



Designation: B 746/B 746M – 95 (Reapproved 2000)

Standard Specification for Corrugated Aluminum Alloy Structural Plate for Field-Bolted Pipe, Pipe-Arches, and Arches¹

This standard is issued under the fixed designation B 746/B 746M; 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 Department of Defense.

1. Scope

1.1 This specification covers corrugated aluminum alloy structural plate used in the construction of pipe, pipe-arches, arches, underpasses, and special shapes for field assembly. Appropriate fasteners are also described. The pipe, arches, and other shapes are generally used for drainage purposes, pedestrian and vehicular underpasses, and utility tunnels.

1.2 This specification does not include requirements for bedding, backfill, or the relationship between earth cover load and plate thickness of the pipe. Experience has shown that the successful performance of this product depends upon the proper selection of plate thickness, type of bedding and backfill, controlled manufacture in the plant, and care in the installation. The purchaser must correlate the above factors and also the corrosion and abrasion requirements of the field installation with the plate thickness. The structural design of corrugated aluminum structural plate pipe and the proper installation procedures are given in Practices B 790/B 790M and B 789/B 789M, respectively. A procedure for using life-cycle cost analysis techniques to evaluate alternate drainage system designs using corrugated metal pipe is given in Practice A 930.

1.3 This specification is applicable to orders in either inch-pound units (as B746) or SI units (as B746M). Inch-pound units and SI units are not necessarily equivalent. SI units are shown in parentheses in the text; they are the applicable values when the material is ordered to B746M.

2. Referenced Documents

2.1 ASTM Standards:

- A 153/A 153M Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware²
- A 307 Specification for Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength³
- A 325 Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength³

¹ This specification is under the jurisdiction of ASTM Committee B07 on Light Metals and Alloys and is the direct responsibility of Subcommittee B07.08 on Aluminum Culvert.

Current edition approved Oct. 10, 1995. Published December 1995. Last previous edition B 746/B 746M-93.

² Annual Book of ASTM Standards, Vol 01.06.

³ Annual Book of ASTM Standards, Vol 01.08.

A 449 Specification for Quenched and Tempered Steel Bolts and Studs³

A 563 Specification for Carbon and Alloy Steel Nuts³

A 563M Specification for Carbon and Alloy Steel Nuts [Metric]³

A 930 Practice for Life-Cycle Cost Analysis of Corrugated Metal Pipe Used for Culverts, Storm Sewers, and Other Buried Conduits²

B 209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate⁴

B 209M Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]⁴

B 221 Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes⁴

B 221M Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]⁴

B 666/B 666M Practice for Identification Marking of Aluminum and Magnesium Products⁴

B 695 Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel⁵

B 789/B 789M Practice for Installing Corrugated Aluminum Structural Plate Pipe for Culverts and Sewers⁴

B 790/B 790M Practice for Structural Design of Corrugated Aluminum Pipe, Pipe-Arches, and Arches for Culverts, Storm Sewers, and Other Buried Conduits⁴

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁶

F 467 Specification for Nonferrous Nuts for General Use³

F 467M Specification for Nonferrous Nuts for General Use [Metric]³

F 468 Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use³

F 468M Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use [Metric]³

F 568/F 568M Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners³

F 593 Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs³

F 594 Specification for Stainless Steel Nuts³

⁴ Annual Book of ASTM Standards, Vol 02.02.

⁵ Annual Book of ASTM Standards, Vol 02.05.

⁶ Annual Book of ASTM Standards, Vol 14.02.

TABLE 1 Mechanical Properties of Aluminum Structural Plate, Alloy 5052-H141^A

| Specified Thickness | | Tensile Strength, min | | Yield Strength (0.2 % offset), min | | Elongation, % min in 2 in. or 50 mm |
|---------------------|-----------|--------------------------|-----|---------------------------------------|-----|---|
| in. | mm | ksi | MPa | ksi | MPa | |
| 0.100–0.150 | 2.54–3.81 | 35.5 | 245 | 24.0 | 165 | 6 |
| 0.175–0.250 | 4.44–6.35 | 34.0 | 235 | 24.0 | 165 | 8 |

^A To determine conformance with this specification, each value for tensile strength and for yield strength shall be rounded to the nearest 0.1 ksi (1 MPa) and each value for elongation to the nearest 0.5%, both in accordance with the rounding method of Practice E 29.

F 738M Specification for Stainless Steel Metric Bolts, Screws, and Studs³

F 836/F 836M Specification for Stainless Steel Metric Nuts³

2.2 *American National Standards*:⁷

B18.2.1 Square and Hex Bolts and Screws, Inch Series

B18.2.2 Square and Hex Nuts

B18.2.3.6M Bolts, Metric, Heavy Hex

B18.2.4.6M Hex Nuts, Heavy, Metric

3. Terminology

3.1 *Definitions of Terms Specific to This Standard*:

3.1.1 *arch*—a part circle shape spanning an open invert between the footings on which it rests.

3.1.2 *box culvert*—a rectangular box with short-radius in upper corners and a long-radius crown. It can be with full invert or with footing pads.

3.1.3 *fabricator*—the producer of the components for the finished product.

3.1.4 *flat plate*—sheet or plate used to fabricate structural plate.

3.1.5 *manufacturer*—the producer of the flat plate and accessories.

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

3.1.7 *pipe-arch*—an arch shape with an approximate semi-circular crown, small-radius corners, and large-radius invert.

3.1.8 *pipe, horizontal ellipse*—an elliptically shaped pipe with the horizontal diameter approximately 20 % greater than the nominal diameter.

3.1.9 *pipe, vertically elongated*—an elliptically shaped pipe with the vertical diameter up to 10 % greater than the nominal diameter.

3.1.10 *purchaser*—the purchaser of the finished product.

3.1.11 *special shape*—a shape, other than described elsewhere in this section, suitable for fabrication with structural plate.

3.1.12 *structural plate*—a corrugated and curved plate which is field assembled with other structural plates to form the required structure.

3.1.13 *vehicular underpass*—a high arch shape with an approximate semicircular crown, large-radius sides, small-radius corners between sides and invert, and large-radius invert.

4. Ordering Information

4.1 Orders for material under this specification shall include

the following information as necessary to adequately describe the desired product:

4.1.1 Name of material (aluminum alloy structural plate and accessories),

4.1.2 Description of structure (see Section 3),

4.1.3 Number of structures,

4.1.4 ASTM designation and year of issue, as B 746—___ for inch-pound units or B 746M—___ for SI units.

4.1.5 Dimensions of structure (diameter or span and rise, and length, etc.) (see 7.2),

4.1.6 Thickness of plate (see 7.1),

4.1.7 Type of bolts; whether aluminum, stainless steel, or steel bolts are required or permitted. If not specified, steel bolts and nuts shall be furnished (see 5.3 and Note 2),

4.1.8 End treatment (bevel, skew, grade or slope corrections, or other special provision if required by the project plans or specifications),

4.1.9 Special requirements (including extrusion reinforcement locations and shapes), if required, and

4.1.10 Certification, if required.

NOTE 1—Typical ordering descriptions are as follows: (1) Structural plates and fasteners for two aluminum alloy structural plate pipes, per ASTM B 746—___, 180-in. dia, 0.100-in. plate thickness, each 140-ft nominal centerline length with end treatment as shown on plans. (2) Structural plates and fasteners for one aluminum alloy structural plate pipe arch, per ASTM B 746—___, 3860 mm span by 2460 mm rise, 3.81 mm plate thickness, 27.0 m nominal centerline length with square ends.

5. Materials

5.1 *Flat Plate*—Insofar as applicable, flat plate shall conform to the requirements of Specification B 209 or B 209M. The plates shall be fabricated from alloy 5052-H141. The mechanical properties for alloy 5052-H141 shall conform to the requirements of Table 1.

5.2 *Extrusions*—The extrusions for circumferential or longitudinal stiffeners, or secondary structural components, shall be fabricated from aluminum alloys 6061-T6 or 6063-T6 conforming to Specification B 221 or B 221M.

5.3 *Assembly Fasteners*—Except as provided elsewhere in this section, bolts and nuts shall conform to the requirements specified in Table 2 and Table 3. The bearing surface of both bolts and nuts shall be shaped to a 1-in. (25-mm) radius spherical surface, or to a uniform taper of approximately 22° to form a conical surface. In lieu of bolts and nuts with the special bearing surface, standard type bolts and nuts with special washers may be used. The number of nuts and bolts of each size and length furnished shall be 2 % in excess of the theoretical number required to field erect the structure or structures. Bolt lengths shall be such as to result in at least “full nut” engagement when tightened in place.

⁷ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

NOTE 2—Aluminum bolts and nuts, due to lower strength properties