

SECTION 33 30 00

SANITARY SEWERS  
04/08

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE PIPE ASSOCIATION (ACPA)

ACPA 01-102 (2000) Concrete Pipe Handbook

ACPA 01-103 (2000) Concrete Pipe Installation Manual

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION  
(AREMA)

AREMA Eng Man (2007) Manual for Railway Engineering

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4 (2003) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

AWWA C105/A21.5 (2005) Polyethylene Encasement for Ductile-Iron Pipe Systems

AWWA C110/A21.10 (2003) Ductile-Iron and Gray-Iron Fittings for Water

AWWA C111/A21.11 (2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

AWWA C115/A21.15 (2005) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges

AWWA C151/A21.51 (2002; Errata 2002) Ductile-Iron Pipe, Centrifugally Cast, for Water

AWWA C153/A21.53 (2006) Ductile-Iron Compact Fittings for Water Service

AWWA C302 (2004) Reinforced Concrete Pressure Pipe, Noncylinder Type

AWWA C600 (2005) Installation of Ductile-Iron Water Mains and Their Appurtenances

- AWWA C605 (2005) Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
- AWWA C606 (2006) Grooved and Shouldered Joints
- AWWA C900 (2007) Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution
- AWWA M23 (2002) Manual: PVC Pipe - Design and Installation
- AWWA M9 (1995) Manual: Concrete Pressure Pipe

ASME INTERNATIONAL (ASME)

- ASME B1.20.1 (1983; R 2006) Pipe Threads, General Purpose (Inch)
- ASME B16.1 (2005) Standard for Gray Iron Threaded Fittings; Classes 125 and 250
- ASME B18.2.2 (1987; R 2005) Standard for Square and Hex Nuts (Inch Series)
- ASME B18.5.2.1M (2006) Metric Round Head Short Square Neck Bolts
- ASME B18.5.2.2M (1982; R 2005) Metric Round Head Square Neck Bolts

ASTM INTERNATIONAL (ASTM)

- ASTM A 123/A 123M (2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- ASTM A 307 (2007b) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
- ASTM A 47/A 47M (1999; R 2004) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
- ASTM A 48/A 48M (2003) Standard Specification for Gray Iron Castings
- ASTM A 536 (1984; R 2004) Standard Specification for Ductile Iron Castings
- ASTM A 563 (2007a) Standard Specification for Carbon and Alloy Steel Nuts

ASTM A 563M	(2007) Standard Specification for Carbon and Alloy Steel Nuts (Metric)
ASTM A 74	(2006) Standard Specification for Cast Iron Soil Pipe and Fittings
ASTM A 746	(2003) Standard Specification for Ductile Iron Gravity Sewer Pipe
ASTM C 12	(2007) Standard Practice for Installing Vitrified Clay Pipe Lines
ASTM C 14	(2007) Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C 14M	(2005a) Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe (Metric)
ASTM C 150	(2007) Standard Specification for Portland Cement
ASTM C 260	(2006) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C 270	(2007a) Standard Specification for Mortar for Unit Masonry
ASTM C 33	(2003) Standard Specification for Concrete Aggregates
ASTM C 361	(2005e1) Standard Specification for Reinforced Concrete Low-Head Pressure Pipe
ASTM C 361M	(2005) Standard Specification for Reinforced Concrete Low-Head Pressure Pipe (Metric)
ASTM C 425	(2004) Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings
ASTM C 443	(2005a) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C 443M	(2007) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric)
ASTM C 478	(2007) Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 478M	(2007) Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric)
ASTM C 564	(2003a) Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

ASTM C 700	(2007a) Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
ASTM C 76	(2007) Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 76M	(2007) Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C 828	(2006) Low-Pressure Air Test of Vitrified Clay Pipe Lines
ASTM C 923	(2007) Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C 923M	(2007) Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals (Metric)
ASTM C 924	(2002) Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
ASTM C 924M	(2002) Testing Concrete Pipe Sewer Liner by Low-Pressure Air Test Method (Metric)
ASTM C 94/C 94M	(2007) Standard Specification for Ready-Mixed Concrete
ASTM C 969	(2002) Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM C 969M	(2002) Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines (Metric)
ASTM C 972	(2000; R 2006) Compression-Recovery of Tape Sealant
ASTM C 990	(2006) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM C 990M	(2006) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants (Metric)
ASTM D 1784	(2007) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

ASTM D 1785	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2235	(2004) Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D 2241	(2005) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2321	(2005) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2412	(2002) Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
ASTM D 2464	(2006) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2680	(2001) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
ASTM D 2751	(2005) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D 2996	(2001; R 2007e1) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 2997	(2001; R 2007e1) Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 3034	(2006) Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3139	(1998; R 2005) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

ASTM D 3212	(2007) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3262	(2006) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe
ASTM D 3350	(2006) Polyethylene Plastics Pipe and Fittings Materials
ASTM D 3753	(2005e1) Glass-Fiber-Reinforced Polyester Manholes and Wetwells
ASTM D 3840	(2001; R 2005) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Fittings for Nonpressure Applications
ASTM D 4101	(2007) Standard Specification for Polypropylene Injection and Extrusion Materials
ASTM D 412	(2006a) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D 4161	(2001; R 2005) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals
ASTM D 624	(2000e1) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM F 402	(2005) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F 405	(2005) Corrugated Polyethylene (PE) Tubing and Fittings
ASTM F 477	(2007) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 714	(2006a) Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM F 758	(1995; R 2007e1) Smooth-Wall Poly(Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage
ASTM F 794	(2003) Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
ASTM F 894	(2007) Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe

ASTM F 949 (2006a) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301 (2004) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

CISPI 310 (2004) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-60005 (Basic) Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.27 Fixed Ladders

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-6 (1998) Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

##### Temporary Service Plan; G

Plan to maintain sewer service while work is taking place.

#### SD-02 Drawings

##### Shop Drawings

Layout and installation drawings  
Precast concrete manhole  
Metal items  
Frames, covers, and gratings

##### As-built drawings

#### SD-03 Product Data

##### Pipeline materials

Submit manufacturer's standard drawings or catalog cuts.

#### SD-06 Test Reports

##### Reports

Test and inspection reports for all tests required.

## 1.4 DRAWINGS

### 1.4.1 Shop Drawings

The Contractor shall submit shop drawings for new sanitary sewer main installation consisting of end to end layout drawings of main with offset dimensions to existing site features and connection points to existing manholes and service laterals. Shop drawings shall indicate necessary offsets to existing utilities such that crossing points are coordinated. Shop drawings shall be coordinated with shop drawings required by other specification sections. Shop drawings shall be submitted 30 days in advance of start of work.

### 1.4.2 As-Built Drawings

The as-built drawings shall be a record of the construction as installed. The drawings shall include the information shown on the contract drawings as well as deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be a full sized set of prints marked to reflect deviations, modifications, and changes. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall provide three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction. The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within 10 calendar days from the time the drawings are returned to the Contractor.

## 1.5 DELIVERY, STORAGE, AND HANDLING

### 1.5.1 Delivery and Storage

#### 1.5.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

#### 1.5.1.2 Metal Items

Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

### 1.5.1.3 Cement, Aggregate, and Reinforcement

As specified in Section 03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE.

### 1.5.2 Handling

Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Carry, do not drag, pipe to trench.

## 1.6 PROJECT/SITE CONDITIONS

Submit drawings of **existing conditions**, after a thorough inspection of the area in the presence of the Contracting Officer. Details shall include the environmental conditions of the site and adjacent areas. Submit copies of the records for verification before starting work.

## PART 2 PRODUCTS

### 2.1 PIPELINE MATERIALS

Pipe shall conform to the respective specifications and other requirements specified below.

#### 2.1.9 PVC Plastic Gravity Sewer Piping

##### 2.1.9.1 PVC Plastic Gravity Pipe and Fittings

**ASTM D 3034**, SDR 35, or **ASTM F 949** with ends suitable for elastomeric gasket joints. **ASTM F 794**, Series 46, for ribbed sewer pipe with smooth interior, size 8 inch through 48 inch diameters.

##### 2.1.9.2 PVC Plastic Gravity Joints and Jointing Material

Joints shall conform to **ASTM D 3212**. Gaskets shall conform to **ASTM F 477**.

##### 2.1.11 High Density Polyethylene Pipe

**ASTM F 894**, Class 63, size 18 inch through 120 inch. **ASTM F 714**, size 4 inch through 48 inch. The polyethylene shall be certified by the resin producer as meeting the requirements of **ASTM D 3350**, cell Class 334433C. The pipe stiffness shall be greater than or equal to 1170/D for cohesionless material pipe trench backfills. Fittings for High Density Polyethylene Pipe: **ASTM F 894**. Joints for high density polyethylene pipe: Rubber gasket joints shall conform to **ASTM C 443**.

### 2.2 CONCRETE MATERIALS

#### 2.2.1 Cement Mortar

Cement mortar shall conform to **ASTM C 270**, Type M with Type II cement.

#### 2.2.2 Portland Cement

Portland cement shall conform to **ASTM C 150**, Type II for concrete used in concrete pipe, concrete pipe fittings, and manholes and type optional with

the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking.

### 2.2.3 Portland Cement Concrete

Portland cement concrete shall conform to **ASTM C 94/C 94M**, compressive strength of 4000 psi at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 2500 psi minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

## 2.3 MISCELLANEOUS MATERIALS

### 2.3.1 Precast Concrete Manholes

Precast concrete manhole risers, base sections, and tops shall conform to **ASTM C 478**; base and first riser shall be monolithic.

### 2.3.2 Gaskets and Connectors

Gaskets for joints between manhole sections shall conform to **ASTM C 443**. Resilient connectors for making joints between manhole and pipes entering manhole shall conform to **ASTM C 923** or **ASTM C 990**.

### 2.3.3 External Preformed Rubber Joint Seals

An external preformed rubber joint seal shall be an accepted method of sealing cast iron covers to precast concrete sections to prevent ground water infiltration into sewer systems. All finished and sealed manholes constructed in accordance with paragraph entitled "Manhole Construction" shall be tested for leakage in the same manner as pipelines as described in paragraph entitled "Leakage Tests." The seal shall be multi-section with a neoprene rubber top section and all lower sections made of Ethylene Propylene Di Monomer (EPDM) rubber with a minimum thickness of 60 mils. Each unit shall consist of a top and bottom section and shall have mastic on the bottom of the bottom section and mastic on the top and bottom of the top section. The mastic shall be a non-hardening butyl rubber sealant and shall seal to the cone/top slab of the manhole/catch basin and over the lip of the casting. Extension sections shall cover up to two more adjusting rings.

### 2.3.4 Metal Items

#### 2.3.4.1 Frames, Covers, and Gratings for Manholes

**FS A-A-60005**, cast iron; figure numbers shall be as follows or as indicated on the drawings (drawings shall take precedence where conflicts exist):

- a. Traffic manhole: Provide in paved areas.

Frame: Figure 1, Size 22A  
Cover: Figure 8, Size 22A  
Steps: Figure 19

- b. Non-traffic manhole:

Frame: Figure 4, Size 22  
Cover: Figure 12, Size 22

Steps: Figure 19

Frames and covers shall be cast iron or ductile iron. Cast iron frames and covers shall be as indicated or shall be of type suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 400 pounds. The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

#### 2.3.4.2 Manhole Steps

Zinc-coated steel conforming to 29 CFR 1910.27. Steps are not required in manholes less than 4 feet deep.

#### 2.3.4.3 Manhole Ladders

A steel ladder shall be provided where the depth of a manhole exceeds 12 feet. The ladder shall not be less than 16 inches in width, with 3/4 inch diameter rungs spaced 12 inches apart. The two stringers shall be a minimum 3/8 inch thick and 2 inches wide. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A 123/A 123M.

### 2.4 REPORTS

Submit Test Reports. Compaction and density test shall be in accordance with Section 31 00 00 EARTHWORK. Submit Inspection Reports for daily activities during the installation of the sanitary system. Information in the report shall be detailed enough to describe location of work and amount of pipe laid in place, measured in linear feet.

## PART 3 EXECUTION

### 3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

#### 3.1.1 General Requirements for Installation of Pipelines

These general requirements apply except where specific exception is made in the following paragraphs entitled "Special Requirements."

##### 3.1.1.1 Water Main Separation

Where new sanitary sewer piping is required to be installed in the proximity of potable water mains the separation distances specified in Title 22 California Code of Regulation, Safe Drinking Water Act, Section 64572 shall be met.

When new water mains, new sanitary sewer mains, or other nonpotable fluid carrying pipelines are being installed in existing developed areas, local conditions (e.g., available space, limited slope, existing structures) may create a situation in which there is no alternative but to install water mains, sanitary sewer mains, or other nonpotable pipelines at a distance less than that required by the regulations. In such cases through permit action California DPH may approve alternate construction criteria. Contractor shall request and receive approval through the COTR, California DPH approval prior to performance of alternative construction criteria.

##### 3.1.1.2 Earthwork

Perform earthwork operations in accordance with SECTION 31 00 00 EARTHWORK for Utilities.

#### 3.1.1.3 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper facilities for lowering sections of pipe into trenches. Lay nonpressure pipe with the bell ends in the upgrade direction. Adjust spigots in bells to give a uniform space all around. Blocking or wedging between bells and spigots will not be permitted. Replace by one of the proper dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Laser beam method shall be used for checking and ensuring that pipe invert elevations are as indicated. Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for ABS pipe shall comply with Table 3 of [ASTM D 2751](#); and saddles for PVC pipe shall conform to Table 4 of [ASTM D 3034](#).

#### 3.1.1.4 Maintaining Service to Existing System

Contractor shall provide the necessary facilities for insuring that service is not interrupted. The Contractor shall provide for continuous sewage flow around the section or sections of pipe designated for the installation process. This may include installing temporary piping between manholes or installation of temporary catchbasins and pumping out on a regular basis. A plan shall be submitted to the Contracting Officers Technical Representative for approval for the method of maintaining temporary service prior to start of work.

### 3.1.2 Special Requirements

#### 3.1.2.1 Installation of PVC Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of [ASTM D 2321](#) for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of [ASTM D 2321](#) for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

#### 3.1.3 Manhole Construction

Construct base slab of cast-in-place concrete or use precast concrete base sections. Make inverts in cast-in-place concrete and precast concrete bases with a smooth-surfaced semi-circular bottom conforming to the inside contour of the adjacent sewer sections. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as manhole size will permit. For cast-in-place concrete construction, either pour bottom slabs and walls integrally or key and bond walls to bottom slab. No parging will be permitted on interior manhole walls. For precast concrete construction, make joints between manhole sections with the gaskets specified for this purpose; install in the manner specified for installing joints in concrete piping. Parging will not be required for precast concrete manholes. Cast-in-place concrete work shall be in accordance with the requirements specified under paragraph

entitled "Concrete Work" of this section. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the recommendations of the connector manufacturer. Where a new manhole is constructed on an existing line, remove existing pipe as necessary to construct the manhole. Cut existing pipe so that pipe ends are approximately flush with the interior face of manhole wall, but not protruding into the manhole. Use resilient connectors as previously specified for pipe connectors to concrete manholes.

### 3.1.5 Miscellaneous Construction and Installation

#### 3.1.5.1 Connecting to Existing Manholes

Pipe connections to existing manholes shall be made so that finish work will conform as nearly as practicable to the applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. The connection shall be centered on the manhole. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1.5 times the diameter of the pipe. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.

#### 3.1.5.2 Metal Work

a. Workmanship and finish: Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron to shape and size with sharp lines and angles. Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and arises. Provide necessary rabbets, lugs, and brackets wherever necessary for fitting and support.

b. Field painting: After installation, clean cast-iron frames, covers, gratings, and steps not buried in concrete to bare metal of mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint. Do not paint surfaces subject to abrasion.

#### 3.1.7 Installations of Wye Branches

Cutting into piping for connections shall not be done except in special approved cases. When the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, the pipe shall be encased in concrete backfill or supported on a concrete cradle as directed. Concrete required because of conditions resulting from faulty construction methods or negligence by the Contractor shall be installed at no additional cost to the Government. The installation of wye branches in an existing sewer shall be made by a method which does not damage the integrity of the existing sewer. One acceptable method consists of removing one pipe section, breaking off the upper half of the bell of the next lower section and half of the running bell of wye section. After placing the new section, it shall be rotated so that the broken half of the bell will be at the bottom. The two joints shall then be made with joint packing and cement mortar.

## 3.2 FIELD QUALITY CONTROL

### 3.2.1 Field Tests and Inspections

The Contracting Officer will conduct field inspections and witness field tests specified in this section. Perform field tests and provide labor, equipment, and incidentals required for testing. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

### 3.2.2 Tests for Nonpressure Lines

Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the adjoining end of line. When pressure piping is used in a nonpressure line for nonpressure use, test this piping as specified for nonpressure pipe.

#### 3.2.2.1 Leakage Tests

Test lines for leakage by either infiltration tests or exfiltration tests, or by low-pressure air tests. Prior to testing for leakage, backfill trench up to at least lower half of pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

- a. Infiltration tests and exfiltration tests: Perform these tests for sewer lines made of the specified materials in accordance with [ASTM C 969](#). Make calculations in accordance with the Appendix to [ASTM C 969](#).
- b. Low-pressure air tests: Perform tests as follows:
  - 5 PVC plastic pipelines: Test in accordance with [UBPPA UNI-B-6](#). Allowable pressure drop shall be as given in [UBPPA UNI-B-6](#). Make calculations in accordance with the Appendix to [UBPPA UNI-B-6](#).

#### 3.2.2.2 Deflection Testing

Perform a deflection test on entire length of installed plastic pipeline on completion of work adjacent to and over the pipeline, including leakage tests, backfilling, placement of fill, grading, paving, concreting, and any other superimposed loads determined in accordance with [ASTM D 2412](#). Deflection of pipe in the installed pipeline under external loads shall not exceed 4.5 percent of the average inside diameter of pipe. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection measuring device.

- a. Pull-through device: This device shall be a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section. Pull-through device may also be of a design promulgated by the Uni-Bell Plastic Pipe Association, provided the device meets the applicable requirements specified in this

paragraph, including those for diameter of the device, and that the mandrel has a minimum of 9 arms. Ball, cylinder, or circular sections shall conform to the following:

1 A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.

2 Homogeneous material throughout, shall have a density greater than 1.0 as related to water at 39.2 degrees F, and shall have a surface Brinell hardness of not less than 150.

3 Center bored and through-bolted with a 1/4 inch minimum diameter steel shaft having a yield strength of not less than 70,000 psi, with eyes or loops at each end for attaching pulling cables.

4 Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.

b. Deflection measuring device: Sensitive to 1.0 percent of the diameter of the pipe being tested and shall be accurate to 1.0 percent of the indicated dimension. Deflection measuring device shall be approved prior to use.

c. Pull-through device procedure: Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions.

d. Deflection measuring device procedure: Measure deflections through each run of installed pipe. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, replace pipe which has excessive deflection and completely retest in same manner and under same conditions.

---END OF SECTION---