

SECTION TABLE OF CONTENTS

SITE WORK

SECTION 02711

FOUNDATION DRAINAGE SYSTEM

PART 1 GENERAL

- 1.1 SUMMARY (Not Applicable)
- 1.2 REFERENCES
- 1.3 SUBMITTALS
- 1.4 DELIVERY, STORAGE AND HANDLING

PART 2 PRODUCTS

2.1 MATERIALS

- 2.1.1 Clay Pipe
- 2.1.2 Perforated Clay Pipe
- 2.1.3 Concrete Pipe
- 2.1.4 Perforated Concrete Pipe
- 2.1.5 Porous Concrete Pipe
- 2.1.6 Clay Drain Tile
- 2.1.7 Perforated Clay Drain Tile
- 2.1.8 Concrete Drain Tile
- 2.1.9 Cast-Iron Soil Pipe
- 2.1.10 Perforated Corrugated Steel Pipe
- 2.1.11 Perforated Corrugated Aluminum Alloy Pipe
- 2.1.12 Perforated Asbestos-Cement Underdrain Pipe
- 2.1.13 Plastic Pipe
 - 2.1.13.1 Corrugated Polyethylene (PE) Drainage Pipe
 - 2.1.13.2 Acrylonitrile-Butadiene-Styrene (ABS) Pipe
 - 2.1.13.3 Polyvinyl Chloride (PVC) Pipe
 - 2.1.13.4 Circular Perforations in Plastic Pipe
 - 2.1.13.5 Slotted Perforations in Plastic Pipe
- 2.1.14 Fittings
- 2.1.15 Cleanouts and Piping Through Walls
- 2.1.16 Cover and Wrapping Materials for Open Joints in Drain Tile
- 2.1.17 Bedding and Pervious Backfill for Foundation Drains

PART 3 EXECUTION

GENERAL REQUIREMENTS

- 3.1.1 Extent
- 3.1.2 Outlet Connections
- 3.1.3 Drainage Lines
- 3.1.4 Outlet Lines

INSTALLATION

- 3.2.1 Trenching and Excavation
- 3.2.2 Bedding
- 3.2.3 Pipe Laying
- 3.2.4 Jointing

- 3.2.4.1 Perforated and Porous Pipes
- 3.2.4.2 Nonperforated Drain Tile
- 3.2.4.3 Perforated Corrugated Metal Pipe
- 3.2.4.4 Joints of Concrete or Clay Sewer Pipe
- 3.2.4.5 Joints of Cast-Iron Pipe
- 3.2.4.6 Perforated Corrugated Polyethylene Drainage Tubing
- 3.2.4.7 Perforated Asbestos-Cement Pipe Joints
- 3.2.4.8 Plain-End Perforated Clay
- 3.2.4.9 ABS Pipe
- 3.2.4.10 PVC Pipe
- 3.2.5 Outlet Lines
- 3.2.6 Backfilling
- 3.2.7 Cleanouts
- 3.3 FIELD TESTS
- 3.4 PROTECTION FROM EXPOSURE TO SUN

End of Table of Contents

SECTION 02711

FOUNDATION DRAINAGE SYSTEM

PART 1 GENERAL

SUMMARY (Not Applicable)

REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 252 (1985) Corrugated Polyethylene Drainage
Tubing

AASHTO M 294 (1986) Corrugated Polyethylene Pipe, 12
to 24-in. Diameter

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 74 (1987) Cast Iron Soil Pipe and Fittings

ASTM A 760 (1989) Corrugated Steel Pipe,
Metallic-Coated for Sewers and Drains

ASTM B 745 (1990) Corrugated Aluminum Pipe for
Sewers and Drains

ASTM C 4 (1962; R 1986) Clay Drain Tile

ASTM C 14 (1988) Concrete Sewer, Storm Drain,
and Culvert Pipe

ASTM C 33 (1990) Concrete Aggregates

ASTM C 412 (1983; R 1988) Concrete Drain Tile

ASTM C 425 (1988) Compression Joints for
Vitrified Clay Pipe and Fittings

ASTM C 444 (1980) Perforated Concrete Pipe

ASTM C 498 (1965; R 1986) Perforated Clay Drain Tile

ASTM C 508 (1988) Asbestos-Cement Underdrain

Pipe

ASTM C 654	(1988) Porous Concrete Pipe
ASTM C 700	(1989a) Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
ASTM D 2751	(1989) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D 3034	(1989) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1989) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM F 405	(1989) Corrugated Polyethylene (PE) Tubing and Fittings
ASTM F 667	(1985) Large Diameter Corrugated Polyethylene Tubing and Fittings
ASTM F 758	(1982) Smooth-Wall Poly(Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage
ASTM F 949	(1989) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings

FEDERAL SPECIFICATIONS (FS)

FS WW-P-405	(Rev B; Am 1) Pipe, Corrugated Iron or Steel, Zinc Coated)
-------------	--

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300
SUBMITTAL DESCRIPTIONS:

SD-13 Certificates

Materials; GA.

Certifications from the manufacturers attesting that materials meet specification requirements.

SD-14 Samples

Materials; GA

Two randomly selected samples of each type of pipe and fitting, prior to delivery of materials to the site.

1.4 DELIVERY, STORAGE AND HANDLING

Materials placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Plastic pipe shall not be exposed to direct sunlight for more than 6 months from time of manufacturer to installation.

PART 2 PRODUCTS

2.1 MATERIALS

Pipe for foundation drainage system shall be of the type and size indicated. Appropriate transitions, adapters, or joint details must be used where pipes of different types or materials are connected.

2.1.1 Clay Pipe

ASTM C 700, standard or extra strength.

2.1.2 Perforated Clay Pipe

ASTM C 700, standard or extra strength.

2.1.3 Concrete Pipe

ASTM C 14, Class [1] [2] [3].

2.1.4 Perforated Concrete Pipe

ASTM C 14, Class [1] [2] [3] with perforations conforming to ASTM C 444, Type [I] [II].

2.1.5 Porous Concrete Pipe

ASTM C 654, standard or extra strength class.

2.1.6 Clay Drain Tile

ASTM C 4, [standard] [extra-quality] [heavy-duty] class.

2.1.7 Perforated Clay Drain Tile

ASTM C 498, [standard] [extra-quality] [heavy-duty] class.

2.1.8 Concrete Drain Tile

ASTM C 412, [standard-] [special-] [extra- [heavy-duty-extra-] quality.

2.1.9 Cast-Iron Soil Pipe

ASTM A 74, [extra-heavy] [service].

2.1.10 Perforated Corrugated Steel

FS WW-P-405, Class I or II, Shape 1, Coating A; or ASTM A 760, Type III, Class [1] [2] Perforations.

2.1.11 Perforated Corrugated Aluminum Alloy Pipe

ASTM B 745 Type III, Class [1] [2] Perforations

2.1.12 Perforated Asbestos-Cement Underdrain Pipe

ASTM C 508.

2.1.13 Plastic Pipe

Plastic pipe shall contain ultraviolet inhibitor to provide protection from exposure to direct sunlight.

2.1.13.1 Corrugated Polyethylene (PE) Drainage Pipe

Use ASTM F 405 heavy duty for pipe 3 to 6 inches in diameter inclusive, ASTM F 667 for pipe 8 to 24 inches in diameter; or use AASHTO M 252 for pipe 3 to 10 inches in diameter or AASHTO M 294 for pipe 12 to 24 inches in diameter. Fittings shall be pipe manufacturer's standard type and shall conform to the indicated specification.

2.1.13.2 Acrylonitrile-Butadiene-Styrene (ABS) Pipe

ASTM D 2751, with a maximum SDR of 35.

2.1.13.3 Polyvinyl Chloride (PVC)

ASTM F 758, Type PS 46, ASTM D 3034 with maximum SDR of 35 and with flexible elastomeric seal joint, or ASTM F 949 with a minimum pipe stiffness of 46 psi.

2.1.13.4 Circular Perforations in Plastic Pipe

Circular holes shall be cleanly cut, not more than 5/16 inch or less than 3/16 inch in diameter, and arranged in rows parallel to the longitudinal axis of the pipe. Perforations shall be approximately 3 inches apart, center-to-center, along rows. The rows shall be approximately 1-1/2 inches apart and arranged in a staggered pattern so that all perforations lie at the midpoint between perforations in adjacent rows. The rows shall be spaced over not more than 155 degrees of circumference. The spigot or tongue end of the pipe shall not be perforated for a length equal to the depth of the socket and perforations shall continue at uniform spacing over the entire length of the pipe. Manufacturer's standard perforated pipe which essentially meets these requirements may be used with prior approval of the Contracting Officer.

2.1.13.5 Slotted Perforations in Plastic Pipe

Circumferential slots shall be cleanly cut so as not to restrict the inflow of water and uniformly spaced along the length and circumference of the tubing. Width of slots shall not exceed 1/8 inch or be less than 1/32 inch. The length of individual slots shall not exceed 1-1/4 inches on 3-inch diameter tubing; 10 percent of the tubing inside nominal circumference on 4- to 8-inch diameter tubing; and 2-1/2 inches on 10-inch diameter tubing. Rows of slots shall be symmetrically spaced so that they are fully contained in quadrants of the pipe. Slots shall be centered in the valleys of the corrugations of profile wall pipe. The water inlet area shall be a minimum of 0.5 square inch per linear foot of tubing. Manufacturer's standard perforated pipe which essentially meets these requirements may be used with prior approval of the Contracting Officer.

2.1.14 Fittings

Fittings shall be of compatible materials for pipe, of corresponding weight and quality, and as specified herein.

2.1.15 Cleanouts and Piping Through Walls

Cleanout pipe and fittings and piping through walls and footings shall be cast-iron soil pipe. Each cleanout shall have a brass ferrule and a cast-brass screw-jointed plug with socket or raised head for wrench.

2.1.16 Cover and Wrapping Materials for Open Joints in Drain Tile

Cover material may be tar paper, roofing paper, reinforced building paper, glass fiber fabric, or other similar type material. Wrapping material shall be 18-14 mesh, 0.01-inch diameter nonferrous wire cloth.

2.1.17 Bedding and Pervious Backfill for Foundation Drains

Bedding and pervious backfill shall be [in accordance with Section 02221 EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS] [coarse aggregate conforming to ASTM C 33, size number [8] 4 [_____]].

PART 3 EXECUTION

GENERAL REQUIREMENTS

3.1.1 Extent

Foundation drainage shall be furnished and installed as a complete system as shown.

2 Outlet Connections

Foundation pipe shall be terminated as shown.

3.1.3 Drainage Lines

Drainage lines shall be constructed of drain tile, perforated pipe, or porous pipe.

3.1.4 Outlet Lines

Outlet lines shall be constructed of closed-joint nonperforated, nonporous pipe.

3.2 INSTALLATION

3.2.1 Trenching and Excavation

Required trenching and excavation shall be in accordance with Section 02221 EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS. Trenches shall be kept dry during installation of drainage system. Changes in direction of drain lines shall be made with 1/8 bends. Wye fittings shall be used at intersections.

3.2.2 Bedding

Graded bedding, minimum 6 inches in depth, shall be placed in the bottom of trench for its full width and length and compacted as specified prior to laying of foundation drain pipe. Each section shall rest firmly upon the bedding, through the entire length, with recesses formed for bell joints. Except for recesses for bell joints, the bedding shall fully support the lower quadrant of the pipe.

3.2.3 Pipe Laying

Drain lines shall be laid to true grades and alignment with a continuous fall in the direction of flow. Bells of pipe sections shall face upgrade. Interior of pipe shall be cleaned thoroughly before being laid. When drain lines are left open for connection to discharge lines, the open ends shall be temporarily closed and the location marked with wooden stakes. Perforated pipe shall be laid with perforations facing down. Any length that has had its grade or joints disturbed shall be removed and relaid at no additional cost to the Government. Perforated corrugated polyethylene drainage tubing and plastic piping shall be installed in accordance with manufacturer's specifications and as specified herein. Tubing and piping with physical imperfections shall not be installed.

3.2.4 Jointing

3.2.4.1 Perforated and Porous Pipes

Perforated and porous types of drain pipes shall be laid with closed joints.

3.2.4.2 Nonperforated Drain Tile

Nonperforated and plain-end drain tile shall be laid with 1/8-inch to 1/4-inch open joints. Open joints shall be covered or wrapped. Covered joints shall have one thickness of the cover material placed over the joint. Material shall overlap the joint not less than 4 inches on each side and cover the tile for not less than the upper half or more than the upper two-thirds of the circumference of the tile. Strips of wire cloth wrapping material 3-inches wide shall be used for wrapped joints, with ends

fastened together.

3.2.4.3 Perforated Corrugated Metal Pipe

Perforated corrugated metal pipe sections shall be joined with standard connecting bands and bolts furnished by the pipe manufacturer.

3.2.4.4 Joints of Concrete or Clay Sewer Pipe

Joints of concrete or clay sewer pipe shall be caulked with oakum and filled solid with cement mortar except where compression joints conforming to ASTM C 425 are used on vitrified clay pipe.

3.2.4.5 Joints of Cast-Iron Pipe

Joints of cast-iron pipe or connections between cast-iron and porous concrete pipes shall be caulked with oakum gasket and filled with lead.

3.2.4.6 Perforated Corrugated Polyethylene Drainage Tubing

Perforated corrugated polyethylene drainage tubing shall be installed in accordance with AASHTO M 252 or AASHTO M 294. Tubing and pipe with physical imperfections shall not be installed. No more than 5 percent stretch in a section will be permitted.

3.2.4.7 Perforated Asbestos-Cement Pipe Joints

Perforated asbestos-cement pipe joints shall be made with tapered couplings or with sleeve-type couplings suitable for holding the pipe firmly in alignment without use of sealing compound or gaskets.

3.2.4.8 Plain-End Perforated Clay

Plain-end perforated clay drain tile joints shall be made with spring-wire clips, coated with a rust preventive, that will maintain a taut but elastic joint between sections when laid.

3.2.4.9 ABS Pipe

ABS pipe shall be joined using solvent cement or elastomeric joints and shall be in accordance with ASTM D 2751, with dimensions and tolerances in accordance with TABLE II therein.

3.2.4.10 PVC Pipe

PVC pipe joints shall be in accordance with ASTM D 3034, ASTM D 3212, or ASTM F 949.

3.2.5 Outlet Lines

The outlet end of drain lines connecting with an open gutter or outfall shall be [covered with a removable wire basket of 16-mesh copper or bronze wire cloth fastened with brass or wire straps] [finished as shown].

3.2.6 Backfilling

After joints and connections have been inspected and approved, the specified pervious backfill material shall be placed [a minimum width of 6 inches on each side of the pipe or tile] [for the full width of the trench and full width between pipe and adjacent walls] and 12 inches above the top of the pipe. When placing the backfill, care shall be taken to prevent displacement of or injury to the pipe or tile. A protective covering, as specified, shall be placed over the pervious backfill for the full width of the trench before regular backfill is placed. Backfill shall be compacted as specified in Section 02221 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS.

3.2.7 Cleanouts

Cleanouts shall be provided in locations indicated. Cleanouts in unpaved areas shall be set in 12-by 12-by 4-inch concrete blocks.

3.3 FIELD TESTS

Drain lines shall be tested by a method approved by the Contracting Officer before being covered. Obstructions shall be removed and the test repeated until the system is satisfactory. The entire system shall again be tested after all backfill is placed. Portions of the lines which restrict the flow shall be repaired or removed and replaced, as directed, until the entire system is satisfactory.

3.4 PROTECTION FROM EXPOSURE TO SUN

Prior to and during installation, plastic pipe shall not be exposed to direct sunlight for more than 14 days.

End of Section