CCFSS Technical Bulletin

Vol. 10, No. 1 February 2001

ASTM Material Changes

The new ASTM A1008 and A1011 Standards are consolidated standards that replace ASTM Standards A366, A569, A570, A607, A611, A620, A622, A715, A963, and A969. The intent of these new standards is to provide a set of consolidated standards without technical changes to the actual steel grades. The following charts show the relationship between the old steel grades and the new steel grades.

New ASTM A1008-00 CR Steel Designations

OLD DESIGNATION	NEW DESIGNATION
ASTM A366 • CS Type A • CS Type B • CS Type C	**ASTM A1008** • CS Type A • CS TypeB • CS Type C
ASTM A607 HSLA • Grade 45 Class 1 or Class 2 • Grade 50 Class 1 or Class 2 • Grade 55 Class 1 or Class 2 • Grade 60 Class 1 or Class 2 • Grade 65 Class 1 or Class 2 • Grade 70 Class 1 or Class 2	**ASTM A1008 HSLAS** • Grade 45 Class 1 or Class 2 • Grade 50 Class 1 or Class 2 • Grade 55 Class 1 or Class 2 • Grade 60 Class 1 or Class 2 • Grade 65 Class 1 or Class 2 • Grade 70 Class 1 or Class 2
ASTM A611 SS • Grade A • Grade B • Grade C Type 1 or Type 2 • Grade D Type 1 or Type 2 • Grade E	**ASTM A1008 SS** • Grade 25 • Grade 30 • Grade 33 Type 1 or Type 2 • Grade 40 Type 1 or Type 2
ASTM 620 DS • Type A • Type B	**ASTM A1008 DS** • Type A • Type B
ASTM 715 HSLAS-F • Grade 50 • Grade 60 • Grade 70 • Grade 80	**ASTM A1008 HSLAS-F** • Grade 50 • Grade 60 • Grade 70 • Grade 80
ASTM A963 DDS	**ASTM A1008 DDS**
ASTM A969 EDDS	**ASTM A1008 EDDS**

ASTM Material Changes (continued)

New ASTM A1011-00 HR Steel Designations

OLD DESIGNATION	NEW DESIGNATION
ASTM A569 • CS Type A • CS Type B • CS Type C	**ASTM A1011** • CS Type A • CS Type B • CS Type C
ASTM 570 SS • Grade 30 • Grade 33 • Grade 36 Type 1 or Type 2 • Grade 40 • Grade 45 • Grade 50 • Grade 55	**ASTM A1011 SS** • Grade 30 • Grade 33 • Grade 36 Type 1 or Type 2 • Grade 40 • Grade 45 • Grade 50 • Grade 55
ASTM A607 HSLAS • Grade 45 Class 1 or Class 2 • Grade 50 Class 1 or Class 2 • Grade 55 Class 1 or Class 2 • Grade 60 Class 1 or Class 2 • Grade 65 Class 1 or Class 2 • Grade 70 Class 1 or Class 2	**ASTM A1011 HSLAS** • Grade 45 Class 1 or Class 2 • Grade 50 Class 1 or Class 2 • Grade 55 Class 1 or Class 2 • Grade 60 Class 1 or Class 2 • Grade 65 Class 1 or Class 2 • Grade 70 Class 1 or Class 2
ASTM 622 DS • Type A • Type B	**ASTM A1011 DS** • Type A • Type B
ASTM A715 HSLAS-F • Grade 50 • Grade 60 • Grade 70 • Grade 80	**ASTM 1011 HSLAS-F** • Grade 50 • Grade 60 • Grade 70 • Grade 80

Only the following grades are deemed acceptable for cold-formed steel construction and are contained in the AISI Specification:

ASTM A1008/A1008M (SS Grades 25, 30, 33, and 40; HSLAS Classes 1 and 2, Grades 45, 50, 55, 60, 65, and 70; HSLAS-F Grades 50, 60, 70, and 80), Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy with Improved Formability.

ASTM A1011/A1011M (SS Grades 30, 33, 36, 40, 45, 50, and 55; HSLAS Classes 1 and 2, Grades 45, 50, 55, 60, 65, and 70; HSLAS-F Grades 50, 60, 70, and 80), Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

STANDARD TEST METHODS FOR DETERMINING THE TENSILE AND SHEAR STRENGTH OF SCREWS

Although the AISI Specification contains design equations for evaluating the design strength of a screw connection, the Specification does not provide the shear or tensile design strength for a screw. To provide guidance to engineers and manufacturers for the determination of the strength of the screw, the following test protocol was adopted at the February 2001 Committee on Specifications meeting.

1. Scope

1.1 These performance test methods establish procedures for conducting tests to determine the tensile and shear strength of carbon steel screws. The screws may be thread-forming or thread-cutting, with or without a self-drilling point, and with or without washers. The intended application for these screws is to connect cold-formed sheet steel material.

1.2 These standard test methods describe mechanical tests for determining the following properties:

	Section
Tensile Strength	3.3
Single Shear Strength	3.4

1.3 These standards do not intend to address all of the safety concerns, if any, associated with their use. It is the responsibility of the user of these standards to establish appropriate safety and health practices, and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 ASTM Standards:
A 370 - Standard Test Methods and Definitions for Mechanical Testing of Steel Products
E 4 - Standard Practices for Force Verification of Testing Machines
F 606 - Standard Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, and Rivets

2.2 AISI Documents:
Specification for the Design of Cold-Formed Steel Structural Members, 1996 Edition with Supplement No. 1
Test Methods for Mechanically Fastened Cold-Formed Steel Connections, *Cold-Formed Steel Design Manual,* 1996 Edition

3. Test Methods

A test series shall be conducted for each screw material grade, head type, thread series and nominal diameter.

3.1 *Tensile Tests* - This test is intended to determine the ability of a screw to withstand a load when applied along the axis of the screw.

3.2 *Single Shear Test - This* test is intended to determine the ability of a screw to withstand a load applied transversely to the axis of the screw.

3.3 Tensile Tests

3.3.1 The screw shall be tested in a holder with the load axially applied between the head and a suitable fixture, which shall have sufficient thread engagement to develop the full strength of the screw. A sample test setup is shown in Figure 1. (Note: Threads may be clamped directly by jaws of testing machine if screw shank is not crushed in so doing.)

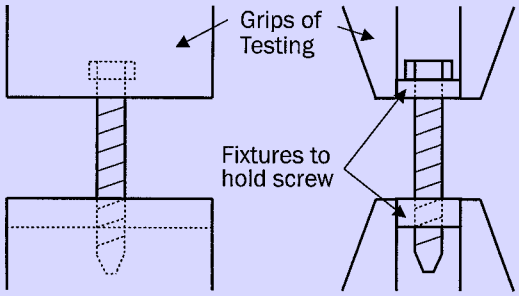

Figure 1 Standard Tensile Test

3.3.2 The speed of testing, as determined by the rate of separation of the testing machine heads, shall be limited to the greater of 0.1 in. (2.5 mm) per minute or the separation rate caused by a loading rate of 500 pounds (2kN) per minute.

3.3.3 The maximum load applied to the specimen, coincident with or prior to screw failure, shall be recorded as the tensile strength of the screw.

3.4 Single Shear Tests

3.4.1 The specimen shall be tested using steel plates or shapes of sufficient thickness to preclude bearing failure and ensure failure through the fully-threaded section. The shear plates or shapes shall create a single-lap joint connected with one or two fasteners. If two fasteners are used, the total shear strength of the connection shall be divided by two to determine the shear strength for one screw. Suggested geometrical proportions of the test specimen are as given in Table 1, with reference to Figures 2 and 3. The test fixure shall provide for central loading across the lap joint. When the machine grips are adjustable, or when the thickness of either plate is less than 1/16 in. (2 mm), packing shims are not required for central loading.

Table 1 Geometrical Proportions of Specimen

Screw Diameter, d in. (mm)	w in. (mm)	L in. (mm)	e in. (mm)	p in. (mm)
≤ 0.250 (6.5)	2 (50)	Min. 10 (250)	1 (25)	2 (50)
> 0.250 (6.5)	8d	Min. 10 (250)	3d > 1 (25)	3d > 2 (50)

3.4.2 The test specimen may be assembled in a shear fixture or threaded into two flat sheets. The test specimen shall be mounted in a tensile-testing machine capable of applying load at a controllable rate. The grips shall be self-aligning and care shall be taken when mounting the specimen to assure that the load will be transmitted in a straight line transversely through the test screw(s). Load shall be applied and continued until failure of the screw(s). Speed of testing, as determined by the rate of separation of the tesing machine heads, shall be limited to the greater of 0.1 in. (2.5 mm) per minute or the separation rate caused by a loading rate of 500 pounds (2kN) per minute.

3.4.3 The maximum load applied to the specimen, coincident with or prior to screw failure, shall be recorded as the shear strength of the screw.

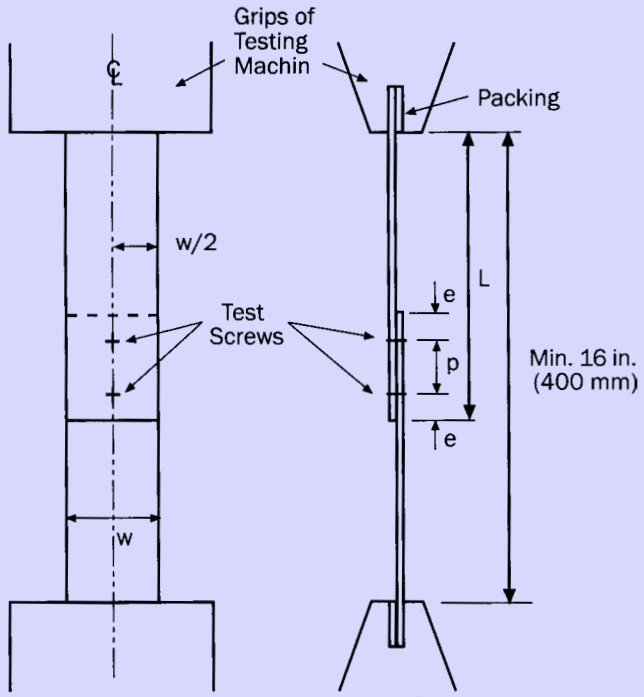

Figure 2 Standard Lap-Joint Shear Test - 2 Screws

4. Report

4.1 The objectives and purposes of the test series shall be stated at the outset of the report so that the necessary test results such as the maximum load per fastener and the mode of failure are identified.

4.2 The type of tests, the testing organization, the supervising engineer, and the dates on which the tests were conducted shall be included in the documentation.

4.3 The test specimen shall be fully documented, including:
(a) The measured dimensions and identification data of each specimen:

- thread O.D.
- thread I.D.
- threads per unit length
- head dimensions
- screw length
- manufacturer
- designation or type
- unthreaded length or imperfect threads below head
- grade of material
- drill-point diameter and length of flutes for self-drilling screws
- any other distinguishing characteristics

(b) The details of fastener installation including pre-drilling, diameter of the pilot drill if used, tightenting torque, and any unique tools used in the installation,

(c) Identification of the washers or washer-head data including diameter, thickness, material, and data on the sealant if present.

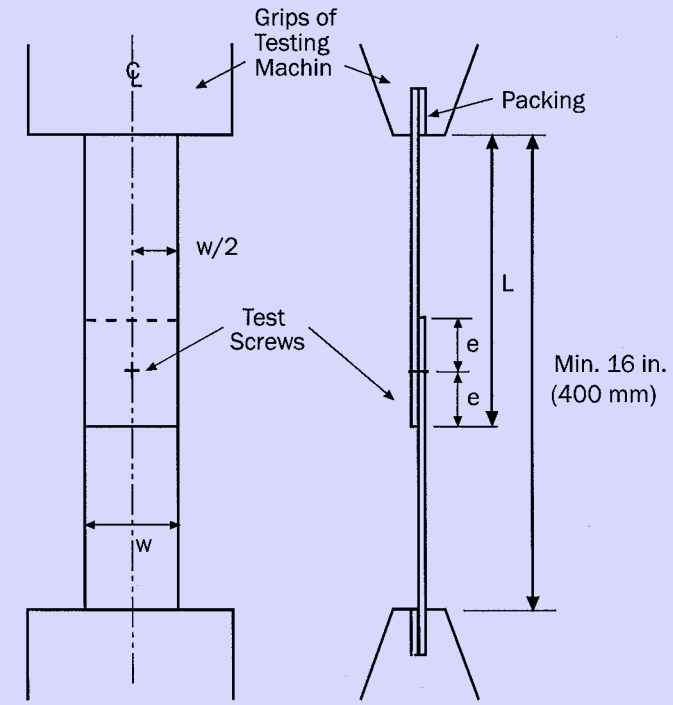

Figure 3 Standard Lap-Joint Shear Test - 1 Screw

4.4 The test set-up shall be fully described including the type of testing machine, the specimen end grips or supports.

4.5 The test procedure shall be fully documented including the rate of loading.

4.6 In accordance with the test objectives stated by the responsible engineer, the report shall include a complete documentation of all applicable test results for each specimen such as the maximum load and the mode of failure. The report shall also include the necessary calculations for the screw design strength and safety factors/resistance factors based on the requirements specified in Section F1 of the *Specification for the Design of Cold-Formed Steel Structural Members.*