories
15060	Piping – Installation

SECTION 02223

TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.1 DESCRIPTION

This Section describes materials, testing, and performance of trench excavation, backfilling, and compacting.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Refer to the following Specification section(s) for additional requirements:

- A. Submittals: Section 01300
- B. Asphalt Pavement: Section 02461
- C. General Concrete Construction: Division 3
- D. General Piping Requirements: Division 15

1.3 SUBMITTALS

Furnish submittals in accordance with the requirements of Section 01300, Submittals. The following submittals are required:

- A. Submit Drawings showing excavation and shoring, bracing, or sloping for worker protection.
- B. Submit six copies of a report from a testing laboratory verifying that backfill material conforms to the specified gradations or characteristics for pea gravel, granular material, imported sand, rock refill for foundation stabilization, and water.

1.4 PROTECTION OF EXISTING UTILITIES AND FACILITIES

- A. General: Protect all existing sewer pipelines, water pipelines, gas mains, storm drains, culverts, or other facilities and structures that may be encountered in or near the area of Work.
- B. Notification: Notify each agency having jurisdiction over the Work and make arrangements for locating each agency's facilities prior to beginning construction by calling Underground Service Alert/Dig Alert two full working days prior to performing any excavations.
- C. Damage: In the event of damage to any existing facilities during the progress of the Work due to the failure of the CONTRACTOR to exercise proper precautions, the CONTRACTOR shall pay for the cost of all repairs and protection to said facilities, at CONTRACTOR's sole expense. The CONTRACTOR's Work may be stopped until repair operations are complete without cost to the OWNER.

1.5 PROTECTION OF LANDSCAPING

- A. General: Protect all trees, shrubs, fences, and other landscape items adjacent to or within the site unless directed otherwise in the Drawings. In the event of damage to landscape items, replace the damaged items in a manner satisfactory to the ENGINEER.
- B. Restoration: After the completion of Work in planted or improved areas within public or private easements, restore such areas to original condition. Restoration shall include re-grading, placement of 5 inches of topsoil, reseeding, and replacement of landscaping.

PART 2 - MATERIALS

2.1 DEFINITION OF ZONES

- A. Pavement Zone: The pavement zone shall include the asphaltic concrete (or portland cement concrete) and aggregate base pavement section placed over the street zone.
- B. Street Zone: The street zone shall consist of the top 18 inches of the trench immediately below the pavement zone in paved areas or areas to be paved.
- C. Trench Zone: The trench zone shall include the portion of the trench from the top of the pipe zone to the bottom of the street zone in paved areas or to the final grade in unpaved areas.
- D. Pipe Zone: The pipe zone shall include the full width of trench from the bottom of the pipe or conduit to a horizontal level 12 inches above the top of the pipe. Where multiple pipes or conduits are placed in the same trench, the pipe zone shall extend from the bottom of the lowest pipe(s) to a horizontal level 12 inches above the top of the highest or topmost pipe.
- E. Pipe Base: The pipe base shall be defined as a layer of material immediately below the pipe zone and extending over the full trench width.

2.2 NATIVE EARTH BACKFILL--TRENCH ZONE

Excavated native earth backfill shall be fine-grained non-organic materials free from peat, roots, debris, and rocks larger than 3 inches, and which can be compacted to the specified relative compaction.

2.3 BACKFILL--PIPE ZONE AND PIPE BASE

Unless otherwise specified or shown on the Drawings, the pipe base and pipe zone backfill material shall be imported sand as specified herein.

2.4 IMPORTED SAND--PIPE ZONE AND PIPE BASE

Imported sand used in the pipe zone or for the pipe base shall have the following gradation:

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

Minimum sand equivalent shall be 30 per ASTM D 2419.

2.5 IMPORTED BACKFILL

When suitable material for backfill is not available at the site, CONTRACTOR shall use imported material. Such materials shall be clean soil, free from organic material, trash, debris, rubbish, broken portland cement concrete, bituminous materials, or other objectionable substances.

CONTRACTOR shall deliver to the OWNER a sample of the imported material for backfill not less than 10 days prior to use. The sample shall have a minimum dry weight of 100 pounds and shall be clearly identified as to source, including street address and community of origin. The OWNER will determine the suitability, the minimum relative compaction to be attained, and the placement method.

If the imported material is not substantially the same as the approved sample, it shall not be used for backfill and shall be removed from the Work site at the CONTRACTOR's sole expense.

The densification method for imported material authorized by the OWNER will be dependent upon its composition, the composition of the in-place soil at the point of placement, and the relative compaction to be obtained.

2.6 GRAVEL AND CRUSHED ROCK--PIPE ZONE AND PIPE BASE

Gravel or crushed rock material shall conform to the Standard Specifications, Section 200-1.2 and shall meet the following gradation:

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

2.7 REFILL MATERIAL FOR FOUNDATION STABILIZATION

Refill material below the pipe shall be either material conforming to the 1½-inch size requirement for gravel or crushed rock, or naturally occurring rock having the following gradation:

Sieve Size	Percent passing by Weight
3 inches	100
1-1/2 inches	70 - 100
3/4-inch	60 - 100
No. 4	5 - 55
No. 30	0 - 30
No. 200	0 - 10

2.8 SAND-CEMENT SLURRY REFILL MATERIAL FOR FOUNDATION STABILIZATION IN PIPE BASE AND PIPE ZONE

Sand-cement slurry shall consist of one and one-half (1.5) sack of portland cement per cubic yard of sand and sufficient moisture for workability.

2.9 PEA GRAVEL

Pea gravel shall be defined as gravel, uniformly graded from coarse to fine with less than 10% passing a No. 200 sieve, less than 50% passing a No. 4 sieve, and having a maximum particle size of ¾ inch.

2.10 WATER FOR COMPACTION

Water used in compaction shall have a maximum chloride concentration of 500 mg/l, a maximum sulfate concentration of 500 mg/l, and shall have a pH of 7.0 to 9.0. Water shall be free of acid, alkali, or organic materials injurious to the pipe coatings.

PART 3 - EXECUTION

3.1 TESTING FOR COMPACTION

- A. The CONTRACTOR shall perform compaction testing at no cost to the OWNER and as described below.
- B. Methods: Determine the density of soil in place by the sand cone method, (ASTM D 1556), or by the nuclear method (ASTM D 2922 or D 3017).
- C. Soil Moisture-Density Relationship: Determine the laboratory moisture-density relations of soils shall be determined per ASTM D 1557.
- D. Cohesionless Materials: Determine the relative density of cohesionless materials by ASTM D 4253 and D 4254.
- E. Sampling: Sample backfill materials per ASTM D 75.
- F. Relative Compaction: Express "relative compaction" or "relative density" as the ratio, expressed as a percentage, of the in place dry density to the laboratory maximum dry density.
- G. Compaction Compliance: Compaction shall be deemed to comply with the Specifications when none of the tests falls below the specified relative compaction.
- H. Locations for Compaction Testing: The locations for compaction testing shall be as selected by the ENGINEER or his desingee.

3.2 COMPACTION REQUIREMENTS

Unless otherwise shown on the Drawings or otherwise described in the Specifications for the particular type of pipe installed, relative compaction in pipe trenches shall be as follows:

- A. Pipe Base and Pipe Zone: Pipe base and pipe zone--90% relative compaction. Note 95% relative compaction requirement in specific areas shown on the plan and profile Drawings.
- B. Trench Zone - Not Beneath Paving: Backfill in trench zone not beneath paving--90% relative compaction.
- C. Trench Zone - Paved Areas: Backfill in trench zone in paved areas--90% relative compaction.
- D. Street Zone: Backfill in street zone in paved areas--95% relative compaction.
- E. Foundation Stabilization: Rock refill material for foundation stabilization--90% relative density.
- F. Overexcavation: Rock refill for overexcavation--90% relative density.

- G. CONTRACTOR shall test all imported or native materials before the start of compaction operations to determine the moisture density relationship for materials with cohesive components, and the maximum density for cohesionless materials. Variations in imported or native earth materials may require a number of base curves of the moisture-density relationship.
- H. Unless noted otherwise, CONTRACTOR shall perform compaction tests at random depths and at 200-foot intervals, and as directed by the ENGINEER.

3.3 MATERIAL REPLACEMENT

CONTRACTOR shall remove trenching and backfilling material, which does not meet the Specifications and replace at no additional expense to OWNER.

3.4 SHEETING, SHORING, AND BRACING OF TRENCHES

Trenches shall have sheeting, shoring, and bracing conforming to CAL/OSHA requirements and the Contract Documents. Base lateral pressures for design of trench sheeting, shoring, and bracing on type of soil exposed in the trench, groundwater conditions, surcharge loads adjacent to the trench, and type of shoring that will be used in the trench.

3.5 TRENCH WIDTHS

- A. Pipe Diameter 12 inches and Greater: Unless shown otherwise on the Drawings, trench widths in the pipe zone shall be equal to the pipe outside diameter plus 12 inches on each side of the pipe. Trench width at the top of the trench shall not be limited except where width of excavation would undercut adjacent structures and footings. In such cases, width of trench shall be such that there is at least 18 inches between the top edge of the trench and the structure or footing.
- B. Pipe Diameter 10 inches and Under: Excavation and trenching shall be true to line so that a clear space of not more than 8 inches or less than 6 inches in width is provided on each side of the largest outside diameter of the pipe in place measured at a point 12 inches above the top of the pipe. The largest outside diameter shall be the outside diameter of the bell on bell and spigot pipe.
- C. Where the trench width, measured at a point 12 inches above the top of the bell of the pipe, is wider than the maximum set forth above, backfill the trench area around the pipe with crushed rock, Class B concrete, or slurry to form a cradle for the pipe, at the discretion of the ENGINEER.

3.6 GRADE

CONTRACTOR shall excavate trenches to the lines and grades shown on the Drawings with allowance for pipe thickness and for pipe base. If the trench is excavated below the required grade, CONTRACTOR shall refill the portion of the trench excavated below the grade with refill material at no additional cost to the OWNER. CONTRACTOR shall place the refill material over the full width of trench in compacted layers not exceeding 6 inches deep to the required grade less allowance for the pipe base. CONTRACTOR shall also remove hard spots that would prevent a uniform thickness of pipe base.

Before laying pipe sections, CONTRACTOR shall check the grade with a 10-foot straightedge and correct any irregularities. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point.

3.7 PIPE BASE THICKNESS

Thickness of the pipe base shall be as shown on the Drawings or as otherwise described in the Specifications for the particular type of pipe installed, but in no case shall the thickness be less than 4 inches.

3.8 DEWATERING

A. Means and Devices: CONTRACTOR shall provide and maintain suitable and sufficient means and devices to continuously remove and dispose of all water entering the trench excavation during the time the trench is being prepared for the pipe laying, during the laying of the pipe, and until the backfill at the pipe zone has been completed. These provisions shall apply during the noon hour as well as overnight. CONTRACTOR shall dispose of water of in a manner to prevent damage to adjacent property. It shall not drain trench water through the pipeline under construction. Nor shall CONTRACTOR allow groundwater to rise above the bottom of the pipe until jointing compound has firmly set (if any) and the pipe is watertight.

B. Notification: CONTRACTOR shall notify the OWNER 48 hours prior to commencement of dewatering. Methods employed shall be in conformance with the OWNER's existing NPDES permits.

3.9 STORAGE OF EXCAVATED MATERIAL

During trench excavation, CONTRACTOR shall store excavated material only within the Work area. CONTRACTOR shall not obstruct roadways or streets. The safe loading of trenches with excavated material shall conform to all applicable Laws and Regulations.

3.10 LENGTH OF OPEN TRENCH

The length of open trench shall be limited to 600 feet in advance of pipe laying, or the amount of pipe installed in one working day, whichever is less. CONTRACTOR shall complete backfilling and temporary or first layer paving so that not more than 500 feet of trench is open in the rear of pipe laying. It shall backfill or adequately bridge sidewalks, driveways and other traveled ways to provide safe access and egress at the completion of each day's Work.

3.11 FOUNDATION STABILIZATION

After the required excavation has been completed, the ENGINEER shall inspect the exposed trench subgrade to determine the need for any additional excavation. It is the intent of this section that additional excavation shall be conducted in all areas within the influence of the pipeline where unacceptable materials exist at the exposed subgrade. Overexcavation shall include the removal of all such unacceptable material that exists directly beneath the pipe base and to the depth required. The presence of unacceptable material may require excavating a wider trench. CONTRACTOR shall backfill the overexcavated portion of the trench to the subgrade of the pipe base with refill material

for foundation stabilization. It shall place foundation stabilization material over the full width of the excavation and compacted in layers not exceeding 6-inches in compacted depth, to the required grade.

3.12 TRENCH BACKFILLING AND COMPACTION

- A. General: Trench backfilling shall conform to requirements of the detailed piping specification for the particular type of pipe and the following.
- B. Pipe Base: CONTRACTOR shall place the specified thickness of pipe base material over the full width of trench. It shall grade the top of the pipe base ahead of the pipe laying to provide firm, uniform support along the full length of the barrel of the pipe.
- C. Bell Holes: CONTRACTOR shall excavate holes at each joint to permit proper assembly and inspection of the entire joint.
- D. Pipe Zone: After the pipe has been bedded, CONTRACTOR shall place pipe zone material simultaneously on both sides of the pipe, keeping the level of backfill the same on each side. It shall carefully place material around the pipe so that the pipe barrel is completely supported and that no voids or uncompacted areas are left beneath the pipe. Particular care shall be taken in placing material on the underside of the pipe to prevent lateral movement during subsequent backfilling. CONTRACTOR shall compact material placed within the pipe zone by hand tamping only.
- E. Trench Zone: CONTRACTOR shall carefully deposit backfill material onto the backfill previously placed in the pipe zone. Free fall of the material shall not be permitted until at least 2 feet of cover is provided over the top of the pipe. CONTRACTOR shall not drop sharp or heavy pieces of material directly onto the pipe or the tamped material around the pipe.
- F. Trench Backfill: CONTRACTOR shall Compact trench backfill to the specified relative compaction. Compaction shall be performed by using mechanical compaction or hand tamping equipment. Unless specified otherwise, consolidation by jetting or flooding shall not be permitted. CONTRACTOR shall not use high impact hammer-type equipment except where the pipe manufacturer warrants in writing that such use will not damage the pipe.
- G. Equipment: CONTRACTOR shall not use axle-driven or tractor-drawn compaction equipment within 5 feet of walls and structures.
- H. Street Zone Backfill: Street zone backfill shall be done in accordance with the requirements and to the satisfaction of the agency having jurisdiction over such process.

3.13 IMPORT OR EXPORT OF BACKFILL MATERIAL

- A. Excess Material: CONTRACTOR shall remove and dispose of excess excavated soil material off the sites at no additional expense to the OWNER. It shall dispose of excess soil material in accordance with all applicable Laws and Regulations.
- B. Imported Material: CONTRACTOR shall import, place and compact any additional backfill material necessary to return all grades to plus or minus 0.2 foot from the grade encountered at the beginning of construction or as shown on the Drawings, at no additional cost to the OWNER.

3.14 MOISTURE CONTENT OF BACKFILL MATERIAL

During the compacting operations, CONTRACTOR shall maintain optimum feasible moisture content required for compaction purposes in each lift of the backfill material. CONTRACTOR shall maintain moisture content throughout the lift at a uniform level. If placement is discontinued and proper moisture content not maintained, CONTRACTOR shall bring the upper layer back to proper moisture content by sprinkling, cultivating and rolling the backfill material before placing new material. At the time of compaction, the water content of the material shall be at optimum water content plus or minus two percentage points. CONTRACTOR shall not work material, which contains excessive moisture to obtain the required compaction. Material having excessive moisture content may be dried by blading, discing, or harrowing to hasten the drying process.

PART 4 - PAYMENT

Payment for the Work in this Section shall be included as part of the lump sum or unit prices bid for which such Work is appurtenant thereto, and no additional payment will be made specifically for the Work in this Section.

END OF SECTION

SECTION 15041

WATER PIPELINE TESTING AND DISINFECTION

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes flushing and testing of all pressure pipelines and appurtenant piping for potable water and disinfection of all pipelines and appurtenant piping for potable water, complete, including providing test water and all disposal thereof.

1.2 STANDARD SPECIFICATIONS

- A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the latest edition of the Standard Specifications for Public Works Construction (SSPWC) together with any latest Supplement Amendment and State of California, Department of Public Health, Title 22 of the California Administration Code.

1.3 SPECIFICATIONS AND STANDARDS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:
 - 1. ANSI/AWWA B300 Hypochlorites
 - 2. ANSI/AWWA B301 Liquid Chlorine
 - 3. ANSI/AWWA C651 Disinfecting Water Mains
 - 4. APHA, AWWA, and WEF Standard methods for the Examination of Water and Wastewater
- B. Where the OWNER's standard as stated herein this Section is more stringent than above stated standards, the OWNER's standard supersedes the above stated standards.

1.4 TESTING DISINFECTION SCHEDULE, REQUIREMENTS AND RESULTS

- A. A written plan for proper installation, flushing and testing of new watermains must be submitted to the OWNER or their designee for approval prior to start of work. The plan will address how the CONTRACTOR will meet the requirements of this specification. At a minimum, it will include:
 - 1. Schematic map of the project showing sampling points, points of connection and flushing points.
 - 2. Make and model number of backflow prevention device(s) and flow meter used to connect to the water system for flushing and testing.

3. Calculations for sizing of source water connection(s), flushing velocities and total quantity, chlorine dosing, and de-chlorination.
 4. A detailed work schedule listing the approximate dates for each activity covered in this specification.
 5. A detailed work plan listing procedures and approximate dates for each activity covered in the specification.
 6. Detailed procedures for each activity.
 7. NPDES permit and compliance procedures for initial flushing and flushing during de-chlorination of pipelines.
 8. The appropriate certifications of the laboratory and the disinfection subcontractor.
 9. Emergency contact information.
- B. The written plan for installation, flushing, shutdowns, tie-ins, and activation will be submitted through the assigned OWNER Inspector to the OWNER two weeks prior and returned to the CONTRACTOR one week prior to the activity.
- C. Protection of the potable water distribution system is the ultimate responsibility of Monte Vista Water District. No entity or agent other than OWNER staff will be allowed to operate any valve or facility of the approved distribution system without the written consent and direct supervision of the OWNER Staff.
- D. Handling of New Pipe
1. Care shall be exercised in handling, loading, unloading, and storing ductile-iron pipe and fittings to avoid distortion, scratches, gouges, dents, and, in particular, scuffing of the ends.
 2. All ductile-iron pipe and fittings shall be stored under cover in a flat, horizontal position, and protected from the sun and the elements until ready for installation.
 3. Ductile-iron pipe shall be transported in a vehicle having a bed long enough to provide support for the full length of the pipe.
 4. Any length of pipe or fitting that has been damaged or distorted shall be replaced.
 5. When work is not in progress, open ends of pipe and fittings shall be securely closed so that no water, earth, or other substances will enter the pipe or fittings.
 6. The CONTRACTOR shall maintain sanitary conditions in the ditch line.
 7. CONTRACTOR shall protect the exposed interior during backfill, and not allow soil, bedding, backfill material and compaction water to enter the pipe.

8. CONTRACTOR shall seal the end of pipe with a flange, cap or plug to prevent contamination at the end of each day. Rags and plywood do not meet this requirement.

E. Initial Flushing

1. The minimum flushing velocity will be 5.0 fps.
2. The backflow device and metered connection to the potable supply will be sized to meet this minimum flow requirement. Supporting calculations will be submitted with the flushing/disinfection plan.
3. The CONTRACTOR will secure and adhere to an NPDES permit for discharged water.
4. The pipeline(s) will be flushed for sufficient time to achieve two (2) exchanges of the total volume of the pipeline as a minimum and until the water flushed runs clear. Clear means not more than two (2) NTU turbidity as measured with a portable turbidity meter and a maximum of 0.5 mg/L suspended solids as measured in an eimhoff cone at all outlets.

F. Disinfection

1. Disinfection shall not be combined with any other activity such as pressure testing or flushing.
2. For new watermains, the continuous feed method will be the only acceptable method of disinfection. Refer to AWWA Standard C651 for the procedure.
3. The chlorine concentration in the feed will be 100 mg/l and the residual after 24 hours will be at least 50 mg/l free chlorine.
4. All appurtenances are to be disinfected.
5. Disinfection against a closed valve will not be permitted. All disinfection shall be against a capped or plugged line.

G. Flushing after Disinfection

1. The high chlorine concentration water will be flushed completely from the main.
2. The NPDES general discharge permit requires neutralization of the chlorine before it contacts the "waters of the State." How this will be achieved must also be covered in the approved flushing and disinfection plan. A field test kit may be used to adjust the neutralization. Samples must be collected and analyzed by the titration method to demonstrate the effectiveness of the neutralization.
3. The total chlorine residual will be measured in the source water. A field test kit that measures total and free chlorine and is approved for potable water reporting purposes must be used. No pool kits. When the same total

chlorine residual as measured in the source water is detected at all outlets and no free chlorine is present, then the flushing is complete.

4. The pipeline must sit undisturbed for 24 hours before bacteriological sampling.

H. Sampling

1. The sampling must be accomplished by a certified treatment/distribution operator or an employee of a certified laboratory. This certification will be evidenced in the approved plan.
2. At the OWNER's discretion, the source water will be sampled or the nearest water quality sample station's most recent results will be used to determine the baseline water quality. If the source water is sampled, it must be accomplished by or under the supervision of the OWNER's Water Production and Distribution Division staff.
3. Samples must be collected from extreme ends, all branches of the new main and at intervals not exceeding 300-feet. The sample points will also be part of the approved plan.
4. The temperature and total chlorine residual will be measured with a field test kit and recorded by the sampler on the "chain of custody" form.
5. After another 24-hour period, a second set of samples will be collected from the same sample points.
6. Both sets will be analyzed for total and fecal coliform presence/absence and heterotrophic plate count.
7. OWNER reserves the right to sample for bacteria at its own discretion with notice.

I. Laboratory Report

1. Lab results will be reported on a chain of custody, lab work sheet, or summary letter imprinted with the laboratory's name, address, and phone number. The report will include the field tests and laboratory analysis. The report will be signed by the laboratory director.
2. The laboratory report will be submitted for approval through the assigned Inspector to the OWNER or their designee.
3. It will be the OWNER's right, and responsibility to reject the report if any data is missing or suspect due to conflicting indications.

J. Satisfactory Results

1. Restated:
The new main should be at least as clean as the existing distribution system. A reasonable expectation is that it be better because it is new.

2. Therefore:
 - a. If a new line passes disinfections, it must be placed in service within one (1) week from date of sampling or it will be resampled as previously outlined.
 - b. The results for the source water sample will be used as a baseline to determine satisfactory results.
 - c. Some degradation of the total chlorine residual will be expected after sitting 24/48 hours. The residual in the new main samples must be no less than 50 percent of the source water.
 - d. All samples must be total and fecal coliform absent.
 - e. All samples must have an HPC no greater than 2 times the baseline after 24 hours and 4 times the baseline after 48 hours.
 - f. All samples will have an HPC less than 500 cfu/ml.

K. Authority

California State Health and Safety Code Title 22.

L. Resampling

The CONTRACTOR may choose to resample to verify or discredit laboratory results when one or two of many are unsatisfactory and a sampling error is suspected.

M. Acceptance of the New Main as a Whole

Because a closed valve is not sufficient protection, there is no facility to isolate portions of the new main with satisfactory lab results from those with unsatisfactory results. Therefore, the new main will be accepted as a whole and not in portions as they pass inspection. The one and only exception will be for very large projects where physical separations or test plates are used at predetermined locations and the procedures are clearly detailed in the pre-approval plan.

PART 2 - PRODUCTS

2.1 MATERIALS REQUIREMENTS

- A. All test equipment, chemicals for chlorination, temporary valves, temporary blow-offs, bulkheads, backflow devices, or other water control equipment and materials shall be determined and furnished by the CONTRACTOR. No materials shall be used which would be injurious to the pipeline or its future function.
- B. Chlorine for disinfection shall be in the form of liquid chlorine or sodium hypochlorite solution.
- C. Liquid chlorine shall be in accordance with the requirements of ANSI/AWWA B301. Liquid chlorine shall be used only:
 1. In combination with appropriate gas flow chlorinators and ejectors;

2. Under the direct supervision of an experienced technician;
 3. When all appropriate safety practices are observed.
- D. Sodium hypochlorite shall be in accordance with the requirements of ANSI/AWWA B300.

PART 3 - EXECUTION

3.1 GENERAL

- A. Unless otherwise indicated, potable water for testing and disinfecting water pipelines will be furnished by the CONTRACTOR. The CONTRACTOR shall furnish and install all materials including but not limited to approved backflow devices and also make all necessary arrangements for conveying the water to the points of use.
- B. All pressure pipelines shall be tested. Disinfection shall be accomplished by chlorination. All chlorinating and testing operations shall be performed in the presence of the OWNER's authorized representative.
- C. Disinfection operations shall be scheduled by the CONTRACTOR as late as possible during the contract time period so as to assure the maximum degree of sterility of the facilities at the time the WORK is accepted by the OWNER.

3.2 HYDROSTATIC TESTING OF PIPELINES

- A. Prior to hydrostatic testing, all pipelines shall be flushed or blown out as appropriate. The CONTRACTOR shall test all pipelines in sections and in accordance with the approved disinfection plan. No section of the pipeline shall be tested until all field-placed concrete or mortar has attained an age of 14 days. The test shall NOT be made by closing valves. The test shall be made by placing temporary bulkheads in the pipe and filling the line slowly with water. The CONTRACTOR shall be responsible for ascertaining that all test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to, or movement of, the adjacent pipe. Any unharnessed sleeve-type couplings, expansion joints, or other sliding joints shall be restrained or suitably anchored prior to the test, to avoid movement and damage to piping and equipment. The CONTRACTOR shall provide sufficient temporary air tappings in the pipelines to allow for evacuation of all entrapped air in each pipe segment to be tested. After completion of the tests, such taps shall be permanently plugged. Care shall be taken to see that all air vents are open during filling.
- B. The pipeline shall be filled at a rate which will not cause any surges or exceed the rate at which the air can be released through the air valves at a reasonable velocity and all the air within the pipeline shall be properly purged. After the pipeline or section thereof has been filled, it shall be allowed to stand under a slight pressure for at least 24 hours to allow the concrete or mortar lining, as applicable, to absorb water and to allow the escape of air from any air pockets. During this period, bulkheads, valves, and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to the OWNER shall be taken.

- C. The hydrostatic test shall consist of holding the test pressure on the pipeline for a period of 4 hours. The test pressure for distribution and transmission pipelines shall be 50 psi over the pressure class of the pipes being tested or 225 psi, whichever is lesser of the two. No pressure test will be required for a reservoir overflow line. All visible leaks shall be repaired in a manner acceptable to the OWNER.
- D. The maximum allowable leakage for distribution and transmission pipelines shall be per SSPWC Subsection 306-1.4.5. The allowable leakage rate shall be determined as follows:

$$L = \frac{CND\sqrt{P}}{1850}$$

Where:

L = Maximum allowable leakage in gallons per hour for section of pipeline tested.

N = Number of joints in length tested.

D = Diameter of pipe (in).

P = Test pressure (psi).

C = 1.0 for reinforced concrete pressure pipe with rubber gasket joints, cylinder type.

C = 3.0 for reinforced concrete pressure pipe with rubber gasket joints, non-cylinder type.

C = 0.5 for ductile iron pipe with mechanical or rubber gasket joints.

Steel pipe with welded joints shall have no leakage.

In the case of pipelines that fail to pass the prescribed leakage test, the CONTRACTOR shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipelines.

3.3 DISINFECTING PIPELINES

- A. **General:** All potable water pipelines except those appurtenant to hydraulic structures shall be disinfected in accordance with the requirements of ANSI/AWWA C651 using the Continuous-Feed Method as modified herein. Preliminary and final flushing shall be done at the ends of mains, which have been hydrostatically tested.
- B. **Chlorination:** A chlorine-water mixture shall be uniformly introduced into the pipeline by means of a solution-feed chlorinating device. The chlorine solution shall be introduced at one end of the pipeline through a tap in such a manner that as the pipeline is filled with water, the dosage applied to the water entering the pipe shall be approximately 50 mg/l. Care shall be taken to prevent the strong chlorine solution in the line being disinfected from flowing back into the line supplying the water.
- C. **Chlorine Residual Test:** The CONTRACTOR shall make 24-hour chlorine residual tests. The CONTRACTOR shall notify the OWNER of the chlorine test result. Chlorinated water shall be retained in the pipeline for at least 24 hours. After the

chlorine-treated water has been retained for the required time, the free chlorine residual at the pipeline extremities and at other representative points shall be at least 50 mg/l.

- D. **Repetition of Test:** The disinfection testing procedure shall be repeated if the initial tests fail to produce satisfactory results. Two consecutive satisfactory test results shall be required after any unsatisfactory test. The tablet method shall not be used for repeated disinfection.
- E. **Chlorinating Valves:** During the process of chlorinating the pipelines, all valves and other appurtenances shall be operated while the pipeline is filled with the heavily-chlorinated water.
- F. **Final Flushing:** Final Flushing shall be done by the CONTRACTOR after he has achieved a satisfactory chlorine residual test. After the applicable retention period, the heavily chlorinated water shall be flushed from the pipeline until chlorine measurements show that the concentration in the water leaving the pipeline is no higher than that generally prevailing in the system or is acceptable for the intended use. A reducing agent shall be applied to the water to neutralize thoroughly the chlorine residual remaining in the water at no additional cost.
- G. **Disinfection of Connections:** Pipe and appurtenances used to connect the newly installed water main shall also be disinfected in accordance with AWWA C651.
- H. **Neutralization of Chlorinated Water:** Neutralizing and disposing of chlorinated water shall be in accordance with Appendix "B" of AWWA Standard C651.

3.4 BACTERIOLOGICAL TESTING OF DISINFECTED PIPELINES

- A. The CONTRACTOR shall collect a minimum of 2 sets of samples at least 24 hours apart after completion of final flushing as indicated above. Samples will be taken at locations indicated in ANSI/AWWA C651 and will be tested for coliform organisms and heterotrophic plate count according to the latest edition of the Standard Methods for the Examination of Water and Wastewater. Laboratory costs of testing will be the CONTRACTOR's responsibility.
- B. Satisfactory bacteriological results will be
 - a) absence of total and fecal coliform,
 - b) a heterotrophic plate count less than 500 CFU and
 - c) CL2 Residual
- C. If disinfection fails to produce satisfactory bacteriological counts, the pipe shall be re-flushed and will be resampled and retested at all sampling points. If counts from analysis of the second samples exceed the criteria in Standard methods, the pipe shall be re-disinfected and will be re-sampled and retested at all sampling points until satisfactory results are obtained. The CONTRACTOR shall be responsible for all repeat bacteriological testing costs.

PART 4 - PAYMENT

Payment for the work in this section shall be included as part of the lump sum or unit price bid for which such work is appurtenant thereto and no additional payment will be made specifically for the work in this section.

END OF SECTION

SECTION 15050

PIPING, VALVES AND ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included in this Section: The CONTRACTOR shall furnish and install all piping, including fittings, valves, supports, and accessories as shown on the Drawings, described in the Specifications and as required to completely interconnect all equipment with piping for complete and operable systems.

1.2. QUALITY ASSURANCE

All materials and equipment furnished under this Section shall be of a manufacturer who has been engaged in the design and manufacture of the specific materials and equipment for a period of at least 5 years.

1.3 SUBMITTALS

A. Shop Drawings:

1. Verify by excavation, inspection and measurement all installation conditions for shop fabricated pipe before preparation of Shop Drawings. Submit field measurements and photos with Shop Drawings where exposed conditions are significantly different than indicated on the Drawings.
2. Layouts and Schematics: Submit detailed installation drawings of all piping. Schematics may be submitted for piping 4-inches and smaller. The drawings shall include pipe support locations, and types if different than shown on the Drawings and specifications, all fittings, valves, and other appurtenances.
3. Submit data to show that the following items conform to the Specification requirements:
 - a. Pipe, fittings, and accessories.
 - b. Fabricated pipe supports and other pipe supports as required herein.
 - c. Flexible couplings and flanged adapters.
 - d. Valves.
4. Submit certified test reports as required herein and by the referenced standard specifications.
5. Pipe, fittings and joint fabrication details for welded steel pipe.

- B. Affidavits: The CONTRACTOR shall furnish affidavits from the manufacturers for valves.

1.4 APPURTENANCES

Furnish and install all necessary guides, inserts, anchors and assembly bolts; washers nuts, hangers, supports, gaskets, and flanges; all other appurtenant items shown on the Drawings, specified or required for the proper installation and operation of the piping; devices included in or on the piping equipment; and piping accessories. Provide insulation for dissimilar metals with the use of insulating bushings, gasket sets or wrappings, as appropriate.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Pipe and valve sizes are nominal inside diameter unless otherwise noted.
- B. All materials delivered to the job site shall be new, free from defects, and marked to identify the material, class, and other appropriate data such as thickness for piping.
- C. Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the complete product. Acceptance of installed piping systems shall be based on inspection and leakage tests as specified hereinafter.

2.2 GENERAL MATERIAL REQUIREMENTS

- A. Gaskets:
 - 1. Gaskets for Flanged Joints: Gaskets for flanged joints shall be 1/8-inch thick and be made of Ethylene Propylene Diene Monomer (EPDM), or synthetic fiber. Gaskets shall be suitable for a water pressure of 350 psi at a minimum temperature of 180°F. Gaskets shall be NSF 61 certified for potable water applications. For potable and non-potable water applications, gaskets shall be compatible with water that may have a chlorine residual of 25 mg/L.
 - 2. Full Face Type Gaskets or Ring Gaskets for Flanged Joints: Full face type gaskets with pre-punched holes shall be used where both flanges are flat face. Ring gaskets extending to the inner edge of the bolts may be used where a raised face flange is present.
 - 3. Gaskets for Push-on, Mechanical, and Restrained Joints: Gaskets for push-on, mechanical, and restrained joints shall be synthetic or natural rubber in accordance with AWWA C-111.
 - 4. Manufacturers: Gaskets shall be Garlock 3000, 3760, 8314, and 98206; Klinger 4401, Tedit Style NA 1002, or U.S. Pipe Flange-Tyte.
- B. Bolts and Tie Rods: Unless specifically specified otherwise, flange bolts and nuts, tie rods and other flange hardware shall conform to AWWA C110, and be as follows:

1. Exposed: Bolts and Nuts: ASTM A307 Grade A and shall be zinc plated; Bolts additionally shall be ANSI B1.1, Class 2A coarse threads; Nuts additionally shall be ASTM 563 and ANSI B1.1.
2. Encased: Bolts and Nuts: ASTM A307 Grade A and shall be zinc plated; Bolts additionally shall be ANSI B1.1, Class 2A coarse threads; Nuts additionally shall be ASTM 563 and ANSI B1.1.
3. Buried: Bolts and Nuts: ASTM A307 Grade A and shall be zinc plated; Bolts additionally shall be ANSI B1.1, Class 2A coarse threads; Nuts additionally shall be ASTM 563 and ANSI B1.1.

2.3 MATERIALS

A. PVC Pipe

1. 2 inches and Smaller

PVC pipe shall meet the following requirements:

Pipe	PVC SCH 80 as identified on plans
Joints	Solvent Weld
Unions	PVC, SCH 80, Solvent Weld
Ball Valves	150 PSI, with TFE true union ends with TFE seats and seals
Check Valves	150 PSI, true union ball check with TFE seats and seals

2. PVC Pipe 4-Inch through 12-Inch

PVC pipe 4-inches and larger in diameter shall meet the requirements of AWWA C900, DR 35. Bedding shall be in accordance with the plans.

B. Copper Pipe 2½-inches and Smaller

Copper pipe and appurtenances shall be in accordance with the following:

Pipe	Seamless, Type K copper tubing, ASTM B88 below grade
Pipe Joints	Soldered, 3-piece, screwed
Fittings	Wrought copper, compression type, 3-piece, Parker, Swagelok or equal
Gate Valves	200 psi, WOG, bronze, ends, screwed bonnet, rising stem, solid wedge
Globe Valves	200 psi, WOG, bronze, screwed bonnet, renewable seat

Check Valves 200 psi, WOG, bronze, screwed ends, swing type, bronze disc, screwed cap

C. Ductile Iron Pipe

1. Materials: Pipe, fittings and appurtenances shall conform to the thickness class Ductile Iron Pipe as designated on the Plans.
2. All ductile iron pipes shall be new and shall conform to all requirements of Federal Specification WW-P-421C, ANSI A21.51 (latest revision) and AWWA C151 (latest revision).
3. The ductile iron used shall be one of these three:

Manufacturer	Joint Type
U.S. Pipe	TR Flex
McWane	TR Flex
American Cast Iron Pipe Company	Flex-Ring

4. All pipe and fittings shall be clearly marked with the name of the manufacturer or with a trademark of the size and type that has been approved by and filed with the OWNER.
5. Field welding of ductile iron restrained joint or ductile iron components is not acceptable.
6. Lining and Coating: The interior of all pipe and fittings shall be lined with cement-mortar per ANSI/AWWA C-104/A-21.4. Lining shall be the double thickness listed in AWWA C-104, Section 4.8. Lining materials shall conform to ASTM C-150, Type II. Exterior surfaces of pipe and fittings shall be coated with an asphaltic material in conformance with ANSI/AWWA C-110/A-21.10, and ANSI/AWWA C-151/A-21.51. The coating shall be free from blisters and holes; shall adhere to the metal surface at ambient temperatures encountered in the field.
7. Polyethylene encasement: All ductile-iron pipe and fittings buried underground shall be protected with a polyethylene encasement wrap in accord with AWWA C105. Wrap shall be a loose 8-mil-thick linear low-density polyethylene tube or a 4-mil thick high-density cross-laminated polyethylene tube. All joints between plastic tubes shall be wrapped with 2-inch-wide, 10-mil thick, polyethylene adhesive tape. Tape to be used shall be Polyken 900, Scotchrap 50, or approved equal.
8. Fittings: All fittings for ductile iron pipe, unless otherwise required by the Standard Drawings, shall be one of the following:
 - a. Manufacturer's locking restraint system per above Article 2.3.C.3 above.

- b. Mechanical joint fittings with mechanical joint restraints: mechanical joint fittings shall conform to AWWA C111/A-21.11 (latest revision) and have a pressure rating of 350 psi for 12-inch nominal diameter pipes and smaller. Additionally, mechanical joint fittings shall meet or exceed the ASTM A-536 requirements. Torque off bolts shall be tightened per manufacturer's recommendations and shall be inspected by the District prior to backfill. Approved manufacturers include: Ford Products, EBAA Iron, One-Lok, Romac, and RomoGrip.
9. Delivery and Handling: All pipe and fittings shall be manufactured, handled, loaded and shipped in such a manner that it is delivered undamaged, in sound condition, and conforming in all respects to these Specifications. Care shall be taken in loading and handling the pipe so as not to injure the pipe coating. No other pipe or material of any kind shall be placed inside any pipe or fitting at any time after the coating has been applied and prior to installation. All pipe and fittings installed on the work shall be new material which has never been previously used for any purpose whatsoever.

2.4 PIPE COUPLINGS AND FLEXIBLE PIPE PIECES

- A. General: For typical pipe joints refer to pipe material specifications. Other joint devices shall be furnished where called for as specified below.
- B. Flexible Couplings and Restrained Flange Coupling Adaptors:
 - 1. Sleeve: Ductile iron or fabricated steel.
 - 2. Followers: Ductile iron, or steel.
 - 3. Sleeve Bolts: ASTM A325, Type 3; malleable iron; or equivalent.
 - 4. Coating: Fusion epoxy lined and coat sleeve and followers.
 - 5. Pressure Rating: Pressure rating shall be equal to or greater than that of pipe being connected as determined by Barlow's Formula.
 - 6. Manufacturers:
 - a. Flexible Couplings: Smith-Blair 461, Romac 501
 - b. Flange Coupling Adaptors: Romac; or equal.
 - c. Victaulic Couplings: Style 44 Type D Vic Ring coupling with ductile iron housing and grade E gasket.
 - 7. Gaskets: Nitrile (Buna N) NSF 61 approved.
 - 8. Joint Restraint: Provide joint harnesses (tie rod lug or attachment plate assemblies) across all flexible couplings, flange coupling adaptors, except where specifically indicated otherwise on the Drawings. For flanged coupling adaptors, anchor studs may be substituted for the harnesses on pipe up to

12-inch. Design restraint for 1-1/2 times the test pressure of the applicable service.

2.5 VALVES AND ACCESSORIES

A. General Requirements for Valves:

1. All valves of each type shall be the product of one manufacturer, and shall be listed on the OWNER's Approved Materials List.
2. All valves shall be epoxy lined and coated; and furnished with operators, handwheels, levers, or other suitable type wrench including handles as specified herein or as shown on the Drawings.
3. All threaded stem valves shall open by turning the valve stem counter-clockwise.
4. All valves and valve operators shall have a nonbleeding shop coat.

B. Butterfly Valves, 6-inch and larger:

- a. General: Tight closing, rubber-seat type that fully complies with AWWA Standard C504-94. Provide Class 200B minimum unless a higher class is shown on the Drawings or required in the Specifications. Valves shall be bubble-tight at rated pressures in either direction. Where a buried installation is indicated on the Drawings, valves shall be suitable for buried service. Valve discs shall rotate 90 degrees from the full open position to the tight shut position. The 6-inch to 12-inch valves shall be Pratt or equal.
- b. Valve Body: Cast iron per ASTM A126, Class B. All valves shall have flanged connections with 150 pound flanges faced and drilled in accordance with ANSI B16.1.
- c. Valve Disc: Cast iron ASTM A48 or ductile iron ASTM A536 or fabricated steel with stainless steel seating edge. The valve disc shall be attached to the valve shaft by 18-8 stainless steel pins.
- d. Valve Shaft: Turned, ground and polished and constructed of Type 304 or Type 316 stainless steel. Shafts shall be two-piece, stub-type keyed for operator connection. Shaft diameters shall meet minimum requirements established by AWWA C504-94 for their class where applicable. The shaft shall be keyed for attachment to the disc. The valve shaft shall be marked and corresponding marks placed on the valve body to indicate whether the valve is open or closed.
- e. Valve Seat: Peroxide cured EPDM. Seats shall be a full 360 degrees without interruption. Valve seats shall be field adjustable around the full 360 degree circumference and replaceable without dismantling operator, disc or shaft and without removing the valve from the line.

The rubber seat shall be field replaceable. Seat shall be in the valve body, not on the disc.

- f. Valve Bearings: Sleeve-type bearings, corrosion resistant and self-lubricating. Bearing load shall not exceed 1/5 of the compressible strength of the bearing or shaft material.
- g. Finish: Factory lined with epoxy, minimum dry film thickness of 16 mils, and factory applied exterior finish of universal primer suitable to receive epoxy, coal tar epoxy, or alkyd base machinery enamel top coats. For valves for buried service, factory coat with coal tar epoxy, minimum dry film thickness of 16 mils.
- h. Manual Operators:
 - 1. Manual (non-buried service): Traveling nut, self-locking type. Equip with mechanical stop-limiting devices, adjustable in place in the field, to prevent overtravel of the disc in the closed and open positions. Provide handwheel or chainwheel in accordance with Paragraph 2.04 B. designed to produce the specified torque with a maximum pull of 80 lb. on the handwheel or chainwheel. Operator components shall withstand an input torque of 300 ft. lbs. at extreme operator positions without damage. Conform to AWWA C504-87. Provide exterior finish as specified for the valve body.
 - 2. Manual (buried service): Where a buried installation is indicated on the Drawings, provide operators specifically designed for buried service. Buried service operators shall conform to the requirements above for manual non-buried.
 - 3. Manufacturer's Identification: The manufacturer's name and catalog number shall be molded or stamped on the valve where it can be easily seen after the valve is installed.
 - 4. Submittals for Approval. The following submittals shall be furnished to be approved by the OWNER or its representative before the valve is installed (this article only applies to CONTRACTOR supplied material):
 - a) Certification from the valve manufacturer that both the valve and the operator conform to all requirements of AWWA C-504.
 - b) Certified drawings of valve and operator as specified in Section 3.2 of AWWA C-504.
 - c) Certified copies of reports of the torque rating of the manual operator as specified in Section 11.2.3 of AWWA C-504.

PART 3 - PAYMENT

Payment for the Work in this Section shall be included as part of the lump sum or unit price bid for which such Work is appurtenant thereto and no additional payment will be made specifically for the Work in this Section.

END OF SECTION

SECTION 15060

PIPING - INSTALLATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work included in this section of the specifications consists of furnishing, installing and testing all piping, fittings and appurtenances, as indicated on the Drawings and specified herein or as required to complete the work.
- B. Whenever the word "piping" is used in this section, it shall be understood to refer to all exposed and buried pipes, fittings, valves, flanges gasketing, hangers and supports or bedding comprising any given system, plastic piping and instrument tubing included.
- C. All piping shall be installed to the lines and grades shown on the Drawings or as required for the mechanical equipment. All piping shall be properly supported and provisions shall be made for expansion and contraction.
- D. Dissimilar metals shall be properly insulated with the use of insulating bushings, gasket sets or wrappings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Piping, Valves, and Accessories - Section 15050.
- B. Trench Excavation and Backfill - Section 02223.

1.3 CODES AND PERMITS

- A. Installation shall comply with all applicable federal, state and local laws whether or not explicitly specified.
- B. The CONTRACTOR shall furnish to the OWNER a certificate of final inspection and approval from the inspecting authority having jurisdiction.

1.4 INSPECTIONS AND TESTING

- A. The quality of all materials, the process of manufacture and finished pipe shall be subject to inspection and approval of the OWNER. Pipe may be inspected at the place of manufacture, and on the work site, and shall be subject to rejection at any time even though submitted samples may have been approved. In addition, the OWNER reserves the right to have any or all pipe or fittings inspected or tested, or both, by an independent inspection service at either the manufacturer's plant or elsewhere. Such inspections and/or tests shall be at the OWNER's expense.

- B. All pipe, fittings and appurtenances shall be carefully inspected in the field before installation. All piping found to be defective, as determined by the OWNER, shall be pulled out and not installed. Such rejected pipe shall be clearly tagged in such a manner as not to deface or damage it, and the pipe shall then be removed from the job site by the CONTRACTOR at its own expense. Results of shop tests which may be required shall be submitted to the OWNER prior to installation of the pipe for which such tests were ordered.

PART 2 - PRODUCTS

2.1 MATERIALS

Piping materials shall conform to requirements specified in Section 15050.

PART 3 - EXECUTION

3.1 GENERAL PIPING INSTALLATION PRACTICES

- A. Any conflict arising during the erection of piping shall be brought to the attention of the OWNER. No improvising or field changes shall be permitted without the approval of the OWNER.
- B. All piping shall be erected in such a manner as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending moments at joints or connections to equipment.
- C. Full lengths of pipe shall be used wherever possible. Short lengths of pipe with couplings will not be permitted, except as may be approved by the OWNER to eliminate overstressing or misalignment. All pipes shall be cut to exact measurement and shall be installed without forcing or springing.
- D. Tool marks and unnecessary pipe threads shall be avoided. Burrs formed when cutting pipe shall be removed by reaming. Before installing any pipe, care shall be taken that the inside is thoroughly cleaned and free of cuttings and foreign matter.
- E. Where piping is pitched for drainage, an accurate grade shall be maintained. Piping shall be supported in such a manner as to prohibit deflection due to gravity that would be sufficient to pocket the lines when full of liquid. All changes in direction shall be made by using pipe fittings unless otherwise shown on the Drawings or as approved by the OWNER.
- F. Unions shall be installed in all piping connections to equipment, regulating valves, and wherever necessary to facilitate the dismantling of piping and removal of valves and other items requiring maintenance. Flanges on equipment may be considered as unions. At least one union shall be provided in every straight run of pipe unless otherwise noted or permitted.

- G. Raised face flanges shall not be used for connection to 125-psi cast iron flanges. The raised face shall be removed before use and full-face gaskets shall be employed.
- H. In general, all service piping shall come off the top of headers, and if possible, service piping shall slope for drainage.
- I. Pipe anchors, thrust blocks, expansion joints, loops and bends shall be installed as indicated on the Drawings, and as required to properly protect the piping against vibration, misalignment and overstraining.
- J. Exposed piping shall be neatly arranged, straight, run parallel to or at right angles to walls and shall be so graded that the entire system can be drained. Drain valves shall be installed at the low points of piping. Vent valves shall be installed at all high points of the piping.
- K. Installed piping shall not interfere with the operations or accessibility of doors or windows and shall not encroach on aisles, passageways and equipment and shall not interfere with the servicing or maintenance of any equipment. Adjacent piping shall be grouped in the same horizontal or vertical plane.
- L. All buried bolts, nuts, lugs, rods, brackets, etc., shall be epoxy tar coated carbon steel. All exposed steel pipe supports and hangers shall be cleaned and painted similar to structural steel items as specified under Section 09900.
- M. When a pipe joint is made at the intersection of a pipeline with a pump nozzle, all bolts and nuts shall be installed loose until after the entire pipeline has been installed, aligned and checked.
- N. All piping shall be installed in such a manner that it shall be free to expand and contract without injury to itself, structural steel or anchors. On all piping, self-equalizing type expansion joints of an approved make and quality shall be installed in all straight runs of 90 feet or more, unless otherwise shown on the Contract Drawings.
- O. When pipe is cut in the field, the cut end shall be tapered back approximately 1/8 inch, at an angle of 30 degrees with the centerline of the pipe, with a coarse file or grinder to remove any rough edges which might injure a gasket, where applicable.
- P. Dissimilar metals shall be properly insulated to preclude galvanic corrosion.

3.2 BURIED PIPING INSTALLATION PRACTICES

- A. Installation shall be in accordance with AWWA Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances, AWWA C600-93, AWWA C900-89 and WPCF Manual of Practice No. 9, Design and Construction of Sanitary and Storm Sewer, except as otherwise noted in the Specifications.
- B. Joining Push-On, Mechanical Joint and Restraint Joint Piping: After placing a length of pipe in the trench, the spigot end shall be centered in the socket and

the pipe forced "home" and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under and around it. Wherever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, the amount of deflection allowed shall not exceed that required for making a satisfactory joint and shall be subject to the approval of the OWNER.

- C. Where it is necessary to join pipes of different types, the CONTRACTOR shall furnish and install the necessary adapter. Adapters shall have ends conforming to specifications for the appropriate type of joint to receive the adjoining pipe.
- D. The CONTRACTOR shall furnish and install all supports necessary to hold the piping and appurtenances in a firm, substantial manner at the lines and grades indicated on the Drawings or as directed by the OWNER.
- E. Underground bends, tees and other pipeline fittings shall be restrained type joints per plans.
- F. All buried ductile iron pipe shall be polyethylene wrapped in accordance with ANSI/AWWA C105/A21.5 and shall conform to the following procedure, and wrapping shall be applied to the pipe in the field in the following manner:
 - 1. Placement of Polyethylene Encasement: Using a sling, the pipe shall be picked up with a crane at the side of the trench and raised about 3 feet off the ground. The polyethylene tube, cut approximately 2 feet longer than the length of pipe, shall be slipped over the spigot end of the pipe and bunched up, accordion fashion, between end of the pipe and the sling.
 - 2. Placement of Pipe into Trench: The pipe shall be lowered into the trench. The spigot shall be seated into the bell of the adjacent installed pipe, and the pipe lowered into the trench bottom. A shallow bell hole shall be provided in the trench bottom to facilitate the wrapping of the joint.
 - 3. Joint Assembly: The pipe joint shall then be made up as described herein.
 - 4. Adjustment of Polyethylene Encasement: The sling shall be removed from the center of the pipe and hooked into the bell cavity. The bell shall be raised approximately 12 inches and the tube of polyethylene film slipped along the full length of the pipe barrel. Enough of the film shall be left bunched up, accordion fashion, at each end of the pipe to overlap the adjoining pipe about 1 foot. Care shall be taken to ensure that soil that adheres to the pipe is removed as the polyethylene film is placed around the pipe.
 - 5. Overlapped Joints: To make the overlapped joint wrap, the film shall be pulled over the bell of the pipe, folded around the adjacent spigot, and wrapped with about three circumferential turns of the plastic adhesive tape in order to seal the tube of film to the pipe. The tube on the adjacent pipe shall be then pulled over the first wrap on the pipe bell

and sealed in place behind the bell, using about three circumferential turns of the polyethylene adhesive tape.

6. Attachment of Encasement: The resulting loose wrap on the barrel of the pipe shall be pulled snugly around the barrel of pipe, the excess material folded over the top and the fold held in place by means of short strips of the 2-inch wide, 10-mil thick adhesive tape at intervals 5 feet apart along the pipe barrel.

3.3 WELDED PIPE

- A. All welding of steel piping shall be in accordance with the AWWA Standard for Field Welding of Steel Water Pipe, AWWA C206-91, latest edition. All welders and machine operators shall be certified as qualified under the above code.
- B. All other metallic pipe welding shall be in accordance with the ANSI Code for Pressure Piping, ANSI B31.1 Power Piping, latest edition. All welders and welding machine operators shall be certified as qualified under the above code. The CONTRACTOR shall submit a list of welding personnel with certification to the OWNER for approval.
- C. CONTRACTOR shall submit its proposed welding procedures to the OWNER for review. Proposed procedures shall be in accordance with the above codes and the recommendations of the manufacturers of the piping and welding materials. The OWNER shall have the right at any time to call for and witness the making of test specimens by any welder, in accordance with the above, and to observe the physical testing of specimens. Materials shall be furnished and all tests shall be made by and at the expense of the CONTRACTOR.
- D. Welding of fusion bonded epoxy lined and/or coated pipe shall not be allowed after the application of the fusion bonded epoxy.

3.4 PUSH-ON TYPE JOINTS

- A. Inspect gasket, socket and spigot for cleanliness. Remove any foreign matter and excessive coating. When cast iron or ductile iron pipe is cut in the field, the cut end can be readily conditioned so that it may be used to make up the joint. The outside of the cut end should be tapered back approximately 1/4 inch, at an angle of about 30 degrees with the centerline of the pipe, with a coarse file or a portable grinder. All sharp or rough edges which otherwise might injure the gasket shall be removed.
- B. Insert the gasket in the socket, bulb end toward the inside. Heel of gasket shall be uniformly seated around the inside of the socket.
- C. Lubricate the exposed face of the gasket and the spigot using push-on joint lubricant. Do not use lubricant other than that furnished with pipe and fittings.
- D. The fittings and the pipe shall be aligned and the spigot entered into the socket until it just makes contact with the gasket. Joint assembly shall be completed by

forcing the spigot of the entering pipe past the gasket (which is thereby compressed) until it makes contact with the bottom of the socket.

- E. If assembly is not accomplished with the application of reasonable force by the methods indicated, the spigot end of the pipe shall be removed to check for the proper positioning of the gasket. The joint shall be kept in straight alignment during assembly.

3.5 MECHANICAL JOINT PIPING

Spigot ends and bells of pipe and the rubber gaskets shall be washed thoroughly with soapy water to remove all foreign matter which may damage the gaskets. The gaskets shall be either plain rubber, metal tipped, duck tipped, polysulfide rubber tipped, or other special type. The gland shall be placed on the pipe with its raised lip facing the spigot end and at least 3-1/2 inches from that end. The spigot shall be inserted in the socket until it is "home". The gasket shall be pushed into position with the fingers, making sure that it is evenly seated in the socket. Place the gland against the face of the gasket, insert the tee head bolts and tighten the nuts on all bolts by opposite pairs until they are finger-tight. The bolts shall then be tightened in a similar manner until they are snug and bearing evenly against the gland around the circumference of the pipe.

3.6 RESTRAINED JOINT PIPING

Installation shall be in accordance with the manufacturer's recommended procedures.

3.7 PVC PIPING

PVC piping shall be installed in accordance with the manufacturer's recommended procedures.

3.8 COPPER PIPING

- A. Copper service runs shall be one piece with no soldering.
- B. Flared joints for copper tubing shall be cut and deburred. The sleeve nut shall be slipped on the tubing and the end flared with a flaring tool. Care shall be taken in flaring not to crack or slit the flared portion. If inspection reveals such damage, the flare shall be cut off and a new flare made. The flared end shall be squarely seated on the fitting and the nut tightened.
- C. All changes in direction shall be made by using the pipe and fitting unless other means are approved by the OWNER.

3.9 PIPE SUPPORTS

- A. The CONTRACTOR shall furnish all necessary pipe supports as per contract drawings, for supporting the various piping installed by him under this Contract. The CONTRACTOR shall obtain the OWNER's approval of the method of supporting the piping before installation.
- B. Expansion bolts shall be used only upon the approval of the OWNER.

- C. Heavy valves or fittings shall be supported by flanged type supports on poured concrete blocks or other special provisions that may be necessary to avoid undue line deflection.
- D. Hose and plastic tubing shall be continuously supported in steel angle, channel or tray.

3.10 APPURTENANCES

- A. The CONTRACTOR shall furnish and install all valves and piping not mentioned in the piping classification, but shown on the Drawings.
- B. All valves and drains not mentioned in the classification of piping material specifications and furnished under this specification shall be as specified on the Drawings.
- C. Flanged joints shall be made up with approved full-face gaskets and carbon steel ASTM A307 bolts and nuts and coated with non-oxide type grease, except where otherwise noted in the Specifications.
- D. All joints shall be made drop tight under all pressures up to the specified field test pressure of the line in which installed.

3.11 FIELD TESTING

- A. All pressure piping shall be subjected to hydrostatic pressure test of 250 psi but not exceeding the maximum allowable working pressure of the piping. The normal operating pressures shall be defined by the OWNER. No air testing shall be permitted.
- B. Pressure mains shall be tested at 250 psi. Gravity lines shall be subjected to hydrostatic pressure test of 150 percent of the maximum head that can be imposed upon the piping during operation as defined by the OWNER.
- C. Test of buried piping shall be made only after completion of partial or complete backfill as specified and not until at least 36 hours after the last joint to be tested has been made, and at least 36 hours after the last concrete thrust or reaction blocking has been cast with high early strength cement, ASTM C150 Type III. Joints shall be left clear for examination during tests on pressure pipe.
- D. Each section of pipeline shall be slowly filled with water and the specified test pressure measured at the point of lowest elevation. Pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the OWNER. The pump, pipe connection, gauges, pipe taps and all necessary apparatus, shall be furnished by the CONTRACTOR. The CONTRACTOR shall provide all necessary assistance for conducting the test. The duration of the test shall be 4 hours, unless otherwise directed by the OWNER. All air must be expelled from the pipeline prior to the test period.
- E. During the test, all pipes, fittings, valves, hydrants and joints shall be carefully examined. If found to be cracked or defective, they shall be removed and

replaced by the CONTRACTOR with sound material in the manner prescribed. The test shall then be repeated until satisfactory to the OWNER.

- F. After the pressure test, the pipe shall be tested for leakage. The pressure during the leakage test shall be at the normal operating pressure. The duration of the leakage test shall be 2 hours unless otherwise directed by the OWNER. The test shall be conducted in the same manner as the pressure test except that the CONTRACTOR shall provide suitable equipment for measuring the amount of leakage.
- G. No pipe installation will be accepted until or unless the leakage for the section of line tested is less than the rate of leakage specified below:

Flanges, welded or screwed piping – No measurable leakage

Push-on, mechanical joints or caulked – In accordance with AWWA Standard for Installation of Cast-Iron Water Mains, AWWA C600, Sect. 13.7
- H. Should any test of a section of pipeline disclose leakage greater than that permitted, the CONTRACTOR shall, at its own expense, locate and repair the defective joints and/or pipe until the leakage is within the permitted allowances.

PART 4 - PAYMENT

Payment for the Work in this Section shall be included as part of the lump sum or unit price bid for which such Work is appurtenant thereto and no additional payment will be made specifically for the Work in this Section.

END OF SECTION