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USACE / NAVFAC / AFCEA / NASA UFGS-33 01 99 (May 2009)  
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Preparing Activity: NASA NEW

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in Agreement with UMRL dated October 2010

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SECTION TABLE OF CONTENTS

DIVISION 33 - UTILITIES

SECTION 33 01 99

SLIP LINING OF EXISTING PIPING

05/09

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
  - 1.2.1 Design Requirements
  - 1.2.2 Performance Requirements
- 1.3 SUBMITTALS
- 1.4 QUALITY ASSURANCE
  - 1.4.1 Survey of Pipe Locations
  - 1.4.2 Qualifications
  - 1.4.3 Pre-Installation Conference
- 1.5 DELIVERY, STORAGE, AND HANDLING
- 1.6 [PROJECT] [SITE] CONDITIONS
- 1.7 SEQUENCING AND SCHEDULING

PART 2 PRODUCTS

- 2.1 MATERIALS
  - 2.1.1 PVC Pipe
  - 2.1.2 Polyethylene Pipe
  - 2.1.3 Fiberglass Reinforced Polymer (FRP) Pipe
  - 2.1.4 Grout Materials and Mixes

PART 3 EXECUTION

- 3.1 PREPARATION
  - 3.1.1 Safety
  - 3.1.2 Pre-Lining Cleaning
  - 3.1.3 Insertion and Pulling of Mandrel
  - 3.1.4 Pipe Line Obstructions
  - 3.1.5 Bypass Pumping
- 3.2 INSTALLATION
- 3.3 INSTALLATION CERTIFICATION
- 3.4 WARRANTY

-- End of Section Table of Contents --

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### SECTION 33 01 99

#### SLIP LINING OF EXISTING PIPING 05/09

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NOTE: This guide specification covers the requirements for the procurement, installation, and testing of slip lining for existing exterior piping.

Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

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## PART 1 GENERAL

### 1.1 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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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 WATER WORKS ASSOCIATION (AWWA)

AWWA M45 (2005; Errata 2008; 2nd Ed) Fiberglass  
Pipe Design

ASTM INTERNATIONAL (ASTM)

ASTM C 138/C 138M (2010a) Standard Test Method for Density  
("Unit Weight"), Yield, and Air Content  
(Gravimetric) of Concrete

ASTM C 150 (2009) Standard Specification for Portland  
Cement

ASTM C 403/C 403M (2008) Standard Test Method for Time of  
Setting of Concrete Mixtures by  
Penetration Resistance

ASTM C 495 (2007) Compressive Strength of Lightweight  
Insulating Concrete

ASTM C 581 (2003; R 2008e1) Standard Practice for  
Determining Chemical Resistance of  
Thermosetting Resins Used in  
Glass-Fiber-Reinforced Structures,  
Intended for Liquid Service

ASTM C 796 (2004) Foaming Agents for Use in Producing  
Cellular Concrete Using Preformed Foam

ASTM C 869 (1991; R 2006) Foaming Agents Used in  
Making Preformed Foam for Cellular Concrete

ASTM C 939 (2010) Flow of Grout for  
Preplaced-Aggregate Concrete (Flow Cone  
Method)

ASTM D 1784 (2008) Standard Specification for Rigid  
Poly(Vinyl Chloride) (PVC) Compounds and  
Chlorinated Poly(Vinyl Chloride) (CPVC)  
Compounds

ASTM D 2122 (1998; R 2010) Determining Dimensions of  
Thermoplastic Pipe and Fittings

ASTM D 2412 (2010) Determination of External Loading  
Characteristics of Plastic Pipe by  
Parallel-Plate Loading

ASTM D 2657 (2007) Heat Fusion Joining Polyolefin Pipe  
and Fittings

ASTM D 2837 (2008) Standard Test Method for Obtaining  
Hydrostatic Design Basis for Thermoplastic

Pipe Materials or Pressure Design Basis  
for Thermoplastic Pipe Products

ASTM D 3034	(2008) Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
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	(2010) Polyethylene Plastics Pipe and Fittings Materials
ASTM D 3567	(1997; R 2006) Standard Practice for Determining Dimensions of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fittings
ASTM D 4161	(2001; R 2005) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals
ASTM F 1803	(2006) Standard Specification for Poly (Vinyl Chloride) (PVC) Closed Profile Gravity Pipe and Fittings Based on Controlled Inside Diameter
ASTM F 477	(2010) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 585	(1994; R 2007) Standard Practice for Insertion of Flexible Polyethylene Pipe into Existing Sewers
ASTM F 714	(2008) Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM F 794	(2003; R 2010) 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	(2010) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

1.2 SYSTEM DESCRIPTION

This section consists of the requirements and work needed to rehabilitate

existing pipes by furnishing and installing pipe liners by the method of slip lining. Use pipes and pipe liners of the sizes, types, design, and dimensions shown on the plans, and include all connections, joints, and other appurtenances as required to complete the work.

Specified in this section are requirements of slip lining of existing pipelines, including but is not limited to the following:

Flow diversion and temporary works

Traffic management

Excavating entry and exit pits

Pipe lining fabrication, storage and placement

Service connections, connecting to access chambers and make water tight

Grouting

Other specific structural works

Testing

Reinstatement

#### 1.2.1 Design Requirements

Provide slip lining pipe designed to allow the maximum conveyance capacity possible and in no case can provide less capacity than currently exists. The actual pipe diameter installed may be less than the desired pipe diameter only if satisfactory documentation is submitted to the [Contracting Officer] [Contract Administrator] demonstrating that it is impossible or impractical to construct the project with standard, commercially available pipe diameters and dimensions.

Provide pipe and joint dimensions in accordance with [ASTM D 2122](#) or [ASTM D 3567](#) unless otherwise specified.

Calculate slip liner structural properties and submit to the [Contracting Officer] [Contract Administrator] prior to construction based upon the following:

- a. All existing pipelines are considered in the state of deterioration specified.
- b. Locate water table to establish hydrostatic pressure criteria.
- c. New pipe is to have 5 percent ovality and a maximum allowed 5 percent deflection at end of installation.
- d. Maximum depth to invert of existing pipeline is [\_\_\_\_\_].
- e. Safety factor of 2.0 for bending and wall crush, and 2.5 for buckling.
- f. Modulus of soil reaction is [\_\_\_\_\_].
- g. Soil weight is [\_\_\_\_\_].

### 1.2.2 Performance Requirements

Notify the [Contracting Officer] [Contract Administrator] 24 hours in advance of tests, and perform tests at the work site if practicable. Conform to local, state, and federal requirements.

### 1.3 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

Contractor Qualifications  
List of proposed subcontractors[; G][; G[, [\_\_\_\_]]]  
List of proposed products[; G][; G[, [\_\_\_\_]]]  
Construction Progress Schedule[; G][; G[, [\_\_\_\_]]]  
Manufacturer's Sample Warranty  
Manufacturer's Certification of Florida Product Approval

#### SD-02 Shop Drawings

Survey of Pipe Locations  
Detail Drawings

Submit manufacturer's detailed product data with complete information on pipeline materials, physical properties, dimensions, maximum recommended external grout pressure, and minimum bending radius or maximum joint angular deflection. Include a manufacturer's certificate of compliance with specifications for proposed materials.

SD-03 Product Data

Submit manufacturer's catalog data for the following items:

Pipes  
Joints  
Gaskets

SD-06 Test Reports

Coatings  
Resins

After liner installation, perform a low pressure air test in accordance with [ASTM D 2837](#) before the liner has been completely sealed into place. Check integrity of joints and verify that liner has not been damaged during installation. Repair if needed using liner manufacturer's recommended procedure and retest for leaks.

SD-08 Manufacturer's Instructions

Manufacturer's recommendations for shipping, handling, erection procedures, and care and maintenance upon completion of installation.

- [ SD-09 Manufacturer's Field Reports
  - Manufacturer's Certification of Installation
- ] SD-11 Closeout Submittals
  - Manufacturer's Warranty

1.4 QUALITY ASSURANCE

1.4.1 Survey of Pipe Locations

Submit a certified survey meeting the requirements specified herein.

1.4.2 Qualifications

Submit [Contractor Qualifications](#) for slip lining piping, proving its engagement in the successful installation of similar slip lining systems for at least [\_\_\_\_\_] years.

#### 1.4.3 Pre-Installation Conference

[Within [30][15] calendar days of notice to proceed][At the Pre-installation conference] provide, for approval, submit the following:

- a. Detail drawings in an approved form, for each slip lining system,
- b. List of proposed products showing existing pipe diameters,
- c. New diameters of slip lining installed,
- d. Depths of pipes, top and bottom elevations
- e. Water table conditions,
- f. Dates of excavation and pipe placement,
- g. Joints, gaskets, proposed resins, conforming to ASTM C 581 and coatings, [\_\_\_\_], and other pertinent information.
- h. Proposed Construction Progress Schedule
- i. List of proposed subcontractors
- j. Manufacturer's Sample Warranty
- k. Manufacturer's Certification of Florida Product Approval

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Prevent injury or abrasion to pipe during loading, transportation, and unloading. Do not drop pipe from cars or trucks, nor allow pipe to roll down skids without proper restraining ropes. Use suitable pads, strips, skids, or blocks for each pipe during transportation and while awaiting installation in the field.

Remove pipe with cuts, gashes, nicks, abrasions, or any such physical damage which is deeper than 10 percent of the wall thickness from the Site and replace with undamaged pipe at no additional cost to the Government.

#### 1.6 [PROJECT] [SITE] CONDITIONS

Subsurface soil data logs are shown on the drawings. The subsurface investigation report and samples of materials, as taken from subsurface investigations, are available for examination at [\_\_\_\_].

#### [1.7 SEQUENCING AND SCHEDULING

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NOTE: Sequence of work criteria should be modified  
for agency requirements.  
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[ Submit plan for final approval of construction sequence and schedule prior to commencing construction.]



## ] PART 2 PRODUCTS

### 2.1 MATERIALS

Provide pipes constructed of corrosion resistant, thermoplastic, or thermosetting resin. Suitable pipe lining materials include but are not limited to HDPE, LDPE, UPVC, and FRP. Secure written product approval from the [Contracting Officer] [Contract Administrator] before commencing any work.

#### [2.1.1 PVC Pipe

Provide pipe manufactured to meet the requirements of [ASTM F 794](#), [ASTM F 949](#), [ASTM D 3034](#) and / or [ASTM F 1803](#), with joints meeting the requirements of [ASTM D 3212](#), and gaskets meeting the requirements of [ASTM F 477](#).

Provide pipe manufactured of PVC compound having a minimum cell classification of 12364A as defined by [ASTM D 1784](#), with a minimum long term pipe stiffness of [\_\_\_\_\_] psi when tested in accordance with [ASTM D 2412](#).

Use pipe with joints designed so that neither the outside diameter of the pipe is increased nor the internal diameter of the pipe is decreased at the joint.

#### ] [2.1.2 Polyethylene Pipe

Provide pipe manufactured to meet the requirements of [ASTM F 894](#) or [ASTM F 714](#), with joints meeting the requirements of [ASTM D 3212](#) or [ASTM D 2657](#) if fusing is required, and gaskets meeting the requirements of [ASTM F 477](#).

Provide pipe manufactured of High or Low Density Polyethylene compound having a minimum cell classification of 345434C as defined by [ASTM D 3350](#).

Use only pipe having a minimum long term pipe stiffness of [\_\_\_\_\_] psi when tested in accordance with [ASTM D 2412](#) and a tensile modulus of elasticity of [\_\_\_\_\_] psi. If fusion is required, perform fusion of joints by a technician with a minimum of 5 years of experience. Design all joints so that neither the outside diameter of the pipe is increased nor the internal diameter of the pipe is decreased at the joint.

#### ] [2.1.3 Fiberglass Reinforced Polymer (FRP) Pipe

Provide pipe manufactured to meet the requirements of [ASTM D 3262](#) and [AWWA M45](#), with joints meeting the requirements of [ASTM D 4161](#), and gaskets meeting the requirements of [ASTM F 477](#).

Use only pipe manufactured from fiberglass reinforcing materials, polyester resin and pure silica sand, conforming to [ASTM D 3262](#) standards, with gaskets of rubber material conforming to [ASTM F 477](#).

Use only pipe having a minimum long term pipe stiffness of [\_\_\_\_\_] psi when tested in accordance with [ASTM D 2412](#), with low-profile fiberglass bell and spigot type joints or flush fiberglass bell and spigot type, when the fit requires. Provide nominal lengths of [\_\_\_\_\_] feet, however, shorter lengths are allowed where needed.

#### ]2.1.4 Grout Materials and Mixes

Establish proposed grout material and mixes, equipment, placement procedures, applicator, set-up, and criteria that the grouting operations meet. Provide a grouting system having sufficient gauges, monitoring devices, and tests to determine the effectiveness of the grouting operation. Document compliance with the project and slip liner pipe specification design limits. Modify the grouting operation if the grouting does not perform as submitted and not approved by the [Contracting Officer] [Contract Administrator].

Grouting materials include, but are not limited to, neat cement grout (cementation) and cellular grout (cellular concrete), conforming to [ASTM C 150](#) [ASTM C 796](#) and [ASTM C 869](#).

Provide grout with a minimum compressive strength of [\_\_\_\_\_] in 24 hours when tested in accordance with [ASTM C 403/C 403M](#) and a minimum of [\_\_\_\_\_] in 28 days when tested in accordance with [ASTM C 495](#). Design a grout mix with a density that will not float the slip liner pipe while maintaining an apparent viscosity as tested in accordance with [ASTM C 939](#). Verify the density in conformance with [ASTM C 138/C 138M](#) or by other methods as approved by the [Contracting Officer] [Contract Administrator].

### PART 3 EXECUTION

#### 3.1 PREPARATION

Complete the following preparations, unless approved otherwise by the [Contracting Officer] [Contract Administrator]. The [Contracting Officer] [Contract Administrator] makes no guarantee regarding the information, data, and physical condition of underground facilities or existing pipe lines. Before commencing with any work, or ordering any materials, physically measure and perform CCTV inspection of the existing pipe line to verify that the rehabilitation specified herein is appropriate.

##### 3.1.1 Safety

Carry out all operations in strict accordance with all applicable OSHA Standards. Particular attention is directed to those safety requirements involving entry into a confined space. It is the Contractor's responsibility to familiarize themselves with OSHA Standards and Regulations pertaining to all aspects of the work.

##### 3.1.2 Pre-Lining Cleaning

It is the Contractor's responsibility to wash, clean, and video existing pipe before lining. Plan work after review of CCTV inspection video and CCTV reports.

##### 3.1.3 Insertion and Pulling of Mandrel

It is the responsibility of the Contractor to pull a mandrel with a minimum length of one joint of pipe completely through each proposed rehabilitated pipe line. Use a mandrel of the same outside diameter as the slip lining pipe.

##### 3.1.4 Pipe Line Obstructions

If a pre-installation inspection with a mandrel reveals an obstruction

(such as heavy solids, dropped joints, or collapsed pipe) in the existing pipe that cannot be removed by pipe cleaning equipment, perform a point repair prior to slip lining as approved by the [Contracting Officer] [Contract Administrator]. Complete all point repairs, mobilize equipment and material, and inform the [Contracting Officer] [Contract Administrator] of the impending work schedules for liner installations.

#### 3.1.5 Bypass Pumping

If required, provide for continuous bypass flow around the section or sections of pipe designated for the liner process. Provide pump and bypass lines of adequate size and capacity to handle the necessary flow.

### 3.2 INSTALLATION

Adhere to the following installation procedures using [ASTM F 585](#) unless otherwise specified by the [Contracting Officer] [Contract Administrator]:

- a. Remove and replace fences, repair damage to yards, lawns, streets, sidewalks, driveways, etc., due to installation and movement of the mandrel, cleaning, boiler, steam, or other trucks and/or erection of equipment.
- b. Point repairs, deemed necessary at any point on the existing pipe line by the [Contracting Officer] [Contract Administrator], require locating the insertion pit at the point repair location.
- c. Identify all service connections, locate, excavate, and disconnect prior to the slip line pipe insertion. Submit the complete list of service laterals, including relevant footage and diameter of lateral, to the [Contracting Officer] [Contract Administrator], prior to slip lining, for informational purposes only. Upon completion of insertion of the slip line pipe and pipe relaxation period, expedite the reconnection of services to minimize any inconvenience to the customers. Smoke test all re-established services prior to backfilling.  
The Contractor is responsible for any existing pipe flow control or backups during slip lining operations.
- d. If the slip line pipe is HDPE, allow the installed pipe to relax and cool following installation in accordance with manufacturer's recommended time, but not less than [\_\_\_\_\_] hours, prior to any reconnection of service lines, grouting of the annulus, or backfilling of the insertion pit.
- e. Prior to the introduction of grout and backfilling of re-established service connections, perform a dye water test on the liner pipe to test the bulkheads at each end for leaks. Place grout within [\_\_\_\_\_] hours of slip lining.
- f. After all work is completed, provide the [Contracting Officer] [Contract Administrator] with videotape showing both pre- and post-installation conditions including the restored connections. Correct all defects discovered during the post-installation television inspection, at no cost to the Government, before the work under the Contract will be considered for substantial completion.

#### [3.3 INSTALLATION CERTIFICATION

Submit a signed copy of the [Manufacturer's Certification of Installation](#) to

the [Contracting Officer] [Contract Administrator] upon completion of final inspection.

] 3.4 WARRANTY

Submit [\_\_\_\_\_] copies of the signed [Manufacturer's Warranty](#) to the [Contracting Officer] [Contract Administrator] within [\_\_\_\_\_] [days] [weeks] of final completion of the work.

-- End of Section --