



Designation: ~~B864/B864M-00 (Reapproved 2007)~~ Designation: B 864/B 864M – 08

Standard Specification for Corrugated Aluminum Box Culverts¹

This standard is issued under the fixed designation B 864/B 864M; 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.

1. Scope*

1.1 This specification covers material, geometric, and wall section properties of aluminum box culverts manufactured from corrugated plate or sheet, with attached rib stiffeners, for field assembly. Appropriate fasteners and optional materials, such as aluminum invert plates and headwalls, are also described. Applications for aluminum box culverts include conduits for gravity flow drainage of surface water, such as culverts and storm drains, as well as for small bridges and grade separation structures such as pedestrian or vehicular underpasses, and utility tunnels.

1.2 This specification does not include requirements for foundations, backfill, or the relationship between earth cover or live loads and strength requirements. These important design considerations are described in the AASHTO Standard Specifications for Highway Bridges and the AASHTO LRFD Bridge Design Specifications.

1.3 This specification does not include requirements for the hydraulic design of these structures. Hydraulic design, placement of footings or inverts, and end treatments to resist scour are described in FHWA HDS No. 5.

1.4 Appendix X1 lists nominal dimensions of box culvert sizes commonly available. Also listed are cross-sectional area and hydraulic design parameters for these sizes.

1.5 Appendix X2 lists manufacturer's suggested design properties for the rib stiffener types, spacing classes, and material thicknesses described in this specification.

1.6 The values stated in either ~~inch-pound~~ SI units or ~~SI~~ inch-pound units are to be regarded separately as standard. ~~Within the text, the SI units are shown in brackets. The values stated in each system are~~ may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the specification. ~~standard.~~

2. Referenced Documents

2.1 ASTM Standards:²

A 36/A 36M Specification for Carbon Structural Steel

A 123/A 123M Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A 153/A 153M Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

A 307 Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

A 563 Specification for Carbon and Alloy Steel Nuts

A 563M Specification for Carbon and Alloy Steel Nuts (Metric)

B 221/B 221M Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.

B 746/B 746M Specification for Corrugated Aluminum Alloy Structural Plate for Field-Bolted Pipe, Pipe-Arches, and Arches

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

2.2 AASHTO Standard:

Standard Specifications for Highway Bridges ³

LRFD Bridge Design Specifications

2.3 FHWA Standard:

~~HDS No. 5, Hydraulic Design of Highway Culverts, Report No. FHWA-IP-85-15~~ Hydraulic Design of Highway Culverts, Report No. FHWA-NHI-010-020, Sept. 2001 (Revised May 2005)⁴

¹ This specification is under the jurisdiction of ASTM Committee B07 on Light Metals and Alloys and is under the direct responsibility of B07.08 on Aluminum Culvert. Current edition approved ~~Sept. 1, 2007~~ Nov. 1, 2007. Published ~~September 2007~~ December 2008. Originally approved in 1995. Last previous edition approved in ~~2000~~ 2007 as B 864/B 864M-00 (2007).

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.

³ Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001, <http://www.transportation.org>.

⁴ Available from National Technical Information Service (NTIS), 5285 Port Royal Rd., Springfield, VA 22161, <http://www.ntis.gov>.

*A Summary of Changes section appears at the end of this standard.

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *box culvert*—a generally rectangular conduit having a cross section symmetric about a vertical axis, with a long radius crown segment, short radius haunch segments, and straight side segments, with rib stiffeners (see Fig. 1).

3.1.2 *crown*—the long radius top arc segment of a box culvert cross section (see Fig. 1).

3.1.3 *haunch*—the short radius segments at the upper corners of a box culvert cross section, making the transition between the long radius crown segment and the straight side segments (see Fig. 1).

3.1.4 *rib stiffeners*—spaced extruded aluminum structural members, curved to the shape of the transverse cross section of box culverts and attached by field-bolting to the corrugated plate shell (see Fig. 1).

3.1.5 *rise*—the clear inside vertical dimension from the bottom of the straight side segments of a box culvert to the crown, measured at the axis of symmetry (see Fig. 1).

3.1.6 *shell*—the continuous, structural enclosure of the box culvert consisting of modular, field-assembled, and bolted corrugated aluminum plate members forming the crown, haunch, and side segments (see Fig. 1).

3.1.7 *span*—the clear inside horizontal dimension of a box culvert, measured at the bottom of the straight side segments (see Fig. 1).

4. Classification

4.1 Aluminum box culverts consist of a 9 by 2½ in. [229 by 64 mm] corrugated aluminum plate shell in combination with extruded aluminum stiffening ribs. The plate thickness, stiffener type, and spacing class at the crown and haunch of the box culvert may differ, provided they satisfy the ordering information and the design properties (see 5.1 and 6.1). The plate thickness and stiffener type and spacing class may be varied along the length of the box culvert in accordance with cover and loading requirements, as agreed upon between the purchaser and the fabricator.

4.2 Rib Stiffener Type and Spacing Class:

4.2.1 Rib stiffeners shall consist of either Type 1, Type 2, or Type 210 at the option of the fabricator. Geometry, section, and mechanical properties must conform to the requirements of Fig. 2. Rib stiffener spacing classes shall be as defined in 4.2.2-4.2.5 and illustrated in or Fig. 3. Rib stiffener spacing classes shall be as defined in 4.2.2-4.2.5 and illustrated in Fig. 4 or Fig. 5.

4.2.2 *Class A Spacing*, consisting of either Type 1, Type 2, or Type 210 external rib stiffeners spaced at 54 in. [1372 mm] center-to-center.

4.2.3 *Class B Spacing*, consisting of either Type 1, Type 2, or Type 210 external rib stiffeners spaced at 27 in. [686 mm] center-to-center.

4.2.4 *Class C Spacing*, consisting of either Type 1, Type 2, or Type 210 external rib stiffeners spaced at 18 in. [457 mm] center-to-center.

4.2.5 *Class D Spacing*, consisting of either Type 1 or Type 2 external rib stiffeners spaced at 9 in. [229 mm] center-to-center.

5. Ordering Information

5.1 Orders for products specified herein shall include the following information required as necessary to adequately describe the desired product characteristics:

5.1.1 Name of product (corrugated aluminum box culvert),

5.1.2 ASTM designation and year of issue, as B XXX-____ for inch-pound units or B XXXM-____ for SI units,

5.1.3 Number of structures,

5.1.4 Nominal dimensions of each structure including the rise, span, length (measured along the bottom centerline), and cross sectional area required,

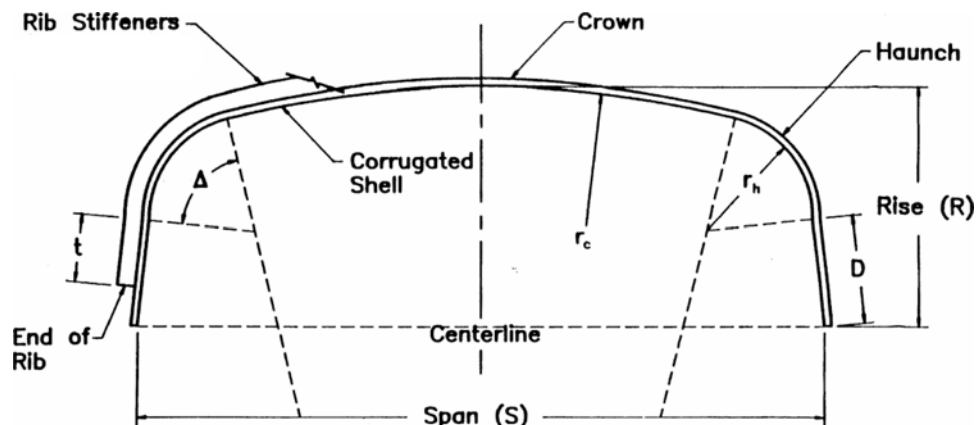
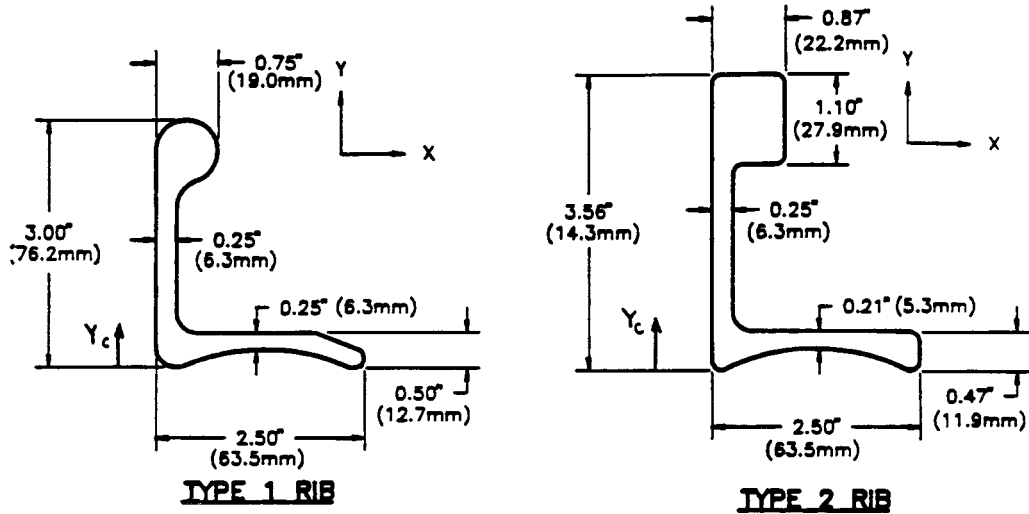
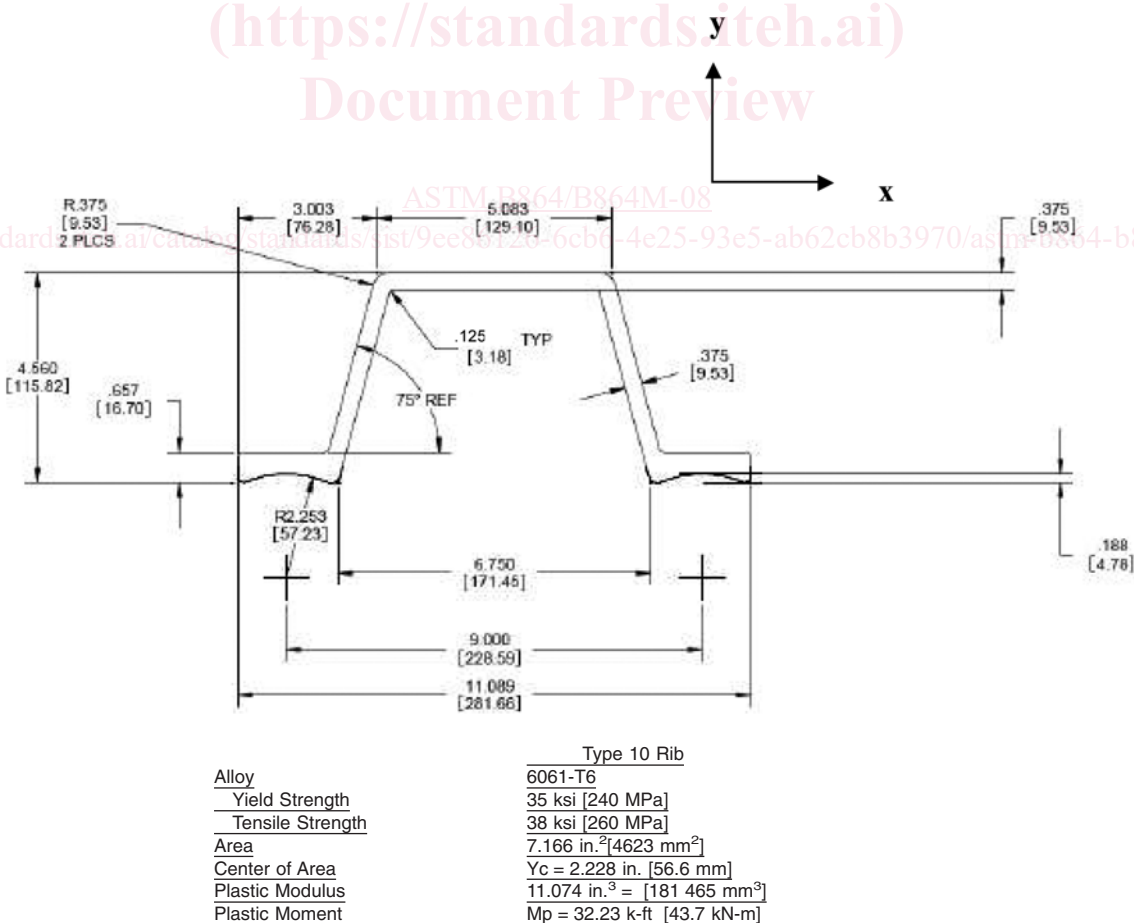


FIG. 1 Box Culvert Geometry



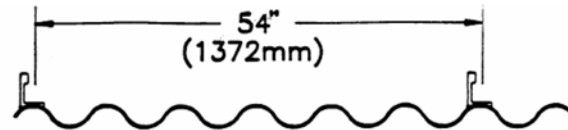
	Type 1	Type 2
Alloy	6061-T6	6061-T6
Yield Strength	35 ksi [241.3 MPa]	35 ksi [241.3 MPa]
Yield Strength	35 ksi [240 MPa]	35 ksi [240 MPa]
Tensile Strength	38 ksi [262.0 MPa]	38 ksi [262.0 MPa]
Tensile Strength	38 ksi [260 MPa]	38 ksi [260 MPa]
Area	1.71 in. ² [1103 mm ²]	2.27 in. ² [1465 mm ²]
Center of Area	Yc = 1.02 in. [26.0 mm]	Yc = 1.76 in. [44.8 mm]
Plastic Modulus	1.70 in. ³ [27 858 mm ³]	2.68 in. ³ [43 917 mm ³]
Plastic Moment	Mp = 4.97 k-ft [6.72 kN-m]	Mp = 7.81 k-ft [10.60 kN-m]

FIG. 2 Extruded Aluminum Rib Stiffeners Geometry and Nominal Design Properties for D Typesig 1 and 2 Ribs

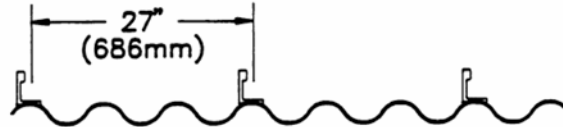


	Type 10 Rib
Alloy	6061-T6
Yield Strength	35 ksi [240 MPa]
Tensile Strength	38 ksi [260 MPa]
Area	7.166 in. ² [4623 mm ²]
Center of Area	Yc = 2.228 in. [56.6 mm]
Plastic Modulus	11.074 in. ³ [181 465 mm ³]
Plastic Moment	Mp = 32.23 k-ft [43.7 kN-m]

FIG. 3 Geometry and Nominal Design Properties for Type 10 Ribs



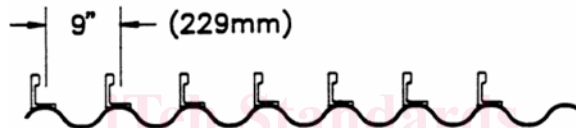
Class A spacing



Class B spacing

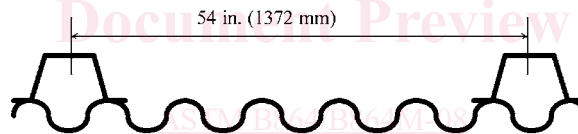


Class C spacing

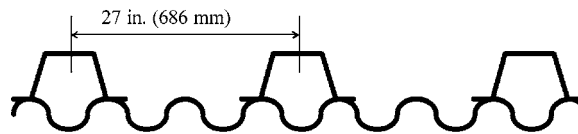


Class D spacing

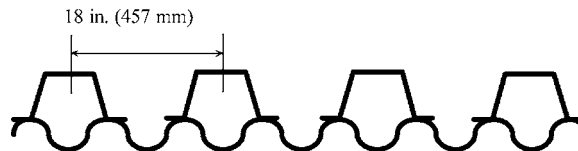
FIG. 4 Rib Stiffener Spacing Classes for Type 1 and Type 2 Ribs



Class A



Class B



Class C

FIG. 5 Rib Stiffener Spacing Classes for Type 10 Ribs

NOTE 1—The nominal length increment is 2.25 ft [0.68 m]. Special lengths can be provided.

5.1.5 Minimum and maximum cover height over structure top centerline (measured from the inside crest of the corrugated plate to the finished surface of the traveled way),

NOTE 2—The minimum and maximum cover height is assumed to apply to the entire length of the structure unless the purchaser specifies otherwise. The design specifications limit cover height to a range of between 1.4 ft and 5.0 ft [0.43 m and 1.52 m]. Small deviations in the height of cover can make a significant difference in the design. It is recommended that the purchaser specify minimum and maximum cover heights to the nearest 0.1 ft [30 mm].