



Designation: A1108 – 17 (Reapproved 2022)

Standard Test Method for Determining the Ultimate Strength of Deep Corrugated Structural Plate Bolted Longitudinal Lapped Seams¹

This standard is issued under the fixed designation A1108; 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 test method provides a comprehensive method for determining the seam strength for bolted longitudinal lapped seams in deep corrugated structural steel plate. The test method includes a laboratory test procedure which specifies specimen preparation, test equipment, and data collection. The test method also includes a method to calculate seam strength from the test results. This standard test method is applicable to corrugated steel structures with ultimate strength of bolted seams provided in Practice [A796/A796M](#).

1.2 *Units*—The values stated in inch-pound units are to be regarded as standard.

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:

[A370](#) Test Methods and Definitions for Mechanical Testing of Steel Products

[A761/A761M](#) Specification for Corrugated Steel Structural Plate, Zinc-Coated, for Field-Bolted Pipe, Pipe-Arches, and Arches

[A796/A796M](#) Practice for Structural Design of Corrugated Steel Pipe, Pipe-Arches, and Arches for Storm and Sanitary Sewers and Other Buried Applications

[A902](#) Terminology Relating to Metallic Coated Steel Products

2.2 AISC Standards:²

[ANSI/AISC 360](#) Specification for Structural Steel Buildings

2.3 AASHTO Standards:³

[LRFD](#) Bridge Design Specifications

3. Terminology

3.1 *Definitions*: See Terminology [A902](#) for definitions of general terminology relating to metallic-coated steel products.

3.1.1 *bolt hole bearing*—deformation that is a measure of the strength of the material upon which the bolt shank bears and not a measure of the strength of the bolt. Bolt hole bearing is identified as (in-plane) deformation of the steel corrugated material upon which the bolt shank bears.

3.1.2 *bolt prying*—deformation that is characterized by a movement of the connected parts such that the fasteners (bolts) rotate into the connected part causing local yielding of the steel corrugation, out-of-plane deformation around the bolt holes, and tension and bending in the bolts. May result in failure of the entire profile when advanced.

3.1.3 *bolt shear failure*—failure that is defined as movement in the connected parts which causes shearing stresses that exceed the shear strength of the bolts. Bolt shear failure may be identified audibly, and may not result in separation of the sheared bolt or bolts from the test specimen.

3.1.4 *circumferential seam*—a connection seam along the edge of the plate parallel to the corrugation.

3.1.5 *Deep Corrugated Structural Plate (DCSP)*—corrugated plate with a corrugation depth greater than 5.0 in.

3.1.6 *lapped connection*—bolted lap seams as shown in Specification [A761/A761M](#).

3.1.7 *local buckling*—visible local wrinkling in one or more elements of the wall section resulting from compressive load that may result in failure of the entire profile when advanced.

3.1.8 *longitudinal seam*—a connection seam along the edge of the plate perpendicular to the corrugation.

¹ This test method is under the jurisdiction of ASTM Committee [A05](#) on Metallic-Coated Iron and Steel Products and is the direct responsibility of Subcommittee [A05.17](#) on Corrugated Steel Pipe Specifications.

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² Available from American Institute of Steel Construction (AISC), 130 E. Randolph St., Suite 2000, Chicago, IL 60601-6219, <http://www.aisc.org>.

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>.

3.1.9 *specimen length*—specimen length is defined in Fig. 1 (and Section 6.2) and includes adjacent plates connected with circumferential seams.

3.1.10 *specimen height*—specimen height is defined in Fig. 1 (and Section 6.3).

4. Summary of Test Method

4.1 This test method consists of preparing representative seamed specimens, testing them in compression, and normalizing the results. Test specimens are loaded in uniform compression along their top and bottom faces until failure. Normalization processes address differences between test specimens and installed structure seams.

5. Significance and Use

5.1 This test method provides a procedure for testing to determine the ultimate strength in compression of bolted longitudinal seams with lapped connections in deep corrugated structural plate. This test method is applicable to variable length longitudinal seams with circumferential seams between adjacent plates.

NOTE 1—The testing is intended for bolted longitudinal seams in plate with the following corrugation sizes in Practice A796/A796M: 15 in. by 5.5 in. (Practice A796/A796M Tables 34 and 35), 20 in. by 9.5 in. (Practice A796/A796M Tables 36 and 37), and 16 in. by 6 in. (Practice A796/A796M Table 38 and 39).

5.2 The maximum load achieved in this testing, along with normalization procedures in this test method, are used to

establish values for ultimate strength of bolted structural plate longitudinal seams for design in accordance with Practice A796/A796M.

6. Test Specimen

6.1 Specimens shall be cut from the seam areas of finished, non-curved (non-radiused) corrugated structural plate. Specimens shall be cut flat (level) and parallel along their loaded and free ends.

6.2 Specimens shall consist of three full standard length plate segments connected by standard circumferential seams. Specimen length will be the centerline-to-centerline dimension between the outermost bolts as shown in Fig. 1.

6.3 Specimen height shall not be less than one full out-to-out dimension of the circumferential seam stagger (including standard plate edge distance from the bolt holes) plus a minimum of 4 in., as shown in Fig. 1.

7. Apparatus

7.1 *Test Machine*—The test machine shall be a universal testing machine capable of applying and measuring a load greater than the expected ultimate seam strength. The test machine shall record the applied load with accuracy better than 0.5% of the ultimate seam strength.

7.2 *Load Heads and Test Fixture*—Load shall be applied to the specimen using a load head which provides uniform load under the contact surface with the line of action through the specimen mid-depth. Compressible material shall be placed

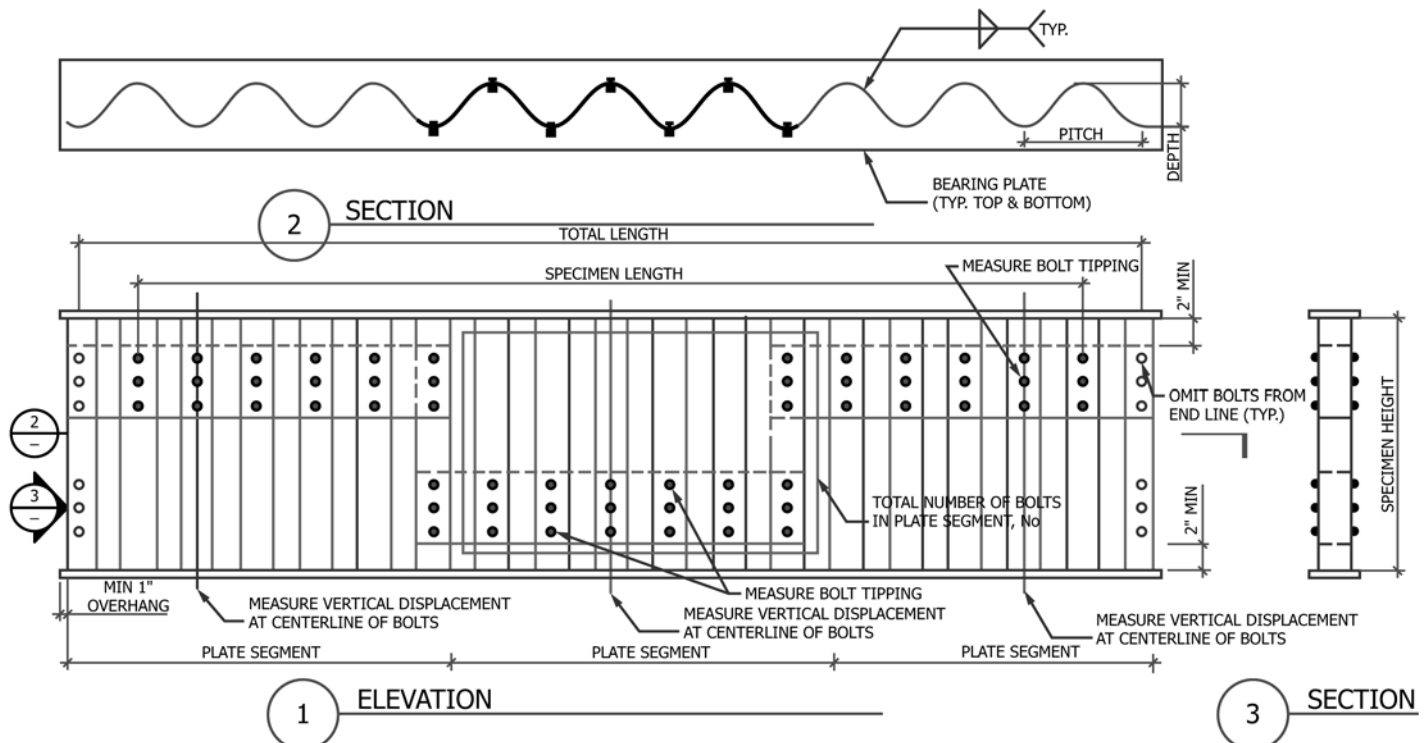


FIG. 1 Lapped Connection Specimen for Structures with Staggered Longitudinal Seams (Typical for Practice A796/A796M plates with 15 in. by 5.5 in., 20 in. by 9.5 in., and 16 in. by 6 in. corrugations)