Preparing Activity: AFCEC Superseding
UFGS-33 05 23.13 (November 2013)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in Agreement with UMRL dated July 2023
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SECTION TABLE OF CONTENTS

DIVISION 33 - UTILITIES

SECTION 33 05 23.13

UTILITY HORIZONTAL DIRECTIONAL DRILLING

11/19

PART 1 GENERAL

1.1 REFERENCES
1.2 SUBMITTALS
1.3 QUALITY CONTROL
1.3.1 Qualifications
1.3.2 Safety
1.3.3 Horizontal Directional Drilling Plan
1.3.3.1 Layout Plan
1.3.3.2 Utility Profile
1.3.3.3 Equipment List
1.3.3.4 Drilling Fluid Management Plan
1.3.3.5 Pedestrian Access
1.3.3.6 Method and Procedures
1.3.3.7 Safety Data Sheets
1.3.3.8 Revisions
1.3.4 Fusion Technician Qualifications
1.4 DELIVERY, STORAGE, AND HANDLING

PART 2 PRODUCTS

2.1 EQUIPMENT
2.1.1 Drill Rod
2.2 MATERIALS
2.2.1 Pipe
2.2.1.1 Fusible PVC
2.2.1.2 HDPE
2.2.2 Drilling Fluids
2.2.3 Additives
2.2.4 Tracer Wire

PART 3 EXECUTION

3.1 EXAMINATION

3.2 INSTALLATION
3.2.1 Drill Set-Up
3.2.1.1 Drilling Fluids
3.2.2 Drill Entrance and Exit Pits
3.2.3 Drill Entrance and Exit Angle
3.2.4 Pilot Hole
3.2.5 Guidance Systems
3.2.6 Reaming
3.2.7 Pull Back
3.2.8 Drilling Fluids Disposal
3.2.9 Connection of Product Pipe to Pipeline
3.3 FIELD QUALITY CONTROL
3.3.1 Daily Work Log
3.3.2 Drill Logs
3.3.3 Field Tests
3.4 CLOSEOUT ACTIVITIES

-- End of Section Table of Contents --

Preparing Activity: AFCEC Superseding
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SECTION 33 05 23.13

UTILITY HORIZONTAL DIRECTIONAL DRILLING
11/19

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NOTE: This guide specification covers the requirements for directional drilling systems, equipment, piping (PVC and HDPE), and procedures.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(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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NOTE: Refer to UFGS Section 33 05 23 TRENCHLESS UTILITY INSTALLATION for microtunneling gravity sanitary sewer and storm sewer mains 300 mm12 inches and larger in diameter.

NOTE: Refer to UFGS Section 33 11 00 WATER UTILITY DISTRIBUTION PIPING for testing requirements for potable and non-potable water systems in which the largest pipe diameter is 152.4 cm60 inches and the maximum working pressure is 150 psi.

Refer to UFGS Section 33 31 23.00 10 SANITARY SEWER FORCE MAIN PIPING for testing requirements for sanitary sewer force mains.

Refer to UFGS Section 33 11 23 NATURAL GAS AND

LIQUID PETROLEUM PIPING for testing requirements for polyethylene gas piping up to 20.32cm8 inches in nominal pipe size.

Use other pipe specifications as necessary for any other required pipe testing.

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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 Reference Identifier (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 ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(2017) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C605	(2021) Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
AWWA C900	(2016) Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm)
AWWA C906	(2021) Polyethylene (PE) Pressure Pipe and Fittings, 4 In. through 65 In. (100 mm Through 1,650 mm), for Waterworks

ASTM INTERNATIONAL (ASTM)

ASTM D1784	(2020) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D1785	(2015; E 2018) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D2241	(2015) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2513	(2018a) Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings
ASTM D3350	(2021) Polyethylene Plastics Pipe and Fittings Materials
ASTM F714	(2022) Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
ASTM F1674	(2011) Standard Test Method for Joint Restraint Products for Use with PVC Pipe
ASTM F2620	(2020a; E 2021) Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI Z535.1	(2017) Safety Colors

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

29 CFR 1926.652	Safety and Health Regulations for Construction; Subpart P, Excavations; Requirements for Protective Systems

1.2 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a “G” to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification 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

Statement of Qualifications and Records; G[, [____]]

Horizontal Directional Drilling Plan; G[, [____]]

SD-03 Product Data

Pipe; G[, [____]]

Drilling Fluids; G[, [____]]

Additives; G[, [____]]

Tracer Wire; G[, [____]]

SD-05 Design Data

Secondary Containment Plan; G[, [____]]

SD-06 Test Reports

Soil Test Data

SD-07 Certificates

Drill Rod

Fusion Technician Qualifications

SD-11 Closeout Submittals

Record Drawings

Complete Work Logs of Guided Directional Drill Operations

1.3 QUALITY CONTROL

1.3.1 Qualifications

Ensure that the field supervisor and workers assigned to this project are experienced in work of this nature and have successfully completed similar projects of similar length, pipe type, pipe size, and soil type using directional drilling in the last three (3) years. As part of the bid submission, submit project descriptions which include, at a minimum, a listing of the location(s), date of project(s), owner, pipe type and material, size installed, length of installation, manufacturer of equipment used, and other information relevant to the successful completion of the project.

1.3.2 Safety

Include in directional drilling equipment machine safety requirements a common grounding system to prevent electrical shock in the event of underground electrical cable strike. Ensure the grounding system connects all pieces of interconnecting machinery; the drill, mud mixing system, drill power unit, drill rod trailer, operator's booth, worker grounding mats, and any other interconnected equipment to a common ground. Equip the drill with an "electrical strike" audible and visual warning system that notifies the system operators of an electrical strike.

1.3.3 Horizontal Directional Drilling Plan

Provide a plan prepared, signed, and sealed by a licensed Professional Engineer. Submit supporting calculations, certifications, and material product data demonstrating the strength of the product pipes for acceptance before the beginning of the installation. Demonstrate that the proposed material satisfies the purpose of the utility and withstands the design and construction stresses and pressures. The HDD Plan will include the following:

1.3.3.1 Layout Plan

Provide a plan location of the operation, including entry and exit points, discussing the relationship of the equipment, pipe assembly, and staging areas.

1.3.3.2 Utility Profile

Provide a profile of the utility plotted at a scale appropriate for the work.

1.3.3.3 Equipment List

Provide a directional drilling equipment list including: drilling rig, drill bit, back-reamer, mud mixing and pumping systems, down-hole tools, guidance system, and rig safety system. Provide calibration records for guidance system.

1.3.3.4 Drilling Fluid Management Plan

Provide a drilling fluid management plan to include drilling fluid types and specifications, cleaning and recycling equipment, estimated flow rates, procedures for minimizing drilling fluid escape, and the method/location for final disposal of waste drilling fluids. Provide a frac out control plan, including frac control materials that will be onsite and contact information for emergency personnel.

1.3.3.5 Pedestrian Access

When and where installations disrupt pedestrian use of sidewalk for periods exceeding two consecutive days, provide an alternate route that meets current ADA requirements.

1.3.3.6 Method and Procedures

Provide an outline of the methods and procedures, describing the pilot hole drilling procedure, the reaming operation, and the pullback procedure, including drawings, schedule of operations, specifications, and method of operation. Include pipe storage and handling details and pipeline assembly and installation procedures.

1.3.3.7 Safety Data Sheets

Submit safety data sheets for fluids and additives.

1.3.3.8 Revisions

If site conditions change and require modification to the HDD Plan, submit revised drilling plan to achieve successful installation. Explain, in the revised submittal, the anticipated and encountered conditions that mandated the change in plans.

1.3.4 Fusion Technician Qualifications

The fusion technician must be qualified by the fusion equipment manufacturer to thermally butt-fuse the size of pipe used at the time of fusion performance. Each joint must be datalogged, recorded, and submitted for review.

1.4 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the site for damage. All materials found during inspection or during the progress of work to have cracks, flaws, surface abrasions, or other defects will be rejected. Remove defective materials from the job site.

Protect stored piping from moisture and dirt and place on level surface. Store plastic piping protected from direct sunlight.

PART 2 PRODUCTS

2.1 EQUIPMENT

2.1.1 Drill Rod

Select the appropriate drill rod to be used. Submit certified statement

that the drill rod has been inspected and is in satisfactory condition for its intended use.

2.2 MATERIALS

2.2.1 Pipe

[2.2.1.1 Fusible PVC

Install [_____] inch [(nominal)] diameter fusible polyvinyl chloride pipe [with a dimension ratio of [18 (DR 18)] [14 (DR 14)] [_____] conforming to AWWA C900] [with a standard dimension ratio of [17 (SDR 17)] [21 (SDR 21)] [26 (SDR 26)] [_____] conforming to ASTM D2241] [, [Schedule 40] [Schedule 80] [_____] conforming to ASTM D1785]. Provide pipe made from PVC compound meeting or exceeding cell classification 12454 per ASTM D1784. Provide fusible polyvinyl chloride pipe with plain ends. Pipe is [blue] [green] [purple] [_____] in color.

Use butt fusion jointing method for plain end PVC pipe. Comply with [AWWA C900] [AWWA C605] [ASTM F1674] [_____] for butt fusion joints.

][2.2.1.2 HDPE

Install [_____]-inch [(nominal)] diameter high density polyethylene pipe (HDPE) with a standard dimension ratio of [11 (SDR11)] [9 (SDR9)] [_____]. Provide pipe conforming to[ASTM D3350][ASTM F714][ASTM D2513][AWWA C906] [_____]. [Pipe is [_____] in color.][Pipe is [_____] in color with [_____] striping.]

Use butt fusion jointing method for plain end HDPE pipe. Comply with[AWWA C906][ASTM F2620] [_____] for butt fusion joints.

]2.2.2 Drilling Fluids

Use a high quality [bentonite][_____] drilling fluid to ensure hole stability, cuttings transport, bit and electronics cooling, and hole lubrication to reduce drag on the drill pipe and the product pipe. Use only fluid with a composition which complies with all Federal, State, and local environmental regulations.

2.2.3 Additives

Use admixtures as required to address soil conditions and water conditions such as water hardness, acidity, and alkalinity.

2.2.4 Tracer Wire

Use a continuous sheathed solid conductor copper wire line, minimum #12 AWG. Sheathing must be color coded to match the utility.

PART 3 EXECUTION

3.1 EXAMINATION

a. Soil Test Data

Provide written documentation of conformance with AASHTO T 180.

3.2 INSTALLATION

Ensure all utilities are located and clearly marked prior to start of excavation or drilling.

3.2.1 Drill Set-Up

Design and construct the drill entrance and exit pits.

3.2.1.1 Drilling Fluids

Mix the [bentonite][_____] drilling fluid with potable water (of proper pH) to ensure no contamination is introduced into the soil during the drilling, reaming, or pipe installation process. Make any required additive adjustments.

3.2.2 Drill Entrance and Exit Pits

Drill entrance and exit pits are required. Maintain at minimum size to allow only the minimum amount of drilling fluid storage prior to transfer to mud recycling or processing system or removal from the site.

Do not allow drilling mud to flow freely on the site or around the entrance or exit pits. Remove spilled mud and restore ground to original condition.[Provide shore pits in compliance with OSHA Standards, 29 CFR 1926.652].

[Drilling near wetlands or water courses requires secondary containment to prevent drilling fluids from entering the wetlands. Secure written approval of a secondary containment plan from the Contracting Officer.

]3.2.3 Drill Entrance and Exit Angle

Ensure entrance and exit angles and elevation profile maintains adequate cover to reduce risk of drilling fluid breakouts and ground exit occurs as specified herein. Ensure that entrance and exit angles generate pullback forces that do not exceed [5][7.5][_____] percent strain on the [high density polyethylene][fusible polyvinyl chloride] pipe.

3.2.4 Pilot Hole

The type and size of the pilot string cutting head and the diameter of the drill pipe are at the Contractor's discretion.

Drill the pilot hole along the path shown on the plan and profile drawings. Pilot hole tolerances are as follows:

a. Vertical Tolerance: Provide minimum cover below channel bottom as specified on the plans. Pilot hole may go deeper if necessary to prevent breakout.

b. Horizontal Tolerance: Plus or minus - 152.4 cm 60 inches [_____] from the centerline of the product pipe.

c. Curve Radius: No curve is acceptable with a radius less than 304.8 m 1,000 feet.

d. Entry Point Location: Make pilot hole entry point within plus or minus - 152.4 cm 60 inches [_____] of the location shown on the

drawings or as directed by the Contracting Officer in the field.

e. Exit Point Location: Make the exit point location within plus/minus - 152.4 cm 60 inches [_____] of the location shown on the drawings or as directed by the Contracting Officer in the field.

f. Mandatory pipeline cover requirements are as shown on the drawings or as specified.

3.2.5 Guidance Systems

Walkover guidance systems are not acceptable for this project; use a magnetic survey tool locator installed behind the pilot string cutting head and an electric grid (tru-tracker) system for this project. Ensure proper calibration of all equipment before commencing directional drilling operation.

3.2.6 Reaming

Conduct reaming operations at the Contractor's discretion. Determine the type of back reamer to be utilized by the type of subsurface soil conditions that are encountered during the pilot hole drilling operation. The reamer type is at the Contractor's discretion.

3.2.7 Pull Back

Fully assemble the entire pipeline to be installed via direction drill prior to commencement of pull back operations.[Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe in accordance with ANSI Z535.1. Attach wire to top of pipe in such a manner that it will not be displaced during construction operations.]

Support the pipeline during pullback operations in a manner to enable it to move freely and prevent damage. Install the pipeline in one continuous pull.

Minimize torsion stress by using a swivel to connect the pull section to the reaming assembly.

Maximum allowable tensile force imposed on the pull section is not to exceed [90][_____] percent of the pipe manufacturer's safe pull (or tensile) strength. If the pull section is made up of multiple pipe size or materials, the lowest safe pull strength value governs and the maximum allowable tensile force is not to exceed [90][_____] percent of this value.

Minimize external pressure during installation of the pullback section in the reamed hole. Replace damaged pipe resulting from external pressure at no cost to the Government. Buoyancy modification is at the discretion of the Contractor.

3.2.8 Drilling Fluids Disposal

Collect drilling fluid returns in the entrance pit, exit pit, or spoils recovery pit. Immediately clean up any drilling fluid spills or overflows from these pits.

Dispose of fluids in a manner that is in compliance with all permits and applicable Federal, State, and local regulations. Disposal of the drilling fluids may occur on approved land owned by the Government subject

to written approval from the Contracting Officer. Spread the drilling slurry over the Government-approved disposal area and plow into the soil.

Conduct disposal in compliance with all relative environmental regulations, right-of-way and work space agreements, and permit requirements.

[3.2.9 Connection of Product Pipe to Pipeline

After the product pipe has been successfully installed, allow the product pipe to recover for 24 hours prior to connection of the pipeline. Ensure that a sufficient length of the product pipe has been pulled through the hole so that the pull-nose is not pulled back into bore hole due to stretch recovery of the product pipe.

]3.3 FIELD QUALITY CONTROL

3.3.1 Daily Work Log

Maintain a work log of construction events and operations including, but not limited to, the following for each day's work:

a. Hours worked.

b. Log of each drill rod added or withdrawn during drilling, reaming, and pull back.

c. Groundwater control operations.

d. Description of soil conditions encountered.

e. Tools and equipment in use, drilling fluid, fluid pumping rate, and drilling head location.

f. Any unusual conditions or events.

g. Reasons for operational shutdown in event work is halted.

3.3.2 Drill Logs

Maintain drilling logs that accurately provide drill bit location (both horizontally and vertically) at least every 5.1 cm 2 inches along the drill path. In addition, keep logs that record, as a minimum the following, every 15 minutes throughout each drill pass, back ream pass, or pipe installation pass:

a. Drilling Fluid Pressure

b. Drilling Fluid Flow Rate

c. Drill Thrust Pressure

d. Drill Pullback Pressure

e. Drill Head Torque

Make all instrumentation, readings, and logs available to the Contracting Officer at all times during operation.

3.3.3 Field Tests

Perform field tests and provide labor, equipment, and incidentals required for testing. Submit test results, identifying any results that do not meet requirements, to the Contracting Officer within four days of test completion. Provide corrective action and retest pipe not meeting requirements. Provide corrective action as recommended by the pipe manufacturer and subject to approval by the Contracting Officer.

3.4 CLOSEOUT ACTIVITIES

Immediately upon completion of work, remove all rubbish and debris from the job site. Remove all construction equipment and implements of service leaving the entire area involved in a neat condition acceptable to the Contracting Officer.

Immediately clean "blow holes" or "breakouts" of drilling fluid to the surface and return the surface area to its original condition. Dispose of all drilling fluids, soils, and separated materials in compliance with Federal, State, and local environmental regulations.

[Provide a post-construction fusion report including the following data for each fusible connection:

a. Pipe Size and Thickness

b. Machine Size

c. Fusion Technician Identification

d. Job Identification

e. Fusion Joint Number

f. Fusion, Heating, and Drag Pressure Settings

g. Heat Plate Temperature

h. Time Stamp

i. Heating and Cool Down Time of Fusion

j. Ambient Temperature]

Submit an electronic copy and three hard copies of the record drawings to the Contracting Officer within five days after completing the pull back. Include in the record drawings a plan, profile, and all information recorded during the progress of the work. Clearly tie the record drawings to the project's survey control. Maintain, and submit upon completion, signed complete work logs of guided directional drill operations.

-- End of Section --