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VOLUME 1 - STANDARD SPECIFICATIONS

FOR INSTALLATION OF
WATER MAINS 20″ AND SMALLER

♦

October 2022

EAST BAY MUNICIPAL UTILITY DISTRICT

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STANDARD SPECIFICATIONS FOR INSTALLATION OF
WATER MAINS 20" AND SMALLER

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SECTION 00 72 00P
(FORMERLY GC)

INSTALLATION OF WATER MAINS 20" AND SMALLER

GENERAL CONDITIONS

1. DEFINITIONS

Wherever in the specifications and other contract documents the following terms, or pronouns in place of them, are used, the intent and meaning shall be interpreted as follows:

District:	The East Bay Municipal Utility District.
Engineer:	The Director of Engineering and Construction of the District acting directly or through authorized agents acting within the duties entrusted to them.
Applicant:	Individual, partnership, joint venture, corporation, or public agency with whom the contract is made by the District to accomplish the work.
Contractor:	Applicant, or District Forces when they are assigned responsibility for accomplishment of the work.
Weekday Work Hours:	7:00 a.m. to 4:30 p.m. Monday through Friday.

2. AUTHORITY OF THE ENGINEER

The decisions of the Engineer shall be final and binding upon all parties with respect to all questions concerning the acceptability or classification of material, the execution of the work, and conflicting interests of Applicants or other District contractors performing related work.

3. CHANGES

If, during the progress of the work, changes in design, material, or location are deemed necessary by the Engineer for proper construction of the work, the Engineer reserves the right to make such changes. The increase in the cost of material and construction caused by such changes shall be borne by the Applicant, unless the changes are made on mains to be installed for the convenience of the District, in which case the increase in cost will be borne by the District.

4. INSPECTION

All work performed under this contract will be subject to inspection by the District. The Engineer shall have safe access to all parts of the work at all times. Work or material that does not conform to the specifications will be rejected at any stage of the work. The Applicant shall remove and rebuild at its own expense any part of the work that has been improperly executed.

Whenever work under these specifications is to be performed outside weekday working hours, on Saturday, Sunday, or on holidays, the Applicant or its agent shall notify the Engineer not less than 48 hours prior to beginning work.

Overtime construction work performed at the option of, or for the convenience of, the Applicant will be inspected by the District at the expense of the Applicant and will be billed to and shall be paid for by the Applicant on a periodic basis. For any such overtime beyond the regular 8-hour day and for any time worked on Saturday, Sunday, or District holidays, the charges will be 150% of the hourly pay rate of the District employee(s) performing the inspection.

District holidays are:

New Year's Day
Martin Luther King Day (3rd Monday in January)
Lincoln's Birthday
Washington's Birthday (3rd Monday in February)
Cesar Chavez's Birthday
Memorial Day (last Monday in May)
Juneteenth Holiday (June 19)
Independence Day
Labor Day (1st Monday in September)
Columbus Day (2nd Monday in October)
Veteran's Day
Thanksgiving and the following Friday

Christmas Day
Day after Christmas

When a holiday falls on Sunday, the following Monday shall be observed as the holiday. When a holiday falls on Saturday, the preceding Friday shall be observed as the holiday.

a. Day after Christmas Exception:

1) When the Day after Christmas falls on a Saturday, the Day after Christmas holiday shall be observed on the following Monday.

2) When the Day after Christmas falls on a Monday, the Day after Christmas holiday shall be observed on the following Tuesday.

There will be no charge for the inspection of overtime work ordered by the Engineer.

5. CONTRACTOR'S LICENSE

The Applicant or its agent performing the work shall possess a Class A or Class C-34 license from the Contractors State License Board and such other State and local licenses as are required by law, and shall furnish satisfactory proof to the Engineer upon request that such licenses are in effect during the entire period of construction. Applicant shall also have previous experience of not less than one year in installing pressurized potable water mains 6″ – 20″ size.

6. INSTRUCTIONS TO APPLICANT

The Applicant shall at all times be represented on the work in person or by a competent superintendent or other duly designated agent. Instructions and information given by the Engineer to the Applicant's superintendent or agent on the work shall be considered as having been given to the Applicant.

7. GUARANTEE

The Applicant hereby guarantees that any work performed by it under this contract will be performed in accordance with the drawings and specifications; that any material furnished by it will be in accordance with the drawings and specifications; and that both work and materials will fully meet the requirements of these specifications.

The Applicant hereby agrees to promptly reinstall, at its own expense, any part of the water main or any appurtenance which has not been installed in accordance with these specifications and drawings.

The District has sole responsibility for making any repairs to the newly installed pipeline and appurtenances once the pipeline is placed into service. The Applicant agrees that if, from the time that the pipeline is placed into service, any portion of the work furnished, installed, or constructed by the Applicant fails to fulfill any of the requirements of the contract, then the Applicant shall reimburse the District for all costs of said repairs (including overhead) beginning from the in-service date to within one year after written acceptance of the work completed under contract.

The Applicant shall be responsible for the full expense incidental to fulfilling any and all of the above guarantees and agreements. The above guarantees and agreements are covenants, the performance of which shall be binding upon the Applicant and its sureties.

8. RELOCATION OF INSTALLED MAIN

The Applicant is required to promptly relocate the main and appurtenances at its own expense should the street grade or alignment, curb lines, lot lines, or driveways be changed for any reason after the main and appurtenances are installed.

Should the Applicant fail to act promptly in accordance with this requirement or should the exigencies of the case require the relocation to be made before the Applicant can be notified or can respond to notification, the District may, at its sole option, perform the necessary work, and the Applicant shall pay the District the cost, including overhead, of such work.

9. SAFETY DATA SHEETS (FORMERLY MATERIAL SAFETY DATA SHEETS)

Attention is directed to the provisions of General Industry Safety Orders, Section 5194, Title 8, California Code of Regulations. The Applicant shall submit to the Engineer a Safety Data Sheet (SDS) for each hazardous substance proposed to be used, 10 days prior to the delivery of such substance to the jobsite or use of such substance at a manufacturing plant where the Engineer is to perform an inspection. For substances which are to be tested in District laboratories, the SDS shall be submitted with the sample(s). Hazardous substance is defined as any substance included in the list (Director's List) of hazardous substances prepared by the Director, California Department of Industrial Relations, pursuant to Labor Code Section 6382. Failure to comply with the submittal of an SDS for any hazardous substance will result in suspension of construction work.

10. CONTAMINANTS

A. In the event of known contaminants or contaminants that are encountered during installation of the main extension facilities, Applicant shall provide a complete and specific written remedial plan prepared by a Certified Industrial Hygienist. The plan shall include the methodology, planning and design of necessary systems for the removal, treatment, and disposal of all identified soil and/or water contaminants. The Applicant shall be solely responsible for the costs of all related activities including but not limited to providing required training, personnel protective equipment, access control, remobilization, and any redesign. The Applicant shall conduct a site safety briefing for each of the following situations: 1) beginning of the job, 2) change of tasks, 3) change of personnel, 4) change of conditions.

B. Applicant expressly agrees to indemnify, defend, and hold the District, its Directors, officers, agents, and employees free and harmless from and against any and all loss, liability, expense, costs, claims, suits, and damages including attorneys' fees related to the removal, treatment, and/or disposal of soil and/or water, contaminated with hazardous substances, including, but not limited to, petroleum products or byproducts, and any additional construction costs caused by the removal, treatment, and disposal of contaminated soil and/or water.

11. WAGE AND HOUR LAWS

A. Prevailing wages: Pursuant to Section 1773 et seq. of the Labor Code of the State of California and any amendments thereof:

1. The District has obtained from the Director of Industrial Relations of the State of California, the general prevailing rates of per diem wages and the general prevailing rates for holiday and overtime work in the locality in which the work is to be performed, for each craft, classification, or type of worker needed to perform the work. A copy of the prevailing wage rates is on file and available for inspection by any interested party on request at the District's Specifications and Engineering Support Section. The prevailing wage rates are also available on the internet at http://www.dir.ca.gov/OPRL/DPreWageDetermination.htm.

2. Applicant shall post a copy of the general prevailing rate of per diem wages at the jobsite pursuant to Section 1773.2 of the Labor Code of the State of California.

3. The Applicant and its subcontractor shall pay not less than the specified prevailing rate of wages to all workers employed on the work.

4. The holidays upon which such rates shall be paid shall be all holidays recognized in the collective bargaining agreement applicable to the particular craft, classification, or type of worker employed on the work.

B. Hours of Labor: Pursuant to Sections 1810 et seq. of the Labor Code of the State of California and any amendments thereof:

1. Eight hours labor constitutes a legal day's work.

2. The time of service of any worker employed upon the work shall be limited and restricted to eight hours during any one calendar day, and forty hours during any one calendar week.

3. Work performed by employees of the Applicant in excess of eight hours per day, and forty hours during any one calendar week, shall be permitted upon compensation for all hours worked in excess of eight hours per day at not less than one and one-half times the basic rate of pay.

12. WAGE RELATED WORKPLACE POSTINGS

A. The Contractor and every Subcontractor shall post at the workplace and comply with all required wage related workplace postings. Copies of the required postings may be downloaded or ordered electronically from the Department of Industrial Relations website at http://www.dir.ca.gov/wpnodb.html.

13. PRE-CONSTRUCTION CONFERENCE

A. Seven days before the start of construction work, the Applicant is responsible for contacting the Engineer for arrangement of a pre-construction conference to be attended by the Applicant's project representative authorized to commit on the behalf of the Applicant and to direct the performance of the work by others. Contact phone

number for Construction Inspection is (510) 287-1168 for projects in Alameda County, and (510) 287-1124 for projects in Contra Costa County.

B. The purpose of this conference will be to establish a working relationship and understanding between the parties and to discuss project organization, job communications, the construction schedule, materials, shop drawing submittals and processing, inspection, survey requirements, testing, safety, water discharge requirements, and such other subjects as may be pertinent for the proper execution of the work. The District will provide final project drawings to the Applicant to disseminate to the parties responsible for the work, prior to or at the conference.

14. TRADE NAMES AND "OR EQUAL AS APPROVED BY THE ENGINEER" PROVISION

A. Whenever in the specifications or on the project drawings materials or equipment to be incorporated into the work are designated by brand or trade name, such designation is intended to indicate a measure of quality and utility or as a standard. Except in those instances where the product is designated to match others in use on a particular improvement either completed or in the course of completion, the Applicant may substitute any other brand of the product of equal quality and utility with the approval of the Engineer.

15. APPROVAL OF MATERIALS

A. The Applicant shall furnish to the District such quantities of construction materials as may be required by the Engineer for test purposes.

B. Each sample submitted shall be labeled. A letter, in duplicate, submitting each shipment of samples shall be mailed to the Engineer by the Applicant. Both the label on the sample and the letter of transmittal shall indicate the material represented, its place of origin, the names of the producer and the Applicant, the Agreement number, and a reference to the applicable project drawings and specification paragraphs.

C. Materials of which samples are required shall not be used on the work until approval has been given by the Engineer in writing. Approval of any sample shall be only for the characteristics or for the uses named in such approval, and no other.

END OF SECTION

SECTION 01 10 00.01P
(Formerly SECTION 01000.1)

GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope:

1. These specifications cover the fabrication and installation of ductile iron, polyvinyl chloride, high density polyethylene, and steel water mains. Fabrication and installation under these specifications are applicable to:

a. Ductile iron pipe 16" diameter and smaller,

b. Polyvinyl chloride pipe 12" diameter and smaller,

c. High density polyethylene pipe 20" diameter and smaller, and

d. Steel pipe 20" diameter and smaller

2. When high density polyethylene pipe larger than 12" diameter is to be installed by Contractor, additional specifications will be provided.

3. Unless noted otherwise, the Contractor shall comply with all the requirements of these specifications.

B. Drawings:

1. The District's Standard Drawings for Installation of Water Mains 20" and Smaller form a part of these specifications and shall be followed in the installation of water mains.

2. Project drawings showing the size and location of the mains to be installed and other pertinent project details will be provided for each installation, and when so provided will become a part of these specifications.

3. In case of conflict between the project drawings and specifications, the specifications shall govern. In case of conflict between the project drawings and the standard drawings, the project drawings shall govern. Specific requirements shall take precedence over general requirements.

C. Related Work Done by District:

1. See Section 00 72 00P General Conditions, Article 7, for District repairs to the pipeline after it has been placed in service.

2. The District will install service laterals and meters once the pipeline has been completed and connections made to existing distribution system, required pipeline kills have been performed, and the pipeline has met all requirements set forth in Section 33 11 13.21P including successful completion of hydrostatic pressure and leakage testing, flushing and chlorination, and bacteriological sampling.

1.2 PRE-JOB REQUIREMENTS

A. Permits: Obtain all necessary permits for completing the work and provide copies to the Engineer. Where requirements of a permit differ from those of the District drawings and specifications, the more stringent requirements shall apply.

B. Prior to obtaining District-furnished material or start of construction, Applicant shall ensure that:

1. Earthwork and rough grading is completed; the pavement subgrade is acceptable to the city or county having jurisdiction; the street area is rough graded to within 0.5 feet to the plus of subgrade; and all sewage and storm pipelines have been installed as shown on improvement drawings as submitted to the District for design purposes of the new pipeline.

2. Survey stakes are established by a California licensed land surveyor as follows:

a. Set offset stakes along the pipeline alignment at an offset distance of not more than 17 feet from the center line of the alignment, and not more than 50 feet apart.

b. Indicate on offset stakes the offset distance, pipeline alignment survey station, feature (valve, tee, etc.) and cut or fill to the top of curb elevation. In addition, where profile is shown on project drawings, provide cuts to outside bottom of pipe and top of curb elevation/finish grade. The stationing shown on the offset stakes shall be consistent with the transit line stationing shown on the District drawings.

c. Set offset stakes at forward and backward tangents of angle points located along pipeline alignment.

d. Set offsets stakes at valves, tees, galvanic anode test stations, air valves, and other appurtenances.

e. Set offset stakes at grade breaks.

f. Provide at least two offset stakes with elevations to top of curb for each fire hydrant. Maximum offset stake distance is 10 feet. See Standard Drawing 9496-GB-1 for setback requirements.

g. Provide information at 500-foot intervals that ties the pipeline alignment survey to the transit line survey.

h. Indicate on field stakes the top of curb elevation where each storm drain crosses the pipeline.

3. The following documentation is furnished to the Engineer:

a. Statement that alignment and grade of the street area along the pipeline right of way is in accordance with the city or county approved improvement plans, coincides with the District drawings, and elevation of the street area is within 0.5 feet to the plus of subgrade.

b. City or county approved road pavement sections and extents for all pavement structures within the project. This shall include the extents and limits of all decorative pavement structures.

c. Cut sheets for the pipeline shall include as a minimum all information required on survey stakes and street name for each section surveyed.

d. Written designation of Competent Persons. See Section 31 23 33P.

e. Copy of each permit, including approved traffic control plans, required for this work.

f. Required submittals and samples for approval. Do not proceed until all items requiring approval have been approved by the Engineer.

g. Chlorination and flushing plan per Section 33 11 13.21P.

1.3 REFERENCES

A. Referenced Standards: The standard referred to, except as modified, shall have full force and effect as though printed in this Specification, and shall be the latest edition or revision, unless a particular edition or revision is indicated. Abbreviations and terms, or pronouns in place of them, shall be interpreted as follows:

ANSI	-	American National Standards Institute
ASTM	-	ASTM International
AWWA	-	American Water Works Association
Cal/OSHA	-	California/Occupational Safety and Health Administration
CSS	-	Caltrans Standard Specifications, State of California, Department of Transportation
ISO	-	International Standards Organization

NACE - National Association of Corrosion Engineers, Standards
NSF - NSF International

1.4 LAYOUT OF PIPELINES

A. The alignment and elevation of the water main and appurtenances shall be established in the field by the Contractor by measurement from the curb and by surveying. The Contractor shall preserve all benchmarks, stakes, and other survey marks and, in case of their removal or destruction, the Contractor shall be responsible for their accurate replacement.

1.5 MATERIALS IN CONTACT WITH DRINKING WATER

A. All materials, equipment, or products that will be in contact with drinking water (potable water) shall be tested and certified as meeting the specifications of NSF/ANSI 61 Standard in accordance with California Code of Regulations, Title 22, Section 64591. Examples include, but are not limited to, valves, pumps, flow meters, protective materials (coatings, linings, liners), joining and sealing materials, pipes, tanks, pipe fittings, filters, cleaning chemicals and lubricants.

B. All materials, equipment, or products that will be in contact with drinking water (potable water) or may contain lead shall be tested and certified as "lead-free" per California Health and Safety Code Section 116875.

1.6 CONSTRUCTION FACILITIES AND CONTROLS

A. Water:

1. Applicant only:

a. The District will furnish water for hydrostatic testing and disinfection of the pipeline. Water for initial testing and disinfection will be furnished without charge. See Section 33 11 13.21P.

b. Applicant shall provide all construction water except that provided by the District for hydrostatic testing and disinfection.

2. Provide and maintain all necessary equipment and facilities for conveying water, including water for testing and disinfection, to places where it will be used and for increasing the pressure if required.

3. Plan and perform work in a manner which will avoid waste of water.

B. Discharged Water:

1. Provide for the caring of drainage on the entire work area and the disposal of such drainage from commencement of work until completion. District Forces shall comply with requirements contained in the District's BMP Manual for

Drinking Water System Discharges. Applicant shall comply with Section 33 11 13.21P and with the following requirements:

a. Water discharged from or flowing from the jobsite shall be of such purity and cleanliness as not to introduce any contaminants into any water course, stream, lake, reservoir, or storm drain system. Contaminants include but are not limited to silt, construction debris, concrete, or washings thereof; petroleum or paint products; or other hazardous substances. No liquid except clean, dechlorinated water shall be discharged or allowed to flow from the site.

b. Discharged water includes but is not limited to rainwater, groundwater, water pumped or otherwise removed from excavations whether introduced to the excavation or naturally occurring groundwater, water furnished to the Applicant by the District, and water used by the Applicant for any purpose.

c. Discharged water shall cause no erosion of earth, whether disturbed or not disturbed, or of excavated or dredged earth stored on site, or of material imported for fill or other purposes.

d. No soil or other material shall be discharged in a quantity that will have an adverse effect on the receiving waters. Discharge shall not cause or contribute to a violation of any water quality standard.

e. In addition to other requirements, treat and test discharged water to ensure:

(1) Non-detectable total chloramine residual (below the detection limit of the test method).

(2) pH greater than 6.5 and less than 8.5.

C. Public Safety:

1. Provide and maintain such fences, barricades, "Street Closed" signs, warning lights and flaggers as required to provide safety against accidents to the public and to comply with all permit requirements. In no case shall the spacing between the warning lights be more than 50 feet along the length of the trench where it is adjacent to or within the boundaries of a thoroughfare.

2. Convenient access to driveways, houses, and buildings along the line of work shall be maintained at all times. Temporary approaches to, and crossings of, intersecting streets shall be provided and kept in good condition.

3. No material or equipment shall be placed where it will interfere with the free and safe passage of public traffic.

D. Maintaining Service:

1. Operating nuts of valves controlling live lines shall be accessible and operational at all times.

2. No material or other obstruction shall be placed within 15 feet of fire hydrants and blowoffs.

E. Sound Control:

1. Comply with all local sound control and noise level rules, regulations and ordinances that apply to the work performed.

F. Construction Cleaning:

1. Maintain the site and all stored items in a neat and orderly condition allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.

2. Dispose of refuse as often as necessary so that at no time shall there be any unsightly accumulation of rubbish.

3. Sweep the paved street in the work area with a mobile sweeper on a daily basis. The sweeper shall be equipped with a dust suppression system and capable of collecting rock, gravel, sand, and dust.

4. Prior to completion of the work, remove from the jobsite all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final cleaning to leave a completely clean project.

G. Dust and Littering Control:

1. Provide and maintain dust control within the site and provide adequate measures to prevent a dust problem for neighbors.

2. Load all trucks in a manner that will prevent dropping of materials or debris on streets. Trim loads and remove all material from the shelf area of vehicles to prevent spillage. Take precautions when necessary to avoid creating dust and littering by watering the load after trimming and by promptly sweeping the pavement to remove dirt and dust.

H. Traffic Control:

1. Comply with all traffic control requirements of agencies having jurisdiction.

I. Confined Spaces:

1. Attention is directed to the provisions of Article 108 of the General Industry Safety Orders, Title 8, California Code of Regulations, and Article 4 of the Construction Safety Orders, Title 8, California Code of Regulations.

2. Definition: Confined spaces for the purpose of this Article shall mean the interior of storm drains, sewers, vaults, utility pipelines, manholes, reservoirs, and any other such structure which is similarly surrounded by confining surfaces so as to permit an oxygen deficient atmosphere or the accumulation of dangerous gases or vapors.

3. Tests for the presence of combustible or dangerous gases and/or oxygen deficiency in confined spaces shall be made with an approved device immediately prior to a worker entering the confined space and at intervals frequent enough to ensure a safe atmosphere during the time a worker is in such a structure. A record of such tests shall be kept at the jobsite.

4. No employee shall be permitted to enter or remain within a confined space where tests indicate the presence of a hazardous atmosphere, unless the employee is wearing suitable and approved respiratory equipment, or until the hazardous atmosphere has been removed from the confined space by continuous forced air ventilation.

5. Confined spaces that contain or that have last been used as containers of toxic gases, light oils, hydrogen sulfide, corrosives, or poisonous substances, shall, in every case, be tested by means of approved devices or chemical analysis before being entered without wearing approved respiratory equipment.

6. Sources of ignition, including smoking, shall be prohibited in any confined space until after the atmosphere within the confined space has been tested and found safe.

7. Reservoirs, vessels, or other confined spaces having openings or manholes in the side as well as in the top shall be entered from the side openings or manholes when practicable.

J. Worker Safety:

1. The safety provisions of applicable laws and construction codes shall be observed. All safety standards, orders, rules and regulations applicable to the work to be performed and issued pursuant to the California Occupational Safety and Health Act shall be obeyed and enforced.

K. Restoration of Property:

1. Restore all damaged property, including sidewalks; adjacent roadway surface; curbing; pipes; conduit; gas, water and other services; meter boxes; sewers; monuments; stakes; trees; shrubs and other planting and other public or private

property to their original "as-found" condition or as otherwise specified, at the completion of the work.

1.7 SUBMITTALS (Applicant Only)

A. Submission requirements specified in the submittal sections of the technical specifications pertain only to the Applicant. Submit 5 copies of data and drawings by mail to:

Construction Division, MS #62
East Bay Municipal Utility District
P.O. Box 24055
Oakland, CA 94623-1055
Attn: Supervising Construction Inspector

or have them hand delivered to:

Construction Division Office
1100 21st Street Oakland, CA 94607

1.8 PRE-ACCEPTANCE INSPECTION

A. When the work has reached a suitable completion stage, the Engineer and the Contractor shall make a joint inspection of the job to determine the deficient work items required to be completed prior to the acceptance of the job by the District. The Contractor is responsible to schedule this meeting with the Engineer 48 hours prior to requested date. The deficient work items will be transmitted in writing to the Applicant once the job walk is completed.

END OF SECTION

SECTION 01 64 05P
(Formerly SECTION 01600.1)

DISTRICT-FURNISHED MATERIALS
(Applicant Only)

PART 1 - GENERAL

1.1 MATERIALS FURNISHED BY THE DISTRICT

A. General:

1. Upon payment to the District in accordance with the Agreement, and after the conditions of Document 00 72 00P - Article 1.2 Paragraph B have been met, the District will furnish to the Applicant pipe, fittings, and other materials, in the quantities needed for the project, as listed in Paragraph B. All other materials shall be furnished by the Applicant as specified in Article 1.2.

2. During the progress of work, District will issue any additional material, if listed in Paragraph B, required as a result of changes in design, material, or location for the convenience of the District.

B. List of District-furnished Materials:

Item	Reference
ML&PCS - mortar-lined and plastic-coated steel pipe and fittings, 16" and smaller, as shown on the drawings	Project Drawings
ML&CS - mortar-lined and coated steel pipe and fittings, 16" and smaller as shown on the drawings	Project Drawings
Steel, DI, or iPVC Fire Hydrants, including Hydrant Set, except Valve Pot Installation items per Standard Drawing 321-EA	Standard Drawing 9496-GB and 9496-GB-1
Butterfly Valves - Main Line	Project Drawings
Gate Valves - Main Line, Hydrant, and Blowoff	Standard Drawing 288-EA and 288-EA-1
Valve Operating Shaft Extension with nut	Standard Drawing 1241-A

Steel Pipe and 45˚ Elbows for Offset - Returns 4", 6", 8", and 12" (Applicant shall fabricate)	Standard Drawing 1870-A and 1996-A
Size on Size Main-Line Valve with 4" Blowoff for 6" and 8" Steel and PVC Mains except Items 2, 3, 5, and Valve Pot Installation Items per Standard Drawing 321-EA	Standard Drawing 332-EA
Size on Size Main-Line Valve with 4" Blowoff for 6" and 8" Restrained Ductile Iron and PVC Mains except Items 2, 3, 4, 7, and Valve Pot Installation Items per Standard Drawing 321-EA	Standard Drawing 332-EA-1
4" Blowoff Assembly except Items, 8, 10-12, 16, and Valve Pot Installation Items per Standard Drawing 321-EA	Standard Drawing 169-EA
6" Blowoff and Pumping Tee except Items 1, 2, 8, 11, 12, 15, 16, 17, 19, 20, and 21	Standard Drawing 199-EA
Flexible Coupling for Insulating Joint	Standard Drawing 3446-GB
4" x 4" Marker Post	Standard Drawing 1336-A
Split Tees for Wet Taps	Standard Drawing 282-EA
Air Valves (above grade) except items 2, 3, 6, 7, 10, 11-14, 16, 17, 19-21, 23	Standard Drawing 189.1-B
Air Valves (below grade) except items 2, 3, 6, 7, 10, 11, 13-19, 21-23	Standard Drawing 189.2-B
Galvanic Anodes except plastic tape, cement mortar, epoxy putty, and exothermic welding kit	Standard Drawing 286-EA
Chlorination Taps	Standard Drawing 9020-GB
Manhole Frames and Covers	Standard Drawing 199-EA, Standard Drawing 333-EA

C. Requisition of Materials:

1. In all cases materials will be issued only upon approval by the Engineer. The Applicant shall submit a completed materials requisition form (Form P-013) to the Engineer a minimum of five workdays before the date of scheduled pick-up. The Applicant shall bear the responsibility for any schedule and cost impacts due to unavailability of material if the Applicant fails to provide the required advance notice of the scheduled pick-up date. At least one day before the scheduled pick-up date, the Applicant shall call the designated location to confirm that materials are ready for pick-up. The District will identify any unavailable materials at this time. If materials are unavailable and the Applicant provided the required notice, the District may, at its discretion, elect to deliver the remaining items rather than have the Applicant return when those items are available. Receipts for materials signed by the bearer of the request shall be conclusive evidence of delivery to the Applicant of the materials therein specified. Material requisitioned for one District job shall not be used on another without permission of the Engineer.

D. Delivery of Materials:

1. Delivery of all materials to be furnished by the District shall be taken by the Applicant at the District's yard where such material is stored. Detailed information regarding storage may be obtained by contacting the District's Material Storage Foreman at 1200 21st Street, Oakland, telephone (510) 986-7701. The locations, telephone numbers, and business hours of the District yards are:

Oakport Storage Center 5601 Oakport Street Oakland, CA (across from Oakland Coliseum) (510) 287-0426	Central Warehouse 1200 - 21st Street Oakland, CA (510) 986-7703

Hours: 8:30 a.m. - 3:30 p.m.

2. After approval of project submittals, up to 5 days are needed to pull and consolidate project materials for pickup. Materials will be issued only during the business hours listed above. Receipts for materials signed by the Applicant shall be conclusive evidence of delivery. All handling, loading, hauling from their delivery point to the jobsite, and unloading of such materials shall be performed by the Applicant. The Applicant shall provide all necessary materials handling equipment (including forklift), tiedowns, and dunnage. Also, see Sections 33 11 13.06P, Installation of ML&PCS Pipe, and Section 33 11 13.07P, Installation of ML&CS Pipe, Article 1.3.

E. Materials furnished by the District have been inspected and are assumed to be in perfect condition upon delivery to the Applicant. The Applicant shall inspect and ascertain the condition of all materials at the time of delivery and shall assume all responsibility for the condition of all materials from the time of such delivery until final acceptance of the work by the Engineer. If it is subsequently determined that furnished materials are defective and unsuitable for the intended purpose and such condition is not the result of damage after delivery to the Applicant and could not have been ascertained immediately upon delivery to the Applicant, the District's liability is limited to providing similar replacement material.

F. Additional Materials:

1. All materials to be furnished to Applicant under the following circumstances will be furnished at Applicant's expense and shall be paid for in full before issue by District:

   (a) For repair of damage to District property when such damage is attributable to the Applicant.

   (b) For replacement of District materials lost by, damaged by, or stolen from the Applicant.

   (c) For changes under Article 3 of Section 00 72 00P General Conditions, except changes made on mains installed for the convenience of the District.

4. If damaged District materials are repairable as determined by the Engineer, and if the damaged District materials are returned by the Applicant, the Applicant will be credited for the current material value less the repair costs.

G. Return of Materials:

1. At the completion of the job, all excess material furnished by the District and recovered materials shall be returned to the same designated location from which they were picked up (or delivered). The Applicant shall submit a completed Material Return Order (Form P-015) to the Engineer within 7 days after establishment of the in-service date. Confirmed Material Return orders and a transmittal cover letter will be mailed directly to the Contractor. Returned materials will be accepted only during the business hours listed in Paragraph D. Unloading of all returned material at the yard shall be done by the Applicant at locations designated by the District. Applicant shall furnish all necessary materials handling equipment. Excess material assembled by the Applicant shall be disassembled before returning the material to the yard.

2. The Applicant will be billed for the materials furnished by the District for installation under this specification, which are not installed or returned to the proper District yard within 20 calendar days after the new pipeline is made ready for service by the Applicant. At this time determination of the quantities

and value of the materials not installed or returned will be made by the Engineer and will be billed to and shall be paid for by the Applicant.

1.2. MATERIALS FURNISHED BY THE APPLICANT

A. The Applicant shall furnish polyvinyl chloride (PVC) pipe and associated fittings (cast iron, ductile iron, or PVC); ductile iron (DI) pipe and fittings; 20" diameter steel pipe and fittings; high density polyethylene (HDPE) pipe and associated fittings; and all other material required for complete and acceptable installation of the pipe, except those items furnished by the District under Article 1.1.

B. All materials furnished by the Applicant shall be new, of the best commercial quality, and as specified herein. Failure of the specifications to set forth or describe items or components does not relieve the Applicant of furnishing all items necessary to ensure complete performance and operation of the pipeline in the service intended.

C. All materials furnished by the Applicant must comply with California Code of Regulations, Title 22, Division 4, Chapter 16, Article 7, Section 64591 or Section 64593, sub-paragraph (c).2. Applicant must furnish current evidence of compliance to the Engineer, if requested.

END OF SECTION

SECTION 03 30 76P
(FORMERLY SECTION 03376.1)

CONCRETE FOR PIPELINE INSTALLATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Furnish and install plain and reinforced concrete for pipelines, including anchors, encasement, supports, and other pipeline appurtenances.

B. Related Sections:

1. Section 32 12 16.81P – Asphalt Pavement Replacement

C. Work Not Included: Concrete curbs, gutters, sidewalks, and pavement shall conform to applicable city, county, or state specifications.

1.2 REFERENCES

A. ASTM International:

1. ASTM C33 – Specification for Concrete Aggregates

2. ASTM C150 – Specification for Portland Cement

3. ASTM A615 – Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

4. ASTM A1064 – Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete compressive strength shall be a minimum of 3,000 psi at 28 days.

B. Portland Cement: ASTM C150, Type II containing not more than 0.60% by weight of alkalis, calculated as percentage of sodium oxide plus 0.658 times the percentage of potassium oxide

C. Aggregate: ASTM C33

D. Water: CSS 90 – 1.02.D

E. Reinforcement:

1. Bar reinforcement: ASTM A615, Grade 60 (deformed)

2. Welded wire fabric: ASTM A1064

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. Forms shall be smooth, mortar tight, and shall maintain shape during placing of concrete.

B. Concrete anchors shall be placed against solid undisturbed ground.

C. Reinforcing bars shall be clean and placed accurately to the dimensions shown on the drawings.

D. Moisten ground where concrete is to be placed.

E. Do not place concrete in free water.

F. Consolidate concrete with vibrators while placing.

G. Cure by keeping concrete surface moist for 7 days, or by using approved curing compound.

H. Do not backfill over anchors, concrete caps, and encasements until at least 24 hours after placement of concrete has been completed.

END OF SECTION

SECTION 05 05 24P
(Formerly SECTION 05095.1)

PIPE WELDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Welding of steel pipe in the field

B. Related sections:

1. Section 33 11 13.06P – Installation of ML&PCS Pipe – 20" and Smaller

2. Section 33 11 13.07P – Installation of ML&CS Pipe – 20" and Smaller

1.2 TERMS AND DEFINITIONS

A. Certified Welding Inspector (CWI) – A person qualified as a welding inspector as given in AWS QC1- Latest Edition, Standard for AWS Certification of Welding Inspectors.

B. Nondestructive Examination (NDE) – The act of determining the suitability of some material or component for its intended purpose using techniques that do not affect its serviceability.

C. NDE Level II Technician/Operator (NDE Level II): An individual certified at Level II as defined in American Society for Nondestructive Testing (ASNT) Recommended Practice SNT-TC-1A specific to the NDE method used.

D. Procedure Qualification Record (PQR) – A record of welding variables used to produce an acceptable test weldment and the results of tests conducted on the weldment to qualify a welding procedure specification.

E. Welding Procedure Specification (WPS) – A document providing the required welding variables for a specific application to assure repeatability by qualified welders and welding operators. WPSs that are not prequalified by Code shall be supported with a PQR.

F. Standard Welding Terms and Definitions: See AWS 3.0, Standard Welding Terms and Definitions.

1.3 QUALITY ASSURANCE

A. Welding Procedure Specifications:

1. All welds shall be completed in accordance with a qualified WPS.

a. The Contractor may use a pre-qualified WPS per AWS D1.1, Section 3.

2. All WPS's that are not pre-qualified as given above shall be qualified in accordance with one of the following:

    a. ASME Boiler & Pressure Vessel Code, Section IX, or

    b. AWS D1.1, 2020, Section 6

3. An AWS CWI shall review, sign and stamp all WPSs.

4. An AWS CWI shall witness, review, sign and stamp all PQRs.

B. Qualification of Welders:

1. Welders shall be qualified under ASME Boiler & Pressure Vessel Code, Section IX, Part QW; AWS D1.1-2020 Structural Welding Code Clause 6 for Structural Welding Code Clause 6 for the welding processes, positions, and procedures to be used for this project.

2. Welders shall have verifiable evidence they have maintained their qualifications in accordance with AWS D1.1, Clause 6 or ASME Boiler & Pressure Vessel Code, Section IX, Part QW-322.

3. Welders shall have verifiable evidence that their qualification is current and valid under the applicable code. Requires qualification in the 6G test position.

4. Welder Qualification shall be witnessed and evaluated by a certified AWS QCI welding inspector from an independent testing laboratory utilizing calibrated equipment.

5. Welder Qualification(s) shall be witnessed, evaluated, stamped and signed by an AWS CWI.

6. All measuring and test equipment used in the qualification of welders shall be properly calibrated, and a copy of calibration certificates provided.

C. Nondestructive Examination (NDE) of Production Welds:

1. In addition to any NDE required by the Contract Documents, the Engineer may elect to perform additional NDE of in-process or completed shop or field welds to verify weld quality. Any additional NDE may be performed by District personnel or the Engineer may request the Contractor perform or subcontract these examinations.

2. Types of NDE:

    a. Radiographic Examination (RT) per Paragraph UW-52, Section VIII, ASME Boiler & Pressure Vessel Code

    b. Ultrasonic Examination (UT) per Paragraph UW-53, Section VIII, ASME Boiler & Pressure Vessel Code

c. Other non-destructive tests such as Liquid Penetrant (PT) and Magnetic Particle (MT) in accordance with Section V, ASME Boiler & Pressure Vessel Code. Acceptance criteria shall be as given by AWS D1.1, Section 6, Part C.

d. Test coupons shall be in accordance with ASTM E8.

e. Welded seam shall develop strength of adjacent steel sheet or plate.

3. Cost of Examinations:

a. The cost of NDE identified in the Contract Documents for specific welded connections shall be borne by the Contractor.

b. The cost of additional NDE requested by the District will be borne by the District in the event that all examined welds are found to be acceptable. In the event of a rejected weld, the costs of all NDE, repairs, re-inspection and re-examination that result from the reject shall be borne by the Contractor.

c. The cost of NDE performed by District personnel will be borne by the District. The costs of repairs, re-inspection and re-examination resulting from a rejected weld shall be borne by the Contractor.

1.4 SUBMITTALS

A. Qualification of welders:

1. Submit verifiable evidence of initial qualification for each welder for each weld that particular welder will use on the project.

2. Submit verifiable evidence indicating each welder has maintained current qualification under the applicable code.

3. For field welders, submit a schedule of required project qualification tests.

4. Submit results of all field welder project qualification testing.

B. Submit WPS's with supporting PQR's for approval.

C. Submit verifiable evidence of current qualification for each AWS CWI used to qualify procedures or welders under Articles 1.2.A and 1.2.B above.

D. Provide all submittals to Engineer at least seven calendar days prior to commencing pipe welding.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 GENERAL PROCEDURES

A. Use shielded metal arc welding (SMAW) method or flux-cored arc welding (FCAW) method unless the Engineer approves another method prior to use.

B. Welds shall be fused with base metal, uniform in appearance, free from cracks, and reasonably free from irregularities.

C. Restart in weld zone on clean and sound metal.

D. Limit porosity and slag inclusions in accordance with Section VIII, Boiler and Pressure Vessel Code.

E. Repair defective welds by chipping, grinding, flame gouging, or air-arc gouging.

F. Do not undercut along side of finished pass.

G. Use procedures or welding sequences that will minimize eccentric stresses, shear, or distortion in the weld.

H. Butt welds shall have complete penetration and fusion.

I. Finished weld bead shall be central to the seam.

J. Artificial or forced cooling of welded joints is not permitted.

K. Low hydrogen electrode storage shall be in accordance with AWS D1.1, Article 4.5.

L. See Drawing 323-EA, 324-EA, and 325-EA for welding of flanges.

M. Grind down all sharp weld projections prior to tape wrapping.

3.2 MANUAL WELDING

A. Welding shall be performed in at least two layers.

B. Passes shall not exceed 1/4" in throat dimension.

C. Welds shall be thoroughly cleaned after each pass.

END OF SECTION

SECTION 05 05 26P
(Formerly SECTION 05097.1)

FLANGE BOLTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Furnish and install bolts, washers, and nuts for flanged connections and where shown on the drawings.

B. Related Sections:

1. Section 33 10 01P – Protection from Corrosion

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI B1.1 – Unified Inch Screw Threads (UN and UNR Thread Form)

2. ANSI B16.1 – Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250

3. ANSI B18.2.1 – Square and Hex Bolts and Screws, Inch Series

4. ANSI B18.2.2 – Square and Hex Nuts, Inch Series

5. ANSI B18.22.1 – Plain Washers

B. ASTM International:

1. ASTM A193 – Specification for Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service

2. ASTM A194 – Specification for Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both

3. ASTM A449 – Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use

4. ASTM A563 – Specification for Carbon and Alloy Steel Nuts

5. ASTM D2000 – Standard Classification System for Rubber Products in Automotive Applications

6. ASTM F436 – Specification for Hardened Steel Washers

7. ASTM F844 – Specification for Washers, Steel, Plain (Flat), Unhardened for General Use

8. ASTM F2329 – Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

C. American Water Works Association (AWWA):

1. AWWA C207-13 – Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In. (100 mm through 3,600 mm)

D. SAE International:

1. SAE J429 – Mechanical and Material Requirements for Externally Threaded Fasteners

2. SAE J995 – Mechanical and Material Requirements for Steel Nuts

1.3 SUBMITTALS

A. Submit manufacturer's literature and application schedule for all bolting to demonstrate conformance with these specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Standard bolting:

<table>
<tr><td rowspan="5">Carbon Steel</td><td>Bolts:</td><td colspan="2">Plain or Galvanized: ASTM A449 Type 1
Plain Only: ASTM A193 Grade B7 or SAE J429 Grade 5.</td></tr>
<tr><td rowspan="2">Nuts:</td><td>1/4" to 1":</td><td>Plain or Galvanized: ASTM A563 Grade B, standard hexagonal flat nuts
Plain Only: A194 Grade 2H or SAE J995 Grade 5, standard hexagonal flat nuts</td></tr>
<tr><td>1-1/8" to 1-1/2":</td><td>ASTM A563 Grade B, heavy hexagonal flat nuts</td></tr>
<tr><td>Washers:</td><td>Diameter 1-1/2" and smaller:</td><td>ASTM F436 Type 1</td></tr>
<tr><td>Coating:</td><td>Hot-Dip Galvanized</td><td>ASTM F2329 for A449 bolts, A563 nuts and F436 washers</td></tr>
</table>

Stainless Steel, Standard	Bolts:	ASTM A193 Class 1, B8 (Type 304) or B8M (Type 316)	
	Nuts:	ASTM A194, Grade 8 (Type 304) or Grade 8M (Type 316), Standard Hex	
	Washers:	Type 304 or 316 to match bolts and nuts	
Stainless Steel, High Strength	Bolts:	ASTM A193 Class 2, B8 (Type 304) or B8N (Type 304N), Carbide solution treated and strain hardened.	
	Nuts:	1/4" to 1-1/2"	ASTM A194, Grade 1 standard hex or Grade 8-S1 (Type 304) Heavy Hex and Strain Hardened
	Washers:	Type 304 or 316 to match bolts and nuts	

1. Unless otherwise noted or shown, flange bolting type shall be Carbon Steel for all buried pipelines.
2. Refer to standard drawing 323-EA, 324-EA or 325-EA for the specific bolt grade that corresponds to the pipe pressure of the application.

2.2 CONSTRUCTION

Bolts	ANSI B18.2.1, standard hexagonal heads
Nuts	ANSI B18.2.2
Washers	ANSI B18.22.1 Type A, Narrow

2.3 BOLTING MATERIAL OTHER THAN STEEL

A. Threading and dimensions shall conform to the requirements for steel heads and nuts.

B. Class 3 Fit ANSI B1.1

2.4 BOLT MARKING

A. Identification symbols shall be applied to each bolt head to identify the material and grade of each bolt. The bolt identification symbols shall be as follows:

1. Carbon Steel: Three radial lines, 120 degrees apart

2. Stainless Steel: B8 (type 304), B8M (type 316)

2.5 LENGTH OF BOLT

A. After assembly, the bolts shall extend a minimum distance of two threads beyond the nut. In addition, the bolt length shall be no longer than 1-inch beyond the nut and shall not interfere with any appurtenance or the operation of any device.

2.6 THREADS

A. Coarse thread series – Class 2 Fit ANSI B1.1

2.7 BOLT THREAD ANTI-SEIZE COMPOUND

A. Compound shall be food grade meeting NSF code H1 standards for incidental contact, and shall be designed to prevent rusting, seizure and galling of bolt threads.

B. Acceptable products:

1. Loctite Food Grade Anti-Seize

2. Saf-T-Eze, by Saf-T-Lok®

3. Or equal as approved by the Engineer

2.8 FLANGE GASKETS

A. Potable Water:

1. General Requirements: See Section 01 00 00.01P – Materials in Contact with Drinking Water. NSF-61 certified: required.

2. Potable Water Service Conditions: Suitable for chloraminated water and in accordance with Standard Drawings 323-EA – Steel Pipe Flanges, Low Pressure, 324-EA – Steel Pipe Flanges, High Pressure, and 325-EA – Steel Pipe Flanges, Extra-High Pressure.

3. Composition Gasket: PTFE with aluminosilicate or hollow glass microspheres, meeting the requirements of AWWA C207-13. Full-face type gaskets shall be used for flat-faced flange sets and ring-type gaskets that extend outward to the inside of the bolt hole circle shall be used for raised-face flange sets. Thickness as shown on the Standard Drawings listed above.

a. At a minimum, gaskets shall be rated for 750 psig @ 0 deg F and 0 psig @ 400 deg F; shall meet ASTM F36 compressibility ≥ 25% and recovery ≥ 25%; ASTM D1708 Tensile Stress ≥ 2000 psi; ASTM F38 creep relaxation ≤ 40%; and an ASTM F586 design "m" factor ≥ 2.0, and a design "y" factor ≥ 1500 psi for 1/16" and 1/8" thick gaskets.

1) Acceptable products:

a) Garlock 3505 EPX

b) Garlock 3505

c) Teadit TF1572 SAN

d) Or equal as approved by the Engineer.

4. Rubber Gasket: Premium peroxide-cured EPDM rubber per ASTM D2000, Shore Type A 60 - 90 durometer, full-faced type. Rated for 175 psig and -40 to 275 deg F. Full-face type. Thickness as shown on the Standard Drawings listed above.

    a. Acceptable products:

        1) Garlock 98206

        2) AmericanBiltrite AB-576

        3) American Toruseal

        4) Or equal as approved by the Engineer.

B. Raw Water: Composition Gasket; Synthetic fibers with nitrile (Buna-N) binder 1/8-inch thick; suitable for water, hydrocarbons, oils, and gasoline; 400 deg F continuous operating temperature; 500 psi maximum pressure. NSF-61 certified. Full-face type gaskets shall be used for "low pressure" steel flat-faced flange sets and "high pressure" steel flanges mating to a valve or appurtenance with cast iron flanges, while ring-type gaskets, which extend outward from the ID to only the inside of the bolt circle, shall be used for raised-face flange sets and "high pressure" steel flange sets. "Low pressure" and "High pressure" are defined on drawings 323-EA - Steel Pipe Flanges, Low Pressure and 324-EA - Steel Pipe Flanges, High Pressure.

    1. Acceptable products:

        a. Garlock "Multi-Swell" Style 3760-U

        b. Or equal as approved by the Engineer

C. All Chemical Services: Low torque type, full face meeting ANSI B16.1 (Class 150), PTFE molded to EPDM body, with dual concentric convex sealing rings molded in PTFE between center hole and bolt circle.

    1. Acceptable products:

        a. Garlock Style 370

        b. Proco 9013-ET

        c. Harrington Plastics

        d. Chemline, Asahi

        e. Or equal as approved by the Engineer

2.9 FLANGE INSULATION SETS

A. General Requirements: See Section 01 00 00.01P – Materials in Contact with Drinking Water.

B. Insulating Gasket: NSF-61 certified, 1/8" full face NEMA grade G10 glass reinforced epoxy retainer with minimum 750 volts/mil dielectric strength and minimum 65,000 psi compressive strength, EPDM sealing element on the retainer, 200 deg F (minimum) at rated pressure, with NEMA grade G10 insulating sleeves and washers, and stainless steel backup washers.

C. Acceptable products:

1. Advance Products & Systems, Inc., APS Voltacept™ Trojan G-10

2. GPT LineBacker® 61

3. Lamons Isoguard

4. Or equal as approved by the Engineer

PART 3 - EXECUTION

3.1 FLANGE BOLTING PROCEDURES

A. All flange bolt torque values shall be verified using a properly calibrated torque wrench. The Contractor shall provide the torque wrench certificate of calibration upon request. Refer to Drawings 323-EA, 324-EA, and 325-EA for torque procedure details. Install the appropriate gasket.

B. Install washers under both bolt heads and nuts. Verify that the OD of the washers does not extend past the OD of the flange.

C. Coat bolt threads with anti-seize compound.

END OF SECTION

SECTION 09 96 56.10P
(Formerly SECTION 09969.1)

FUSION-BONDED EPOXY COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Fusion-bonded epoxy coating on ferrous metal surfaces.

1.2 REFERENCES

A. SSPC PA Guide 3, A Guide to Safety in Paint Application

B. SSPC Vol 2, Steel Structures Painting Manual, Systems and Specifications

1. SSPC-SP 10 Near-White Metal Blast Cleaning

2. SSPC-SP 11 Power Tool Cleaning to Bare Metal

C. AWWA C116: Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray Iron Fittings

D. AWWA C213: Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines

E. ASTM International (ASTM):

1. D1002 – Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension loading (Metal-to-Metal).

F. American National Standards Institute (ANSI)/NSF International

1. ANSI/NSF 61: Drinking Water System Components – Health Effects

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's current specifications or technical information that proves compliance with the specified requirements.

B. Manufacturer's Instructions: Submit the manufacturer's written instructions and recommendations for field coating and repair of the coating system.

C. Submit list of all coatings proposed for use.

1. Identify each coating by brand name and manufacturer and indicate which items will be painted with the coating.

D. Test reports: Submit manufacturer's certification that shop applied coatings passed tests.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Applicator: Regularly engaged in application of similar coatings for at least two years immediately prior to this work.

2. Workers: Experienced and knowledgeable in preparation for and application of fusion-bonded epoxy coatings.

1.5 JOB CONDITIONS

A. Environmental conditions:

1. Do not abrasive blast when ambient temperature is less than 5° F above dew point.

2. Apply coatings only when conditions are within the limits prescribed by the manufacturer but, in any case, do not apply coatings when:

a. Metal temperature is less than 425° F for fluidized bed.

b. Metal temperature is below 55° F for repair work.

c. Relative humidity is greater than 70 percent for fluidized bed.

d. Relative humidity is greater than 85 percent for repair work.

3. The cleaned pipe surface shall be protected from conditions of high humidity, rainfall, and surface moisture. The pipe surface shall not be allowed to flash rust before coating.

B. Safety:

1. Comply with the applicable safety recommendations of SSPC-PA-Guide 3 and Good Painting Practice, Chapters 2.4 and 5.3.

PART 2 - PRODUCTS

2.1 SHOP APPLIED COATINGS

A. 100% solids, fusion-bonded, thermo-setting resin powder certified in accordance with ANSI/NSF standard 61.

B. Approved Products:

1. Electrostatic spray: 3M Scotchkote No. 134, manufactured by 3M.

2. Fluidized bed: 3M Scotchkote No. 203 or No. 206N, manufactured by 3M.

3. Or equal as approved by the Engineer.

2.2 FIELD REPAIR COATINGS:

A. Approved Products:

1. Scotchkote No. 314 for use in field repair of shop applied Scotchkote No. 134

2. Scotchkote No. 323 for use in field repair of shop applied Scotchkote No. 203, No. 206N, or No. 134

3. Scotchkote 226P, Hot Melt Patch Compound may be used to repair small areas of external coating damage (less than 1 square inch), installed per the manufacturer's recommendation.

4. Or equal as approved by the Engineer.

2.3 APPROVED APPLICATORS

A. JIFCO, Livermore, CA, (925) 449-4665

B. U.S. Pipe Fabrication., Marysville, CA, (530) 742-5171

C. California Pipe Fabricators, Dixon, CA, (707) 678-3069

D. Poly-Engineering, Richmond, CA, (510) 233-1420

E. Reliable Powder Coating, San Leandro, CA, (510) 895-5551

F. Or applicator that is certified by the manufacturer

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Prepare surfaces to be coated in accordance with manufacturer's written instructions, but not less than specified herein.

B. Grind smooth all surface irregularities, welds, and weld spatter.

C. Grind smooth and round all sharp metal edges.

D. Abrasive blast surfaces to near-white metal in accordance with SSPC-SP 10.

E. Surface anchor profile: 1.5 to 4.0 mils.

F. Oxidation of the steel prior to coating in the form of "blueing" or other apparent oxide formation is not acceptable. If such oxidation occurs, the material shall be cooled to ambient temperature and recleaned.

G. The heat surface shall not leave a residue or contamination on the pipe surface. Graduated "Tempilstik" crayons shall be used and supplied to the District by the Contractor to measure the temperature. Only a small spot of pipe shall be touched with the "Tempilstik". Optical pyrometers may be used in addition to, or in lieu of "Tempilstik's". The calibration of the optical pyrometer shall be checked at least twice daily.

3.2 COATING APPLICATION

A. Preheating, coating application, and post-curing shall be in accordance with AWWA C213 or C116 and the coating manufacturer's instructions.

B. Dry film thickness of cured coating shall be 12 mils minimum.

C. Finished coating shall be well bonded and have no sags or runs.

D. Coating shall be free of holidays and pinholes.

3.3 INSPECTIONS AND TESTS FOR SHOP APPLIED COATINGS

A. The finished coating shall be inspected and tested at the coating plant by the applicator for holidays, adhesion, and for coating thickness. All testing shall be done in the presence of the Engineer.

1. Holiday test: Low voltage wet sponge holiday detector, such as K-D Bird Dog or Tinker-Rasor M-1, shall be used for testing. Add a non-sudsing wetting agent, such as Eastman Kodak Photo-Flo to the water used to saturate the sponge.

2. Adhesion test:

a. Tension: 3,000 psi when pulling apart two 1/2" diameter coated rods joined by coating, using an Instron testing machine.

b. Shear: Minimum 4,000 psi when tested in accordance with ASTM D1002.

3. High voltage holiday detector, for coatings more than 20 mils dry film thickness, shall be equal to Tinker-Rasor AP-W or D. E. Stearns Model 14/20. Use in accordance with coating manufacturer's recommendations except use voltage of 125 volts per mil of coating.

4. Thickness: Measure with a nondestructive point film thickness gauge such as Mikrotest.

B. Any work found defective shall be repaired and brought to full compliance with these specifications. Retest after coating repairs.

3.4 FIELD REPAIR OF COATINGS

A. After installation of coated items, repair damaged shop-applied coatings and coat field welds with the coating manufacturer's recommended repair material. Mastic products shall not be used for interior surface repairs.

B. Comply with coating manufacturer's recommendations for field repair.

C. Prior to coating, clean surfaces to bare metal free of all visible foreign matter in accordance with SSPC-SP 11. Maintain specified surface profile.

D. Apply one or two coats as required to obtain a dry film thickness of 12 mils minimum, using brush or spray. Brush shall only be used for touch-up work of less than 3 sq. ft.

END OF SECTION

SECTION 31 23 23.15P
(Formerly SECTION 02720.1)

IMPORTED BACKFILL AND DRAIN ROCK MATERIALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Furnish imported backfill and drain rock materials as shown on the drawings and as specified herein.

1.2 SUBMITTALS

A. Certificates:

1. Submit certificate of compliance with laboratory soil resistivity test results.

B. Samples:

1. Submit representative 50-pound samples of each material to be imported at least 2 weeks but not more than 4 weeks in advance of installation operations for testing by the Engineer.

2. Each sample shall be labeled showing the material transmitted, its source of origin, its intended use, the Agreement Number and pipeline job numbers referenced, and Applicant's name.

3. Deliver samples to the EBMUD Materials Testing Laboratory located at 1100 21st Street, Oakland. Prior to delivery, call (510) 287-1990, between 8:00 a.m. and 10:00 a.m. to make an appointment.

C. Approval:

1. Materials for which samples are required shall not be used on the work until approval has been given by the Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Class I Backfill:

1. Shall be clean, sound, and durable natural or crushed sand, free from organic material and other deleterious substances

2. Shall not originate from salt water environments

3. Measured resistivity of material passing the No. 4 sieve, using a soil resistivity box in accordance with ASTM G57, shall not be less than 5,000 ohm-cm.

4. Soil pH shall be measured in accordance with ASTM G51 and shall not be less than 6.5.

5. The sand equivalent value as determined by California Test 217 shall not be less than 30.

6. Shall conform to the following grading when tested in accordance with ASTM C136:

Sieve Size	Percent Passing
3/4" (19.00mm)	100
No. 4 (4.75mm)	70-100
No. 8 (2.36mm)	30-100
No. 200 (0.075mm)	0-5

B. Class III Backfill:

1. Shall be material free of roots, organic matter, and other deleterious substances, and shall not contain rocks or unbroken masses of soil larger than 3" in greatest dimension.

2. Plasticity index shall not exceed 15, determined in accordance with ASTM D4318.

C. Class I and Class II Drain Rock:

1. Shall be clean and durable gravel or crushed stone

2. Shall not slake nor decompose with alternate wetting and drying

3. Class I drain rock shall have a sand equivalent value not less than 75 as determined by California Test 217.

4. Shall conform to the following grading when tested in accordance with ASTM C136:

	Percent Passing	
Sieve Size	Class I	Class II
1-1/2"	-	100
1"	100	-
3/4"	90-100	95-100
3/8"	40-100	-

No. 4	25-40	0-7
No. 8	18-33	0-3
No. 30	5-15	-
No. 50	0-7	-
No. 200	0-3	-

D. Aggregate Base:

1. Shall be Class 2, 3/4" maximum conforming to CSS Section 26

2. Use of recycled material is permitted provided material conforms to requirement above. Material is not recommended for use during wet conditions. If found to be pumping, material shall be rejected and replaced with suitable material.

PART 3 - NOT USED

END OF SECTION

SECTION 31 23 23.34P
(Formerly SECTION 03345.1)

CONTROLLED LOW STRENGTH MATERIAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Furnish and place Controlled Low-Strength Material (CLSM) for use as an alternate material for pipe bedding and embedment as appropriate. CLSM refers to a self-compacting excavatable cementitious material used primarily as backfill in place of compacted fill. CLSM is used as pipeline bedding or backfill material.

B. Two types of CLSM are acceptable: Native Soil CLSM and Ready-mix CLSM. CLSM can be supplied by a ready-mix plant, or may by mixing suitable native soils with cementitious materials.

C. Related Sections:

1. Section 31 23 33P – Trenching and Backfilling

D. Performance requirements:

1. Total calculated air content: Not less than 8.0 percent nor greater than 12.0 percent.

2. Minimum unconfined compressive strength: Not less than 50 pounds per square inch measured at 28 days.

3. Maximum unconfined compressive strength: Not greater than 150 pounds per square inch measured at 28 days.

4. Wet density: Not greater than 132 pounds per cubic foot.

1.2 REFERENCES

A. ASTM International (ASTM):

1. ASTM C33: Specification for Concrete Aggregates

2. ASTM C150: Specification for Portland Cement

3. ASTM C231: Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

4. ASTM C260: Specification for Air-Entraining Admixtures for Concrete.

5. ASTM C618: Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

1.3 SUBMITTALS

A. Submit product data completely describing products.

B. Submit sieve analyses of fine and coarse aggregates being used in triplicate. Resubmit at any time there is a significant change in grading of materials.

C. Submit full mix details, including mix design calculations for mix proposed for use.

D. Trial batch test data:

a. Submit data for each test cylinder.

b. Submit data that identifies mix and slump for each test cylinder.

E. Cement mill tests: Include alkali content, representative of each shipment of cement for verification of compliance with specified requirements.

F. Identify source of pozzolan and certify compliance with requirements of ASTM C618.

G. Proposed methods to support the pipe during CLSM placement

H. Proposed methods to prevent pipe flotation during CLSM placement

I. Native Soil CLSM:

1. Submit details of the proposed batching and mixing process including the following:

a. Equipment and methods to process native soils into source material in compliance with Paragraph 1.4.

b. Staging and batch plant mixing areas relative to the work areas where the CLSM will be placed.

c. Means of transport for mixed CLSM material from the batching and mixing area to the work area where the CLSM will be placed.

2. Mix Design:

a. A mix design shall be established before a full-scale field mix is used. Test batches shall be prepared using each of the excavated soil

source/types proposed for full-scale production. The CLSM used in the test cylinders shall be prepared using the same equipment proposed for full-scale batching and mixing.

b. The minimum cement content for the mix design shall be 3 percent by dry mass of the soil.

c. Cementitious fly ash (Class C or F) may be used in the mix provided that the strength and consistency requirements in Paragraph 1.1.D are met.

d. Air entraining admixtures may be used in the mix provided the strength and consistency requirements of Paragraph 1.1.D are met.

e. The CLSM shall be sampled according to ASTM D5971 – Standard Practice for Sampling Freshly Mixed CLSM.

f. The following tests shall be conducted on representative samples of the native soils proposed for use in preparing CLSM:

1) ASTM D422 – Standard Test Method for Particle Size Analysis of Soils

2) ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils

g. The following tests shall be conducted for each CLSM trial batch:

1) ASTM D4832 – Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders

2) ASTM D6023 – Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Controlled Low Strength Material

3) ASTM D6024 – Standard Test Method for the Ball Drop on Controlled Low Strength Material to Determine Suitability for Load Applications

h. The Contractor shall submit the results of the laboratory testing program and the selected mix design for full-scale field production for review and approval by the Engineer. After acceptance, the batch and mix process or native source material shall not be changed without submitting new test results.

J. Ready-mix CLSM:

1. The contractor shall submit the following documents to the Engineer:

a. National Ready Mix Concrete Association's (NRMCA) plant and truck certification demonstrating the ability to produce a uniform CLSM.

b. Delivery batch tickets for each truck load that show the CLSM mix (weight and volume of materials used), the batch size (weight and volume), and the time batched.

1.4 QUALITY ASSURANCE

A. Native Soil CLSM shall be composed of a cementitious material, water and suitable native soils as described below.

1. The cementitious material shall be Portland cement. Fly ash may be substituted for cement provided the requirements of this section are met.

2. The appropriate CLSM mix proportions shall be determined by preparing test batches and testing trial cylinders in accordance with Subparagraph 1.3.I.2.

3. The CLSM mixture shall contain no particles larger than 3".

4. Native Soils:

a. The soil shall be free of organic impurities.

b. The amount of material passing a #200 sieve shall not exceed 30 percent.

c. The Plasticity Index of the soil shall not exceed 3. The sand equivalent of the soil shall be at least 15. For native material with a sand equivalent between 10 and 15, approval shall be dependent on production and successful testing of a sample batch of CLSM.

B. Ready-mix CLSM shall be composed of a cementitious material, water, fine and coarse aggregate, and an admixture.

1. The cementitious materials shall be Portland cement in combination with fly ash.

2. The admixture shall be an air-entraining agent.

3. The proportions of all material used in the CLSM shall conform to the mix design.

4. Aggregate Content:

a. Aggregates need not conform to ASTM C33. Any aggregates which produce performance characteristics of the CLSM shall be submitted for approval.

b. CLSM mixture shall contain no aggregate that is larger than 1/2".

c. The amount of material passing a #200 sieve shall not exceed 12 percent.

d. No plastic fines shall be present.

5. Air Content:

a. The air content by volume based on measurement made immediately after discharge from the mixer shall be determined by ASTM C231 or C173.

b. The total measured air content of the sample prepared in accordance with ASTM C231 or C173 shall not exceed 10.0 percent.

6. Mix Design:

Material	Weight	Sp. Gr.	Abs. Vol.
Cement	30 lbs.	3.15	0.15
Fly ash	300 lbs	2.30	2.09
Water	283 lbs.	1.00	4.54
Coarse aggregate	1533 lbs.	2.68	9.16
Fine aggregate	1534 lbs.	2.68	9.17
Admixture(air)	5 - 7 oz.	-	1.89
Total	3680 lbs.	-	27.0 cu.ft

C. The mixture shall have a consistency such that the CLSM completely fills the space between the pipe and the excavated trench walls without bleeding or segregation.

D. During full-scale CLSM placement, the Engineer will take samples and perform tests to determine compliance with the specified unconfined compression strength requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement shall conform to ASTM C150, Type II.

B. Fly ash (if used in the mix) shall conform to ASTM C618, Class F. The fly ash shall not contain more than 3% carbon (low).

C. Water shall conform to CSS 90-1.02.D.

D. Native Soil CLSM:

1. Native soils used in the CLSM mix shall be granular and meet the requirements of Article 1.4.

E. Ready-mix CLSM:

1. Air entraining admixture shall conform to ASTM C260.

2. Aggregates:

a. Fine aggregate: #1 sieve concrete sand

b. Coarse aggregate: #2 sieve – 3/8" pea gravel

PART 3 - EXECUTION

3.1 BATCHING, MIXING, AND DELIVERING

A. Native Soil CLSM shall be batched and mixed in the field with the processed native soils similar to that used in the trial mix design program.

B. Ready-mix CLSM shall be batched by a ready mixed concrete plant and mixed and delivered to the jobsite by means of transit mixing trucks.

3.2 INSTALLATION

A. Ready-mix CLSM shall be discharged directly from transit mix trucks into the excavation to be backfilled.

B. Use sufficient shores or other supports to prevent soil from caving onto pipe. Remove soil fallen into trench before placing CLSM.

C. CLSM shall be placed on one side of the pipe and allowed to flow under until it is seen on the other side.

D. The CLSM shall be brought uniformly to the elevation as shown on the drawings.

E. Place CLSM between the trench bottom and 0.15 D above the bottom of the pipe as part of a single lift, where D is the diameter of the pipe.

F. The CLSM shall be placed so there is complete contact between the pipe and excavated pipe trench walls and floor.

G. Prevent CLSM from entering bell holes before joint coating and testing are complete.

H. If CLSM is placed near a joint before application and testing of joint coating, place a blanket or cover over joint to prevent CLSM spatter onto joint area.

I. The support materials used to haunch the pipe and contain the CLSM during placement shall not exceed the compressive strength of the CLSM.

J. Prevent flotation of the pipe during CLSM placement.

K. CLSM shall not be placed when the air temperature is below 4°C (40°F).

L. Allow CLSM to set before placing backfill above CLSM.

M. No equipment or traffic shall be allowed on the CLSM until the surface of the CLSM will withstand the weight of the equipment or traffic without displacement or damage. Suitability for load applications shall be determined by ASTM D6024.

1. If necessary to prevent displacement or damage, provide steel trench plates that span the trench or other means that prevent equipment or traffic contact with CLSM.

END OF SECTION

SECTION 31 23 33P
(Formerly SECTION 02316.1)

TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Trenching, backfilling, and compacting for the installation of pipe and pipeline appurtenances, to the required lines and grades.

B. Related Sections:

1. Section 31 23 23.15P – Imported Backfill and Drain Rock Materials

2. Section 31 23 23.34P – Controlled Low Strength Material

3. Section 32 12 16.81P – Asphalt Pavement Replacement

C. Definitions:

1. Competent Person: As defined in Section 1504 of the Construction Safety Orders Title 8, Chapter 4, Subchapter 4 of the California Code of Regulations: One who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them.

1.2 QUALITY ASSURANCE

A. The Contractor shall take samples and perform tests to determine compliance with the specified compaction requirements.

1. Compaction requirements are specified as relative compaction and expressed as a percentage. Relative compaction is the ratio of the field in-place dry density to the laboratory maximum dry density.

2. Laboratory maximum dry density will be determined in accordance with California Test 216.

3. Field in-place density will be determined in accordance with ASTM D6938.

1.3 SUBMITTALS

A. Submit written designation of Competent Persons for the District's record prior to work.

B. Submit copy of Cal/OSHA excavation permit prior to work.

C. Submit a detailed plan for worker protection and control of ground movement for the District's record prior to any excavation work at jobsite. Include drawings and details of system or systems to be used, area in which each type of system will be used, de-watering (if applicable), means of access and egress, storage of materials, and equipment restrictions. If plan is modified or changed, submit revised plan.

D. Submit compaction test results for the District's record prior to hydrostatic pressure testing of pipeline.

1.4 SITE CONDITIONS

A. Existing Utilities:

1. Locations of known underground utilities and structures are shown on the drawings as they are supposed to exist. Appurtenances and service laterals are not usually shown.

2. Locations shown may be based on information furnished by the utility owners at the time of design, derived from visible surface facilities, or based on subsurface exploration by the District.

3. If a utility is encountered which was not shown on the drawings or identified in the specifications and is in conflict with the work, immediately notify the utility owner and the Engineer in writing and arrange for necessary work.

B. Excavation Safety:

1. All excavation work and all work in the vicinity of an excavation shall be in full conformance to Article 6, Excavations, of the Construction Safety Orders, in addition to other applicable safety requirements.

2. Designate in writing one or more individuals as Competent Persons. Written designation shall certify that each designated Competent Person has the training, knowledge, and authority required of a competent person under Article 6, Excavations, of the Construction Safety Orders.

3. A designated Competent Person, with authority to inspect the work and supervise conformance with Article 6, shall be on site at all times whenever any excavation work or work in or about an excavation is in progress.

4. All excavations 5 feet or greater or not in stable rock shall have a protective system to prevent earth movement. Protective system shall, at a minimum,

conform to Cal/OSHA standards for sloping and benching, or for timber shoring for trenches, or for aluminum shoring for trenches; or shall be designed and constructed in accordance with tabulated data as allowed by Article 6 of the Construction Safety Orders; or shall be designed and constructed in accordance with a plan that conforms to Paragraph 5 below.

5. For excavations greater than 20 feet in depth or where the protective system differs from those specified in Paragraph 4 above, detailed plans showing the materials and methods to be used shall be prepared by a California registered Civil or Structural Engineer. The registered engineer shall:

   a. Have at least five years' responsible experience in work of this nature.

   b. Inspect the installation of the system prior to entry of any persons into the excavation and certify in writing to the District that the system is installed as designed.

   c. Perform any necessary additional work that may be required because of unanticipated movements, deflections, or settlements of the protective system or the ground.

C. Contaminated Soils:

1. Clean Utility Corridor (CUC)

   a. Clean utility corridors shall be installed as required on the project drawings and per Standard Drawing 9950-GB.

   b. In the event a regulatory agency has more stringent requirements than the CUC drawing and specifications, the regulatory agency requirements will govern. In this case, see the District design drawings for the regulatory agency's requirements.

   c. Acceptable demarcation fabric:

      1) Propex, Geotex 601 Orange DND or Geotex 801 Orange DND

      2) Tencate, Mirafi 160NO

      3) Carthage Mills, FX-60HS Orange or FX-80HS Orange

      4) Or equal as approved by the Engineer

   d. Demarcation fabric shall conform to the following requirements:

      1) Non-woven geotextile

      2) Made of polypropylene staple fibers that are needle punched

3) Orange in color

4) Resistant to biological degradation

5) Resistant to chemicals

6) Minimum Tensile Strength (ASTM D4632): 175 pounds

7) Minimum Grab Tensile Elongation (ASTM D4632): 70 pounds

8) Minimum CBR Puncture value (ASTM D6241): 480 lbs

9) Minimum Trapezoidal Tear value (ASTM D4533): 85 lbs

10) Minimum UV resistance at 500 hours (ASTM D4355): 80%

11) Apparent Opening size (ASTM D4751): 70 U.S. Sieve

12) Maximum Water Flow Rate (ASTM D4491): 150 gpm/ft^2

13) Permittivity range (ASTM D4491): 1.5 sec^{-1} to 2.0 sec^{-1}

2. Applicant only:

a. If contaminated soils are encountered or suspected, see General Conditions, Contaminants Article, for Applicant's responsibility.

b. Immediately notify Engineer of presence or suspected presence of contaminants. Notification is for safety of District personnel and information of the Engineer.

3. District Forces only:

a. If contaminated soils are encountered or suspected, follow procedures outlined in EBMUD Contingency Plan for Contaminated Soils, Appendix A.

1.5 ALTERNATES

A. Controlled Low Strength Material may be used as an alternative backfill material above pipe bedding in both main and lateral trenches where permitted by the agency having jurisdiction. See Section 31 23 23.34P – Controlled Low Strength Material.

PART 2 - PRODUCTS

2.1 BACKFILL MATERIALS

A. No material shall be used for trench backfill which, because of excessive moisture or any other reason, cannot be compacted to the degree specified. Any such

material shall be considered unsuitable, and if it is deposited in the trench, it shall be removed and replaced with suitable material.

B. Imported backfill materials shall conform to Section 31 23 23.15P – Imported Backfill and Drain Rock Materials.

C. Controlled Low Strength Material shall conform to Section 31 23 23.34P.

D. Select backfill shall be material selected from the excavation by the Engineer. Select backfill material shall be free of organic, hazardous, corrosive or other unsuitable materials and shall not include rocks, boulders, or unbroken masses of soil larger than 3" in greatest dimension.

E. Excessively wet soils shall be dried back to 0 to 3 percent above the optimum moisture content prior to use as backfill.

PART 3 - EXECUTION

3.1 EXCAVATION

A. General:

1. All lines and grades will be established by the District, and the Applicant shall provide such assistance and materials as may be required. The Applicant shall carefully preserve all survey stakes and reference points. Should any stakes or points be removed or destroyed during the installation, they may be reset at the Applicant's expense.

2. Notify city, county, or state a minimum of 3 working days prior to work when their survey monuments will be disturbed or when the trench edge will be within 5 feet from the closest edge of the monument so that they may be referenced and relocated. The Applicant is responsible for all costs associated for re-establishing survey monuments. Relocation shall be by or under direction of agency having jurisdiction.

3. Remove all materials of whatever nature encountered necessary to install the pipeline.

4. Blasting is not permitted.

5. Use proper tools and equipment to break pavement accurately to the correct lines. Sawcut existing concrete or AC pavement and dispose of slurry as required by the agency having jurisdiction. Discharged water shall comply with Section 01 10 00.01P, Article 1.6.B.

6. Keep excavation dewatered throughout construction operations.

7. Store excavated materials to minimize obstruction to traffic.

8. Trench shall be backfilled, compacted, and paved at the end of each day's work where excavation is in a public road. An alternative that will permit safe public use of the road and complies with Cal-OSHA standards may be used if advance approval is obtained from the agency having jurisdiction.

B. Trench Excavation:

1. Trench excavation shall follow the alignment of the pipe centerline and shall be in accordance with Drawing 1992-A.

2. Excavation to a greater depth than shown on the drawings may be required if the native material at the bottom of the trench will not provide proper support for the pipe or if the excavation is in rock.

3. If the trench width exceeds that shown or if sloping sides are used, the maximum trench width at the crown of the pipe shall not exceed that allowed by Drawing 1992-A.

4. Sloping sides of the trench excavation will not be permitted in public streets.

C. Excavation shall be supported or excavated so that:

1. Adjoining ground shall be prevented from sliding or settlement.

2. Existing improvements of any kind shall be fully protected from damage.

3. Worker protection is provided as required by Cal/OSHA.

D. Excavation in Sidewalk:

1. Sidewalk shall be removed and replaced where the trench lies within and approximately parallels a concrete sidewalk 4 feet or less in width.

2. Sidewalk shall be removed and replaced to nearest parallel groove or score outside trench where sidewalk is more than 4 feet in width.

E. Excavation Required Beyond Trench Limits:

1. See Paragraph B.2.

2. Excavation (bell holes) where necessary in the sides and bottom of the trench at pipe joint locations shall be large enough to make joints and permit District inspection.

3. Where leaks occur, remove all adjacent saturated material.

F. Disposal:

1. Dispose of excess excavated material and excavated material that is not approved by Engineer for use as backfill. Disposal shall be in accordance with accepted excavated material disposal plan.

2. Deliver and unload salvageable pipe or other material belonging to the District to 5601 Oakport Street, Oakland. Delivery will require a Material Return Order (Form P-015) prepared by the Engineer. See Section 01 64 05P, 1.1.G.1.

3.2 UTILITIES

A. Location:

1. Contractor is responsible for having all underground utilities and structures located by the owners in advance of excavation.

a. Notify all known owners of underground utilities in the area of proposed work and Underground Service Alert, 800-227-2600 or 800-642-2444, at least two work days before the start of actual excavation. Meet with owners/operators of high priority subsurface installation, that are located within 10 feet of a proposed excavation, before opening the excavation per Cal/OSHA Title 8 Section 1541.

b. Identify the area to be excavated as required by PUC/CA Government Code 4216.2.

B. Excavation around Utilities:

1. Excavation and other work under or adjacent to utilities shall not interfere with their safe operation and use.

2. Probe carefully to determine the exact location of utility, and hand excavate where necessary to avoid damage. Hand excavation is required within 24" on either side of the exterior surface of any underground utility (except nonpressurized sewers, drain lines, and storm drains) as that utility has been located by the utility owner except:

a. Power-driven or power-operated equipment may be used for the removal of pavement if there are no utilities in the pavement.

b. Power-driven or power-operated equipment may be used to any depth with agreement of the utility owner.

3. In the event of damage incurred during construction to such structures or property, immediately notify the owners and other authorities, and arrange for immediate repairs.

4. Notify the local fire department every time damage to a gas utility results in a leak or suspected leak or when damage to any utility results in a threat to the public.

C. Tunneling under utilities:

1. Tunneling may be allowed for short distances with the approval of the utility owner.

3.3 BRIDGES

A. Minimum 4-foot wide bridges adequate for pedestrian traffic and with handrails and uprights of dressed lumber shall be installed where necessary.

B. Bridges adequate for handling all vehicular traffic shall be installed when excavation obstructs more than one-half the width of the street or road crossing.

C. Provide bridges from public streets onto private property to permit safe use of all garage driveways and other roadways.

D. Maintain bridges as long as the condition of the work requires.

E. Relocate bridges as required to perform work in the immediate vicinity of a bridge.

3.4 TRENCH BACKFILL

A. General:

1. Prior to backfilling, remove all loose material, wood, and debris from trench.

2. Backfill pipeline trenches to the level of original ground surface or underside of the pavement base course.

3. Backfill material shall not be dropped directly on the pipe.

4. Shoring removal:

a. Carefully remove timbering, sheeting, shoring, and sheet piling using methods that will minimize caving.

b. Metal sheet piling, sheeting, and bracing may be left in place on approval of the Engineer.

5. Low points along the pipe trench shall not be backfilled until all backfill at adjacent higher elevations has been completed. Water collecting at the low points shall be removed by pumping or other means to avoid softening of adjacent ground. Sump pumps shall be supplied to prevent accumulation of water in the trench.

6. If the trench has been excavated below the specified depth, that portion of the trench shall be backfilled with pipe bedding material and compacted before pipe installation.

7. Backfill with the specified material to the full width of the trench as excavated.

B. Pipe Bedding and Compaction:

1. Install Class I Backfill as shown on Drawing 1992-A.

a. Bedding support under pipe:

1) Bring to a uniform grade to provide continuous support for the pipe sections as they are laid in final position.

2) If more than 3 inches thick, compact in 8-inch maximum loose lifts with approved plate-type vibratory compactors.

b. Pipe bedding above grade line:

1) Bring up simultaneously on both sides of the pipe.

2) Maximum lift as it is placed before compaction shall be 24 inches where compaction by saturating with water and vibration is permitted and used.

3) Maximum lift as it is placed before compaction shall be 8 inches where compaction by saturating with water and vibrating is not used.

2. Compaction:

a. Thoroughly tamp each lift, including area under haunches, with handheld tamping bars supplemented by mechanical tamping equipment, vibrating plates, and/or concrete vibrators. Ensure that voids are completely filled before placing each successive lift.

b. Compact by saturating with water and vibrating where permitted. Saturate by water jets or by other approved means while densification by vibration is in progress. Excessive or improper saturation or flooding will not be allowed. Consolidate mass with immersion type vibrators of sufficient length to extend to the bottom of each lift. Vibrate and water jet alternately on both sides of pipe. Do not remove vibrators from the mass until water jets are removed.

c. Compact by impact, vibration, or a combination of these methods where compaction by saturating with water and vibrating is not permitted.

d. Thoroughly compact before additional fill is placed.

e. Do not dump backfill material directly on top of pipe. Use caution during placement and compaction of backfill to avoid damage to pipe and/or coatings.

f. Compaction methods and equipment are subject to the approval of the Engineer.

C. Backfill and compaction above pipe bedding:

1. Install Aggregate Base backfill material where excavation is in a paved public road, unless another backfill material is permitted by the local agency permit. Install select backfill material at other locations.

2. Install Aggregate Base backfill material in lieu of select backfill when the Engineer determines that excavated material does not meet the requirements for select backfill and orders the use of imported backfill.

3. Do not allow backfill to free fall into the trench or allow heavy, sharp pieces of material to be placed as backfill until at least 2 feet of backfill has been provided over the top of pipe.

4. Maximum lift as it is placed before compaction shall be 8 inches. Lifts to 12 inches may be allowed if specified compaction can be obtained without adverse effects on the pipe.

5. Install the following import materials when there is insufficient quantity of select native material:

a. Aggregate Base when the excavation is adjacent to public road.

b. Class III Backfill for all other areas.

6. Compact by impact, vibration, or a combination of these methods. Compaction methods and equipment are subject to the approval of the Engineer. Compaction by jetting, flooding or saturating with water and vibrating is not permitted.

7. Placement of the backfill shall not damage the pipe coating.

8. Only hand-operated motor driven mechanical compacting equipment shall be used over pipelines until the backfill has been compacted to 24" over the crown of the pipe.

9. Paved public or private roads:

a. Compact Aggregate Base backfill that is more than 3 feet below the existing surface to at least 90 percent relative compaction.

b. Compact Aggregate Base backfill in the upper 3 feet of the excavation to at least 95 percent relative compaction.

10. Other locations: Compact backfill to at least 90% relative compaction.

11. At the time of compaction, the moisture content of backfill material shall be such that the required relative compaction will be obtained.

    a. Condition material which contains insufficient moisture or excessive moisture until the moisture content is such that the required relative compaction will be obtained.

12. Controlled Low Strength Material (CLSM) may be used in lieu of aggregate base backfill material where excavation is in a paved public road and where this option is permitted. See Section 31 23 23.34P.

D. Backfill and Compaction in Lateral Trenches:

1. Lateral trenches:

    a. Any trench extending from a water main at 60^{o} to 90^{o} angle to the centerline of a street.

    b. Backfill with Aggregate Base material or CLSM and compact as for main trench unless required otherwise by local agency permit.

2. Where leaks occur:

    a. Remove all adjacent saturated material.

    b. Backfill with imported fill materials and compact as for adjoining trenches.

3.5 GRADING

A. Top of the backfill in the areas with no additional planned improvements (such as paving or structures) shall be graded with a crown for positive drainage away from the backfill area.

B. Areas outside of the trench limits shall also be graded for a positive drainage but grading shall not alter the existing drainage pattern.

END OF SECTION

SECTION 32 12 16.81P
(Formerly SECTION 02951.1)

ASPHALT PAVEMENT REPLACEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Replace all cut or damaged street pavement sections, curbs, gutters, driveways, and sidewalks following the completion of pipeline trench backfill.

B. Related Sections:

1. Section 31 23 33P – Trenching and Backfilling

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aggregate Base:

1. Class 2, 3/4" maximum conforming to CSS Section 26

2. Shall be clean, sound, and durable aggregate base, free from organic material and other deleterious substances

B. Prime Coat:

1. Liquid asphalt Type SC-70 conforming to CSS Section 93

C. Paint Binder or Tack Coat:

1. Asphaltic emulsion, Type SS-1 conforming to CSS Section 94

D. Asphalt Concrete:

1. Aggregate: Type B, 1/2" maximum, medium grading, CSS Section 39

2. Paving asphalt: Grade PG 64-10, confirming to CSS Section 92

3. Mix design: CSS Section 39

E. Portland Cement Concrete:

1. Use for base or surface course, curb, gutter, driveways, and sidewalk.

2. Conform to applicable City/County requirements, and CSS Section 90.

2.2 TRAFFIC MARKINGS

A. Replacement of striping shall be thermoplastic and conform to CSS Section 84.

PART 3 - EXECUTION

3.1 EXISTING PAVEMENT

A. Replace structural pavement section (pavement and base materials) to match the existing section or as required by the local agency permit.

B. Repair all pavement damaged by the work to "as found" or as required by the local agency permit.

3.2 TEMPORARY PAVEMENT

A. The material at the surface of the trench shall be relatively smooth and maintained at all times at a grade level with the adjacent existing paving.

B. Maintain daily inspection of trench area.

C. Maintain warning lights and barriers where unsafe conditions exist.

D. Unless the local agency has different permit requirements, the applicant shall utilize one of the following processes to install temporary pavement during construction

1. Install temporary asphaltic plant mix (cutback) at trench surface and replace it with thicker temporary hot mix asphalt pavement prior to project completion.

    a. Place cutback immediately after backfilling has been completed.

        1) Minimum thickness shall be 1-1/2".

    b. Prior to project completion, remove top 4" of materials from the trench surface.

    c. Install temporary hot mix asphalt pavement at trench surface.

        1) Minimum thickness shall be 4" or as determined by the local agency permit requirements.

2. Option 2 – Install temporary hot mix asphalt pavement at trench surface directly.

    a. Place temporary hot mix asphalt pavement immediately after backfilling has been completed.

        1) Minimum thickness shall be 4" or as required by the local agency permit.

E. Maintain temporary paving at the same grade as the existing paving. Repair subsidence immediately.

3.3 PERMANENT PAVEMENT

A. Install permanent replacement pavement within 14 calendar days after the backfill and all other work in the area to be paved is completed.

1. Permanent pavement shall be installed per local agency permit requirements.

a. The thickness of permanent pavement shall be equal to the adjacent permanent pavement thickness, or as required by the local agency permit.

b. The width of permanent pavement shall be as required by the local agency permit.

1) If the edge of trench is within 12" of the edge of the existing pavement, that portion of existing pavement shall be removed and replaced as part of the new trench resurfacing.

c. Where gate pot covers are to be raised, existing pavement around gate pot covers shall be cut either circular or square shaped.

2. Remove the temporary pavement just prior to placing the permanent pavement.

3. Prior to Installing Pavement:

a. Depending on the local agency permit requirements, the applicant may perform one of the following pavement replacement procedures:

1) 2" Pavement Replacement:

a) Grind and remove top two inches of existing pavement including the trench surface to a width as determined by the local agency permit.

2) T-cut pavement replacement:

a) Sawcut edges of existing pavement to a vertical plane and in a straight line parallel to centerline of trench and at least 12" outside each side of the trench, or to the outside of bell holes, whichever is greater.

b) Pavement cuts shall encompass all pavement adjacent to the trench that has been damaged or undermined by pipeline construction activities.

c) Dispose of slurry as required by the agency having jurisdiction. Discharged water shall comply with Section 01 00 00.01P, Article 1.5.B.

d) Clean edges of all mud, dust, and dirt.

3) Others as determined by the local agency permit.

4. Prior to Placing Asphalt Concrete:

a. Cover catch basins and manholes to prevent any spillage running into them.

b. Apply tack coat to edges of existing pavement by spraying.

c. Brushes or daubers shall not be used for coating application.

5. Conform to CSS Section 26 and applicable City/County specifications for base installation.

6. Conform to CSS Section 39 and applicable City/County specifications for asphalt concrete installation. After placement of asphalt concrete, seal joints by spraying tack coat over the joints and feathering onto the existing pavements.

7. Conform to CSS Section 51 and applicable City/County specifications for portland cement concrete installation.

a. When washing concrete to remove fine particles and expose the aggregate, avoid creating runoff by draining the water to a bermed or level area.

b. Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose in the trash.

3.4 STREET MARKINGS

A. Install temporary street markings as required to control flow of traffic. Maintain for duration of need.

B. Remove all temporary street markings by abrasive blasting. Cleanup abrasive blasting residue by sweeping.

C. Replace in kind all street markings removed or destroyed.

END OF SECTION

SECTION 33 05 19.05P

FABRICATION OF DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Fabrication of restrained push-on joint Ductile-Iron (DI) pipe, fittings, gaskets, and all necessary components to provide functional installation of a potable water pipeline, including but not limited to the following:

1. 4-inch through 16-inch DI pipe with zinc exterior coating and cement-mortar internal lining

2. 4-inch through 16-inch DI fittings with zinc exterior coating and cement-mortar internal lining

3. 4-inch through 16-inch gaskets for DI pipe and fittings: Push-on and flange

1.2 RELATED SECTIONS

A. Section 05 05 26P – Flange Bolting

B. Section 33 05 19.07P – Installation of Ductile Iron Pipe and Fittings

1.3 REFERENCES

A. American Water Works Association (AWWA)

1. C104 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

2. C110 – Ductile-Iron and Gray-Iron Fittings, 3" through 48", for Water and other Liquids

3. C111 – Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings

4. C115 – Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges

5. C116 – Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service

6. C150 – Thickness Design of Ductile-Iron Pipe

7. C151 – Ductile-Iron Pipe, Centrifugally Cast

8. C153 – Ductile-Iron Compact Fittings, 3" through 12", for Water and Other Liquids

B. Other Standards:

1. ANSI/NSF-61 – Drinking Water System Components

2. ASTM A536 – Standard Specification for Ductile-Iron Castings

3. ISO 8179-1 – Ductile iron pipes, fittings, accessories and their joints – External zinc-based coating — Part 1: Metallic zinc with finishing layer

4. ISO 8179-2 – Ductile iron pipes, fittings, accessories and their joints – External zinc-based coating — Part 2: Zinc-rich paint

1.4 SUBMITTALS

A. Manufacturer's Certificate of Compliance, including references to the casting period and day of manufacturing of the pipe and fittings shall be submitted with each shipment prior to or at the time of delivery. The Certificate of Compliance shall state that the requirements of these specifications have been met for all pipe and fittings furnished, including National Sanitation Foundation (NSF) 61 certification and hydrostatic testing. Hydrostatic testing requirements for pipe shall also be met and included on the Certificate of Compliance.

B. Manufacturer’s published catalog information for all products.

C. Manufacturer’s approved installation and assembly instructions.

D. Manufacturer shop drawings.

E. Certified test results shall be furnished to the Engineer prior to shipment of pipe:

1. Hydrostatic testing per AWWA C151

2. Tensile testing per AWWA C151/153

3. Impact testing per AWWA C151

4. Lining testing per AWWA C104

5. Zinc coating testing per ISO 8179-1

F. Ductile Iron Pipe and Fitting Inspection Checklist.

1.5 QUALITY ASSURANCE

A. Factory Hydrostatic Test: All DI pipe shall be subject to a factory hydrostatic test of at least 500 psi for a period not less than 5 seconds per AWWA C151.

B. Coating Testing: Confirm coatings on pipe and fittings meet the minimum requirements of this specification.

C. All furnished materials shall be new and as specified herein. Refurbished DI pipe and fittings shall not be provided.

D. Inspection of pipe and fittings will be made by the Engineer upon delivery, and at the jobsite prior to installation using the form at the end of this section, DUCTILE IRON PIPE AND FITTING INSPECTION CHECKLIST. The piping materials shall be subject to rejection at any time on account of failure to meet any of the specified requirements. Pipe and materials rejected upon delivery shall be returned to the Manufacturer. Pipe and materials rejected after delivery shall be marked for identification and removed from the storage yard or jobsite.

E. Upon the Engineer's request, records of quality control testing shall be furnished within five calendar days.

1.6 IDENTIFICATION OF PIPE AND FITTINGS

A. DI pipe and fittings shall be clearly marked in compliance with manufacturing standards. Upon request, the manufacturer shall provide information for deciphering the Manufacturer's production code.

B. At a minimum, the following shall be cast or labeled on the pipe:

1. Pressure or thickness class

2. Production code from which the manufactured date and location can be determined

3. Name and/or trademark of manufacturer

4. Nominal pipe size

5. Fitting type (i.e. 45°), for fittings

6. NSF-61 marking

7. Manufacturing standard reference (AWWA, ASTM, etc.)

8. Application of zinc coating

9. Identification that pipe has been Gauged Full Length (for pipe larger than 12 inches in diameter)

1.7 DELIVERY, STORAGE, AND HANDLING

A. Prior to delivery, each opening in the pipe or fittings shall be securely capped or plugged with removable plastic caps or plugs to prevent foreign matter from

entering the pipe. The caps or plugs shall be designed to fit as either a cap on a spigot or a plug in a bell. Ends shall remain capped or plugged until ready for installation. Pipe ends shall be wrapped for shipment so that caps do not become dislodged during transport.

B. All pipe, fittings, and other accessories shall be stored such that they do not accumulate and hold rainwater, dirt, or debris. Gaskets shall be protected from long-term exposure to sunlight. Plugs of rags, wood, cotton, cardboard, waste or similar materials shall not be used. All furnished materials shall be stored away from standing water.

C. During loading, transportation, and unloading, every precaution shall be taken to prevent damage to the furnished material. Under no circumstances shall the pipe, fittings, and appurtenances be dropped or skidded against each other. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior surface or internal lining of the furnished material.

D. Pipe shall be packaged with 4" by 4" timbers under each stack and between each row of pipe with adequate blocking to prevent pipe from rolling or falling during unloading. The District is responsible for all unloading and stacking of pipe. Fittings and other accessories shall be delivered on pallets or in crates.

E. Pipe laid out for installation shall be placed on earth berms, sand berms, or timber cradles to prevent damage to the bottom during storage.

F. Rope or other devices shall not be attached through the interior of pipe for handling. Soft slings may be used inside fittings for handling, if needed.

G. Contractor shall perform inspection of pipe and fittings prior to installation using the form at the end of this section, DUCTILE IRON PIPE AND FITTING INSPECTION CHECKLIST. If furnished materials are damaged or found defective upon delivery, the damaged or unsatisfactory pipe or fittings shall be replaced with materials conforming to these specifications.

H. In case of emergency, the manufacturer shall maintain an inventory of all materials not less than 5% of the District's annual estimated requirements which can be delivered within 24 hours.

PART 2 - PRODUCTS

2.1 GENERAL

A. All water system materials that will eventually come into direct contact with drinking water shall be certified as meeting the specifications of NSF-61. This includes, but is not limited to pipes, fittings, coatings, linings, solvent cements, sealing materials, gaskets, and lubricating oils.

B. Joint lubricants shall be provided with pipe materials. Lubricants shall be compatible with the pipe, fittings, and gasket materials, shall be water-soluble and shall be certified by NSF-61 for use with potable water.

2.2 DUCTILE IRON PIPE

A. DI pipe shall be Special Thickness Class 53 as shown in Table 15 of ANSI/AWWA C150/A21.50 unless otherwise shown on Drawings. All DI pipe shall be manufactured in accordance with the requirements of ANSI/AWWA C151/A21.51. For pipe diameter sizes 12 inches and smaller, all pipe shall be Gauged Full Length. For pipe diameter sizes larger than 12 inches, 15 percent of the pipe delivered shall be Gauged Full Length and identified as such.

B. DI pipe shall be furnished in standard laying lengths of 18 feet ±1 inch, or as otherwise specifically requested by the District. Random lengths shall not be furnished.

C. Any DI pipe with pitting on the exterior surface will be rejected. Pitting will be measured by a pit depth gauge. Pitting will be considered excessive when it exceeds 20 percent of the wall thickness of the pipe or when the pitting exceeds 10 pits over a one square inch area. A pit is defined as a surface void caused by any foreign material or gas on the interior of the mold that displaces the molten iron during casting process that exceeds 10 percent of wall thickness in depth.

D. DI pipe shall have push-on restrained joints in accordance with ANSI/AWWA C111/A21.11 unless otherwise specified herein. Diameters 4" through 12" pipe bells shall be designed to allow for 5 degrees of deflection after assembly. Pipe diameters of 16" shall be designed to allow for 3 degrees of deflection after assembly. Each joint shall be rated for a minimum working pressure of 350 psi.

E. DI pipe interior shall have double thickness cement-mortar lining with a seal coat in accordance with ANSI/AWWA C104/A21.4. Cement-mortar lining shall have a smooth finish and shall be thoroughly bonded to the interior pipe wall. There shall be no cement-mortar in the gasket groove.

F. The DI pipe exterior shall be coated with a layer of arc-sprayed zinc coating per ISO 8179-1 “Ductile Iron Pipes, Fittings, Accessories and their Joints – External zinc-based coating – Part 1: Metallic zinc with finishing layer”. The mass of zinc applied shall be a minimum of 200 g/m^2 of the pipe exterior surface area. A finishing layer of standard topcoat shall be applied over the zinc coating.

G. DI pipe bells shall be painted with white, silver, or grey paint to signify pipe is zinc-coated. Alternatively, the DI pipe can be marked in the approximate middle of the barrel with the words “Zinc-Coated” with a 2-inch wide circumferential band of silver/grey-toned coating applied approximately 2-inches on both sides of that marking.

H. Furnished DI pipe shall have a means for accomplishing restraint at field cuts that allows for the use of the restrained joint to be approved by the Engineer (i.e. locking gaskets shall not be the primary means for accomplishing restrained field cuts.)

I. Iron used in the manufacture of pipe shall be grade 60-42-10 per ASTM A536.

2.3 DUCTILE IRON FITTINGS

A. DI fittings shall have push-on restrained joints in accordance with ANSI/AWWA C111/A21.11 unless otherwise shown on the drawings.

B. DI fittings shall be rated for a 350 psi working pressure. Fittings furnished under these specifications shall conform to all applicable requirements and the latest revision of ANSI/AWWA C110/A21.10, AWWA C153/A21.53 or AWWA C606.

C. The lining and coating materials for all DI fittings shall be:

1. Zinc-rich paint per ISO8179-2 with inorganic binder and a zinc content of at least 85% by weight in the dry film and bituminous topcoat paint compatible with the zinc-rich paint. The zinc-rich paint coating shall be applied to a dry film thickness (DFT) of between 2.0 to 3.5 mils (.0020" to 0.0035").

2. DI fittings may be fusion bonded epoxy coated, instead of zinc-coated, in accordance with AWWA C116, only when approved by the Engineer.

3. DI fitting interiors shall have double-thickness cement-mortar lining with a seal coat in accordance with ANSI/AWWA C104/A21.4. Cement-mortar lining shall have a smooth finish and shall be thoroughly bonded to the interior pipe wall. There shall be no cement-mortar in the gasket groove.

D. Flanged Fittings

1. DI flanged fittings including bell adapters shall be one-piece castings rated for 350 psi with a manufacturer recommended gasket and shall conform to all applicable requirements and the latest revision of ANSI/AWWA C110/A21.10, AWWA C153/A21.53 or AWWA C606. (Bolt circle and bolt holes shall match those of ANSI B16.1 class 125 and ANSI B16.5 class 150 flanges).

2. DI flanged nipples shall be Special Thickness Class 53 and shall be in accordance with AWWA C115/A21.15. (Bolt circle and bolt holes shall match those of ANSI B16.1 class 125 and ANSI B16.5 class 150 flanges).

3. All flanges shall be rated for at least 350 psi working pressure. Flange facing shall be smooth or with shallow serration per AWWA C115. Flange faces on flanged fittings may be coated with asphalt varnish or epoxy only.

4. Provide flange bolts, nuts, and washers per Section 05 05 26P – Flange Bolting.

E. Mechanical Joint Restraints

1. Manufacturers: One of the following or equal:

   a. EBAA Iron, Inc., Megalug® Series 1100

   b. Sigma Corp., One-Lok™ Model SLDE

2. Materials:

   a. Gland body:

      1) Ductile iron in accordance with ASTM A536

   b. Wedges and wedge actuating components:

      1) Ductile iron in accordance with ASTM A536

      2) Wedges shall be heat treated to a minimum of 370 BHN.

   c. Actuating bolts and nuts:

      1) Ductile iron in accordance with ASTM A536

      2) Provide torque-limiting twist off components to ensure proper installation.

3. Coatings:

   a. Provide manufacturer applied coating system.

   b. Manufacturers: One of the following or equal:

      1) EBAA Iron Inc., Mega-Bond

      2) Sigma Corp., Corrsafe™ Electro-deposition coating

4. Working pressure:

   a. Shall include a minimum safety factor of 2:1.

   b. For sizes 3- through 16-inch: 350 pounds per square inch.

5. Restraint shall consist of multiple gripping wedges incorporated into a follower gland meeting the requirements of AWWA C111.

6. Restraint shall allow post assembly angular deflection that is a minimum of 50 percent of the angular deflection allowed by the mechanical joint.

7. Restraint must be in accordance with applicable requirements of AWWA C110 and AWWA C111 for mechanical joints.

F. Iron used in the manufacture of fittings shall be grade 70-50-5 or 65-45-12 per ASTM A536.

2.4 GASKETS FOR DUCTILE IRON PIPE AND FITTINGS

A. DI pipe and fittings shall be provided with TYTON® gaskets, or approved equal in accordance with ANSI/AWWA C111/A21.11 unless otherwise specified.

B. DI flange gaskets shall be full-face with bulb-type rings, minimum 1/8" thickness, compatible with flat face flanges conforming to AWWA C115 and C110, and rated at a minimum of 350 psi. The inside/outside diameter of the gasket shall be equal to that of the flange.

C. All gaskets shall be EPDM rubber unless otherwise specified and in compliance with NSF-61 requirements. EPDM shall be certified by the manufacturer to be chloramine resistant. For installation in soils that are contaminated with VOCs, EPDM may be substituted with NBR.

D. Self-locking gaskets shall be FIELD LOK 350®, or approved equal.

2.5 ACCEPTABLE MANUFACTURERS

A. U.S. Pipe

B. McWane Ductile

C. Or equal as approved by the Engineer

PART 3 - EXECUTION

3.1 SUPPLEMENTS

A. The following supplements follow END OF SECTION and are a part of this Section:

1. DUCTILE IRON PIPE AND FITTING INSPECTION CHECKLIST

END OF SECTION

Ductile Iron Pipe and Fitting Inspection Checklist

Inspector Name:	**Inspection Date:**
Items Inspected:	**Delivery Date:**
Vendor/Manufacturer:	**PO#:**

☐ Review Specifications and Standards

a. Fabrication of Ductile Iron Pipe and Fittings (Specification 33 05 19.05P) and industry standards referenced therein.

☐ Review Manufacturer Submittals

a. Manufacturer's Certificate of Compliance for the items delivered, including references to the casting period and day of manufacturing of the pipe and fittings. The Certificate of Compliance shall state that the requirements of these specifications have been met for all pipe and fittings furnished, including National Sanitation Foundation (NSF) 61 certification. Hydrostatic testing requirements for pipe shall also be met and included on the Certificate of Compliance.
b. Certified test results for the pipe and fittings:
    - Hydrostatic test per AWWA C151
    - Tensile test per AWWA C151/153
    - Impact test per AWWA C151
    - Lining testing per AWWA C104
    - Zinc coating testing per ISO 8179-1

Conduct the following inspection on 10% of delivery (pipe and fittings):

☐ Visual Inspection

a. Pipe packaged with 4"x4" timbers below and between each row of pipe and with adequate blocking between each pipe in a row. Fittings packaged on pallets or crates.
b. Pipe and fitting markings shall include:
    - Pressure or thickness class
    - Production code from which the manufactured date and location can be determined
    - Name and/or trademark of manufacturer
    - Nominal pipe size
    - Fitting type (i.e. 45 deg), for fittings
    - NSF-61 marking
    - Manufacturing standard reference (AWWA, ASTM, etc.)
    - Application of zinc coating
c. Pipe end caps in place
d. No surface irregularities or flat spots, no excessive surface pitting as defined in Section 33 05 19.05P
e. No repairs by welding or caulking
f. Gasket area of the bell to be completely free of casting defects

☐ Pipe Dimensional Inspection

a. Thickness of iron not to be less than the "Minimum Thickness" in Table 1.
b. Pipe outside diameter to be within "Outside Diameter Range" in Table 1.
c. Pipes are standard length (18' for DIP, or 12' or 18' for ERDIP)

Table 1: DI Pipe Dimensional Tolerances (AWWA C151)

Pipe Size	Class	Nominal Cylinder Thickness	Minimum Cylinder Thickness	Outside Diameter Range
4"	53	0.32"	0.27"	4.80" ±0.06"
6"	53	0.34"	0.29"	6.90" ±0.06"
8"	53	0.36"	0.31"	9.05" ±0.06"
12"	53	0.40"	0.34"	13.20" ±0.06"
16"	53	0.43"	0.36"	17.40" +0.05"/-0.08"

Note: *Measure cylinder wall thickness at each end of the pipe. An additional minus tolerance of 0.02" is permitted for cylinder wall thickness along the barrel of the pipe for a distance not to exceed 12". Measure OD at two locations along barrel of the pipe. OD measurements should not be taken within 2' of bell end.*

☐ Cement Mortar Lining Inspection

a. Linings are smooth, free from ridges, corrugations, or defects that reduce the thickness below the minimum. No cement mortar lining in the gasket groove.
b. Longitudinal cracks may be acceptable if the crack length is less than the pipe diameter.
c. Cement mortar lining is "Double Thickness", no less than the values listed in Table 2.
d. Asphaltic seal coat present

Table 2: Required CML Thickness (AWWA C104)

Pipe Size	Minimum CML Thickness
3" – 12"	1/8" (0.125")
14" – 16"	3/16" (0.188")

Note: *Measure CML thickness at each end of pipe. CML thickness measurement shall not be collected within 4" of pipe or fitting end.*

☐ Coating Inspection

a. Asphalt coating on top of the zinc is intact without major defects. Seal-coat finish shall be continuous, smooth, strongly adherent, and neither brittle when cold nor sticky in the sun.

☐ Fittings

a. Fittings are one-piece castings (flanged nipples may be screwed and welded)
b. Flange bolt hole diameters are consistent with AWWA C207 Class D

Table 3: Bolt Hole Size (AWWA C207 Class D)

Pipe Size	Bolt Hole Diameter
4"	5/8"
6" – 8"	3/4"
12"	7/8"
16"	1"

Note: *Consistent with Std Dwgs 323-EA and 324-EA*

☐ Rejection

a. All rejected pipe and fittings shall be marked
b. Fill out Construction Division Field Memo and include pictures of any items that are rejected, including dimensions
c. Notify Oakport warehouse to contact distributor/manufacturer for replacement/refund

SECTION 33 05 19.07P

INSTALLATION OF DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Installation of Ductile Iron (DI) pipe and fittings.

B. Related Sections:

1. Section 03 30 76P – Concrete for Pipeline Installation
2. Section 05 05 26P – Flange Bolting
3. Section 09 96 56.10P – Fusion-Bonded Epoxy Coatings
4. Section 31 23 23.15P – Imported Backfill and Drain Rock Materials
5. Section 31 23 33P – Trenching and Backfilling
6. Section 32 12 16.81P – Asphalt Pavement Replacement
7. Section 33 05 19.05P – Fabrication of Ductile Iron Pipe and Fittings
8. Section 33 10 01P – Protection from Corrosion
9. Section 33 11 13.10P – Polywrap
10. Section 33 11 13.21P – General Pipeline Installation Requirements

1.2 REFERENCES

A. American Water Works Association:

1. AWWA C104 Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water
2. AWWA C105 Polyethylene Encasement for Ductile Iron Pipe
3. AWWA C116 Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service
4. AWWA C600 Installation of Ductile Iron Water Mains and Their Appurtenances

B. Additional Standards:

1.	ANSI/NSF-61	Drinking Water System Components
2.	ASTM A536	Standard Specification for Ductile Iron Castings
3.	ASTM A674	Standard Practice for Polyethylene Encasement for Ductile Iron Pipe
4.	ISO 8179-1 and ISO 8179-2	International Standard for Ductile Iron Pipes – External Zinc-based Coating
5.	ISO 16134	International Standard for Earthquake-Resistant and Subsidence-Resistant Design of Ductile Iron Pipelines
6.	Title 22	California Code of Regulations, State Water Resources Control Board, Division of Drinking Water

PART 2 - PRODUCTS

2.1 DUCTILE IRON PIPE AND FITTINGS

A. Refer to Fabrication of Ductile Iron Pipe and Fittings, Section 33 05 19.05P.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Pipe and fittings shall be delivered, stored, and handled per Section 33 05 19.05P.

3.2 PREPARATION FOR INSTALLATION

A. Keep interior pipe and fitting surfaces clean at all times. Each section of pipe, including couplings and adapters, and each fitting shall be cleaned of dirt and debris before lowering into the trench and immediately prior to assembly. Protect pipe ends at the job site by maintaining plugs and/or caps in good condition.

B. Contractor to perform inspection of pipe and fittings prior to installation using the form at the end of Section 33 05 19.05P, DUCTILE IRON PIPE AND FITTING INSPECTION CHECKLIST.

C. Prep and clean gasket grooves with a wire brush or similar tool, to ensure the groove is smooth and free of excess coating material.

D. Protect pipe, pipe ends, pipe coating and lining, fittings and appurtenances from damage at all times.

E. Minor damage to the zinc coating during handling is acceptable provided the area of damage is no more than 5mm wide. Any non-minor damaged areas of the zinc

coating shall be repaired according to the manufacturer's recommendation using metallic zinc spray, or zinc-rich paint containing more than 85% zinc by mass in the dried film. Wax tape may be utilized in lieu of the metallic zinc spray or zinc-rich paint. Application of wax tape to follow procedure outlined in Article 3.4 of Section 33 10 01P.

F. Repair damaged cement mortar lining to match quality, thickness, and bonding of original lining in accordance with AWWA C104. When lining cannot be repaired or repairs are defective, replace defective piping with undamaged piping.

3.3 PLACING PIPE IN TRENCH

A. Install DI pipe in accordance with AWWA C600 except as modified below.

B. Do not install pipe in same trench with other utilities without approval of the Engineer.

C. Install pipe in accordance with California Code of Regulations, Title 22, Division 4, Chapter 16, Article 4, Section 64572, Water Main Separation, or as directed by the Engineer based on variance approval.

D. Pipe interior shall be free of dirt and debris and shall be maintained in the same manner during and after installation.

E. Install pipeline in trench per Drawing 1992-A, with a minimum cover of 36" below finished grade (42" for 16-inch and larger), and maximum cover of 48", or as directed by the Engineer.

F. Install pipe with uniform bearing on compacted Class I backfill or as approved by the Engineer.

G. When pipe laying operations are not in progress, watertight plugs shall be installed for closure of open ends of pipeline and covered with backfill material or steel plates at the end of each work day.

H. As the pipe is being installed, maintain as much distance as possible and at least 20 feet between the end of the new pipeline and the end of the trench being excavated (except where trenching reached the end of the design alignment) or from any visible obstructions. The purpose of this stipulation is to permit the pipeline crew to see in advance whether any horizontal or vertical adjustments in the pipe alignment will be required to avoid conflicts.

I. Wrap all buried ductile iron pipe and fittings in polyethylene encasement per Section 33 11 13.10P and in accordance with Drawing 4569-B.

J. Inspect all coating systems prior to backfill.

3.4 JOINTS

A. DI Pipe and Fittings

1. All joints shall be restrained.

2. Assemble pipe and fittings in accordance with the manufacturer's instructions using the recommended amount of pipe lubricant.

3. Gaskets shall be EPDM unless otherwise noted on the drawings. NBR gaskets may be specified by the Engineer when pipe is to be installed in areas with VOC contamination.

4. The inside of the pipe socket and the outside of the plain end shall be thoroughly cleaned to remove oil, grit, excess coating and other foreign matter. Ensure joint, gasket groove, rubber ring, and lubricant are clean and smooth prior to and during installation.

5. Pipe and fittings shall be lowered into the trench so ends nearly adjoin each other. Pipe shall be moved longitudinally using equipment with padded slings, or other method (i.e. digging bar, come-alongs) that will not damage coating as approved by the Engineer.

6. Pipe shall be installed to the horizontal and vertical alignment as shown on the drawings. Under no condition shall pipe be subjected to a blow or shock to bring it to required line and grade.

7. Keep DI pipe or fitting straight and level while pushing the pipe or fitting home. The joint deflection shall only be completed after the pipe is homed. The deflection at normally restrained joints shall not exceed 5 degrees. Where allowable deflection will be exceeded, fittings shall be used.

8. Check final location of gaskets within each joint or fitting as recommended by the pipe manufacturer.

9. If the joint assembly is not accomplished with the application of reasonable force, the plain end of the pipe should be removed to check the proper position of the gasket. Care shall be exercised to protect the pipe laid from any foreign materials or obstructions entering the pipe. At the end of each day, plug or cover the open end of the laid pipe.

10. In restrained joint pipe and fittings there is a small amount of slack or pullout available at each joint. This pullout, or expansion capability, is the result of clearance inside the socket required for the insertion of the locking segments. The joints shall be manually pulled to full extension after installing the locking segments and prior to setting the joint deflection to prevent unwanted expansion when the pipe is pressurized.

B. Mechanical Joint Restraint

1. Install only where indicated on the plans, standard drawings, or as directed by the Engineer.

2. Install per AWWA C600, while retaining full mechanical joint deflection during assembly as well as allowing joint deflection after assembly.

3. Field-cut pipe shall be ground or filed to resemble factory beveled pipe.

4. Ensure spigot, bell, gasket, and lubricant are clean and smooth prior to and during installation.

5. Slip the gland onto the spigot end of the pipe with the lip extension of the gland toward the socket or bell end. Place the rubber gasket on the spigot end with the thick edge toward the gland.

6. Push the pipe in until the spigot end fully penetrates the bell. Keep the joint straight during assembly. Press the gasket into place evenly within the bell around the entire joint. Move the DI gland along the pipe into position for bolting.

7. Insert bolts and screw the nuts finger-tight with the final tightening to be done to the Manufacturer's specifications with a torque-limiting wrench. If needed, make deflection after joint assembly but before tightening bolts.

8. Nuts spaced 180 degrees apart shall be tightened alternately to produce equal pressure on the gland (approximately 75-90 ft-lbs or per manufacturer specifications).

9. Ensure proper actuation of the gripping wedges with torque limiting twist-off nuts.

10. Wrap mechanical joint fittings with polyethylene encasement material in accordance with Section 33 11 13.10P – Polywrap.

C. Flanged Joints

1. Flanged joints are not recommended in buried installations. When flanges are used, provide flexibility (such as a flange adapter) adjacent to the flange.

2. Before installing gaskets in flanged joints, the faces of the flanges shall be power-brushed.

3. Full face gaskets with bulb-style rings shall be used to join flanged pipe, fittings or valves.

4. Assemble flanged connections per manufacturer instructions. Appropriate bolt torque for 350 psi is as follows: 110 ft-lbs of torque shall be applied for 4-inch through 8-inch, 130 ft-lbs for 12-inch, 160 ft-lbs for 16-inch, 200 ft-lbs for 20-inch.

5. Flange bolting materials shall meet the requirements of Section 05 05 26P – Flange Bolting. Bolts for flanged joints shall be of sufficient length to give a full nut engagement plus three full turns.

6. When bolting up flanges, the bolts shall be tightened in such a way that the flanges in the completed joint will be parallel and free from unequal stresses.

7. Care shall be taken to prevent damage to the bolt heads, nuts and threads. All damaged material shall be replaced.

8. Flanged joints showing leaks are not acceptable. Leaks shall be stopped by one or all of the following methods: cleaning flange face, replacement of gaskets, and adjustment of tension on bolts. No other method will be permitted.

9. Where, in the opinion of the Engineer, conditions prevent the use of hex head bolts, stud bolts of the proper size shall be substituted.

10. Where pipes of different types are connected, or where pipes are connected to valves or fittings of different materials, the joint shall be insulated for corrosion protection per Section 33 10 01P.

D. Earthquake-resistant pipe systems

1. Pipe installation shall include earthquake joints where indicated on the drawings.

2. Assemble pipe and fittings in the same manner as DI Pipe and Fittings section above, with the following exceptions:

   a. Use recommended amount of subaqueous lubricant on all earthquake joints. Unlike restrained joints, earthquake joints are intended to expand, contract, or deflect with future ground movement. Standard lubricant dries soon after installation, but subaqueous lubricant maintains lubricity over time.

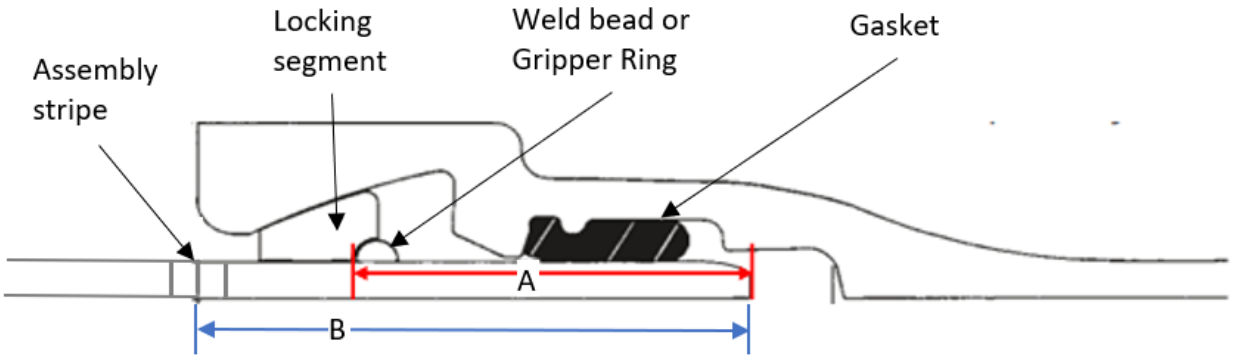
   b. Install earthquake joints at midpoint expansion unless noted otherwise on the drawings. Approaching bends and ends in the pipe, earthquake joints may be shown on the drawings as “fully-extended” to accommodate thrust. No thrust blocks shall be installed with earthquake joints unless specified by the Engineer.

   c. Come-alongs or similar hand tools which isolate movement to the intended joint shall be used to achieve the required joint position. Do not use heavy equipment to stab joints, as it may impact the position of buried or unburied adjacent joints.

3.5 FIELD CUTS

A. Field cuts shall be made using gauged pipe, or by confirming OD is within range. Pipe is not gauged within 24" of the bell due to tapering. The outside of the plain end shall be beveled about 1/4" at an angle of about 30 degrees and the leading edge rounded. The prepared cut end shall be marked in accordance with the dimensions specified by the manufacturer.

		Field Cut Dimensions (A - plain end to back of weld bead or Gripper Ring)		Assembly Stripe Dimensions (B - plain end to front of assembly stripe)	
Pipe Size	OD Range (inches)	TR Flex (inches)	TR Xtreme (inches)	TR Flex (inches)	TR Xtreme (inches, midpoint)
4”	4.74 – 4.86	3.30	N/A	4.375	N/A
6”	6.84 – 6.96	3.53	5.87	4.875	8.66
8”	8.99 – 9.11	3.84	6.21	5.375	9.16
12”	13.14 – 13.26	3.90	6.50	5.875	9.68
16”	17.32 – 17.45	5.15	7.08	7.500	10.71



B. When a field cut is necessary adjacent to a TR FLEX fitting, a spool piece with factory weld beads or multi-bead length of pipe shall be used to maintain restraint. Alternatively, a Gripper Ring may be used to maintain restraint. Field welding on ductile iron pipe is not permitted.

C. Installation of Gripper Rings shall be per manufacturer’s written instructions. Joints shall be installed straight. After assembly the joint shall be fully extended to remove slack and confirm correct installation. Deflection may be made after installation.

D. Gripper Rings shall not be installed on TR Xtreme pipe, or between TR FLEX fittings and TR Xtreme pipe (i.e. no Gripper Rings with earthquake-resistant pipe systems).

E. Any damage to the lining and coating shall be repaired in accordance with the manufacturer’s instructions and is subject to inspection/acceptance by the Engineer.

F. The assembly for field cut pipe to bell shall be completed as described for full-length pipe and per manufacturer instructions. Care should be taken to ensure that

all corners are rounded, and no sharp edges remain that might damage or dislodge the gasket. Any damage to the lining or coating shall be repaired.

3.6 THRUST BLOCKS

A. Install where required by Section 33 11 13.21P – General Pipeline Installation Requirements.

3.7 CORROSION CONTROL

A. Install polywrap per Section 33 11 13.10P and Drawing 4569-B.

B. Install test stations, bonding jumpers, and insulating joints at locations indicated in the drawings and as specified in Section 33 10 01P.

3.8 BLOWOFFS

A. Install size on size main-line valve with 4" blowoff in accordance with Drawing 332-EA-1 at locations shown on the drawings or as specified by the Engineer.

B. Install 6" blowoff and pumping tee in accordance with Drawing 199-EA at locations shown on the drawings or as specified by the Engineer.

3.9 AIR VALVES

A. Install 1" and 2" air and vacuum and air release valves in accordance with Drawing 189.1-B and 189.2-B at the locations shown on the drawings or as specified by the Engineer.

3.10 TRACER WIRE

A. Install tracer wire per Section 33 11 13.21P – General Pipeline Installation Requirements.

3.11 IDENTIFICATION TAPE

A. Install identification tape per Section 33 11 13.21P – General Pipeline Installation Requirements.

3.12 SERVICE TAPS

A. Services 2-inch and smaller will be installed with a service saddle per Drawing 9020-GB.

B. Services 3-inch and larger will be installed with a tee per Drawing 3684-B-1.

3.13 INSTALLATION OF VALVE BOXES AND OPERATORS

A. Install valves, valve boxes, and operators per Section 33 11 13.21P – General Pipeline Installation Requirements.

3.14 LOCATION MARKERS

A. Install location markers per 33 11 13.21P – General Pipeline Installation Requirements.

3.15 HYDROSTATIC PRESSURE AND LEAKAGE TESTING

A. Conduct hydrostatic pressure test per Section 33 11 13.21P – General Pipeline Installation Requirements.

3.16 PIPELINE FLUSHING AND CHLORINATION

A. Conduct flushing, chlorination and water quality testing per Section 33 11 13.21P – General Pipeline Installation Requirements.

END OF SECTION

SECTION 33 10 01P
(Formerly SECTION 09961.1)

PROTECTION FROM CORROSION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General guidelines for corrosion protection of metallic pipelines and appurtenances and utilizing field applied coatings.

2. Lists of coating systems and the brand names of products approved by the Engineer. Apply coatings in accordance with the manufacturer's instructions, as indicated on the drawings, or as specified herein

B. Related Sections:

1. Section 09 96 56.10P – Fusion Bonded Epoxy Coatings

2. Section 33 05 19.07P – Installation of Ductile Iron Pipe and Fittings

3. Section 33 11 13.06P – Installation of ML&PCS Pipe

4. Section 33 11 13.07P – Installation of ML&CS Pipe

5. Section 33 11 13.10P – Polywrap

1.2 REFERENCES

A. ASTM A123 – Specification for Zinc Coatings (Hot-Dip Galvanized) on Structural Steel Shapes, Plates and Bars and Their Products

B. ASTM A153 – Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

C. ASTM A384 – Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies

D. ASTM A385 – Practice for Providing High-Quality Zinc Coatings

E. ASTM B633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel

F. SSPC Vol 2, Steel Structures Painting Manual, Systems and Specifications

1. SSPC-SP 2 Hand Tool Cleaning

2. SSPC-SP 3 Power Tool Cleaning

PART 2 - PRODUCTS

2.1 TYPES OF COATINGS

A. Cement Mortar Coating – See Section 33 11 13.07P

B. Insulating Coatings – See Section 33 11 13.06P

C. Zinc Coating

D. Cold applied tape at steel pipeline joints – See Sections 33 11 13.06P and 33 11 13.07P

E. Polywrap – See Section 33 11 13.10P

F. Low VOC Mastic:

1. Christy's HD50 Bituminous Coal Tar Mastic

2. Bituminous Mastic 50-HT from Hy-Tech Coatings

3. R28 Zero VOC Mastic from Royston

4. Or equal

G. Petrolatum Wax Tape, approved products for buried applications. Primer and wax tape shall be from same manufacturer:

1. Petrolatum or Wax Tape:

a. Denso Densyl Tape available from Farwest Corrosion Control, Downey, CA

b. Wrap-Tite WTP1 Petrolatum Wax Tape available from Protection Engineering, Pittsburg, CA

c. Carboline Carbowrap Tape A from Carboline Company

d. Tapecoat Envirotape Wax Tape available from Farwest Corrosion Control, Downey, CA

e. Trenton #1 Wax Tape available from Protection Engineering, Pittsburg, CA

f. Step 2 Belowground Wax Wrap from Superior Corrosion Control

g. Or equal as approved by the Engineer

2. Corrosion Inhibiting Paste and Primer:

   a. Denso Paste available from Farwest Corrosion Control, Downey, CA

   b. Wrap-Tite WTP1 Primer available from Protection Engineering, Pittsburg, CA

   c. Carboline Carbowrap Paste from Carboline Company

   d. Tapecoat Enviroprime Paste available from Farwest Corrosion Control, Downey, CA

   e. Trenton Wax-Tape Primer available from Protection Engineering, Pittsburg, CA

   f. Step 1 Prime Guard Belowground from Superior Corrosion Control

   g. Or equal as approved by the Engineer

3. For steel pipeline joints: See Sections 33 11 13.06P and 33 11 13.07P.

H. Galvanization: Galvanize structural steel, pipe, bolts, nuts, washers, and other steel items in accordance with applicable specifications including ASTM A123, ASTM A153, ASTM A384, ASTM A385, and ASTM B633.

PART 3 - EXECUTION

3.1 GENERAL

A. Apply coatings in accordance with manufacturer's instructions and as specified.

3.2 PROTECTION OF BURIED PIPELINES

A. Steel Pipe with Insulating Coating: Coat all metallic parts of the pipeline, including the joints, in-the-line elements, and branches. In-the-line elements include valves, collars, couplings, and reducers. Branches to be coated include piping for air valves, blowoffs, hydrants, and steel service taps, but do not include copper service taps or branches electrically isolated from the main. Coatings shall be continuous and free of holidays and pinholes. Coat or wrap all joints and all ferrous appurtenances (such as valves, tees, collars, air valves, and blowoffs). Install galvanic anodes with test stations as shown on Drawing 286-EA where specified on the project drawings.

B. Steel Pipe with Cement Mortar Coating: Coat all metallic parts of the pipeline including the joints, inline elements, and branches with cement mortar. Inline elements include valves, collars, couplings, and reducers. The pipe shall be polywrapped as described in Section 33 11 13.10P. Branches to be coated include air valves, blowoffs, hydrants, and steel service taps, but do not include copper service taps or branches electrically isolated from the main.

C. Insulating Pipe Joints: Electrically isolate ML&PCS pipe from cast iron, ductile iron, and ML&CS pipe or connections with insulating flanges or couplings in accordance with Standard Drawing 3446-GB and 3186-B and at all locations indicated on the project drawings. Install insulating joint test stations at all buried insulating flange locations and extend the test wires to a meter box, valve pot, or post in accordance with Standard Drawing 285-EA.

D. Polyvinyl Chloride Pipe: Wrap all uncoated ferrous elements with petrolatum wax tap, unless already coated.

E. Ductile Iron Pipe with Zinc Coating: All ductile iron pipe shall be polywrapped as described in Section 33 11 13.10P and shown on Drawing 4569-B. Ductile iron pipe may require to be electrically continuous, using joint bonds in accordance with Standard Drawing 220-EA and as determined by the Engineer and indicated on the project drawings. Install test stations and galvanic anodes as presented on Drawing 286-EA at intervals specified on the project drawings, if required. Alternative corrosion control methods may be considered with approval from the Engineer.

F. Copper and Brass Pipe: Electrically isolate copper, brass, and other nonferrous metal from steel, ductile iron, or cast-iron pipe. Eliminate points of direct metallic contact by using insulating bushings, coupling unions, or flanges. Also isolate nonferrous pipe from steel supports and pipe straps using insulating sleeves or tape wrapped around the pipe.

G. Insulation from Concrete: Whenever metal pipe and fittings are partially imbedded in concrete (except mortar coated pipelines) apply a 6-inch minimum band of tape to the steel such that half of the band will be embedded in the concrete and the other half will be exposed.

H. Bolts: On cement mortar coated pipelines, field coat exposed surfaces of bolts with cement mortar. On all other pipelines, field coat bolt surfaces with mastic.

I. Miscellaneous Appurtenances: On other than cement mortar coated pipelines, wrap all buried parts of relatively thin cross section (tie rods, leak clamps, and bolts, etc.) with petrolatum wax tape. On cement mortar coated pipelines, mortar coat or encase such parts in concrete.

J. Bonding: All steel pipe shall be electrically continuous except where electrical separation is specifically designed to avoid a bi-metallic contact or other types of corrosion cells. Ductile iron pipe may require to be electrically continuous as determined by the Engineer and indicated on the project drawings. Joints shall be bonded in accordance with Drawing 220-EA and the project drawings.

3.3 PROTECTION OF MISCELLANEOUS ELEMENTS

A. Miscellaneous Steel Elements Partially Embedded in Concrete (for example, a fence or signpost set in concrete): Whenever a galvanized or bare steel element is partially embedded in concrete, and is exposed to the weather or to dampness, apply a 6inch

minimum band of insulation consisting of tape, mastic, or coal tar epoxy to the steel such that half of the band will be embedded in the concrete and the other half will be exposed.

B. Steel Electrical Conduit: Unless otherwise specified, all buried steel electrical conduit and couplings shall be galvanized and encased in a concrete jacket of 3 inches minimum thickness all around or shall be galvanized and plastic coated to a minimum thickness of 40 mils. At all outdoor locations and at damp indoor locations, galvanized conduit shall be taped or coated at the point specified in Article 3.3.A above.

C. Aluminum: Direct contact between aluminum and concrete or cement mortar is not permitted.

1. Aluminum pipe, bolts, or frames to be installed in concrete: Completely isolate from direct contact by taping or by coating with mastic, high build epoxy, or coal tar epoxy.

2. Aluminum structural members to be mounted on concrete: Isolate from contact by taping or coating (as described above) or by installing isolating pads of neoprene, polyvinyl chloride, or other approved insulating materials.

3. Anchor bolts holding aluminum structures:

a. For dry interior environment, use hot dip galvanized or cadmium coated steel.

b. For damp or exterior environment, use stainless steel, cadmium coated steel, or aluminum, except no aluminum in concrete.

c. For submerged or buried environment, use stainless steel or aluminum, except no aluminum in concrete.

D. The mating surfaces of fabricated metallic elements of a structure which will be immersed in water, buried, or exposed to a humid or corrosive environment shall be sealed to prevent the entrance of moisture around the mating surfaces by an approved method.

3.4 APPLICATION OF WAX TAPE

A. Surface Preparation:

1. Metallic surfaces shall be prepared to SSPC SP3, Power Tool Cleaning.

2. Where physical accessibility precludes the use of SSPC SP3, surfaces shall be cleaned to SSPC SP2, Hand Tool Cleaning.

3. Loose rust, paint, debris and moisture shall be removed from the surface.

B. Primer or paste shall be applied to all surfaces.

C. Tape shall be applied following the application of primer or paste.

1. Tape shall be applied with a minimum 55% overlap.

2. Press out all air pockets.

3. Smooth all lap seams.

END OF SECTION

SECTION 33 11 02P
(Formerly Section 05610.1)

FABRICATION OF 20" ML&TWS PIPE
(Applicant Only)

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Fabricate and furnish 20" cement Mortar Lined and Tape Wrapped Steel (ML&TWS) pipe, Type "TW."

B. Pipe Description

1. Pipe details: Drawing 1884-A

2. Flange details: Drawings 323-EA, 324-EA and 325-EA

3. Pipe shall be made in lengths (40' 2" maximum) convenient for the Applicant.

1.2 QUALITY ASSURANCE

A. Qualification of Welding Procedures, Welders, and Welding Operators:

1. Qualify the welding procedures, welders, and welding operators in accordance with the provisions of Part QW of Section IX of the ASME Boiler and Pressure Vessel Code, or AWS Structural Welding Code, Section 5.

2. Applicant shall test welders at their own expense.

B. Welding Flux

1. When Submerged Arc Welding (SAW) is performed, only new flux shall be used.

C. Cylinder Fabrication Welding Tests (Tension tests, bend tests, and x-rays):

1. Cut tension test and bend test coupons from pipe cylinder for testing of welded seams. Take at least one set of test coupons from each heat of steel and take at least one set of test coupons daily from each welding machine and each operator.

2. Test in accordance with AWWA C200, Paragraph 4.11.5. Welded seams shall develop the ultimate strength specified for adjacent steel sheet.

3. X-ray examination of welds shall conform to Paragraph UW-52 of Section VIII of the ASME Boiler and Pressure Vessel Code.

4. Location for tests will be determined by Engineer. All x-rays and radiographs become the property of the District.

5. Contractor shall pay for all x-rays, tension tests and bend tests of welded seams as required by Paragraph UW-9(d), UW-11(a)(5)(b), UW-14(b) and UW-52, Section VIII ASME Boiler and Pressure Vessel Code. When X-ray examination discloses an unacceptable weld, two additional spot examination locations will be selected by the District as required by Paragraph UW-52 of Section VIII ASME Boiler and Pressure Vessel Code.

6. The manufacturer may elect to substitute full-length Real Time Radiography for spot x-rays. Real Time Radiography shall comply with the following to be considered an acceptable alternative: Real Time Radioscopic Examination of spiral pipe welds shall comply with ASME Section V, Article 2, Mandatory Appendix II utilizing hole type IQI placement per Section T-277.1-C placed on the weld at a minimum of three locations at the approximate center of the weld and one at each end or termination of the weld. Welds shall conform to Paragraph UW-51 of Section VIII of ASME Boiler and Pressure Vessel Code. Final determination of radiography sensitivity is at the discretion of the Engineer.

7. Repair and re-test with the same test method that identified the original defect to assure acceptable repair.

D. Hydrostatic Tests:

1. Shop-test each steel cylinder to develop a circumferential tensile stress equal to 75% of minimum yield point stress for the specified steel used.

2. Maintain pressure during inspection of all seams. All surfaces shall be dry during inspection.

3. Repair by chipping, grinding, air-arcing, and rewelding.

4. Retest all repaired pipe.

5. Cylinders requiring more than 3% of any seam to be repaired may be accepted at the discretion of the Engineer. Approved repairs shall be witnessed by the Engineer.

1.3 SUBMITTALS

A. Submit seven copies of shop drawings, for the Engineer's approval prior to fabrication. Shop drawings shall show the details of fabrication of fittings, and assembly of pipe and fittings for completed pipeline. Shop drawings shall show field location number of each fitting and piece of pipe.

B. Submit welding process and procedure for approval prior to start of fabrication.

C. Submit certification of welders for approval prior to start of work.

D. Submit tapecoat supplier and products to be used prior to start of work.

E. Submit mill certificates, or certificates from approved testing laboratory or other source, for the steel used for pipe cylinders, showing conformance to appropriate ASTM Specifications including chemical and physical characteristics.

F. Submit cylinder manufacturing and hydrostatic test reports, and non-destructive welding test reports with the appropriate information to ensure compliance with these specifications.

G. Submit certificates from approved testing laboratory or other source for cement and sand conformance to specifications.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prevent damage to pipe during transportation, handling, and storage:

1. Bottom saddles shall be rigid, shaped, and cushioned to provide uniform bearing.

2. Do not drag, skid, or drop pipe sections.

3. Block to prevent shifting when transporting.

4. Blocking, chains, and cables for securing the load shall be suitably padded.

5. Cover ends of each pipe section in transit and at the site to prevent drying of the lining. A cover over the entire front end of the truck load shall also be provided during transit.

6. Upon delivery, place off the ground on suitable supports, such as rubber tires or sandbags at quarter points, and securely block.

PART 2 - PRODUCTS

2.1 STEEL FOR FABRICATED PIPE CYLINDERS

A. ASTM A36; ASTM A283, Grade C; or ASTM A1011 and A1018, SS Grades 30, 33, or 36

2.2 FLANGES

A. See Drawings 323-EA, 324-EA, and 325-EA.

2.3 CEMENT MORTAR LINING

A. Cement mortar lining shall be NSF 61 approved for potable water applications.

B. Portland Cement:

1. ASTM C150, Type II or Type V

C. Sand: ASTM C33 and as follows:

1. Fineness modulus: 2.50 to 3.00

2. Average sand equivalent of three successive samples tested by the test method California 217 shall be not less than 75, and no individual sample shall have a sand equivalent of less than 70.

2.4 MACHINE-APPLIED TAPE COATING

A. Conform to AWWA C214 except as modified herein.

B. The tape coating shall have a total thickness of 80 mils nominal and shall have one inner-layer corrosion protection tape and two outer-layer mechanical protection tapes.

C. Compatibility: Primers and tapes shall be supplied by the same manufacturer.

D. The outer layer tape shall have an integral light blue color (Federal Standard Color No. 15450) and shall be resistant to ultraviolet light degradation

E. Approved Products:

1. Polyken YG III System:

Primer, No. 1039
Innerwrap, No. 989, 20 mils nominal
Outerwrap, No. 955, 30 mils nominal
Outerwrap, No. 956, 30 mils nominal

2. Tek-Rap System:

Primer, 200 Series
Innerwrap, 250 Series, 20 mils nominal
Outerwrap, 255 Series, 30 mils nominal
Outerwrap, 255 Series, 30 mils nominal

3. Wrap-tite System:

Primer, WT27EF
Innerwrap, 55-20, 20 mils nominal
Outerwrap, 365-30, 30 mils nominal
Outerwrap, 365-30, 30 mils nominal

4. Or equal as approved by the Engineer

PART 3 - EXECUTION

3.1 INSPECTION OF FABRICATED PIPE CYLINDERS

A. District will inspect all phases of pipe fabrication work and will witness all tests.

B. Notify District's Plant Inspection Section (510-287-1132) to schedule the inspection, at least one week prior to start of the fabrication work, and 2 work days prior to scheduling inspections where the travel is less than 75 miles one way from Oakland.

C. For sites where the travel is between 75 and 200 miles one way from Oakland provide notification a minimum of 5 work days prior to required presence of Engineer.

D. For sites within the continental United States where the travel is 200 miles or more one way from Oakland, provide notification a minimum of 15 work days prior to required presence of Engineer.

E. For international locations and sites outside the continental United States provide notification a minimum of 30 work days prior to the required presence of the Engineer.

F. Expense of rewitnessing failed hydrostatic tests or reinspection of any phase of pipe manufacture shall be paid by the Contractor.

G. Expense of rewitnessing or reinspection by District personnel if any of the inspections are to be performed at a locality exceeding 75 miles one way from Oakland, shall include the employee's wages, transportation, lodging (at an establishment rated three diamond or better by California State Automobile Association (AAA), or comparable listing), and incidental expenses incurred between Oakland and the shop location, at the shop location, and return to Oakland.

1. Expense of rewitnessing or reinspection by the District's authorized agent shall be the total charge billed to the District by the agent.

2. Travel exceeding 200 miles one way from Oakland, travel expenses shall also include round trip direct route coach airfare from Oakland, San Francisco, Sacramento, or San Jose Airports to manufacturer's plant or testing facility, mid-sized car rental or taxi services, fuel, tolls, ground transportation to and from the airport, and airport parking at the departing airport.

a. For international or travel outside the continental United States, per diem rates are those established by the US Department of State for the specific location and dates of travel. Travel expenses may include the direct cost of securing passports, visas, language interpreters, document translators, communications, and internet access.

b. If weekend stays are requested to defray transportation costs, reimbursement for the inspectors stay over the weekend will include meal allowance, hotel expenses, phone and internet access charges, rental car

or transportation charges to and from eating establishments, laundry service, language interpreters, or other necessary business expenses or services.

c. Any witness inspection that has to be repeated due to necessary rework, including District inspector's wages or if done by a District agent, the agent's bill to the District shall be paid for at the Contractor's expense.

3.2 FABRICATION OF STEEL CYLINDERS

A. Cylinders shall be substantially true right cylinders formed from one piece of sheet or coil steel. In order to avoid steel waste, one splice in a cylinder shall be allowed provided radiographic inspection of the splice is performed and the results are submitted to the Engineer. The location of the splice shall be a minimum of 24" from either end of the cylinder.

1. The difference between major and minor axes shall not exceed 1% of the diameter of the pipe.

2. Straightness of cylinders shall be such that no point on the surface of the cylinder shall deviate more than 1/8" in any 10 foot length as measured by a straight edge.

3. Circumferential welds are not acceptable.

4. The mill sheets or plates shall contain no welded seams.

B. Type of welding shall be limited to the following methods unless approved otherwise by the Engineer prior to use:

1. Submerged arc welding (SAW)

2. Shielded metal arc welding (SMAW)

3. Flux cored arc welding (FCAW)

4. Resistance seam welding (RSEW)

5. Manual welding permitted on special sections not suitable for automatic welding.

C. Welding of Longitudinal or Spiral Seams:

1. Butt welds shall be used.

2. Longitudinal seams may be either parallel to the axis of the pipe or spiral. There shall be only one seam in the cylinder.

3. Seams shall have an efficiency of at least 100% of the specified minimum strength of the adjacent sheet.

4. Before welding, edges shall be thoroughly cleaned and properly formed. Forming of material shall not be performed by means of hammering.

5. Weld bead shall be central to the seam and free from depressions, undercut edges, burrs, irregularities, and valleys.

6. Weld shall be continuous for full length of seam.

7. Arc welds shall be built up uniformly at the center of the weld and have complete penetration. Height of weld bead above plate surface shall be 1/32" minimum, but not more than 1/8" on the outside nor more than 3/32" on the inside.

8. All welds shall be thoroughly fused and blend smoothly and gradually with base metal, uniform in appearance, free from cracks, and reasonably free from irregularities.

9. Scattered porosity and slag inclusions in accordance with the Standards of Section VIII of the ASME Boiler and Pressure Vessel Code will be acceptable.

10. Unacceptable defects shall be chipped, flame-gouged, or air-arc gouged to sound metal and rewelded by either manual or automatic welding as approved. The portion of the weld that must be repaired shall be as directed by the Engineer.

11. Restart the welding operation on clean and sound metal.

12. Welding technique shall ensure uniform distribution of residual stresses in the weld or adjacent metal. Undercutting will not be permitted.

13. Weld beads on the outside of plain or spigot ends and on the inside of bells shall be ground flush for a distance of 2-1/2" from the end of cylinders.

14. Butt welds made by the resistance seam welding (RSEW) method shall have not buildup either internally or externally. Pipe made by this method shall be cleaned of all material formed during the welding process beyond the outside circumference of the cylinder.

D. Handling Steel Cylinders:

1. Unlined or uncoated steel cylinders shall be adequately supported during all operations to ensure against development of a permanent out-of-round set.

3.3 APPLICATION OF CEMENT MORTAR LINING

A. The proportions of portland cement, sand, and water shall provide a compressive strength of 3,500 psi at 28 days.

1. Mix proportions shall consist of one part cement to not more than three parts fine aggregate by weight.

2. The water-soluble chloride ion content of the mortar shall not exceed 150 milligrams in 1,000 grams of mortar.

3. Compressive strength shall be determined using samples made from a small spinning device with a steel cylinder dimensioned in accordance with the standard test cylinder as described in ASTM C31, and the mortar shall be spun in the cylinder with a thickness of at least 1-1/2". The mortar shall be removed from the mix in accordance with ASTM C172, "Sampling Fresh Concrete." Curing of test specimens shall be the same as curing the pipe. The specimens shall then be tested in accordance with ASTM C39, using the net mortar area to determine the compressive strength. If laboratory facilities are not available at the plant, then the tests shall be made by an approved testing laboratory. Results of compressive strength tests shall be submitted to the Engineer.

B. Pipe-lining Equipment:

1. A centrifugal lining machine shall be used. Hand-applied lining shall be prohibited.

C. Application of Lining:

1. Line after completion of shop tests and after the interior has been cleaned of loose rust, scale, oil, and foreign matter.

2. Lining shall be shop-applied. Install round-up rings at each end of pipe and install exterior ring beams before spinning the lining. Rings and beams shall remain in place until the lined pipe section is supported for curing on sand ribbons.

3. The number and spacing of ring beams shall be adequate to maintain a rigid and round pipe section within the specified tolerance.

4. The mortar shall be deposited by a method which allows a regulated and uniform quantity of material to be applied throughout the entire length of pipe. Confine lining to dimensions shown on the pipe drawings.

5. Finished lining shall present a smooth, hard, dense, non-gritty surface free from defects.

6. Engineer shall verify sampling, placement, and finish of mortar lining.

D. Handling Lined Cylinders:

1. Lined and/or coated pipe shall be supported by belt slings or shaped rubber pads providing at least 120^{o} support during all handling operations.

2. Prevent slipping or sloughing of new lining.

3. Damaged lining: Cut out damaged lining and reline area.

E. Curing:

1. Start curing as soon as lining has set.

2. Moist curing:

a. Cure for not less than 4 days.

b. Surface shall be kept continuously wet by sealing the pipe ends airtight or by a method approved by the Engineer.

3. Accelerated curing: Steam curing may be used to speed the curing or until the lining has gained sufficient strength to be handled.

a. Start 3 to 6 hours after lining has been applied.

b. Steam shall be saturated vapor at 100°F to 130°F maximum.

c. Steam curing chambers shall protect pipe from drafts.

d. Protect from rapid drops in temperature after curing.

4. Each 1 hour of steam curing will reduce the required 4 day water cure by 4 hours.

F. Protection:

1. During water curing of the lining, protect against being heated by the atmosphere or direct sunlight to above 100°F by covering with burlap or other suitable material.

2. Keep cover continuously wet.

3.4 APPLICATION OF MACHINE-APPLIED TAPE COATING

A. Install in accordance with applicable sections of AWWA C214 as modified below.

B. Minimum Surface Preparation:

1. Prepare surface in accordance with the coating manufacturer's specifications but not less than “Commercial Blast” (SSPC-SP6).

2. Surface profile shall be per manufacturer’s specification and/or recommendation.

3. Grind off all sharp edges and points on welds.

4. Weld toe tape shall not be used. Preparation of welds as described in Sub-paragraphs 3.2.C.7 and 3.2.C.8 is required to assure continuity of tape contact in the weld toe areas.

C. Prime:

1. Mix in accordance with manufacturer's recommendation.

2. Prime immediately after cleaning.

3. Coverage shall be in accordance with manufacturer's recommendations but shall not exceed 800 square feet per gallon.

4. Remove any imperfections such as foreign material, drips, and runs. Reprime.

5. Primer shall be dry to touch prior to application of inner wrap.

D. Apply Inner and Outer Tape Wraps:

1. Pipeline tape shall normally be applied at a roll body temperature above 75°F, and at an ambient temperature above 45°F, and shall be stored up to the time of application under such conditions and for a sufficient period of time that the roll body temperature shall be above 75°F at the time of application.

2. Pipeline tape as specified shall be spirally wrapped by a wrapping machine approved by the tape manufacturer onto suitable cleaned, dry, and frost-free, primed pipe with 1" minimum lap. The end of each new roll shall overlap the end of the preceding roll by a minimum of two tape widths. This end-lap shall be hand applied without tension and shall be pressed into position by several wiping strokes of the hand. Its spiral angle shall parallel the previously applied spiral and it shall be smoothly applied without twist or distortion.

3. The free ends of outerwrap of each pipe section shall be primed and hand pressed into place.

4. Operators shall make necessary adjustments, including spindle-brake tension adjustments, to continuously provide a uniform, tight coating. A smooth, taut coating accomplished with a tape-width drawdown not in excess of 1/2% shall be considered adequate. Wrinkles, puckers, and voids shall be kept to a minimum and the specified lap shall be maintained.

5. Tape spindles shall be adjustable and provide for half-lapping the innerwrap tape by the first outerwrap and half-lapping the first outerwrap by the second outerwrap.

6. The hold-back at the pipe ends shall be as shown on Drawing 1884-A.

E. Inspection and Repair:

1. After the application of the inner pipe tape and prior to the application of the first outerwrap, the pipe tape shall be electrically tested for flaws with a high voltage holiday detector in accordance with NACE International Standard Practice RP-02-74, "High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation." Test in presence of Engineer.

2. The voltage of the detector shall be adjusted to within 20% of the voltage calculated by formula:

$$\text{Voltage} - 1250\ (T)^{1/2};$$

where T = the average thickness of the inner tape wrap in mils.

The optimum travel rate of the holiday detector shall be determined by testing on a tape wrapped pipe section with a known, pin-type holiday.

3. Defective locations shall be clearly indicated by a circular mark or cross immediately upon discovery by either visual examination or by the holiday detector.

4. All holidays and minor damaged or defective coating shall be repaired immediately by removing all loose tape and outerwrap from the damaged area, applying primer, and applying a patch of the specified tape or outerwrap. Primer shall be dry to the touch before the tape patch is applied. Pinholes shall be repaired by applying primer and a patch of inner wrap tape at least 4" square. The patch shall extend a minimum of 4" beyond the damaged area. Prime the tape patch and cover with outerwrap.

5. The repaired areas shall be checked for holidays with a high voltage holiday detector.

3.5 SHOP FABRICATION OF FITTINGS

A. Welding:

4. Conform to the applicable requirements of Article 3.2, Fabrication of Steel Cylinders.

B. Bends:

1. Fabricate from sections of mortar lined and tape coated pipe, Type "TW", or from bare cylinders that have passed the shop hydrostatic test as detailed on shop drawings approved by the District.

2. Bare cylinders shall be of the same quality as specified for Type "TW" pipe.

3. Before cutting pipe remove lining and coating back from the line of cut approximately 2 inches.

4. Use care to avoid injury to the lining and coating beyond the area removed.

5. Remove and replace loosened or broken lining or damaged coating.

C. Tees and wyes:

1. Fabricate from steel plate or from bare cylinders which have passed the shop hydrostatic test.

2. Plate and cylinders shall be the same quality as specified for Type "TW" pipe.

3. Stress relieve all tees and wyes having girder reinforcement plates 1/2-inch or greater in thickness after complete fabrication.

4. Stress relieving shall conform to Paragraphs UW-40 and UCS-56 of Section VIII of the ASME Code.

D. Tapers:

1. Fabricate from steel plate of same quality as specified for Type "TW" pipe.

E. Nozzles:

1. Fabricate and attach to pipe as shown on the drawings.

F. Mortar lining of fittings:

1. The mortar lining and the quality, curing, handling and the protection of the finished lining shall conform to Article 3.3.

2. Apply mortar lining by hand plastering or an approved machine method.

3. For fittings fabricated from steel cylinders or plate, the thickness shall be same as specified for Type "TW" pipe sections unless otherwise shown on the drawings.

4. When bends are fabricated from lined pipe, line exposed cylinder at the welded girth joint with mortar the same thickness as the adjacent pipe lining, and when the strip of exposed cylinder is more than 12 inches wide, reinforce lining with welded wire fabric tack welded to the cylinder. Use an epoxy or adhesive bonding agent to bond new mortar with existing mortar.

G. Tape coating of fittings:

1. Use the same machine applied 80-mil tape coating system used on the pipe where possible.

2. Use the hand applied repair and joint wrap tape system from the same manufacturer when the machine applied system cannot be applied. Double wrap or half lap to provide 100 mils minimum thickness.

3. Coating used and application procedure shall be approved by the tape manufacturer.

4. Inspect and repair in accordance with Article 3.4 E.

3.6 FLANGED SECTIONS

A. Conform to Drawings 323-EA, 324-EA, and 325-EA unless shown otherwise.

B. Flanges fabricated from segments of plate shall be stress relieved before machining.

C. Stress relieving shall conform to Paragraphs UW-40 and UCS-56 of Section VIII of the ASME Code.

D. Flanges shall be welded to pipe sections before machining.

E. Lining and coating of flanges with attached pipe sections shall conform to Articles 3.3 and 3.4.

3.7 IDENTIFICATION OF PIPE AND FITTINGS

A. Cylinders:

1. Each length shall be plainly marked on the outside with a manufacturing number, metal stamped 1" from the bell end. This number shall be used in the cylinder manufacturing and hydrostatic tests to trace the steel used in manufacturing.

2. Transfer this number, by metal stamping, to all pieces to be cut from cylinder, prior to cut.

B. Pipe:

1. Pipe designations as indicated on the drawings shall be plainly marked on the lining and coating on each length of pipe, 1 foot from the bell end. In addition, the date of final coating and identification to show proper location in the pipeline, by reference to layout drawings or schedules, shall be shown.

2. Beveled pipe shall be marked to show degree of bevel, point of maximum pipe length at the spigot end, and the field top at each end.

3. Pipe sections containing angle bends, manholes, or nozzles shall be stenciled on the lining and coating at both ends.

C. Fittings:

1. Mark with appropriate identifying number or symbol indicating its location in the pipeline. Mark vertical field top on each end of each fitting.

3.8 REPAIR OF DAMAGED PIPE

A. Obtain approval of Engineer before performing repair work.

B. Repair in presence of Engineer or replace all pipe sections damaged during manufacturing, handling, transporting, or storing.

C. Reshaping of cylinders, pipes, and fittings shall be accomplished by rolling or pressing. Reshaping by hammering shall be prohibited.

END OF SECTION

SECTION 33 11 13.06P
(Formerly SECTION 02512.1)

INSTALLATION OF ML&PCS PIPE – 20" AND SMALLER

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Installation of mortar lined and plastic coated steel pipe (ML&PCS), 20" nominal diameter and smaller.

B. Related sections:

1. Section 03 30 76P – Concrete for Pipeline Installation
2. Section 05 05 24P – Pipe Welding
3. Section 05 05 26P – Flange Bolting
4. Section 33 10 01P – Protection from Corrosion
5. Section 33 11 02P – Fabrication of 20" ML&TWS Pipe (Applicant-Only)
6. Section 33 11 13.10P – Polywrap
7. Section 33 11 13.21P – General Pipeline Installation Requirements
8. Section 31 23 33P – Trenching and Backfilling

C. Definition: ML&PCS is cement mortar lined steel pipe and may be either extruded plastic coated or plastic tape wrapped. Project drawings usually refer to pipe 16" and smaller as ML&PCS, larger pipe as ML&TWS.

1.2 REFERENCES

A. AWWA C209 – AWWA Standard for Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines

B. ASTM C33 – Specification for Concrete Aggregates

C. ASTM C150 – Specification for Portland Cement

1.3 PIPE HANDLING, TRANSPORTING, AND STORAGE

A. Do not damage lining or coating during handling, transporting, or storage.

B. Transporting Pipe:

1. Block pipe to prevent shifting.

2. Use padded blocking, padded cables, and padded chains for securing the load.

C. Storage at the Jobsite Prior to Laying:

1. Store pipe in a manner safe to the public and in accordance with the local agency requirements.

2. Use specially prepared ground, padded skids, cradles, or sand bags to support pipe.

3. Keep interior of all pipe, fittings, and appurtenances free of dirt or foreign matter. Maintain pipe end covers until installation in the trench.

PART 2 - PRODUCTS

2.1 STEEL PIPE AND FITTINGS FURNISHED BY THE DISTRICT

A. Sixteen-inch nominal diameter and smaller

1. Steel pipe will normally be furnished in 40-foot sections, lined with cement mortar to the end of the section, and coated with extruded plastic, or plastic tape wrapped to within a few inches of the end of the section as shown on the drawings.

2. Steel pipe fittings will be furnished as shown on the drawings.

2.2 STEEL PIPE AND FITTINGS FURNISHED BY APPLICANT

A. Twenty-inch nominal diameter

B. Steel Pipe:

1. See Section 33 11 02P

C. Steel Pipe Fittings:

1. See Drawing 309-EA

2. Shall be cement-mortar lined in accordance with AWWA C104

a. Lining thickness shall be in accordance with Drawing 1884-A

b. No seal coat

2.3 STEEL PIPE CASING

A. The casing shall be new plain straight cylinder steel pipe with outside diameter and wall thickness not less than shown on the drawings. Spiral welded seams are not permitted.

1. Each end shall be beveled to 35° ± 2° and leaving a root face of 1/8" ± 1/32" for butt welding. All butt welds shall be complete joint penetration.

2. The butt welds in the casing pipe and field joints will be subject to ultrasonic inspection in accordance with ASME Volume VIII Appendix 12.

B. The casing pipe shall be ASTM A53 grade B Steel Pipe, Black or Hot-Dipped Zinc-Coated, Welded or Seamless; A134 Steel Pipe, Electric-Fusion (ARC)-Welded (Sizes NPS 16 and Over); A139 grade B or C, Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4 and Over); API 5L grade B, Line Pipe; ASTM A671 Steel Pipe, class 10, grade 60, 65, or 70.

2.4 FIELD MORTAR LINING

A. Portland Cement:

1. ASTM C150, Type II or Type V

2. Shall contain not more than 0.60% alkalis calculated as the percentage of sodium oxide plus 0.658 times the percentage of potassium oxide.

B. Sand:

1. ASTM C33

2. Fineness modulus: Lining 2.50 – 3.00

3. Sand equivalent

a. California Test 217

b. Average of three successive tests shall be not less than 75 and no individual samples shall be less than 70.

C. Sacked mortar mix may be used for small repairs and to complete mortar lining at field joints.

1. Mortar mix shall be a high cement content, high-strength repair mortar with NSF-61 certification.

2. Mix and use according to manufacturer's directions. Added water content shall not exceed manufacturer's direction.

3. Acceptable products: Aquafin Mortar LN, or equal as approved by the Engineer.

2.5 FIELD COATINGS

A. Spirally wrapped pipe tape:

1. Tape shall conform to AWWA C209, Type II.

2. For Applicant supplied pipe, tape coatings shall be products of the manufacturer of the shop applied tape coating and shall be recommended by the manufacturer for use as a field applied tape.

3. The tape shall be resistant to ultraviolet light degradation.

4. Acceptable products:

   a. Polyken 930 tape and Polyken 1027 primer

   b. Tek-Rap 270 Series and Tek-Rap 200 Series primer

   c. Tapecoat H35 and TC Omniprime

   d. Wrap-tite WT 330-35 tape and WT27EF primer available from Protection Engineering, Pittsburg, CA (925) 427-6200

   e. Or equal as approved by the Engineer

5. Minimum tape thickness: 35 mils

6. Tape width: As recommended by the tape manufacturer for the pipe diameter but not less than 2" and no more than 4" wide

B. Mastic: See Section 33 10 01P

C. Polywrap: See Section 33 11 13.10P

2.6 CASING INSULATORS

A. Acceptable products:

1. Available from Calpico, Inc., South San Francisco, (650) 588-2241. See drawings for specific model number

2. Or equal as approved by the Engineer

2.7 CASING END SEALS

A. Acceptable products:

1. TDW Z-Seal, available from T. D. Williamson Inc., Concord, CA, (510) 687-2484.

2. Calpico Model C, available from Calpico, Inc., South San Francisco, (650) 588-2241.

3. Or equal as approved by the Engineer.

PART 3 - EXECUTION

3.1 PLACING PIPE IN TRENCHES

A. Maximum length of pipe placed in the trench shall be limited to a single length of shop-fabricated pipe. Do not use steel cables or chains. Double position straps are required for proper support and protection of pipe.

B. Do not install water mains in the same trench with other utilities without approval of the Engineer.

C. Pipe interior shall be clean and free of dirt and debris, and shall be maintained in the same manner during and after installation.

D. Install pipeline with a minimum cover of 36" below finished grade. Pipelines 16" and greater shall have a minimum cover of 42" below finished grade. Maximum cover shall be 48" or as directed by the Engineer.

E. Allow inspection by Engineer of the underside of the pipe, prior to lowering pipe into trench. Repair any defects.

F. Pipe shall have uniform bearing on compacted Class I backfill except at bell holes for field joints and at locations where excavation below grade for the pipe has been performed to provide for required structures. Laying of pipe is permitted on specially prepared mounds equally spaced to allow testing and repair of coating. Remove all blocking from under pipe prior to commencement of backfilling.

G. Straight sections of pipe shall be cut:

1. To provide closure pieces of correct length

2. To permit the proper location of the pipe sections

3. To locate valve, fittings, and appurtenant structures

H. At the end of each working day when pipe laying operations are not in progress, watertight plugs shall be installed for closure of open ends of pipeline, and covered with backfill material.

3.2 OBSTACLES IN THE WAY

A. Alignment and Elevation:

1. The clearance from existing utilities (pipelines, conduits, cables, and structures) shall be a minimum of 12" vertical and 5' horizontal, unless approved otherwise by the Engineer.

2. When 12" vertical clearance cannot be obtained, install shield between steel pipeline and existing metallic utility. See Drawing 308-EA.

B. Locating Utilities:

1. See Section 31 23 33P

C. Changes in Alignment and Elevation:

1. Engineer may make adjustments as required during the progress of the work.

2. Contractor shall perform additional fabrication and installation work as required per Drawing 1870-A. If pipeline cover at utility crossings is less than 30", a 6" concrete cap is required. Install per Drawing 2003-A unless directed otherwise by the Engineer.

3.3 FIELD CUTS

A. Before cutting pipe remove lining and coating back from the line of cut as shown on pipe detail drawings.

1. Use care to avoid injury to the lining and coating beyond the area removed.

2. Remove and replace loosened, damaged, or broken lining or coating.

3.4 FIELD JOINTS

A. See Drawing 310-EA.

B. Longitudinal or spiral seams of the two adjoining pipes shall be offset by minimum of 2".

C. Girth Joints:

1. Remove temporary protective coating from hold-back at pipe ends. Surfaces to be joined shall be thoroughly cleaned prior to assembling the joint.

2. The clearance between outside of the spigot and inside of the bell or clearance between butt strap and pipe shall not exceed 1/16" at any location during welding operations.

3. Fit butt straps tightly against the pipe and cut to proper length. Bevel ends if thickness is greater than 1/4".

D. Coat after welding and Engineer approval of weld. Forced cooling of welds is not permitted.

E. Flanged Joints:

1. Gasket and bolting criteria: See Drawings 323-EA, 324-EA, and 325-EA.

2. Use an approved thread lubricant on all flange bolt threads.

3. Bolt up torque requirements per Standard drawing 323-EA, 324-EA, and 325-EA.

F. Insulating Joints:

1. See Drawings 3186-B and 3446-GB.

2. Prior to backfill, verify that insulating joint is functioning properly using one of the following insulation testers:

a. MC Miller (Gas Electronics) Model 601 Insulation Checker

b. MC Miller Insulation Checker (M.I.C.) Model 1200

c. Tinker & Rasor Model RF-IT

d. Or District approved equal

3. Testing must be performed in the presence of the Engineer. Make repairs and re-test the insulating joint as necessary until verification of its proper functioning is made.

3.5 PIPE INSTALLATION IN CASING

A. The pipe shall be electrically isolated from the tunnel casing.

1. Install casing insulators on the pipeline, two feet inside each end of casing, and at 10 feet on center (maximum) for the length of casing.

B. Pipe casing shall be welded together in accordance with requirements indicated on the drawings.

C. Casing end seals shall be installed as recommended by the manufacturer of the end seals.

3.6 CONNECTIONS (NOZZLES)

A. See Drawing 238-EA.

B. Coat after welding and Engineer approval of weld.

3.7 BLOWOFFS

A. Install size on size main-line valve with 4" blowoff in accordance with Drawing 332-EA at locations shown on the drawings or as specified by the Engineer.

B. Install 4" blowoff assembly in accordance with Drawing 169-EA at locations shown on the drawings or as specified by the Engineer.

C. Install 6" blowoff and pumping tee in accordance with Drawing 199-EA at locations shown on the drawings or as specified by the Engineer.

3.8 AIR VALVES

A. Install 1" and 2" air and vacuum and air release valves in accordance with Drawing 189.1-B or 189.2-B at the locations shown on the drawings or as specified by the Engineer.

3.9 MORTAR LINING REPAIRS

A. Cement Mortar: Mix proportions shall be approximately one part cement to three parts sand by weight.

B. Where the mortar lining is not flush with the end of the pipe, lining shall be completed to the end of each pipe and allowed to set before making up the joints at butt-welded joints, and at the spigot of bell and spigot joints.

C. Thoroughly clean steel plate.

D. Bond existing mortar to new mortar with an epoxy or adhesive bonding agent.

E. Mortar shall be applied:

1. With plaster's finishing trowel

2. To same thickness as adjacent lining

3. Obtaining a firm bond

F. The lining at repaired areas:

1. Shall be as smooth in texture as the general pipe lining

2. Shall be completely free of checks and cracks

3.10 FIELD COATING

A. General:

1. Conform to the requirements of AWWA C209 unless specified otherwise.

2. Completed pipeline shall have a continuous insulating coating free of holidays and other defects.

3. Coat field girth joints, valves, fittings and branches.

4. Repair damaged original pipe coating.

5. Workers walking on the pipe shall not wear shoes that will damage the coating.

B. Preparation for Field Coating:

1. After completion of inspection of field welding:

a. Grind off all sharp projections and grind round all edges.

b. Wire brush to remove dirt, rust, and scale.

c. Degrease bare steel surfaces and 4" of adjacent coating using solvent and clean rags.

C. Field Coating Girth Joints, Elbows and Tees and Pipeline Appurtenances

1. Spirally wrapped pipe tape:

a. Prime in accordance with tape manufacturer's recommendations. Prior to primer application, ensure all welds are cool to the touch.

b. Spiral wrap tape onto pipe, lapping as required to provide the specified minimum applied thickness. Apply tape with sufficient tension to conform to surface irregularities and in accordance with manufacturer's instructions.

c. Minimum applied thickness: 50 mils for 16" and smaller pipe; 80 mils for 20" pipe.

2. Overlap adjacent existing plastic coating 3" minimum.

D. Field coating of valves and fittings that are not epoxy-coated:

1. Valves and fittings, including bolted flanges, flexible couplings, and nozzles, shall be mastic coated and polywrapped.

a. Coat with mastic.

b. Cover with polywrap, overlapping adjacent pipe coating one foot minimum, and tape wrap ends of polywrap to pipe.

E. Inspection of Field Coatings:

1. Visually inspect shop applied coatings and repair defects.

2. Visually inspect coatings on valves and fittings.

3. Inspect all completed coatings for holidays just prior to lowering pipe into trench. Use high-voltage flaw detector.

4. Test pipe coatings and field girth joint coatings with Contractor-furnished high-voltage flaw detector (Tinker Razor, Model A.P.W. or A.P., or equal as approved by the Engineer) in accordance with National Association of Corrosion Engineers International Standard Practice RP-02.74, "High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation". Test in presence of Engineer. High-voltage flaw detectors: Available from Tinkor & Razor Co. San Gabriel, CA (626) 287-5259 or Farwest Corrosion Control Bakersfield, CA (661) 323-2077.

    a. For 50 mil plastic coating, test voltage shall be 8,000-9,000 volts.

    b. For 80 mil plastic coating, test voltage shall be 10,000-11,000 volts.

F. Repair of Coatings:

1. Pipe shop coatings and field girth joint coatings:

    a. Minor damaged areas: Remove loose and torn coating before patching. Apply tape patch, with primer, to damaged area, and follow with one complete wrapping of tape around pipe.

    b. Extensively damaged areas may require complete removal of damaged coating and repair by girth joint wrapping in accordance with Paragraphs B and C above, at the option of the Engineer.

2. Coatings on valves and fittings:

    a. Touch up minor damaged areas with mastic. Allow mastic to dry or protect with polywrap prior to backfill.

    b. Extensively damaged areas may require complete recoating of the part in the shop at the option of the Engineer.

3.11 GALVANIC ANODES AND TEST STATIONS

A. Install galvanic anode with test station in accordance with Drawing 286-EA Figure A at locations shown on the drawings.

B. Install galvanic anode without test station in accordance with Drawing 286-EA Figure B when specified on the drawings.

C. Install test station without galvanic anode in accordance with Drawing 285-EA at locations shown on the drawings.

3.12 IDENTIFICATION TAPE

A. Non-detectable 3" blue tape, black-imprinted with “CAUTION - BURIED LINE BELOW” shall be installed as follows:

1. Install tape approximately, but not less than, 1 foot above and along the centerline of the installed pipe.

2. If the tape is not continuous, the tape ends shall be overlapped by 2 feet.

END OF SECTION

SECTION 33 11 13.07P
(Formerly SECTION 02513.1)

INSTALLATION OF ML&CS PIPE - 20" AND SMALLER

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Installation of cement mortar lined and coated steel (ML&CS) Pipe, 20 inches nominal diameter and smaller.

B. Related sections:

1. Section 03 30 76P – Concrete for Pipeline Installation
2. Section 05 05 24P – Pipe Welding
3. Section 05 05 26P – Flange Bolting
4. Section 33 11 13.10P – Polywrap
5. Section 33 11 13.21P – General Pipeline Installation Requirements
6. Section 31 23 33P – Trenching and Backfilling

1.2 REFERENCES

A. ASTM C33 – Specification for Concrete Aggregates

B. ASTM C150 – Specification for Portland Cement

C. ASTM A185 – Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handling and Transporting of pipe sections:

1. Lining or coating shall not be damaged.
2. Block pipe to prevent shifting.
3. Use padded blocking, cables, and chains for securing the load.

B. Storage at jobsite prior to laying:

1. Store pipe in a manner safe to the public and in accordance with the local agency permit.

2. Keep interior of all pipe, fittings, and appurtenances free of dirt and other foreign matter. Maintain pipe end covers until installation in the trench.

3. Store pipe in a manner such that neither the coating or lining will be damaged.

4. Use specially prepared ground, padded skids, cradles, or sand bags to support pipe.

PART 2 - PRODUCTS

2.1 STEEL PIPE CASING

A. The casing shall be new plain straight cylinder steel pipe with outside diameter and wall thickness not less than shown on the drawings. Spiral welded seams are not permitted.

1. Each end shall be beveled to 35° ± 2° and leaving a root face of 1/8" ± 1/32" for butt welding. All butt welds shall be complete joint penetration.

2. The butt welds in the casing pipe and field joints will be subject to ultra sonic inspection in accordance with ASME Volume VIII Appendix 12.

B. The casing pipe shall be ASTM A53 grade B Steel Pipe, Black or Hot-Dipped Zinc-Coated, Welded or Seamless; A134 Steel Pipe, Electric-Fusion (ARC)-Welded (Sizes NPS 16 and Over); A139 grade B or C, Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4 and Over); API 5L grade B, Line Pipe; ASTM A671 class 10, grade 60, 65 or 70.

2.2 FIELD INSTALLED MORTAR

A. Portland cement:

1. ASTM C150, Type II, Low Alkali,

B. Shall contain not more than 0.60 percent alkalis calculated as the percentage of sodium oxide plus 0.658 times the percentage of potassium oxide

C. Sand:

1. ASTM C33

2. Fineness modulus:

a. Coating: 2.70 – 3.20

b. Lining: 2.50 – 3.00

3. Sand equivalent:

a. California Test 217

b. Average of three successive tests shall be not less than 75 and no individual samples shall be less than 70.

D. Sacked mortar mix may be used for small repairs and to complete mortar lining at field joints.

a. Mortar mix shall be a high cement content, high-strength repair mortar with NSF-61 certification.

b. Mix and use according to manufacturer's directions. Added water content shall not exceed manufacturer's direction.

c. Acceptable products: Aquafin Mortar LN, or equal as approved by the Engineer.

2.3 REINFORCEMENT FOR CEMENT MORTAR

A. Welded wire fabric, ASTM A1064, 2" x 4", WO.5 x WO.5, galvanized

1. Self-furring for coating

2. Flat for lining

2.4 CASING INSULATORS

A. Acceptable products:

1. Available from Calpico, Inc., South San Francisco, (650) 588-2241. See drawings for specific model no.

2. Or equal as approved by the Engineer

2.5 CASING END SEALS

A. Acceptable products:

1. TDW Z-Seal, available from T. D. Williamson Inc., Concord, CA, (510) 687-2484

2. Calpico Model C, available from Calpico, Inc., South San Francisco, (650) 588-2241

3. Or equal as approved by the Engineer

PART 3 - EXECUTION

3.1 PLACING PIPE IN TRENCHES

A. Maximum length of pipe placed in the trench shall be limited to a single length of shop-fabricated pipe. Do not use steel cables or chains. Double position straps are required for proper support and protection of pipe.

B. Do not install water mains in the same trench with other utilities without approval of the Engineer.

C. Pipe interior shall be clean and free of dirt and debris, and shall be maintained in the same manner during and after installation.

D. Install pipeline with a minimum cover of 36″ below finished grade. Pipelines 16″ and greater shall have a minimum cover of 42″ below finished grade. Maximum cover shall be 48″ or as directed by the Engineer.

E. Allow inspection by Engineer of the underside of the pipe before lowering pipe into trench. Repair any defects.

F. Pipe shall have uniform bearing on compacted Class I backfill except at bell holes for field joints and at locations where excavation below grade for the pipe has been performed to provide for required structures. Laying of pipe is permitted on specially prepared mounds equally spaced to allow testing and repair of coating. Remove all blocking from under pipe prior to commencement of backfilling.

G. Straight sections of pipe shall be cut:

1. To provide closure pieces of correct length

2. To permit the proper location of the pipe sections

3. To locate valves, fittings, and appurtenant structures

H. At the end of each working day when pipe laying operations are not in progress, watertight plugs shall be installed for closure of open ends of pipeline, and covered with backfill material.

3.2 OBSTACLES IN THE WAY

A. Alignment and elevation:

1. The clearance from existing utilities (pipelines, conduits, cables, and structures) shall be a minimum of 12 inches vertical and 5´horizontal, unless approved otherwise by the Engineer.

2. When 12-inch vertical clearance cannot be obtained, install shield between steel pipeline and existing metallic utility. See Drawing 308-EA.

B. Locating utilities:

1. See Section 31 23 33P.

C. Changes in alignment and elevation:

1. Engineer may make adjustments as required during the progress of the work.

2. Contractor shall perform additional fabrication and installation work as required per Drawing 1996-A. If pipeline cover at utility crossings is less then 30″, a 6″ concrete cap is required. Install per Drawing 2003-A unless directed otherwise by the Engineer.

3.3 FIELD CUTS

A. Before cutting pipe, remove lining and coating back from the line of cut as shown on pipe detail drawings.

1. Use care to avoid injury to the lining and coating beyond the area removed.

2. Remove and replace loosened, damaged, or broken lining or coating.

3.4 FIELD JOINTS

A. See Drawing 237-EA.

B. Longitudinal or spiral seams of the two adjoining pipes shall be offset 2" minimum.

C. Girth joints:

1. Surfaces to be joined shall be thoroughly cleaned prior to assembling the joint.

2. Clearance between outside of the spigot and inside of the bell or clearance between butt strap and pipe shall not exceed 1/16-inch at any location during welding operations.

3. Fit butt straps tightly against the pipe and cut to proper length. Bevel ends if thickness is greater than 1/4".

D. Coat after welding and Engineer approval of weld. Forced cooling of welds is not permitted.

E. Flanged joints:

1. Gasket and bolting criteria: See Drawings 323-EA, 324-EA, and 325-EA.

2. Use an approved thread lubricant on all flange bolt threads.

3. Bolt up torque requirements per Standard drawing 323-EA, 324-EA, and 325-EA.

F. Insulating joints:

1. See Drawings 3186-B and 3446-GB.

2. Prior to backfill, verify that insulating joint is functioning properly using one of the following insulation testers:

a. MC Miller (Gas Electronics) Model 601 Insulation Checker

b. MC Miller Insulation Checker (M.I.C.) Model 1200

c. Tinker & Rasor Model RF-IT

d. Or District approved equal

3. Testing must be performed in the presence of the Engineer. Make repairs and re-test the insulating joint as necessary until verification of its proper functioning is made.

3.5 PIPE INSTALLATION IN CASING

A. The pipe shall be electrically isolated from the tunnel casing.

1. Install casing insulators on the pipeline, two feet inside each end of casing, and at 10 feet on center (maximum) for the length of casing.

B. Pipe casing shall be welded together in accordance with requirements indicated on the drawings.

C. Casing end seals shall be installed as recommended by the manufacturer of the end seals.

3.6 CONNECTIONS (NOZZLES)

A. See Drawing 238-EA.

B. Coat after welding and Engineer inspection of weld.

3.7 BLOWOFFS

A. Install size on size main-line valve with 4" blowoff in accordance with Drawing 332-EA at locations shown on the drawings or as specified by the Engineer.

B. Install 4" blowoff assembly in accordance with Drawing 169-EA at locations shown on the drawings or as specified by the Engineer.

C. Install 6" blowoff and pumping tee in accordance with Drawing 199-EA at locations shown on the drawings or as specified by the Engineer.

3.8 AIR VALVES

A. Install 1" and 2" air and vacuum and air release valves per Drawing 189.1-B or 189.2-B, at the locations indicated on the drawings or as specified by the Engineer.

B. Install 4" air and vacuum and air release valve per Drawing 333-EA at the locations indicated on the drawings or as specified by the Engineer.

3.9 MORTAR LINING REPAIRS

A. Cement Mortar: Mix proportions shall be approximately one part cement to three parts sand by weight or an Engineer-approved pre-mixed cement mortar.

B. Where the mortar lining is not flush with the end of the pipe, lining shall be completed to the end of each pipe and allowed to set before making up the joints at butt-welded joints, and at the spigot of bell and spigot joints.

C. Thoroughly clean steel plate.

D. Bond existing mortar to new mortar with an epoxy or adhesive bonding agent.

E. Mortar shall be applied:

1. With plasterer's finishing trowel

2. To same thickness as adjacent lining

3. Obtaining a firm bond

F. The lining at repaired areas:

1. Shall be as smooth in texture as the general pipe lining

2. Shall be completely free of checks and cracks

3.10 FIELD MORTAR COATING

A. General:

1. Completed pipeline shall have a sound, continuous, and unbroken coating of reinforced cement mortar.

2. All field girth joints and fittings shall be coated.

3. Damaged original coating shall be repaired.

B. Field girth joints:

1. After completion and inspection of welding by Engineer, coat as shown on the drawings.

2. Clean to assure adhesion of mortar.

3. Do not apply mortar against hot welds.

4. Field applied mortar coating shall be reinforced with self-furring welded wire fabric tack welded to the steel cylinder.

5. Mortar applied with diapers:

    a. Use diaper wherever possible.

    b. Diaper shall be wide enough to span the joint plus 2 inches minimum on each side and long enough to overlap 8 inches minimum on top.

    c. Cut flaps through the layers of overlapped diaper liner to form a grouting gate.

    d. Fill diapers from one side only.

    e. Use flexible wire to remove air pockets.

    f. Hand plaster top of joint.

    g. Leave diapers in place.

6. Apply mortar by hand where diaper not used.

    a. Use strong pressure to provide a dense coating of the thickness shown on the drawings.

    b. Apply an epoxy or adhesive bonding agent to bond new mortar with existing mortar.

C. Fittings and damaged areas:

1. Coat by hand plastering.

2. Bond old mortar with new mortar with an epoxy or adhesive bonding agent.

3. Use strong pressure to provide a dense mortar coating the same thickness as the original pipe coating.

D. Curing:

1. Use curing compound or water cure. Use curing compound in accordance with the manufacturer's written instructions.

2. Keep continually moist with water for seven days or until backfill is placed.

E. Apply polywrap over mortar coated pipe, valves, and appurtenances. See Section 33 11 13.10P.

3.11 GALVANIC ANODES AND TEST STATIONS

A. Install galvanic anode with test station in accordance with Drawing 286-EA, Figure A at locations shown on the drawings.

B. Install galvanic anode without test station in accordance with Drawing 286-EA, Figure B when specified on the drawings.

C. Install test station without galvanic anode in accordance with Drawing 285-EA at locations shown on the drawings.

3.12 IDENTIFICATION TAPE

A. Non-detectable 3-inch blue tape, black imprinted with “CAUTION - BURIED LINE BELOW” shall be installed as follows:

1. Install tape approximately, but not less than, 1 foot above and along the centerline of the installed pipe.

2. If the tape is not continuous, the tape ends shall be overlapped by 2 feet.

END OF SECTION

SECTION 33 11 13.10P
(Formerly SECTION 06066.1)

POLYWRAP

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install corrosion protective wrapping for ductile iron pipe, fittings, and valves, and mortar coated steel pipe, specials, fittings, and valves.

B. Related sections:

1. Section 33 05 19.05P – Fabrication of Ductile Iron Pipe and Fittings
2. Section 33 05 19.07P – Installation of Ductile Iron Pipe and Fittings
3. Section 33 11 13.06P – Installation of ML&PCS Pipe
4. Section 33 11 13.07P – Installation of ML&CS Pipe

1.2 REFERENCES

A. American Water Works Association:

1. ANSI/AWWA C105/A21.5 – Polyethylene Encasement for Ductile Iron Pipe Systems

1.3 DELIVERY AND STORAGE

A. Store polyethylene encasement (polywrap) indoors in the original packaging.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General purpose polyvinyl chloride (PVC) adhesive tape:

1. Two inches wide by 10 mils thick minimum to 20 mils thick maximum.
2. Scotchrap No. 50, Polyken No. 900, Denso Utility Tape, Calpico Pipe Wrapping Tape, Shurtape PW100, or equal.

B. Polywrap:

1. Material:

a. For ML&CS Pipe: Co-extruded linear low-density polyethylene (LLDPE), black, fused into a single thickness no less than 8 mils.

b. For Ductile Iron Pipe: Co-extruded linear low-density polyethylene (LLDPE), fused into a single thickness no less than 8 mils. The inside surface of the polyethylene film to be in contact with the pipe exterior shall be infused with a blend of anti-microbial components to mitigate microbiologically influenced corrosion and volatile corrosion inhibitor to control galvanic corrosion.

2. Acceptable Manufacturers:

a. For Ductile Iron Pipe: V-Bio® enhanced polywrap licensed by Ductile Iron Pipe Research Association (DIPRA)

3. Minimum polywrap tube size shall be:

Nominal Pipe Diameter (Inches)	V-Bio Flat Tube Width (Inches)	ML&CS Pipe Tube Width (Inches)
4	20	14
6	20	17
8	20	21
12	27	29
16	34	37
20	41	41

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation on pipe (Modified Method A from ANSI/AWWA C105/A21.5, see Std Dwg 4569-B):

1. Polywrap should be installed before the pipe is lowered into the trench, whenever possible.

2. Cut polywrap tube to a length approximately 2 feet longer than the length of the pipe section. Remove dirt, mud, or other materials that may have accumulated on the pipe during transportation or storage.

3. Slip polywrap around the pipe, starting at the spigot end and bunching in accordion fashion. The film shall be folded over and taped to the spigot end of the pipe near the insertion line. After assembly of the joint, the tape should be as close to the face of the bell as possible but not so close to the spigot end that it interferes with the gasket of gasketed pipe.

4. Pull the polywrap tube along the barrel of the pipe, making a snug fit and neatly folding over any excess polywrap. Apply pieces of tape every two feet across the fold to hold it securely, ensuring the polywrap remains snug and no material sags at the bottom.

5. When lifting polywrapped pipe, use a fabric-type sling to protect the polywrap from damage during handling.

6. After completing installation of pipe joint, pull bunched-up polywrap from the bell end of the preceding length of pipe, slip over the spigot end of new length of pipe, with at least 1 foot of overlapping polywrap, and secure in place at the overlap and behind the preceding bell with circumferential wraps of tape plus enough overlap to assure adhesion.

7. Repair any rips, punctures, or other damage to the polywrap with PVC adhesive tape a minimum of 6-inches to either side of rip or puncture, or with short length of polywrap tube cut open, wrapped around the pipe and secured with tape with a minimum 6-inch overlap on both sides of the rip or puncture.

8. Proceed with installation of next section of pipe in the same manner.

B. Bends, reducers and offsets: Cover with polywrap in the same manner as the pipe.

C. Valves, fittings, and odd shaped pieces:

1. Wrap with a flat sheet obtained by splitting open a length of polywrap tube.

a. Polywrap shall extend beyond fittings by 8" on each side and shall be secured by tape.

b. Pass the sheet under the fitting and bring the edges up around the fitting (or to the stem on a valve).

c. Polywrap shall overlap 6" when split is required, seal split with tape.

d. Fold over and tape slack and overlap at joints to ensure a snug fit.

e. Tape polywrap securely in place at valve stem and other penetrations allowing for free movement of valve stem.

D. Openings for appurtenances:

1. Service saddles

a. Wrap two or three layers of PVC adhesive tape completely around the polywrapped pipe to provide a protective surface where the tapping machine will be mounted.

b. Cut a hole in the PVC adhesive tape large enough for the gasket to seat flush against the pipe, then mount the tapping machine and make the tap.

c. After completing the tap, encase the pipe, service saddle, and 3 feet of the copper service lateral in polywrap.

d. Secure the end with circumferential turns of PVC adhesive tape.

2. Direct taps

a. Wrap two or three layers of PVC adhesive tape completely around the polywrapped pipe to provide a protective surface where the tapping machine will be mounted.

b. Mount the tapping machine on the pipe area covered by the PVC adhesive tape and make the tap by installing the corporation stop directly through the tape and polywrap.

c. After installation of the appurtenance inspect the entire circumferential area for damage and make any necessary repairs.

3. Branches, service taps, blowoffs, air valves, etc. of dissimilar metals shall be wrapped with polywrap or PVC adhesive tape for a minimum distance of three feet from the pipe.

a. Secure the end with circumferential turns of PVC adhesive tape.

E. Junctions between wrapped and unwrapped pipe:

1. Where polywrapped pipe joins a pipe which is not wrapped, extend the polywrap tube to cover the unwrapped pipe a distance of two feet, unless otherwise shown on the drawings.

2. Secure the end with circumferential turns of PVC adhesive tape.

F. Replacing polywrap at pipe repairs

1. Where polywrap must be removed or damaged for maintenance, install new polywrap following the instructions above either for Pipe or for Fittings, as appropriate.

G. Backfill:

1. Material and compaction shall be the same as specified for pipe without polywrap.

2. Exercise care to prevent any damage to the polywrap.

END OF SECTION

SECTION 33 11 13.21P
(Formerly SECTION 02511.1)

GENERAL PIPELINE INSTALLATION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Miscellaneous work required for the installation of water mains and appurtenances:

1. Installation of Valves
2. Obstacles in the Way
3. Installation of Fire Hydrants
4. Installation of Blowoffs
5. Installation of Air Valves
6. Installation of Thrust Blocks
7. Installation of Tracer Wire
8. Installation of Identification Tape
9. Installation of Location Markers
10. Installation of Valve Pots
11. Installation of Cathodic Protection
12. Connections to Existing Pipelines
13. Hydrostatic Pressure and Leakage Test
14. Flushing and Chlorinating
15. Salvage or Abandonment of Existing Facilities

B. Related Sections:

1. Section 31 23 33P – Trenching and Backfilling
2. Section 33 11 13.06P – Installation of ML&PCS Pipe – 20" and Smaller
3. Section 33 11 13.07P – Installation of ML&CS Pipe – 20" and Smaller

4. Section 33 11 13.10P – Polywrap

5. Section 33 11 22P – Installation of Polyvinyl Chloride Pipe and Fittings, Cast Iron Fittings, and Ductile Iron Fittings

6. Section 33 11 13.47P – Installation of HDPE Pipe

7. Section 33 05 19.07P – Installation of Ductile Iron Pipe and Fittings

C. Furnished by the District:

1. Materials: See Section 01 64 05P.

2. Water: See Section 01 00 00.01P.

1.2 REFERENCES

A. Standard Methods – AWWA Standard Methods for the Examination of Water and Wastewater

B. Latest AWWA Standard C651 for Disinfecting Water Mains

C. NSF/ANSI Standard 60 Drinking Water Treatment Chemicals – Health Effects

1.3 SUBMITTALS

A. Contractor shall submit a detailed discharged water control and disposal plan for the District's record prior to any work at the jobsite. Plan shall comply with all requirements of the specification and with regulations of the California Regional Water Quality Control Board, San Francisco Bay Region, California Department of Fish and Game, County Flood Control Districts, and any other regulatory agency having jurisdiction, whichever is most stringent.

B. Contractor shall submit a chlorination and flushing plan for approval prior to release of District-furnished material. All phases of filling, flushing, chlorinating, and dechlorinating shall be monitored for chlorine intrusion into the existing piping system. The plan shall address, as a minimum, the key elements listed in checklist provided in Appendix A.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 INSTALLATION OF VALVES

A. Install valves at locations shown on the drawings. See Drawing 1241-A for valve operating shaft installation details.

1. Install butterfly valve operating shaft extension with shearpin on all butterfly valves. Top of operating nut shall be between 12 to 24 inches of finished grade.

2. Install gate valve operating shaft extension on gate valves if the valve operating nut is more than 36 inches below ground level. Top of shaft extension operating nut shall be between 12 to 24 inches of finished grade.

3. For installation of mechanical or restrained push-on valves, trim the pipe/bevel if necessary to ensure gasket is in contact with the full pipe barrel, and not in contact with the bevel.

3.2 OBSTACLES IN THE WAY

A. Alignment and Elevation

1. The clearance from existing utilities (pipelines, conduits, cables, and structures) shall be a minimum of 12 inches vertical and 5 feet horizontal, unless approved otherwise by the Engineer.

2. When 12 inches vertical clearance cannot be obtained between District metallic pipe and other metallic utility, install shield between the pipes per Drawing 308-EA.

B. Locating Utilities

1. Locate utilities per Section 31 23 33P – Trenching and Backfilling.

C. Changes in Alignment and Elevation

1. Engineer may make adjustments as required during the progress of the work.

2. Contractor shall perform additional fabrication and installation work per Drawings 1870-A, 1996-A, and 2010-A as required. If pipeline cover at utility crossings is less than 30 inches, a 6 inch concrete cap per Drawing 2003-A is required. Install per District standard unless directed otherwise by the Engineer.

3.3 INSTALLATION OF FIRE HYDRANTS

A. Install hydrant assembly per Drawings 9496-GB and 9496-GB-1 at locations indicated on the drawings. Applicant is responsible to verify that all fire hydrant locations are in compliance with District and Fire District Standards.

B. Install hydrant with proper setback clearances from face of curb and edge of sidewalk. Maintain minimum 5 feet clearance from fences, walls, structures, and edges of driveways.

C. For steel hydrant ell, if riser flange is above top of curb height or visible, raise hydrant by cutting riser and welding on an appropriate pipe section to conform to final grade elevation. Repair mortar as required. Otherwise an approved hydrant extension is acceptable if approved by the Engineer.

D. Wrap fire hydrant outlets with plastic bags after installation. Plastic bags shall remain in place until water quality has been cleared and fire hydrants are placed in service.

3.4 INSTALLATION OF BLOWOFFS

A. Install 4-inch blowoff in accordance with Drawing 169-EA, 332-EA, or 332-EA-1 at locations shown on the drawings or as specified by the Engineer.

B. Install 6-inch blowoff and pumping tee in accordance with Drawing 199-EA at locations shown on the drawings or as specified by the Engineer.

3.5 INSTALLATION OF AIR VALVES

A. Install 1-inch and 2-inch air and vacuum and air release valves per Drawing 189.1-B and 189.2-B, at the locations shown on the drawings or as specified by the Engineer.

B. Install 4-inch air and vacuum and air release valves per Drawing 333-EA at the locations shown on the drawings or as specified by the Engineer.

3.6 INSTALLATION OF THRUST BLOCKS

A. Anchor all unrestrained horizontal and vertical bends greater than 11-1/4°, dead-ends, tees, and crosses with concrete as shown on Drawings 194-EA and 3360-B.

B. Anchor all 90° bends with concrete as shown on Drawing 3360-B.

C. Install collars and rods with concrete anchors on all cast iron plugs and at other locations indicated on the drawings, or at locations deemed necessary by the Engineer.

D. The concrete shall be poured against a satisfactory bearing surface and be of sufficient size to prevent any movement of the pipeline when subjected to the hydrostatic test pressure.

3.7 INSTALLATION OF TRACER WIRE

A. Install AWG No. 12 TW or THHN, solid, insulated tracer wire with all pipe installation methods, including jacking or drilling.

1. Install wire on the trench bottom under the vertical projection of the pipe to protect the wire in all installations. Wire shall not spiral around pipe barrel.

2. Tracer wire shall form a mechanically and electrically continuous line throughout the pipeline, including jacked or drilled portions, and shall then extend to the nearest valve or other pipeline appurtenance designated by the Engineer. At the valve, the wire shall extend up outside the valve pot riser pipe into the concrete valve pot space where there shall be a 12-inch lead for testing purposes. At other designated appurtenances, the wire shall extend up to the box and terminate with a 12-inch pigtail.

3. Wire shall be spliced with a splicing device consisting of an electro-tin plated seamless copper sleeve connector. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician's tape.

4. Demonstrate that the wire installation is electrically continuous by performing a continuity test in the presence of the Engineer.

3.8 INSTALLATION OF IDENTIFICATION TAPE

A. Non-detectable 3 inch blue tape, black-imprinted with "CAUTION - BURIED LINE BELOW" shall be installed as follows:

1. Install tape approximately 1 foot above and along the centerline of the pipe.

2. If the tape is not continuous, the tape ends shall be overlapped by 2 feet.

3.9 INSTALLATION OF LOCATION MARKERS

A. See Drawing 303-EA for pipeline markers.

B. See Drawing 1336-A for valve, blowoff, air valve, and test station markers.

C. See Drawing 2002-A for curb field markings.

3.10 INSTALLATION OF VALVE POTS

A. Install valve pots at locations shown on the project drawings. See Standard Drawing 321-EA for installation details. See Article 3.1A for installation of valve operating shaft extension.

B. Valve Pot Cover Color Code: Red = Zone Valves (always closed)
White = Hydrant Valves
Blue = Distribution Line Valves
Purple = Recycled Water

3.11 INSTALLATION OF CATHODIC PROTECTION

A. Install cathodic protection as shown and specified.

B. Steel pipe with an insulating coating shall meet the cathodic protection criteria of NACE RP0169-92, Paragraph 6.2.2.1.1.

C. District will test for compliance with specified corrosion control requirements after main has been placed in service.

D. In the event of noncompliance, repair as directed by the Engineer until compliance is obtained.

3.12 CONNECTIONS TO EXISTING PIPELINES

A. General:

1. Connections to the existing mains are shown on the drawings. When a wet tap is designated or when it is determined by the Engineer that a wet tap is required, the District will install the gate valve and split tee or nozzle, and will make the tap. The Contractor shall perform all other work necessary to complete the connection including, but not necessarily limited to, traffic control, excavation, shoring, preparation of the existing pipe for wet tap, connection of the new main to the gate valve, repair of coating to the existing main, application of coating to new installation, adequate blocking where required and concrete anchors where applicable, backfill, compaction, and pavement replacement.

2. Connections to the existing mains prior to hydrostatic pressure testing and chlorination are permitted if subsequent pressure tests are performed against closed, resilient-seated gate valves. If the gate valves are found to be leaking or not of resilient seat, the new pipeline shall be physically isolated and shall have passed the pressure test and chlorination before connection is made to the existing main. Only one connection to the source main is permitted until the pipeline has successfully passed the water quality testing.

3. Applicant only: The existing main may not be located as shown on the contract drawings. The Applicant shall pothole the point of connection to determine the exact location of the main prior to the start of work. The District is not responsible for additional costs incurred arising from the existing main being located differently from that shown on the contract drawings.

4. Applicant only: All costs of making connections to existing mains shall be borne by the Applicant, regardless of the day or time at which the connection work is performed. Pressure testing against closed, resilient-seated gate valves shall be done at Applicant's risk. The District assumes no liability for Applicant's additional costs resulting from District-furnished valves which are found to be leaking during pressure testing.

5. Applicant Only: Give a minimum 5 work days written notification to the Engineer to schedule any flushing and connection operations to be performed.

B. Shutdowns of Existing In-Service Pipelines and Other Distribution Facilities:

1. District personnel will operate all valves in the service system for shutdown.

2. Shutdowns shall be scheduled, for as short a period as possible, during a regular working day unless ordered otherwise by the Engineer.

3. Shutdowns shall cause minimum interference with the operation of the District's distribution system.

4. Connection work shall be completed without interruption.

5. Schedule of shutdown and connection operations shall be prepared jointly by the Contractor and the Engineer.

6. Applicant only: When shutdowns exceed their scheduled time limits and there is no improvement shown in the progress of the work, the District reserves the right to bring in its own crew to complete the connection and restoration of water service and to backcharge the Applicant for all of the associated costs.

C. Existing Mains that are Provided with Fittings for Connecting to New Main:

1. Flush blowoff on existing main and install sample tap 5 days prior to connection.

2. Remove plug or bulkhead from existing main.

3. Remove dished heads or ring-tight plugs after new main is satisfactorily pressure tested and chlorinated, if applicable.

4. Clean and disinfect the ends. Swab or spray the interior of connection pipe with a 1 percent hypochlorite solution.

5. Make connection.

6. Restore water service to existing main. Flush and sample.

7. Repair protective coating, as necessary.

D. Existing Mains that are not Provided with Fittings for Connecting to New Main:

1. Flush blowoff on existing main and install sample tap 5 days prior to connection.

2. Remove the required amount of existing pipe.

3. Remove dished heads or ring-tight plugs after new main is satisfactorily pressure tested and chlorinated, if applicable.

4. Make connection by means of fittings and pipe.

5. Restore water service to existing main. Flush and sample.

6. Apply necessary protective coating.

E. If new pipeline is isolated for pressure test and chlorination, final connection piping shall be thoroughly disinfected prior to installation per the requirements of AWWA C651. Flush and request sampling by the District. See Article 3.14.C.

F. Collars and rods shall be used on all plugs.

G. Cement Lining: See Section 33 11 13.06P and 33 11 13.07P, Article 3.9.

H. Mortar Coating (ML&CS) Pipe: See Section 33 11 13.07P, Article 3.10.

1. Valves, fittings, branches, and damaged areas:

a. Hand plaster with mortar.

b. Repair original damaged coating.

c. Bond new coating to old with epoxy or adhesive under strong pressure to provide coating of thickness of pipe coating.

d. If the existing pipe is wrapped with polywrap or a similar material, install polywrap in accordance with Section 33 11 13.10P.

3.13 HYDROSTATIC PRESSURE AND LEAKAGE TEST

A. Test Equipment Set-up:

1. Contractor shall furnish hoses, pumps, pressure gauges, leakage measuring device, connections, relief valves, other necessary apparatus, and personnel required for making the tests.

2. The pressure gauge shall register pressure in pounds per square inch gauge (psig). The range of the gauge shall be from 0 psig to ((1.5 x test pressure) + 50.0) psig. The gauge face shall have a 1 psig increment inscribed. The gauge shall be calibrated within 45 days prior to the hydrostatic test and the calibration tag affixed to the gauge.

3. The gauge assembly shall be equipped with a 3/4" hose bib and isolation valve to allow the Engineer to install a second gauge and pressure monitoring device.

4. The Engineer may test pressure gauges for accuracy.

B. General:

1. Applicant only: Give a 5 work day minimum written notification to the Engineer to schedule filling and testing of the pipeline. The Applicant shall not fill the pipeline until the submittals of Article 1.3 have been submitted and reviewed by the Engineer.

2. Hydrostatic pressure and leakage test shall be performed in the presence of the Engineer.

3. Pipeline may be divided into sections and tested in stages as approved by the Engineer.

4. Test shall be scheduled to begin and be completed during weekday (Monday - Friday) work hours.

C. Before Testing:

1. All appurtenances shall be completed and shall be tested concurrently.

2. Interior of the pipeline shall be thoroughly cleaned and flushed with water for 1-2 minutes immediately prior to actual testing.

3. Trench backfill, except permanent pavement, shall be installed, compacted, and tested to the satisfaction of the Engineer.

4. Concrete thrust or reaction blocks shall be cured for at least seven days. The time required may be reduced if additional restraint, approved by the Engineer, is provided.

5. Testing shall not be performed against closed valves except where prior approval has been granted by the Engineer.

D. Filling the Pipeline:

1. All air vents and fire hydrants shall be open during the filling of the pipeline with water.

2. For mortar-lined steel pipe only: After a test section is completely filled, and air vents and fire hydrants closed, the pipeline shall be allowed to stand under pressure for a minimum of 24 hours, to allow the lining to absorb water and permit the escape of air.

3. Examine valves and exposed connections for leaks during this period. Repair all visible or known leaks.

4. The volume of water added to the pipeline to maintain test pressure during the test, if any, shall be measured in the presence of the Engineer.

E. Hydrostatic Pressure and Leakage Test:

1. For physically isolated pipeline only: After filling the pipe, the filling apparatus shall be either disconnected or physically isolated from the pipeline.

2. Except when otherwise specified on the drawings, all points in the pipeline being tested shall be subject to a minimum pressure of:

a. PVC or DI – 150 psi at the lowest pressure point of the main, or 125% of working pressure at the highest pressure point of the main, whichever is greater.

b. Steel or copper – 175 psi at the lowest pressure point of the main, or 125% of working pressure at the highest pressure point of the main, whichever is greater.

c. HDPE – See Section 33 11 13.47P for HDPE pipeline hydrostatic testing requirements.

3. Raise the pipeline pressure to the initial test pressure by means of a pump connected to the pipe in a manner satisfactory to the Engineer.

4. For 16 and 20 inch pipe:

   a. The pipeline pressure shall be maintained within 10 psig of the test pressure for a period of 24 hours. At no time shall the pressure be allowed to drop more than 10 psig below the test pressure. At the end of the test period, the pressure shall be brought back to the test pressure for determining the total leakage or as specified by the Engineer.

5. For pipe less than 16 inch diameter:

   a. Maintain pressure within 10 psig of the initial test pressure specified for 30 minutes. Then reduce pressure to line pressure.

   b. Repeat 3. above.

   c. Maintain test pressure within 10 psig of the initial test pressure specified for two hours minimum. At the end of the test period, bring pressure back to the initial test pressure to determine total leakage.

6. An inspection for leaks along the pipeline shall be made by the Contractor while pipe is under pressure and in the presence of the Engineer.

7. Any leaks found shall be recorded by the Contractor and record provided to the District.

8. Use of sound level meter for detecting leaks in the pipeline and its results will not relieve Contractor of responsibilities for furnishing a pipeline which will pass the leakage test.

9. Measured leakage for the pipe is the total quantity of water required to be pumped into the pipeline to maintain the test pressure specified during the respective 24-hour or 2-hour test and to bring pressure back to the initial test pressure less the measured leakage through the bulkheads and exposed connections.

10. For successful completion of the test, the measured leakage shall not exceed:

    a. 7.5 gallons per inch of inside diameter per mile of pipe per 24 hours for PVC or ductile iron pipe 4" and larger.

    b. 1.5 gallons per inch of inside diameter per mile of pipe per 24 hours for steel pipe and 2" PVC or copper pipe.

F. Repairs and Retests:

1. Repair all known leaks and retest the pipe until the hydrostatic pressure and leakage test is successfully completed.

2. Any damage to the protective lining and coating of the pipe and to the caulking or jointing material after the testing shall be repaired.

3. Repairs shall be made subject to the approval of the Engineer.

4. Excavate where required to locate and repair leaks or other defects that develop under the test.

    a. Remove backfill and paving already placed.

    b. After repairs, backfill and pave in same manner as initial work.

3.14 FLUSHING AND CHLORINATING

A. Flushing and chlorinating shall be conducted only after the successful completion of the hydrostatic pressure and leakage test.

Applicant only:

1. Provide a written minimum 5 working day notification to the Engineer to schedule flushing and chlorinating operations.

    a. Schedule shall allow delivery of samples to the District's Laboratory Services Division in Oakland before 2:00 p.m. Monday through Friday, on day samples are taken.

2. Give 24-hour telephone notification to confirm scheduling of the Engineer to witness all phases of flushing and chlorination and dechlorination procedures.

3. Applicant shall not perform flushing, chlorinating, or dechlorinating without the presence of the Engineer.

4. Applicant shall not chlorinate or sample the new pipeline on weekends, District holidays, or outside the hours of 7:00 am - 4:30 pm. See General Conditions, Article 4.

B. Contractor shall:

1. Make necessary piping connections.

   a. Install District-furnished chlorination taps for injection of chlorine at locations designated by the Engineer.

   b. Install temporary blowoffs at every 1,000 feet of pipeline or at locations designated by the District. Each temporary blowoff shall be equipped with a sample tap. See sample tap installation drawing, Appendix A. Sample taps, once installed, shall remain on the blowoffs until water quality test results are satisfactory to the Engineer.

   c. Temporary blowoffs shall permit adequate flushing of the main. The minimum size of blowoffs and minimum number of outlets shall be:

DIAMETER OF MAIN TO BE FLUSHED	REQUIRED BLOWOFF DIAMETER	NUMBER OF OUTLETS
2"	2"	1
4"	2"	1
6"	4"	1
8"	4"	2
12"	4"	3
16"	6"	4
20"	6"	8

   Use 2-1/2" fire hose and dissipator on each outlet.

   d. Remove temporary chlorinating and flushing assemblies when water quality test results are satisfactory to the Engineer. Removal shall be accomplished in the presence of the Engineer. Return District-furnished chlorination taps to the Engineer.

2. Flush and chlorinate the pipeline in accordance with AWWA C651, AWWA Standard for Disinfecting Water Mains (latest edition).

   a. Use Sodium Hypochlorite per Section 4.1.2 of AWWA C651. Sodium hypochlorite to be used for chlorinating shall be NSF/ANSI 60 certified. Available chlorine shall be 12-1/2% to 13% by volume. Sodium hypochlorite shall be stored out of sunlight.

   b. Use Continuous Feed Method of Section 4.4 of AWWA C651. The main shall be flushed until all of the water in the line has been replaced once and for such additional time as may be required for the blowoff water to flow clean.

   c. Pump shall have a pumping capacity range up to 24 GPH. The use of a high-pressure/high-capacity pump to inject chlorine is prohibited. Pump shall be Chem-O-Feeder Model No. 1210 Simplex or Duplex Series type pump or approved equal.

d. Provide an eyewash station that complies with ANSI Z358.1 (1998) regulations onsite during the chlorination.

3. Connect to water source, convey to piping, and dispose of water during flushing without flooding, inundating or damaging any property, or harming the environment with the chlorinated water.

   a. See Section 4.5 and Appendix C of AWWA C651 for disposal of heavily chlorinated water.

   b. Water to be discharged shall meet the requirements of Section 01 10 00.01P, Article 1.6.B., Discharged Water.

4. Provide English-speaking personnel on the job to work with the Engineer at all times during flushing, chlorinating, dechlorinating, and sampling. There shall be radio communication between injection pump operator and personnel operating blow-offs and valves.

5. Operate valves, under District direction, and provide other necessary assistance to the District. System gate valves shall only be operated by the District.

6. Cover fire hydrant openings with plastic bags to prohibit usage prior to chlorination. Cover shall remain in place until water quality test results are satisfactory to the Engineer.

7. Applicant only: Prior to chlorination set up sample points on the existing source main in accordance with approved chlorination and flushing plan to ensure that the existing system chlorine residual is maintained during the chlorination process. Check chlorine residual in source main continuously during chlorination as directed by the Engineer and again, once all chlorination equipment is disconnected from the chlorination tap to ensure that the source water is left at a safe level.

8. Immediately after chlorination, relieve pressure on the chlorinated main, through proper discharges, to a pressure lower than the pressure of the source water at the source connection by a minimum of 10 psi or as directed by the Engineer.

C. District will:

1. Designate locations for chlorination taps and temporary blowoffs.

2. Take a source sample after proper notification by the Contractor:

   a. Prior to initial chlorination and filling.

   b. Each time the tract is fully sampled.

3. Direct and control the operation of valves at all times.

4. Sample and test the water to determine if it meets the following required water quality standards:

    a. Coliform Bacteria: Absence of coliforms as interpreted by the enzyme substrate assay technique in accordance with Procedure 9223B of Standard Methods for the Examination of Water and Wastewater.

    b. Chlorine Residual: Chlorine residual equivalent to the source water reading or at an acceptable level determined by the District as interpreted by the N,N-Diethyl-p-phenylenediamine (DPD) colorimetric method in accordance with Procedure 4500-Cl G of Standard Methods for the Examination of Water and Wastewater.

5. Notify the Contractor of test results within 3 work days after sampling.

D. Flushing/Chlorinating/Testing Operations:

1. These operations normally take about five working days.

2. If the test results indicate that:

    a. Following chlorination, if chlorine readings indicate that the residual chlorine has not been lowered to a level equivalent to the source water or at a higher level determined to be acceptable by the District, then, the Contractor shall continue flushing to bring the residual chlorine level down to the acceptable level.

    b. Following reflush, if chlorine readings indicate that the residual chlorine is less than a level equivalent to the source water or at a lesser level determined to be acceptable by the District, the Contractor shall flush at a velocity of at least 3 ft/sec until water equal to a minimum of 3 times the volume of the new pipe has been displaced.

    c. If conditions in a and b above are encountered, the collection of bacteriological samples may require rescheduling for a later date.

3. Applicant only: All costs for resampling and retesting shall be borne by the Applicant unless it is determined by the Engineer that the need for resampling and retesting is not the fault of the Applicant.

3.15 SALVAGE OR ABANDONMENT OF EXISTING FACILITIES

A. Abandon existing facilities as indicated on the drawings (usually RFS - remove from service drawings).

B. Pipelines:

1. Diameters 12" and under:

a. Remove and dispose of water from the pipeline to be abandoned.

b. Abandon existing facilities as indicated on the Remove from Service (RFS) drawings.

c. Fill abandoned pipe ends with minimum 12" of concrete from end.

d. Plug, rod, and collar every known opening on the pipeline to be abandoned in place. All buried outlets (hydrants, blow-offs, air valves, etc.) shall be closed, capped, and restrained as indicated on the Remove from Service (RFS) drawings.

e. Verify that the pipeline is positively plugged and sealed.

2. Diameters greater than 12": Contact the Engineer.

C. Valves:

1. Salvage valve pot covers over abandoned valves.

2. Cut and remove top 6" of abandoned valve pots and fill with Class II aggregate base rock, compact in same manner as trench backfill and install permanent asphalt paving.

D. Hydrants:

1. Close hydrant valve in street and comply with Paragraph C.

2. Salvage hydrant bodies.

3. Remove upper portion of the hydrant ell or extension to minimum 6" below existing ground.

4. Fill remaining portion of ell with concrete.

E. Air Valves:

1. Salvage valves and boxes. If valve box is located in sidewalk, remove box in its entirety and repair sidewalk satisfactory to the agency having jurisdiction.

F. Test Stations:

1. Remove and dispose of.

G. Markers:

1. Remove locating markers and/or curb markers.

H. Materials Salvaged:

1. Deliver and unload at the District's Oakport Storage Center, 5601 Oakport Street, Oakland, California.

END OF SECTION

SECTION 33 11 13.45P
(Formerly SECTION 02616.1)

FABRICATION OF HIGH DENSITY POLYETHYLENE (HDPE) PIPE

PART 1 - GENERAL

1.1 SUMMARY

A. Work includes: Furnish HDPE pipe and fittings for system pressures not exceeding 200 psi as shown on the drawings and as specified herein.

B. HDPE pipe and fittings shall be made in Iron Pipe Sizes (IPS), from materials meeting requirements of AWWA C906-15 or C901-08, including referenced standards therein, with emphasis and exceptions as provided in this Section and on the drawings. Where this Section and the referenced standards conflict, this Section shall govern.

C. Related Sections

1. Section 01 10 00.01P – General Requirements
2. Section 01 64 05P – District Furnished Materials
3. Section 05 05 26P – Flange Bolting
4. Section 33 11 13.47P – Installation of HDPE Pipe

1.2 REFERENCES

A. HDPE pipe and fitting manufacture and installation shall conform to the following standards, including other standards referenced therein, and to the exceptions and emphasis provided in this Section. In the event of conflict, this Section shall govern. Unless otherwise noted, the most current revision of the listed standard shall apply.

1. AWWA C116 – Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings
2. AWWA C901-08 – Polyethylene (PE) Pressure Pipe and Tubing, ½-inch Through 3-inch, for Water Service
3. AWWA C906-15 – Polyethylene (PE) Pressure Pipe and Fittings 4-inch through 65-inch (100 mm through 1,650mm), for Waterworks
4. AWWA M55 – PE Pipe – Design and Installation
5. ASTM D3261 – Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
6. ASTM A536 – Standard Specification for Ductile Iron Castings.

7. ASTM F1055 – Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.

8. ASTM F2206 – Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock or Block Stock.

9. NSF/ANSI 61– Drinking Water System Components – Health Effects

10. Plastics Pipe Institute (PPI)

    a. Handbook of Polyethylene Pipe

    b. TR-3 HDB/PDB/SDB/MRS Policies

    c. TR-4 HDB/HDS/SDB/PDB/MRS Listed Materials

1.3 SUBMITTALS

A. Prior to ordering and shipping pipe , submit the following:

1. Manufacturer's current specifications or technical information that demonstrates compliance with the specified requirements. Include shop drawings, catalog data, and manufacturer's technical data showing complete information on material composition, physical properties, pipe color (or colored stripe), and dimensions of pipe and fittings.

2. A copy of the PPI TR-4 title page for the most recent update, and the page(s) listing all proposed HDPE materials.

3. A copy of the current NSF 61 web page showing certification for the proposed plant and material.

4. Manufacturer's recommendations for handling, storage, and repair of damaged pipe and fittings. Include a detail of required pipe end caps.

5. A written quality control program meeting the minimum requirements of C906 Section 5, including a description of the labs and equipment for performing all tests.

6. Manufacturer's cut sheets and technical data for appurtenant parts, including flange adapters, mechanical joints, etc. and all items in Part 2.

7. Data logger reports for fabricated fittings.

8. Product Certification Report.

9. Certification that the flange adaptor backup rings have been designed and tested to the specified pressure and use per the requirements of ASME Boiler

Code (Section VIII, Division 1-A , Part UG-101), or per the requirements of ASME Process Piping Code B31.3 (Para A304.7.2).

1.4 QUALITY ASSURANCE

A. Each delivered pipe shall bear the required markings.

1. Marking of pipe and fittings shall conform to AWWA C906/901, and at a minimum include, name of the manufacturer, pressure rating, pressure class, production codes needed for traceability, and time/date/location of manufacture. Upon request, the manufacturer shall provide information for deciphering the manufacturer's production code.

B. The District requires a manufacturer's Product Certification Report that documents the tests and test frequency required in C906, Section 5 for pipe and fittings. The Report shall include the specific resins used, the resins sources, the manufacturer's production codes, pipeline or product numbers, and other data needed for traceability to the required markings on the delivered pipe or fittings.

C. District oversight of manufacture:

1. The Engineer, at the District's expense, reserves the right to conduct plant inspection during production, and shall have free access to all parts of the plant. The manufacturer shall provide 14-calendar-day advance notice of pipe production to the Engineer.

2. The District may conduct independent testing of pipe and fittings at District's expense upon delivery. Test may include all tests listed in C906, Section 5.

a. Any materials that do not meet quality requirements revealed by testing will result in rejection of entire lot, and the testing will then be at the manufacturer's expense.

b. Successfully test replacement materials at the manufacturer's facility before shipment per C906 Section 5, at manufacturer's expense.

3. Pipe shall be manufactured with homogeneous mixing resulting in thorough disbursement of UV inhibitor and pigmentation. Pipe exhibiting windowing shall be rejected.

1.5 HANDLING & DELIVERY

A. Prevent damage to pipe and other materials during transportation, handling, and storage as recommended by the manufacturer. Pipe ends shall be sealed by end caps during shipping and storage until installation. Transport the pipe using appropriate methods and intermittent checks to insure the pipe is properly supported, stacked, and restrained.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials in contact with potable water shall be NSF/ANSI Standard 61 approved for potable water applications.

B. Contractor shall provide all HDPE pipe and fittings, including service saddles.

1. All materials downstream of service saddles, including corporation stops, copper laterals, and meters are supplied and installed by the District.

2. Contractor shall provide all temporary fittings, plugs and caps, etc.

C. Furnish HDPE pipe and fittings in Iron Pipe Sizes (IPS), from materials meeting requirements of AWWA C906 or C901 and the provisions of this Section.

1. C906 pipe (4-inch and larger) shall be made from materials listed in the Plastic Pipe Institute (PPI) TR-4 as conforming to PE 4710 and meeting the policy of PPI TR-3.

2. C901 pipe and tubing (3-inch and smaller) shall be made from PE 4710.

2.2 PIPE

A. The pipe shall be made of virgin material and shall contain no recycled compound. Rework material generated in the manufacturer's own plant may be blended with virgin resin of the same cell classification to manufacture new pipe. Mark pipe containing rework material to indicate the use of rework material. Rework material shall not exceed 10 percent by weight of total material quantity used to manufacture pipe. Do not use rework material for 3" and smaller sizes.

B. All HDPE pipe except solid colored pipe described below, shall include a minimum of 2 percent but no more than 3 percent carbon black for ultra-violet protection.

1. Identifying color is required. Pipes may be solidly colored, or may be striped (3 or more stripes set equally apart axially) by co-extrusion as follows:

a. BLUE – Potable water

b. PURPLE – Recycled water

C. Supply pipe in the longest practical straight lengths for the project. Coiled pipe is not acceptable for 4-inch and larger pipes.

D. Required pipe diameters, total lengths, and dimension ratios are shown on the drawings.

E. Acceptable resin shall:

1. Be bi-modal

2. Have a minimum chlorine resistivity of CC2

3. Have a minimum PENT value of 10,000 hours.

F. Acceptable HDPE pipe manufacturers:

1. WL Plastics

2. JM Eagle

3. Dura-Line

4. Performance Pipe

5. Or equal as approved by the Engineer.

2.3 FITTINGS

A. Molded HDPE fittings shall comply with ASTM D3261. Fabricated HDPE fitting shall comply with AWWA C906 and ASTM F2206. Electrofusion fittings shall comply with ASTM F1055.

1. Molded fittings are preferred.

B. All HDPE fittings and appurtenances shall be at least as strong and have the same pressure rating as the pipelines to which they are attached.

C. Each fitting shall be clearly labeled to identify its size, material code designation, and pressure class (PC) rating.

D. Acceptable HDPE fitting manufacturers:

1. Molded Fittings:

a. Georg Fischer Central Plastics

b. Improved Piping Products

c. Plasson

d. Or equal as approved by the Engineer.

2. Fabricated Fittings (Note that fabricated fittings supplied shall match pressure class of adjacent piping):

a. Georg Fischer Central Plastics

b. Improved Piping Products

c. Plasson

d. Or equal as approved by the Engineer.

3. Electrofusion Fittings:

a. Georg Fischer Central Plastics

b. Improved Piping Products

c. Plasson

d. Or equal as approved by the Engineer.

E. Flange adaptors for connection to steel pipe, valves, etc., shall be:

1. Made with sufficient through-bore length to be clamped in a butt-fusion joining machine without the use of a stub-end holder.

2. Be faced with a concentric or spiral pattern for a no-gasket installation.

F. Flange Adaptor Backup Rings

1. Backup rings shall be rated and clearly marked for not less than 265 psi continuous service operating pressure.

2. Design backup rings for use with AWWA C906 IPS pipe diameters and ASME 125/150.

a. It is the responsibility of the Contractor to verify bolting patterns of back-up rings and the meeting flange or valve.

3. Backup ring minimum thicknesses shall be:

Nominal Diameter (inches)	Backup Ring Minimum Thickness (inches)
4	0.94
6	1.00
8	1.12
10	1.19
12	1.50

4. Backup rings shall consist of convoluted ductile iron (ASTM A536 65-45-12) and match the radius of the HDPE flange adaptor. The same vendor shall provide flange adaptors and backup rings as matched sets.

5. Backup rings shall be fusion-bonded epoxy coated per AWWA C116, except NSF-61 certification is not required.

6. Bolting materials shall conform to Section 05 05 26P Flange Bolting.

7. The District will inspect backup rings on delivery for conformance to all requirements of this specification, including coating dry film thickness and holiday testing. Any backup rings that do not meet the specification will be rejected. If three percent or more of the backup rings are rejected, the entire shipment will be rejected.

8. Acceptable Manufacturers:

    a. GF/Central Plastics

    b. Improved Pipe Products

    c. Integrity

    d. Wolseley

    e. Or equal as approved by the Engineer.

G. Large Branch Saddles for large services, fire services, or new tees shall be DR11 IPS electrofusion type with the butt outlets sized as specified in the drawings and/or specifications. Outlets shall be 75% or less of the base pipe diameter. If this cannot be met, a tee must be used. Acceptable models are:

1. Central Plastics branch saddle with butt outlet

2. Tega electrofusion large branch saddles with butt outlet

3. Or equal as approved by the Engineer.

H. Service saddles shall be DR11 IPS electrofusion type with 1-inch AWWA (CORP) or 2-inch NPT brass outlets sized as specified in the drawings and/or specifications. Acceptable models are:

1. For 4" to 12" pipes:

    a. Plasson Transition Saddles.

    b. Or equal as approved by the Engineer

2. For pipes larger than 12":

    a. Frialen VA and VA-TL Service Saddle. Note: this saddle requires factory-supplied SSPT to NPT adapter.

    b. Tega brass threaded outlet electrofusion saddle

    c. Or equal as approved by the Engineer.

END OF SECTION

SECTION 33 11 13.47P
(Formerly SECTION 02616.1)

INSTALLATION OF HIGH DENSITY POLYETHYLENE (HDPE) PIPE

PART 1 - GENERAL

1.1 SUMMARY

A. Work includes: Install HDPE pipe and fittings for 20" and smaller buried pipe as shown on the drawings and as specified herein.

B. HDPE pipe and fittings shall be made in Iron Pipe Sizes (IPS), from materials meeting requirements of AWWA C906-15 or C901-08, including referenced standards therein, with emphasis and exceptions as provided in this Section and on the drawings. Where this Section and the referenced standards conflict, this Section shall govern.

C. Related Sections:

1. Section 01 64 05P – District Furnished Materials
2. Section 05 05 26P – Flange Bolting
3. Section 31 23 33P – Trenching and Backfilling
4. Section 33 10 01P – Protection from Corrosion
5. Section 33 11 13.21P – General Pipeline Installation Requirements
6. Section 33 11 13.45P – Fabrication of HDPE Pipe

1.2 REFERENCES

A. HDPE pipe and fitting installation shall conform to the following standards, including other standards referenced therein, and to the exceptions and emphasis provided in this Section. In the event of conflict, this Section shall govern. Unless otherwise noted, the most current revision of the listed standard shall apply.

1. ASTM D638 – Standard Test Method for Tensile Properties of Plastics
2. ASTM F2164 – Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure
3. ASTM F2620-13 – Standard Practice for Heat Fusion of Polyethylene Pipe Fittings
4. AWWA C651-14 – Disinfecting Water Mains

5. AWWA C901-17 – Polyethylene (PE) Pressure Pipe and Tubing, 3/4-inch (19mm) Through 3-inch (76mm), for Water Service

6. AWWA C906-15 – Polyethylene (PE) Pressure Pipe and Fittings 4-inch through 65-inch (100 mm through 1,650mm), for Waterworks

7. AWWA M55 – PE Pipe – Design and Installation

8. NSF/ANSI 61 – Drinking Water System Components – Health Effects

9. Plastic Pipe Institute (PPI) Publications

   a. Technical Note 38 – Bolt Torque for Polyethylene Flanged Joints.

   b. Handbook of Polyethylene Pipe.

   c. MAB Generic Electrofusion Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE) Pipe

   d. MAB Generic Electrofusion Procedure for Field Joining of 14 Inch to 30 Inch Polyethylene (PE) Pipe

1.3 SUBMITTALS

A. A minimum of five work days prior to pipe installation, submit the following:

1. Manufacturer's installation instructions including instructions for joining pipe by heat fusion.

2. Documentation of fusion equipment operators' certification and/or qualification by manufacturer and in accordance with ASTM F2620. Documentation of fusion equipment operators' experience.

3. Schedule of bolting torques for flange adaptor connections.

4. A Hydrostatic Test Plan for all pipes showing locations of any temporary heads used for testing.

5. For additional testing of fusion joints as required by the Engineer, submit compliance verification from a certified laboratory to assure that the tensile strength of the joints equals or exceeds that of the materials joined.

B. During installation, submit each day that these tasks occur:

1. Fusion report for each fusion joint performed on the project, including electrofusion joints, any fittings fused in the field, and joints that were rejected. Note: If requested, provide the reports to the Engineer as soon as the joint is complete.

2. Visual inspection report demonstrating that each fusion joint is compliant with the standard visual inspection as described in ASTM F2620 8.3.7.1.

3. Results of destructive joint testing.

4. Electrofusion coupling and service saddle installation inspection checklists.

1.4 QUALITY ASSURANCE

A. All field operations will be inspected by the Engineer.

B. Only technicians certified and/or qualified by the manufacturer and who have a minimum of two years of experience fusion welding pipelines of the diameters used on the subject project shall operate fusion equipment. Certification/qualification shall be based on similar pipe sizes as specified in project and be no older than:

1. Two years for butt fusion,

2. One year for electrofusion (must cover electrofusion saddles and couplings).

3. Joints fused by uncertified personnel will be rejected and cut out.

C. Personnel directly involved with installing the pipe shall receive training by the manufacturer or a manufacturer certified trainer in the proper methods for handling and installing the HDPE pipe.

D. The Engineer may, at its sole discretion:

1. Ask for any joint and/or fitting to be cut out and tested;

2. Disqualify any fuser who cannot produce satisfactory joints and/or fitting fusions. Any fusers who are disqualified shall not perform subsequent fusions on the project until they are re-trained and re-certified. A new certified operator shall be immediately assigned to the project.

E. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine. Collected data shall include: Pipe Size and Thickness, Machine Size, Fusion Technician Identification, Job Identification, Fusion Joint Number, Fusion Heating, and Fusion Drag Pressure Settings, Heat Plate Temperature, Time Stamp, Heating Time of Fusion, Cool Down, Ambient Temperature, and calibration date.

1. Joint data found to be inconsistent with ASTM F2620 will result in joint being removed and re-joined at Engineer's request.

2. Calibrate fusion equipment and data loggers annually.

3. This applies to all fusion joints (butt fusion, electrofusion, sidewall fusion, etc.).

F. Daily Testing and Inspection

1. On each day that butt fusion joints are made, a trial joint shall be assembled, and data for that joint shall be recorded. Perform the test of the trial joint for acceptance by the Engineer before production begins.

   a. Take 4 samples along joint (at every 90-degree).

   b. Use a guided side bend tester for pipes with wall thicknesses up to 7-inches.

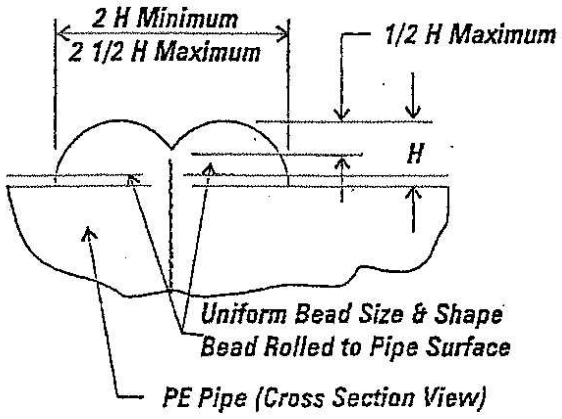
      1) For pipes with wall thicknesses of less than 1-inch a bend back test per ASTM F2620 may be performed.

2. Inspect subsequent butt fusion joints and compare data for each joint to the successful trial joint. Remove all joints failing the visual inspection or deviating from the data of the trial joint.

   a. Visual Inspection: Visually inspect butt fusion joints to ensure joint quality. Use the size and shape of the fusion beads to visually inspect if a proper joint has been made. Refer to the butt fusion visual inspection acceptance guideline in ASTM F2620.

   b. Complete a visual inspection for each joint that demonstrates the joint meets the butt fusion visual inspection acceptance guideline in ASTM F2620-13

   c. Joints that fail to meet the Fusion Bead Visual Inspection Guideline will be rejected.



3. Additional testing required by the Engineer. Perform the testing of two joints, from the first 1,000 feet of pipe in accordance with ASTM D638. The Engineer will determine the locations. Obtain the test specimens by cutting the pipe at least twelve inches on each side of the field-made joint. Re-join the ends so that work may proceed. Provide compliance verification from a certified

laboratory to assure that the tensile strength of the joints equals or exceeds that of the materials joined. One additional test shall be made for each additional 1,000 feet or portion thereof. The party fusing the pipe shall be responsible for the costs of these additional tests.

G. Should an operator have a failed joint, re-training and re-certification is required immediately and a new certified operator shall be assigned to the project.

H. Prior to the installation of service saddles, perform test saddles installation on each of the pipeline sizes encounterd on the project to be destructively tested per ASTM F1055. Allow at least five working days for the test to be complete. If the test passes, the fusion technician may proceed with the saddle installations. If the destructive test fails, find a more qualified fusion technician and perform the test installation again.

I. Engineer may reject any pipe fusions that do not conform to the prescribed field quality assurances set forth in this specification, the drawings, and referenced standards.

1.5 STORAGE, AND HANDLING

A. Upon delivery, place and store the pipe off the ground on suitable supports and securely blocked to prevent scratching or gouging. If pipe is stacked, it shall be done in accordance with the pipe manufacturer's recommendations. Keep the interior of all pipe, fittings and appurtenances free of dirt and other foreign matter. Pipe delivered to the jobsite without end caps in place will be rejected and subject to return to the manufacturer.

B. Do not use chains, hooks or cable type chokers when lifting sections of pipe. Nylon slings are preferred. Spreader bars are recommended when lifting long fused sections.

C. Any pipe accepted by the Applicant that has been damaged or does not meet the District's approval shall be replaced at the Applicant's expense.

D. Pipe end caps shall not be removed until the pipe is ready to be installed.

PART 2 - PRODUCTS

2.1 GENERAL

A. All Applicant installed HDPE pipe and fittings with the exception of materials listed in Section 01 64 05P – District Furnished Materials and service laterals, shall be furnished by Applicant in accordance with this specification.

B. All materials in contact with potable water shall be NSF/ANSI Standard 61 approved for potable water applications.

2.2 TOOLING

A. Scrapers – Scrapers shall be rotary type

1. Acceptable scrapers:

a. Central Plastics

1) Cast Rotary Scraper

2) Machined Rotary Scraper

b. Or equal as approved by the Engineer.

B. Service saddles – use manufacturer-proper tooling

1) Plasson Transition Saddles – follow manufacturer recommendations.

2) Frialen VA and VA-TL Service Saddle – Friatop Pneumatic Top-Loading Tool Required.

3) Tega brass threaded outlet electrofusion saddle – follow manufacturer recommendations

4) For or equal products, use manufacturer tooling.

C. Re-rounding tools – Use re-rounding tools on either side of electrofusion service saddle and on either side of electrofusion coupling.

1. Exceptions:

a. Plasson transition saddles come with a strap that Plasson Engineering deems acts as a re-rounding tool.

b. Alignment tools that include rings (i.e., not straps or chains) may act as a re-rounding tool.

2. Acceptable re-rounding tools:

a. Plasson Re-Rounding Tool

b. Strongbridge re-rounding clamp

c. Jaws with inserts from a butt fusion machine

d. Guillotine style re-rounding tools

e. Victaulic coupling with rubber removed

f. Or equal as approved by Engineer

D. Alignment tools – Use alignment tools on either side of an electrofusion coupling

1. Acceptable alignment tools:

a. Plasson Pipe Clamping Tool

b. Central Plastics Clamp Kits and Liners

c. Or equal as approved by Engineer

PART 3 - EXECUTION

3.1 GENERAL

A. Install HDPE pipe and fittings in accordance with manufacturer's installation instructions and backfill trench as shown on the drawing.

3.2 FIELD JOINTS

A. Fusion Equipment

1. All butt fusion equipment must be in working order including properly coated clean heating iron faces, sharp facer blades, freely moving aligned guide rods, securing clamping devices, and data loggers.

2. Electrofusion power supplies shall be compatible with utilized electrofusion fittings and provide fusion data records through either connected cables or USB memory device connection.

3. Tooling: All clamps, scrapers and alignment devices shall be specifically manufactured for pipe fusion and be in good working order and compatible with fitting and pipe manufacturer's recommendations. Ratchet and cable straps not specifically manufactured for fusion shall not be permitted. Hand scrapers shall not be permitted.

4. Power sources:

a. Ensure all generators used in the field to supply energy required for fusion are rated a minimum of 50% greater than the power required by fusion equipment.

b. Calibrate generating equipment weekly to ensure adequate power supply.

c. Ensure power cord extensions used to connect generators to fusion equipment are capable of delivering the following:

Fitting Type	Fitting Size	Generator Minimum (WATT)	Breaker Minimum 120v/240v	Extension Cord 25 ft.	Extension Cord 50 ft.
Couplings, Tees, Elbows, Reducers, and Caps	3" to 12"	5000	30/20 AMP	#10/3	#8/3
Saddle	ALL	2500	15/15 AMP	#10/3	#8/3
Saddles, Couplings, Tees, Elbows, Reducers, and Caps	14" to 30"	7000	30/30 AMP	#8/3	N/A

d. Disable generator governor control devices before any fusion cycle is initiated.

B. Bending radius

1. Do not install pipe with a bending radii smaller than 100 times the pipe outside diameter size.

2. Do not install fittings or service saddles on curved sections of pipe with radii smaller than 100 times the pipe outside diameter size.

3. If alignment must change due to field conditions, demonstrate to the Engineer that bend radius meets the 100 times OD criteria.

C. Butt fusion:

1. Assesmble and join sections of the HDPE pipe on the job site.

2. Join sections of HDPE pipe into continuous lengths by the thermal butt fusion method and perform per the pipe manufacturer's printed recommendations. Threaded or solvent-cement joints and connections are not permitted.

3. Butt fusion shall conform to ASTM F2620 and pipe manufacturer's criteria for the type of joining. Joints shall indicate a ductile rather than brittle fracture when tested.

4. Fusion equipment used in the joining procedure shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, fusion temperature, alignment, and fusion pressure. Fusion equipment shall have a temperature gauge to record temperature during pipe fusion.

5. Before heating pipe segments to be fused, check that pipe are square and that the cumulative mismatch of outside diameters is no more than +/-10% of the wall thickness.

6. The butt-fused joint shall be true alignment and shall have uniform rollback beads resulting from the use of proper temperature and pressure. Joints shall have internal bead projections as listed in ASTM F2620. Allow the joint adequate cooling time, per the pipe manufacturer's printed recommendations before removal of pressure. The individuals fusing the pipe shall allow further cooling (i.e. rough handling time) prior to the application of stresses due to bending or movement of the pipe. The fused joint shall be watertight and shall have strength equal to that of the pipe.

7. Prevent scratching and/or gouging caused by dragging pipe over rough surfaces. Support pipe by dollies or pipe roller stands when transporting over pavement or other rough surfaces. Pay special attention at entry points where pipe is pulled across pavement edges by placing pipe rollers at these locations to avoid contact with potential sources of damage.

    a. Use pipe support stands or racks on both ends of the butt fusion machine to assist with pipe loading and alignment. Adjust the support stands to align the pipe with the fusion machine centerline.

    b. Use a minimum of two low-profile pipe rollers (one per stick of pipe) on either end of the fusion machine or every 30 feet if using 40 or 50 foot sticks.

8. All joints are subject to acceptance by the Engineer. Cut out and replace all defective joints. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than ten percent (10%) of wall thickness, shall not be used and must be removed from the site. A defective area of the pipe may be cut out and the joint fused in accordance with the procedures specified above. Discard and do not use any section of the pipe having other defects such as concentrated ridges, discoloration, excessive spot roughness, pitting, variable wall thickness or any other defect of manufacturing or handling as determined by the Engineer.

D. Sidewall Fusion

1. Generally not allowed.

E. Electrofusion (EF) Joints and Fittings

1. Where possible, joints shall be by thermal butt-fusion. EF couplings may be used only in straight sections of pipeline to connect special pieces or closure sections, or to facilitate the use of field cut sections. Install electrofusion couplings per the manufacturer's instructions with manufacturer specified tooling.

2. Use the form(s) at the end of this section, ELECTROFUSION COUPLING INSTALLATION INSPECTION CHECKLIST and ELECTROFUSION SERVICE SADDLE INSTALLATION INSPECTION CHECKLIST for every electrofusion fitting installation.

F. Applicant: Flange adapters shall be bolted-up with gaskets

1. Tighten flange gaskets to manufacturer's recommended torque values.

2. See Section 05 05 26P – Flange Bolting for acceptable gaskets.

G. Protect all metals located below ground, including mating flanges, from corrosion. See Section 33 10 01P – Protection From Corrosion.

1. Coat bolts using wax tape.

3.3 PIPELINE APPURTENANCES – NOT USED

3.4 HYDROSTATIC PRESSURE TEST

A. General:

1. This Article takes precedence over Article 3.13 Hydrostatic Pressure and Leakage Test in Section 33 11 13.21P – General Pipeline Installation Requirements.

2. All assemblies are to be hydrostatically tested. Testing shall be per the approved Hydrostatic Test Plan.

3. Test HDPE pipe alone and not as part of a multi-material system.

4. Provide five work day's minimum notice to the Engineer to schedule filling and testing. Do not fill the pipeline until the Hydrostatic Test Plan has been submitted to and approved by the Engineer.

5. Hydrostatic pressure test shall be performed in the presence of the Engineer.

6. Pipeline may be divided into sections and tested in stages as approved by the Engineer.

7. Test shall be scheduled to begin and be completed during weekday (Monday - Friday) work hours.

8. Hydrostatic pressure test shall comply with AWWA C651, Article 4.8.9 – Backflow Prevention.

B. Test Equipment Set-up:

1. Furnish hoses, pumps, pressure gauges, leakage measuring device, connections, relief valves, other necessary apparatus, and personnel required for making the tests.

2. The pressure gauge shall register pressure in pounds per square inch gauge (psig). The range of the gauge shall be from 0 psig to ((1.5 x test pressure) + 50.0) psig. The gauge face shall have a 1 psi increment inscribed. The gauge shall be calibrated within 45 days prior to the hydrostatic test and the calibration tag affixed to the gauge.

3. The gauge assembly shall be equipped with a 3/4" hose bib and isolation valve to allow the Engineer to install a second gauge and a pressure monitoring device.

4. The Engineer may test pressure gauges for accuracy.

C. Before Testing:

1. All appurtenances shall be completed, opened, and tested concurrently.

2. Clean pipeline test section.

3. Trench backfill, except permanent pavement, shall be installed, compacted, and tested to the satisfaction of the Engineer.

4. At direction of the Engineer, the trench shall remain open at the locations of some assemblies or valves to allow for inspection during the hydrostatic test.

5. Concrete thrust or reaction blocks shall be cured for at least seven days. The time required may be reduced if additional restraint, approved by the Engineer, is provided.

D. Filling the Pipeline:

1. Fill the line slowly, not exceeding 3 feet per second. Open fire hydrants and bleed taps on air valves. Close isolation valves at blowoff structures. Ensure operation of air valves during the filling of the pipeline with water.

2. For physically-isolated pipeline only: After filling the pipe, the filling apparatus shall be either disconnected or physically isolated from the pipeline.

3. For pipelines connected to the system: Immediately before pressurizing, flush the pipeline for one minute to move fresh water into the area of the connection.

E. Hydrostatic Pressure Test Procedures:

1. Perform the hydrostatic test in accordance with the guideline provided in ASTM F2164.

a. In the event there is a conflict between the manufacturer's recommendation and the guideline provided in ASTM F2164, the Engineer's decision shall govern.

b. Minimum required hydrostatic test pressure shall be 1.5 times the design working pressure of the pipe at the lowest point in the test section where lower pressure rated components or devices are not present, or have been removed or isolated from the test section.

c. The test pressure is not to exceed the pressure rating of the lowest pressure-rated component in the test section, where lower pressure-rated components or devices cannot be removed or isolated from the test section.

d. See drawings for test pressure.

e. Obtain test pressure from the Engineer if test pressure is not shown on the drawings.

f. If the design working pressure is not specified on the drawings or provided by the Engineer, test pressure at the lowest point in the test section shall not exceed:

1) 300 psi for DR11 pipe.

2. The allowable leakage for a section of heat-fused polyethylene piping is zero.

3. Pressurize the pipeline in accordance with ASTM F2164

a. The hydrostatic testing procedure consists of two phases:

1) an initial expansion phase and

a) For the initial expansion phase, add make-up water as necessary to maintain maximum test pressure for 4 hours.

2) a test phase.

a) For the test phase, reduce the test pressure by 10 psi and monitor pressure for 1 hour.

b) Do not increase pressure or add make-up water.

c) If no visual leakage is observed, and pressure during the test phase remains steady (within 5% of the test phase pressure) for the 1 hour test, a passing test is indicated.

4. The temperature of the test medium and the pipe test section shall be the same, and shall be at ambient temperature.

a. Before applying test pressure, allow time for the test medium and the pipe test section to equalize.

b. Consult with pipe manufacturer regarding recommended waiting time for specific site conditions and especially in cases of elevated temperatures.

5. Raise the pressure at a steady rate to the required test pressure.

6. For any test pressures exceeding the system working pressures, the total test time shall not exceed 8 hours of duration.

7. If a pressure test is not completed due to leakage, equipment failure, or other causes, the test section shall be depressurized.

a. Do not re-pressurize the pipe section to the test pressure within a minimum of 8 hours elapsed time following the prior test.

8. Inspect for leaks along the pipeline while pipe is under pressure and in the presence of the Engineer. Record any leaks found and provide record to the Engineer.

a. Difficulty in locating leaks shall not release the Applicant from the responsibility of furnishing a pipeline that meets the hydrostatic pressure test described here.

F. Repairs and Retests:

1. Excavate where required to locate and repair leaks or other defects that develop under the test.

a. Remove backfill and paving already placed, as necessary, to complete repairs.

2. Repair all known leaks and retest the pipe until the hydrostatic pressure and leakage test is successfully completed.

3. Repairs shall be made subject to the approval of the Engineer.

4. After repairs, backfill and pave in the same manner as the initial work.

3.5 FLUSHING AND CHLORINATION

A. See Section 33 11 13.21P – General Pipeline Installation Requirements.

3.6 CONNECTIONS TO EXISTING PIPELINES

A. See Section 33 11 13.21P – General Pipeline Installation Requirements.

B. Upon completion of HDPE pipe installation, provide a minimum period of 24 hours before joining HDPE pipe to existing pipe materials, to allow the HDPE pipe sufficient time to contract/regain its original size.

C. Connect using electrofusion couplings when the pipe material has the potential for a different or unknown melt index.

D. Only one out of three joints on a tee shall be electrofused.

3.7 TESTING OF ELECTROFUSION SADDLES

A. District forces: Upon completion of rough handling time, hydrostatic test electrofusion service saddles at 200 psi for 5 minutes. Tap accepted electrofusion saddles.

3.8 TRACER WIRE

A. Install tracer wire per Section 33 11 13.21P – General Pipeline Installation Requirements.

3.9 IDENTIFICATION TAPE

A. Install identification tape per Section 33 11 13.21P – General Pipeline Installation Requirements.

3.10 SUPPLEMENTS

A. The following supplements follow END OF SECTION and are a part of this section:

1. ELECTROFUSION COUPLING INSTALLATION INSPECTION CHECKLIST

2. ELECTROFUSION SERVICE SADDLE INSTALLATION INSPECTION CHECKLIST

END OF SECTION

ELECTROFUSION COUPLING INSTALLATION
INSPECTION CHECKLIST

Location / Job # _____ Station # _____ Date/Time_____

Fusion Technician _____ Company _____ Employee #_____

Operator Credential Issued by _____ Credential Issue Date _____ Qualified Pipe Size(s) ____

Pipe Manufacturer _____ Material Type _____

Pipe Size _____ DR _____

EF Coupling Manufacturer _____ Part #_____ Description _____

EF Processor Model _____ Serial Number _____

Generator Make & Model _____ Serial Number _____

Temperature / Weather _____ Trench Conditions _____

General:	
Inspect the equipment for cleanliness and proper operation.	
Verify that the generator / power source is adequately sized for coupling being fused.	
Check that the generator is full of gas.	
Verify that the generator eco throttle / economy setting is turned off.	
Verify that the extension cord is adequately rated for the fusion machine and coupling.	25' cord: #10/3 50' cord: #8/3
Inspect the coupling for damage through original packaging.	
Let the EF processor acclimate to the jobsite weather conditions for a minimum period of 15 minutes before beginning the fusion process.	
Couplings:	
Cut pipe ends squarely and evenly (+/- 3 degrees). The squareness of the cut can be checked by placing a square at the end of the pipe at its longest point and measuring the resulting gap between the square and shortest point of the cut. Maximum measured gap when cut angle is approximately 3 degrees from square: 2" IPS: 1/8", 4" IPS: 1/4", 6" IPS: 3/8", 8" IPS: 1/2", 12" IPS: 5/8".	
Clean pipe ends of dirt and debris prior to scraping.	
Measure and mark one of the pipe ends for the full length of the coupling. Measure and mark the other pipe end for half the coupling length. Mark the entire pipe area to be scraped with an approved non-petroleum based marker.	
Install re-rounding clamps to verify that the pipeline out-of-roundness is within tolerance. Maximum Out-of-Roundness: 4": 0.0625" or 1/16" 6"-12": 0.125" or 1/8"	
Mount the scraper over the area to be scraped. Scrape the outside of the pipe to remove the surface layer and expose clean virgin pipe beneath. Remark stab depths after scraping if necessary. This should remove at least 0.007" of the pipe surface material. Removal of 0.02" on 4" or smaller, or 0.04" on larger sizes is the maximum.	
Bevel / chamfer the pipe ends. Note that this step should be completed when installing couplings with bare exposed heating wires in order to prevent snagging of wires on pipe edge.	
Inspect the scraped pipe surface thoroughly to ensure that all marks are removed and only virgin pipe surface is exposed. Do not touch the scraped pipe surface or the inside of the coupling.	
Clean surfaces with 96% (or higher) solution isopropyl alcohol & lint-free rag.	
Insert the pipe ends to the stab depth marks. If necessary, a block of wood can be placed over the coupling end and a hammer can be used to drive the coupling onto the pipe. Leave plastic bag over coupler to prevent contamination and debris from entering the open end. Use caution not to damage internal wire or terminal pins.	
Secure assembly with an alignment clamp, with coupling centered between stab depth marks.	
Connect the control box leads to the fitting. Scan the numerical barcode on the fitting using the reader wand on the processor.	
Verify that the fitting was read correctly and initiate the fusion cycle.	

ELECTROFUSION COUPLING INSTALLATION INSPECTION CHECKLIST

Verify that the EF processor indicated a complete fusion cycle.		
Did the EF processor indicate a cycle failure? If yes, see * below. If no, see ** below.	Yes	No
*Was the failure due to an input power interruption? If yes, see (A) below. If no, see (B) below. Input power interruption examples include the following: (i) fusion leads were detached during fusion, (ii) generator ran out of gas, or (iii) other circumstances that resulted in processor input power interruption.	Yes	No
(A) If failure was due to an input power interruption, the coupling must be re-fused. 1. Coupling should remain in restrained position. 2. Allow the coupling to cool to ambient temperature. 3. Reconnect coupling to the processor. 4. Completely refuse coupling for the entire fusion time.		
(B) Remove coupling that faults for any other reason and install new coupling.		
**Record the cooling time (CT) and rough handling time (RH) on the pipe wall. See table below for Georg Fischer Central Plastics fusion / cooling times. For other manufacturers, refer to their specifications for fusion / cooling times.		
Fusion cycle end time:	CT:	RH:
Mark the pipe with the station # and technician name.		
Do not move or disturb the joint for the recommended rough handling (RH) time.		
Do not remove alignment clamp until the proper RH time is completed.		
Do not remove re-rounding clamps until the proper RH time is completed.		
Do not backfill surrounding area before / during electrofusion process or during RH time.		
Do not rough handle until the proper RH time is completed. Rough handling includes moving, backfilling, or pressure testing the pipe.		
Was this coupling accepted?	**Yes**	**No**

Comments _____

_____

Inspector _____ Company _____ Employee # _____

Inspector Credential Issue Date _____ Credential Issued by _____ Date _____

Note: At the end of the project, download and review the EF data. Provide EF Data Report to District's Engineering and Construction Department for review and filing.

Georg Fischer Central Plastics Electrofusion Fusion and Cooling Time Chart

Couplings	Connection	Fusion Time (seconds)	Cooling Time (CT) in Clamped Position (minutes)	Total Cooling Time Before Rough Handling (RH) (minutes)	Minimum KVA	Generator Breaker Minimum (A)	Extension Cord Size 25 ft	Extension Cord Size 50 ft
2" IPS	4.7 R	60	10	30	2.5	20	#10/3	#8/3
4" IPS	4.7 R	200	15	35	3.5	30	#10/3	#8/3
6" IPS SDR 11	4.7 R	500	20	45	3.5	30	#10/3	#8/3
8" IPS	4.7 R	500	20	45	3.5	30	#10/3	#8/3
12" IPS FM 200	4.7 S	Requires temperature compensation	45	60	3.5	30	#10/3	#8/3

Revised 5/15/17

ELECTRO-FUSION SERVICE SADDLE INSTALLATION INSPECTION CHECKLIST

Location / Job # _____ Address / Tap # _____ Date/Time_____
Fusion Technician _____ Company _____ Employee #_____
Operator Credential Issued by _____ Credential Issue Date _____ Qualified Pipe Size(s) ____
Pipe Manufacturer _____ Material Type _____
Pipe Size _____ DR _____
EF Saddle Manufacturer _____ Part #_____ Description _____
EF Processor Model _____ Serial Number _____
Generator Make & Model _____ Serial Number _____
Temperature / Weather _____ Trench Conditions _____

General:		
Inspect the equipment for cleanliness and proper operation.		
Verify that the generator / power source is adequately sized for saddle being fused.		
Check that the generator is full of gas.		
Verify that the generator eco throttle / economy setting is turned off.		
Verify that the extension cord is adequately rated for the fusion machine and saddle.	25′ cord: #10/3 50′ cord: #8/3	
Inspect the service saddle for damage through original packaging.		
Let the EF processor acclimate to the jobsite weather conditions for a minimum period of 15 minutes before beginning the fusion process.		
Service saddles:		
Install re-rounding clamps to verify that the pipeline out-of-roundness is within tolerance. Maximum Out-of-Roundness: 4″: 0.0625″ or 1/16″ 6″-12″: 0.125″ or 1/8″		
Clean the pipe of dirt and debris prior to scraping.		
Mark the area to be fused with an approved non-petroleum based marker.		
Scrape the area to be fused with an approved pipe preparation tool.		
Remark the saddle location to be fused with a non-petroleum based marker.		
Clean the area to be fused with 96% (or higher) solution isopropyl alcohol & lint-free rag.		
Clean the fitting to be fused with 96% (or higher) solution isopropyl alcohol & lint-free rag.		
Secure the saddle to the pipe with the manufacturer recommended clamping mechanism.		
Scan the numerical barcode on the fitting using the reader wand on the processor.		
Verify that the fitting was read correctly and initiate the fusion cycle.		
Verify that the EF processor indicated a complete fusion cycle.		
Did the EF processor indicate a cycle failure? If yes, continue to next step below. If no, see page 2.	Yes	No
Was the failure due to an input power interruption? If yes, see (A) below. If no, see (B) below. Input power interruption examples include the following: (i) fusion leads were detached during fusion, (ii) generator ran out of gas, or (iii) other circumstances that resulted in processor input power interruption.	Yes	No
(A) If failure was due to an input power interruption, the saddle must be re-fused. 1. Saddle should remain in restrained position. 2. Allow the saddle to cool to ambient temperature. 3. Reconnect saddle to the processor. 4. Completely refuse saddle for the entire fusion time.		
(B) Abandon saddle that faults for any other reason and install new saddle.		

ELECTRO-FUSION SERVICE SADDLE INSTALLATION INSPECTION CHECKLIST

Record the cooling time (CT) and rough handling time (RH) on the pipe wall. See table below for reference.			
Fusion cycle end time:	CT:	RH:	
Mark the pipe with the house # / tap # and technician name.			
Do not remove saddle clamp until the proper cooling time (CT) is completed.			
Do not remove re-rounding clamps until the proper rough handling (RH) time is completed.			
Do not rough handle until the proper RH time is completed. Rough handling includes moving, backfilling, or pressure testing the pipe.			
Perform hydrostatic test after proper RH time is completed. Test saddle at 200 psi for 5 minutes. - If saddle fails test, abandon saddle and install new saddle next to failed saddle. - Once saddle passes test, the saddle is acceptable for tapping.			
Was this saddle accepted?		**Yes**	**No**

Comments _____

_____

Inspector _____ Company _____ Employee #_____
Inspector Credential Issue Date_____ Credential Issued by _____ Date _____

Note: At the end of the project, download and review the EF data. Provide EF Data Report to District's Engineering and Construction Department for review and filing.

Plasson Electrofusion Fusion and Cooling Time Chart

Transition Saddles with Threaded Outlets	Connection	Fusion Time (seconds)	Cooling Time (CT) in Clamped Position (minutes)	Total Cooling Time Before Rough Handling (RH) (minutes)	Minimum KVA	Generator Breaker Minimum (A)	Extension Cord Size 25 ft	Extension Cord Size 50 ft
12" IPS/DIPS	4.0	220	12	36	1.5	10	#10/3	#8/3

Revised 2/15/17

SECTION 33 11 22P
(Formerly SECTION 02514.1)

INSTALLATION OF POLYVINYL CHLORIDE PIPE AND FITTINGS, CAST IRON FITTINGS, AND DUCTILE IRON FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Furnishing and installing polyvinyl chloride (PVC) pipe and fittings, and cast iron or ductile iron pipe fittings.

B. Related sections:

1. Section 03 30 76P – Concrete for Pipe Installation

2. Section 31 23 33P – Trenching and Backfilling

3. Section 33 11 13.21P – General Pipeline Installation Requirements

1.2 REFERENCES

A. American Water Works Association (AWWA):

1.	AWWA C104	American National Standard for Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water
2.	AWWA C110	American National Standard for Ductile-Iron and Gray-Iron Fittings, 3" through 48", for Water and Other Liquids
3.	AWWA C111	American National Standard for Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
4.	AWWA C153	American National Standard for Ductile-Iron Compact Fittings, 3" through 12", for Water and Other Liquids
5.	AWWA C213	AWWA Standard for Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
6.	AWWA C900	AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in. for Water Distribution
7.	AWWA C605	AWWA Standard for Installation of PVC Pipe
8.	AWWA C907	AWWA Standard for Polyvinyl Chloride (PVC) Pressure Fittings for Water – 4 in. through 8 in.

B. ASTM International (ASTM):

1.	ASTM D1784	Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds
2.	ASTM D1785	Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
3.	ASTM D2464	Threaded Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
4.	ASTM D2467	Socket-type Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
5.	ASTM D2564	Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings
6.	ASTM D2855	Recommended Practice for Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Plastic Pipe and Fittings

1.3 SUBMITTALS

A. Applicant shall submit a manufacturer's affidavit, including references to the lot numbers of the pipe and fittings, with each shipment prior to or at the time of delivery to the jobsite. The affidavit shall state that the requirements of these specifications have been met for all the pipe and fittings furnished.

1.4 DELIVERY AND STORAGE

A. Pipe ends shall be sealed during shipping and storage on site.

B. Keep interior of all pipe, fittings, and appurtenances free of dirt and other foreign matter.

PART 2 - PRODUCTS

2.1 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS – 6" UP TO 12"

A. Polyvinyl chloride (PVC) pipe 6" and larger shall be Class 305 pressure pipe, cast iron O.D., DR 14 with elastomeric gaskets, plain end with couplings or high-deflection couplings, or integral bell ends.

B. PVC pipe 6" up to 12" shall comply with AWWA C900 except as modified below.

Section 4.3.2.3
Delete and replace with:

1. Pipe shall be furnished in standard laying lengths of 20 feet ± 1 inch. Random lengths shall not be furnished.

2. Pipe sections from a fitting, coupling, or bell used for making connections shall not be shorter than 18" in length.

C. Polyvinyl Chloride Fittings shall be Class 235 pressure fittings.

1. PVC fittings may be provided for all required fittings except flanged tees, crosses and fittings that require restraint.

2. PVC fittings and gaskets shall meet all requirements of AWWA C907.

3. Each PVC fitting shall have the required markings of AWWA C907.

4. PVC push-on fittings shall be Harco, Sceptor, Ipex, or equal as approved by the Engineer.

2.2 IRON PIPE FITTINGS

A. For PVC pipe 6" up to 8"

B. Cast Iron Fittings:

1. Cast iron fittings shall meet all requirements of AWWA C110 except for the dimensions in respect to laying lengths.

2. Each cast iron fitting shall have plainly cast on the body:

a. The required markings of AWWA C110 and AWWA C111

b. An identifying mark indicating the type of pipe for which the fitting is designed.

C. Ductile Iron Fittings:

1. Ductile iron fittings shall meet all requirements of AWWA C153.

2. Each ductile iron fitting shall have plainly cast on the body:

a. The required markings of AWWA C111 and AWWA C153

b. An identifying mark indicating the type of pipe for which the fitting is designed.

D. Fittings shall have push-on bell ends unless shown otherwise on drawings.

1. Push-on fittings shall be designed to accept cast iron O.D. PVC pipe.

2. Push-on fittings shall be Tyton or approved equal with ring gasket interchangeable with Tyton gasket.

E. Gaskets shall conform to AWWA C111 and shall be furnished by the fitting manufacturer.

F. All fittings shall be smooth and free from defects. No plugging or filling will be allowed.

G. All fittings shall be epoxy coated and lined or epoxy coated and cement mortar lined.

1. Fusion-bonded epoxy shall be in accordance with Section 09 96 56.10P.

2. Cement mortar lining shall be in accordance with AWWA C104 except the seal coat shall not be provided.

3. Threaded holes and mating surfaces shall not be coated. Flange faces shall be coated with asphaltic varnish only. There shall be no lining material, epoxy or mortar on gasket groove.

H. Flange and plain end nipples shall be provided without the spigot bead on spigot ends of the fittings and shall be cast with external surfaces true and smooth for use with flexible couplings.

I. All flange fittings and flanged nipples shall be one-piece castings.

J. Flanged fittings shall have smooth or shallow serrated face with drilling and dimensions conforming to ANSI B16.1 Class 125 Cast Iron Flanges. Drilling and dimensions of hydrant extensions shall conform to the requirement of Drawing 9496-GB-1.

2.3 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS - 2"

A. Two-inch PVC plastic pipe and fittings shall be made from polyvinyl chloride Type 1, Grade 1 (Cell Classification 12454-B) conforming to ASTM D1784.

B. Pipe and fittings shall be Schedule 80 and shall conform to:

1. Pipe: ASTM D1785

2. Threaded fittings: ASTM D2464

3. Socket-type fittings: ASTM D2467

C. Welding solution and primer shall be in accordance with ASTM D2564, shall be furnished by the same supplier who furnished the pipe, and shall be of a type compounded specifically for use with the pipe furnished.

2.4 PIPE COUPLINGS

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 Flange Coupling Adaptors:

1. Sleeve: Cast iron or fabricated steel

2. Followers: Cast iron, ductile iron, or steel.

3. Sleeve bolts: Type 303; stainless steel; or equivalent.

4. Coating: Fusion epoxy line and coat sleeve and followers.

5. Pressure rating: 250 psi.

6. Buried flexible coupling sleeve: Long barrel

7. Manufacturers:

a. Flexible couplings:

1) Connecting pipe with identical outside diameters: Smith-Blair 411 or 431, Dresser Style 38 or 53, or approved equal.

2) Connecting pipe with slightly different outside diameters: Smith-Blair 413 or R 441, Dresser Style 162, or approved equal.

b. Flange coupling adaptors:

1) Connecting new pipe or new pipe to existing non-ferrous pipe: Smith-Blair 912 or 913, Dresser Style 127 or 128, or approved equal.

2) Connecting new pipe to existing ferrous pipe: Insulating flange coupling adaptor with insulating boot: Smith-Blair 932 or 933, or approved equal.

8. Gaskets: Oil and grease resistant; Smith-Blair Grade 60; or approved equal.

9. Joint restraint: Provide joint harnesses (tie rod lug or attachment plate assemblies) across flexible couplings and flange coupling adaptors where indicated on the Drawings. For flanged coupling adaptors, anchor studs may be substituted for the harnesses on pipe up to 12-inch. Design restraint in accordance with AWWA M-11 for 150 psi if size of the rods are not indicated on the Drawings.

10. Protection for buried connectors and adaptors: Double wrap with polyethylene encasement, AWWA C105 and tape the edges of the encasement with PVC tape.

PART 3 - EXECUTION

3.1 INSPECTION

A. All pipe and fittings shall be subject to inspection by the Engineer at the jobsite.

B. Each section of pipe, including couplings and adapters, and each fitting shall be inspected and approved by the Engineer as acceptable prior to installation.

C. Pipe and fittings rejected as unacceptable by the Engineer shall be removed from the jobsite.

3.2 PREPARATION FOR INSTALLATION

A. Each section of pipe, including couplings and adapters, and each fitting shall be thoroughly cleaned out by the Contractor before lowering into the trench and immediately prior to assembly.

3.3 PLACING PIPE IN TRENCH

A. Install PVC pipe in accordance with AWWA C605 except as modified below.

B. Do not install pipe in same trench with other utilities without approval of the Engineer.

C. Install pipe to comply with the following clearances:

1. 5 foot horizontal distance from parallel existing sanitary sewer.

2. 1 foot vertical distance separation where pipe crosses sanitary sewer.

D. Install pipeline with a minimum cover of 36″ below finished grade. Maximum cover shall be 48″ or as directed by the Engineer.

E. Install pipe with uniform bearing on compacted Class I backfill.

F. Clearance under couplings shall be at least 2".

G. Bending of PVC pipe will not be permitted. Maintain alignment through use of pipe fittings or high deflection PVC couplings.

H. Steel horizontal and vertical angle bends may be required in lieu of ring-tight bends as determined by the Engineer.

I. Anchor all horizontal and vertical bends greater than 11-1/4°, dead-ends, tees, and crosses with concrete as shown on Drawings 194-EA and 3360-B.

J. Install collars and rods with concrete anchors on all cast iron plugs and at other locations indicated on the drawings, or at locations deemed necessary by the Engineer.

K. Where pipe crosses force main sewer, pipe crossing shall be at 90° angle and shall be of steel pipe extending at a minimum 5 feet on each side of the trench width or 12 feet in length, whichever is greater.

L. When pipe laying operations are not in progress, watertight plugs shall be installed for closure of open ends of pipeline and covered with backfill material at the end of each working day.

3.4 JOINTS

A. Polyvinyl Chloride Pipe and Fittings - 6" and Larger:

1. Assemble pipe and couplings in accordance with the manufacturer's instructions using a minimal amount of recommended pipe lubricant as necessary.

2. Check final location of rubber rings within each coupling and fitting as recommended by the pipe manufacturer.

3. Ensure joint, rubber ring, and lubricant are clean prior to and during installation.

B. Iron Fittings to PVC Pipe:

1. Push-on type joints for connection to the existing distribution system shall be made with rubber rings designed for use with the existing pipe.

C. 2" PVC Pipe and Fittings:

1. The connection method (threaded or socket-joint) shall be as shown on the drawings. Use socket-joint connections wherever the connection method is not shown.

2. Socket joint connections for plastic piping shall be made in accordance with ASTM D 2855.

3.5 TRACER WIRE

A. Install tracer wire per Section 33 11 13.21P – General Pipeline Installation Requirements.

3.6 IDENTIFICATION TAPE

A. Install identification tape per Section 33 11 13.21P – General Pipeline Installation Requirements.

3.7 INSTALLATION OF VALVES AND ACCESSORIES

A. Install valves and accessories such that all parts are easily accessible for maintenance and operation.

B. Where valve handwheels are shown on the Drawings, valve orientation shall be as shown. Where valve handwheels are not shown, orient valves to permit easy access to the handwheels or handles and to avoid interferences.

C. Install pressure gauges and thermometers in a position to permit reading them from a point approximately 5 feet above floor level.

D. Provide a union adjacent to each screwed end valve and accessory with additional unions as necessary to facilitate removal.

E. Provide a shutoff valve below each pressure gauge, protective device or air valve unless otherwise specified.

F. Connections between ferrous and non-ferrous piping, valves, accessories or pipe supports shall be made using a dielectric coupling, union, or flange.

G. Where valves or other pipeline items require metal full-face connecting flanges, provide intermediate flanges if the connecting flange is not adequate.

H. Wrap buried valve bodies as specified for flexible couplings and flanged coupling adapters.

I. Use reducing fittings where any change in pipe size occurs between valves or accessories and the attached pipeline. Bushings shall not be used, unless specifically noted on the Drawings. Use eccentric reducing fittings wherever necessary to provide free drainage of lines. Inspect each piece of pipe and each fitting carefully to see that there is no defective workmanship on pipe, or obstructions in pipes and fittings.

J. Install valves as required by valve manufacturer’s written instructions.

3.8 COUPLING INSTALLATION

A. Flexible Couplings and Flange Coupling Adaptors: Prior to installation, thoroughly clean oil, scale, rust, and dirt from the pipe to provide a clean seat for the gasket. Care shall be taken that the gaskets are wiped clean before they are installed. If necessary, flexible couplings and flanged coupling adapter gaskets may be lubricated with soapy water or manufacturer's standard lubricant before installation on the pipe ends. Install in accordance with the manufacturer's recommendations. Bolts shall be tightened progressively, drawing up bolt on opposite sides a little at a time until all bolts have a uniform tightness. Workers tightening bolts shall be equipped with torque-limiting wrenches or other favorably reviewed type.

B. Flexible Expansion Joints: Install in accordance with manufacturer's instructions, unless otherwise shown, install flat, with 1/2 the maximum expansion.

END OF SECTION

APPENDIX A

Flushing and Chlorination Checklist

Sample Tap Installation Drawing

EBMUD Contingency Plan for Contaminated Soils (District Forces only)

FLUSHING AND CHLORINATION CHECKLIST

Contractor's Plan, as a minimum, shall address the following items:

FLUSHING PHASE

- Identify location of discharges
- Indicate where discharge is going (truck, tank, storm drain, sewer)
- If sewer, provide approval by sanitary district
- Mention whether or not flow goes into waterway (if yes, indicate discharge distance)
- Indicate location of monitoring/test points on source main
- Specify feed size
- Indicate number and size of blowoffs and hoses attached to blowoffs
- Calculate estimated flush rate (gal/min) and flush time
- Test and record source main results

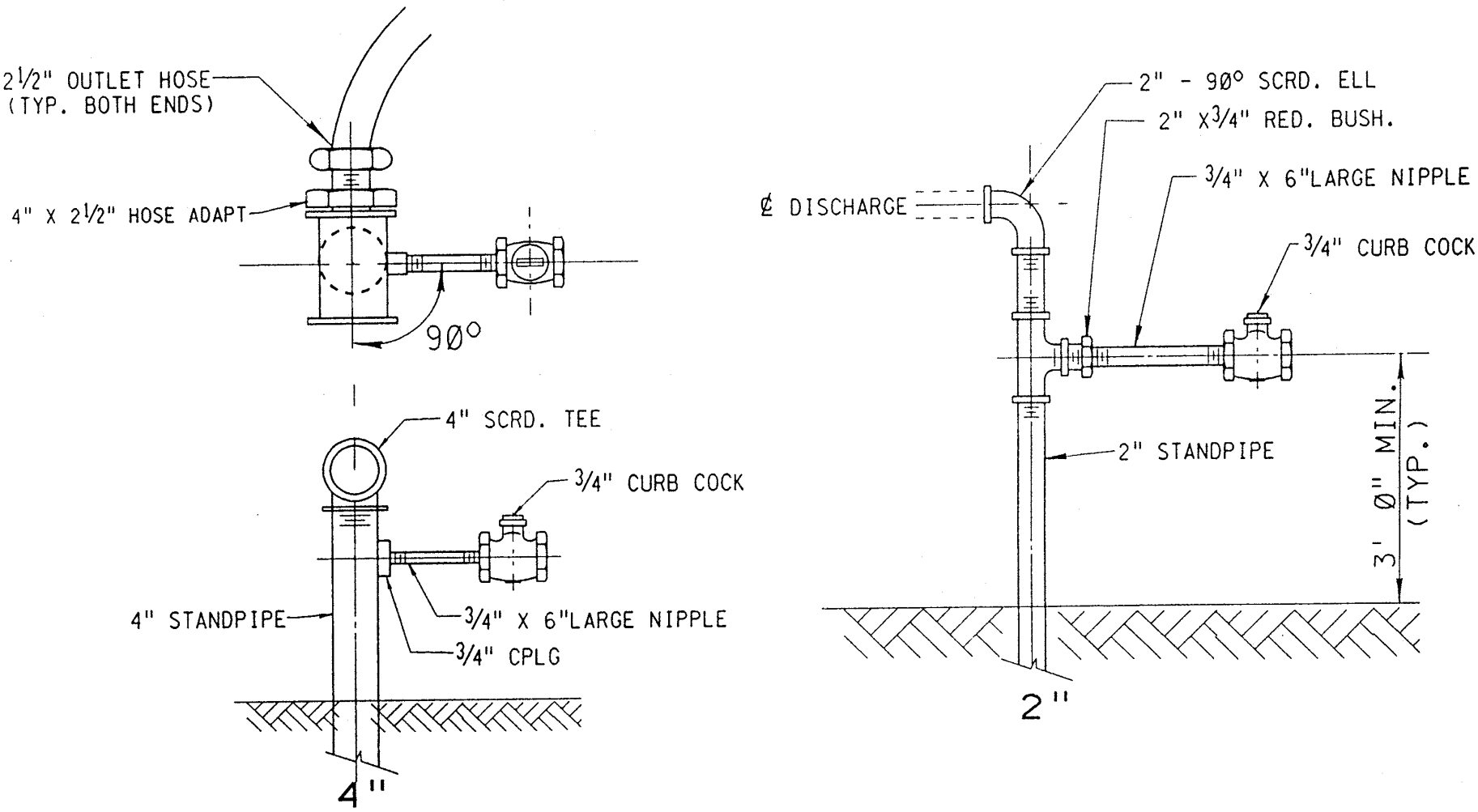
CHLORINATION PHASE

- Identify who will be doing the chlorinating
- Indicate number of trained contractor personnel to be present
- Specify pump to be used
- Indicate method of testing for chlorine residue
- Calculate estimated time to chlorinate and amount of chlorine to be used
- Specify method of verifying no chlorine intrusion to the source main
- Indicate sequence of valve operation where applicable
- Indicate method of communication
- During and after chlorination, test and record source main results

DECHLORINATION PHASE

- Specify dechlorination method
- Indicate location of disposal
- Indicate method of testing for chlorine residue, and record test results

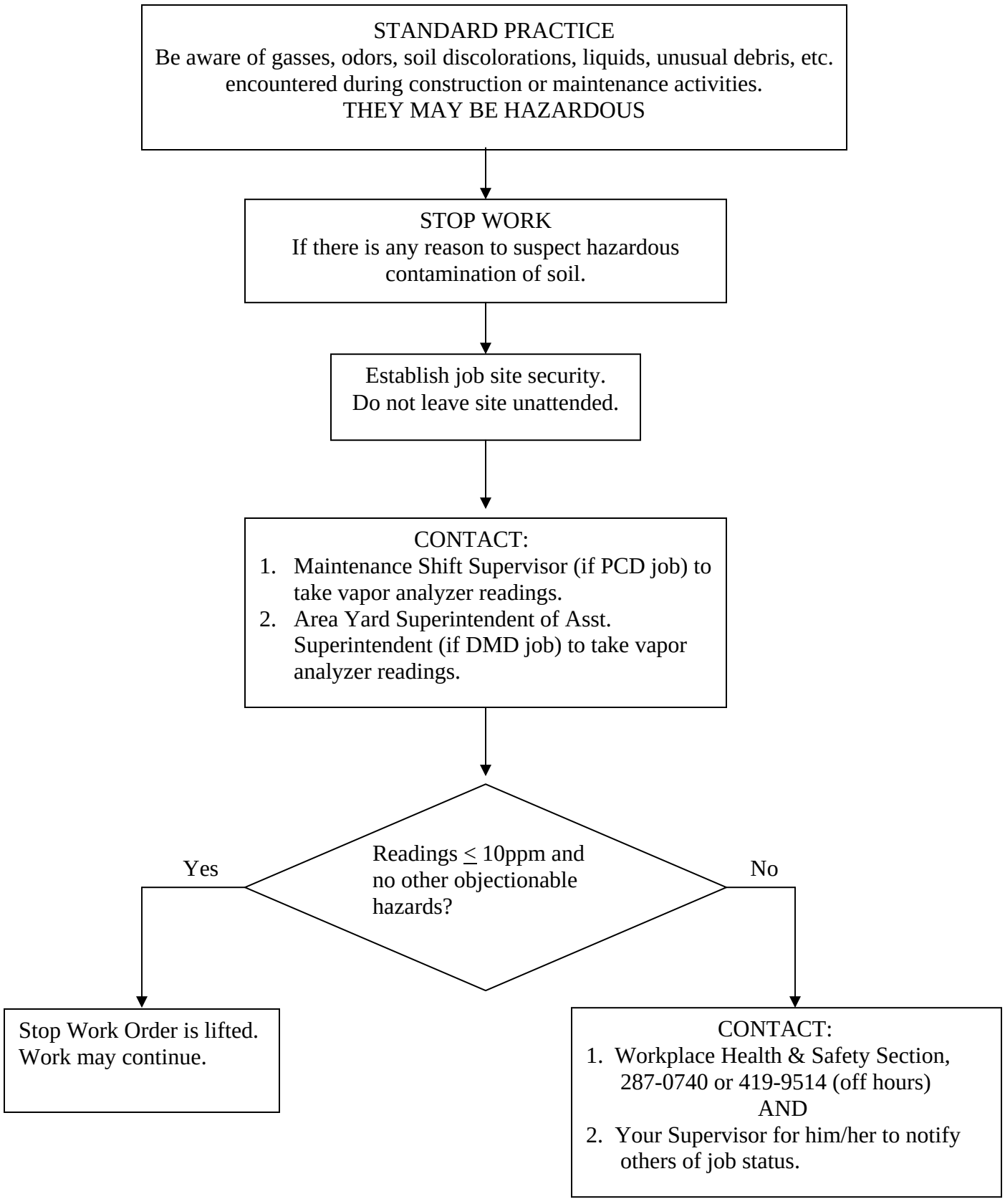
During all phases of flushing, pH levels shall not drop below 6.5 or rise above 8.5.



FLUSHING SAMPLE TAPS (TYP.)

NTS

EBMUD CONTINGENCY PLAN
FOR CONTAMINATED SOILS



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