Designation: B788/B788M – 09 (Reapproved 2020)

Standard Practice for Installing Factory-Made Corrugated Aluminum Culverts and Storm Sewer Pipe[1]

This standard is issued under the fixed designation B788/B788M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This practice describes procedures, soils, and soil placement for the proper installation of corrugated aluminum culverts and storm sewers in either trench or projection installations. A typical trench installation is shown in Fig. 1, and a typical embankment (projection) installation is shown in Fig. 2. The pipes described in this practice are manufactured in a factory and furnished to the job in lengths ordinarily from 10 to 30 ft [3 to 9 m], with 20 ft [6 m] being common, for field joining. This practice applies to structures designed in accordance with Practice B790/B790M.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

B745/B745M Specification for Corrugated Aluminum Pipe for Sewers and Drains

B790/B790M Practice for Structural Design of Corrugated Aluminum Pipe, Pipe-Arches, and Arches for Culverts, Storm Sewers, and Other Buried Conduits

D698 Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

D1556/D1556M Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method

D2167 Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method

D2487 Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

D2937 Test Method for Density of Soil in Place by the Drive-Cylinder Method

D6938 Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *bedding, n*—the earth or other material on which a pipe is supported.

3.1.2 *haunch, n*—the portion of the pipe cross section between the maximum horizontal dimension and the top of the bedding.

3.1.3 *invert, n*—the lowest point on the pipe cross section; also, the bottom portion of a pipe.

3.1.4 *pipe, n*—a conduit having full circular shape; also, in a general context, all structure shapes covered by this practice.

3.1.5 *pipe-arch, n*—a pipe with an approximate semicircular crown, small-radius corners, and large-radius invert.

4. Significance and Use

4.1 Corrugated aluminum pipe functions structurally as a flexible ring which is supported by and interacts with the compacted surrounding soil. The soil constructed around the pipe is thus an integral part of the structural system. It is therefore important to ensure that the soil structure or backfill

[1] This practice is under the jurisdiction of ASTM Committee B07 on Light Metals and Alloys and is the direct responsibility of Subcommittee B07.08 on Corrugated Aluminum Pipe and Corrugated Aluminum Structural Plate.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

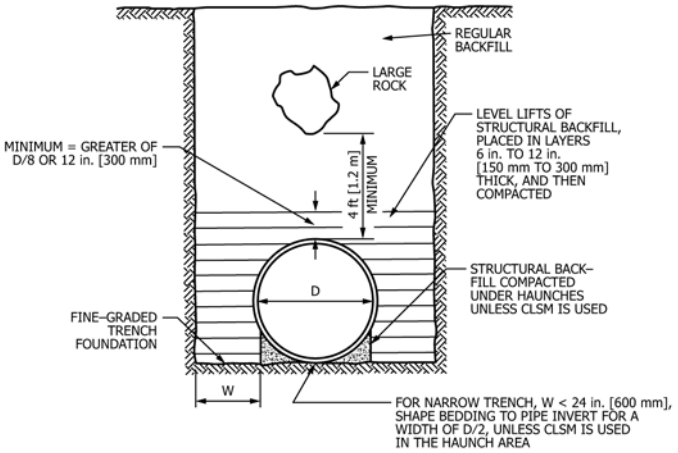

FIG. 1 Typical Trench Installation

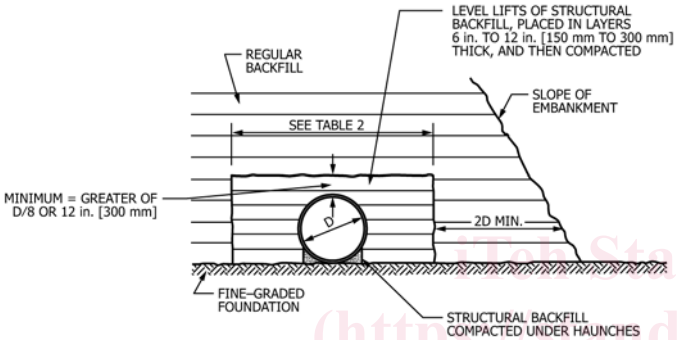

FIG. 2 Typical Embankment (Projection) Installation

is made up of acceptable material and is well-constructed. Field verification of soil structure acceptability using Test Methods D1556/D1556M, D2167, D2937, or D6938 as applicable, and comparing the results with Test Method D698 in accordance with the specifications for each project, is the most reliable basis for installation of an acceptable structure. The required density and method of measurement are not specified by this practice, but they must be established in the specifications for each project.

5. Trench Excavation

5.1 To obtain anticipated structural performance of corrugated aluminum pipe it is not necessary to control trench width beyond the minimum required for proper installation of pipe and backfill. However, the soil on each side beyond the excavated trench must be able to support anticipated loads. When a construction situation calls for a relatively wide trench, it shall be made as wide as required, for its full depth if so desired. However, trench excavation must be in compliance with any local, state, and federal codes and safety regulations.

6. Foundation

6.1 The supporting soil beneath the pipe must provide a reasonably uniform resistance to the imposed load, both longitudinally and laterally. Sharp variations in the foundation must be avoided. When rock is encountered, it must be excavated and replaced with soil. If the pipe runs along a continuous rock foundation, it is necessary to provide a suitable soil bedding under the pipe. See Fig. 3.

6.2 Lateral changes in foundation should never be such that the pipe is firmly supported while the backfill alongside is not. When soft material is encountered during construction and must be removed in order to provide an adequate foundation, remove the soft material for a distance of three pipe widths, unless the engineer has set another limit. See Fig. 4.

6.3 Performance of buried pipe is enhanced by allowing the pipe to settle slightly under load compared to the columns of soil alongside. Thus, for larger pipes it can be beneficial to purposely create a foundation under the pipe itself which will yield under load more than will the foundation under the columns of soil to each side. It can usually be obtained by placing a layer of compressible soil of a suitable thickness, less densely compacted than the soil alongside, beneath the structure. This creates favorable relative movement between pipe and the soil on each side. It is of particular importance on pipe-arches.

6.4 *Pipe-arches*—All pipe-arch structures must have excellent soil support at their corners by both the in-situ foundation and the structural backfill. See Figs. 4 and 5. They do not require the same degree of support under their large-radius inverts.

6.5 The engineer is encouraged to develop details specific to the site based on the general principles for foundation conditions given in 6.1 – 6.4.

7. Bedding

7.1 Material used for bedding beneath the pipe shall meet the requirements of this section. Material in contact with the pipe shall not contain rock retained on a 3-in. [75 mm] ring, frozen lumps, chunks of highly plastic clay, organic matter, corrosive material, or other deleterious material. It is not required to shape the bedding to the pipe geometry. However,

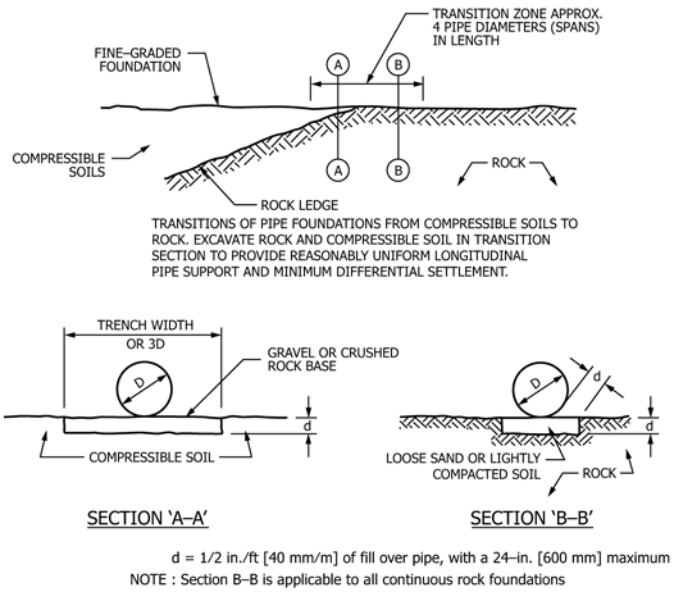

FIG. 3 Foundation Transition Zones and Rock Foundations

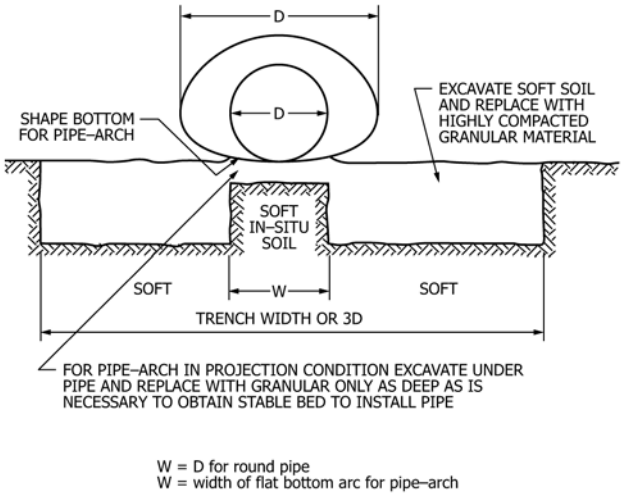

FIG. 4 Soft Foundation Treatment

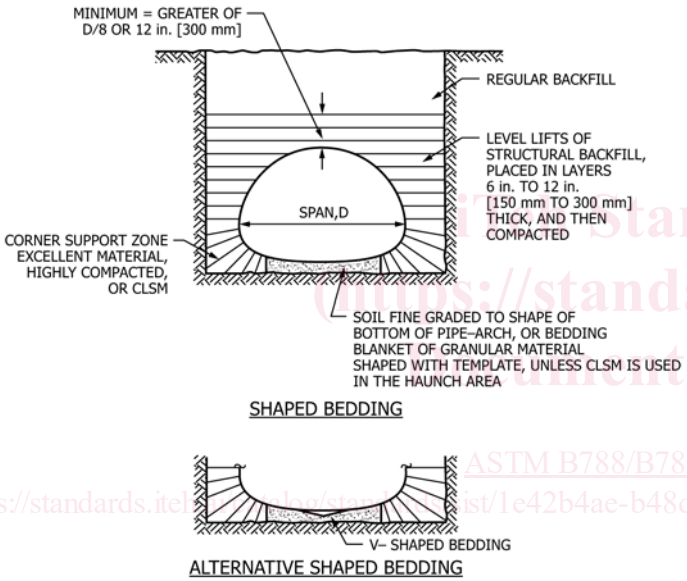

FIG. 5 Bedding and Corner Zone Treatment for Pipe-arch Structures

for pipe-arches, it is recommended to either shape the bedding to the relatively flat bottom arc or fine-grade the foundation to a slight v-shape. This avoids the problem of trying to backfill the difficult area beneath the invert of pipe-arches. See Fig. 5.

8. Pipe Installation

8.1 All pipe shall be unloaded and handled with reasonable care. Pipe shall not be rolled or dragged over gravel or rock and shall be prevented from striking rock or other hard objects during placement on bedding. Pipe with protective coatings shall be handled with special care to avoid damage. Paved inverts shall be placed and centered in the invert.

8.2 *Joining Systems:*

8.2.1 *Purpose of Joining systems*—Joining systems for corrugated aluminum pipe serve several purposes: *(1)* to maintain pipe alignment during installation, *(2)* to join the ends of pipe sections that will subsequently be buried, *(3)* to create a continuous flow line, and *(4)* to limit the amount of infiltration of backfill material into the pipe and to limit exfiltration of the flow through the pipe.

8.2.2 *Joint System Components*—The joining system shall be specified by the project engineer. The components shall conform to the requirements of Specification B745/B745M. The pipe fabricator shall provide the components specified for the project or as designated by the fabricator in accordance with Specification B745/B745M, Ordering Information. Conformance of the joining system components with the project requirements shall be verified upon delivery to the project site.

8.2.3 *Joining System Installation*—The performance of the pipe line and the joining system will be achieved only when all components of the pipe system are properly installed. As an integral portion of the pipe system, the joining system must be assembled in accordance with the details in the project drawings or the recommendations provided by the pipe fabricator.

8.2.3.1 *Gaskets*—If gaskets are a required component of the joining system, they shall be placed on the pipe ends, at the required location on the pipe, prior to installation of the coupler or bands, or prior to stabbing a bell and spigot joint. For joining systems incorporating o-rings(s), the o-ring shall be placed on the spigot end of the pipe when the joint is a stab-type joining system, or one shall be placed on each end of the pipes that form a joining system that incorporates a coupling band. If the joining system includes a flat gasket, the gasket shall be placed over the end of the pipe previously placed and extended over the end of the adjacent pipe after it is positioned. In lieu of a single flat gasket, two smaller flat gaskets may be used with one gasket on the end of the pipe forming the joint. For pipe supplied with a factory installed band or coupler, no field installed gasket will be required on the pipe end with the factory installed device. When recommended by the manufacturer, lubricant shall be applied to the designated surfaces. Once installed, the gasket shall be protected against damage until the joint is completely installed.

8.2.3.2 *Coupling Bands*—Coupling bands shall be placed on the end of the last pipe installed. When installing two-part bands, the first portion of the band shall be placed to cover the bottom portion of the pipe. When the subsequent pipe is placed, the installation of the joining system is completed to ensure proper alignment of the pipeline. The width of the opening between pipe ends shall be as recommended by the pipe fabricator. The band shall be tightened around the pipe ends to the extent necessary to achieve proper performance of the joining system. The band shall be placed over the pipe being joined in a manner that matches any corrugations or dimples in the band with the corrugations in the pipe. Follow the pipe fabricator's instructions and methods for tightening the bands.

8.2.3.3 *Sleeve Coupler and Bell and Spigot Joining Systems*—When a field installed sleeve coupler is utilized, it shall be placed on the end of the pipe previously placed. With a bell and spigot system, the first pipe is to be oriented so the bell is open in a direction in which installation will proceed. The subsequent pipe is installed by inserting the spigot, or pipe