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TECHNICAL NOTE

On Cold-Formed Steel Construction

Cold-Formed Steel Engineers Institute ● Washington, DC ● www.cfsei.org ● 866-465-4732

ASTM STANDARDS FOR COLD-FORMED STEEL

Summary: This Technical Note provides an overview of the principal ASTM standards affecting cold-formed steel framing. These standards are often referenced in building codes and contractual documents, and are available for purchase on the ASTM Web site.

Disclaimer: Designs cited herein are not intended to preclude the use of other materials, assemblies, structures or designs when these other designs and materials demonstrate equivalent performance for the intended use; CFSEI documents are not intended to exclude the use and implementation of any other design or construction technique.

INTRODUCTION

Local building codes remain the basic document governing design and construction in most areas of North America. For this reason, building codes often are called "The Laws of Construction" since they are adopted by state and local jurisdictions into legal requirements/

But the building code by itself is not a complete document since it does not republish the many material, assembly and testing standards that are referenced within the code. The building codes reference within their text a number of standards often called "reference standards" - the standards developed by other entities and adopted, by reference, into the text of the building code. As such, when the building code is adopted into law by a jurisdiction, the standards so referenced become a part of that same law. In addition, some contract documents drawn up by architects and engineers reference standards that may not be required by the building code. This is done to set a specific standard level of performance for a certain aspect of their construction project or to related to a desired proprietary product or system.

Reference standards are important and some are quire lengthy and detailed, such as the American Iron and Steel Institute's *North American Specification for the Design of Cold-Formed Steel Structural Members.* Shorter but more diverse in its content are the standards of ASTM International, formerly known as the American Society for Testing and Materials. These standards, which cover many materials and products beyond just building construction, currently constitute a library of 82 volumes, over 12,000 standards Very few organizations purchase the entire set, but since these documents are part of the laws governing design and construction, a little understanding is needed of those that have a direct impact on cold-formed steel construction.

As a general principle, all those who cite standards in contractual construction documents should have a basic familiarity with those that are being referenced. A little understanding can go a long way to reduce serious future problems. This Technical Note will address the principle ASTM standards that are likely to be referenced for cold-formed steel framing.

TYPES OF ASTM STANDARDS

There are four basic types of ASTM standards: material standards, performance standards, testing standards, and application or procedure standards. Although there are occasional overlaps within these four types of standards, such as an application standard that includes a test method, a generic description of each type follows below.

Material and Product Standards

ASTM material and product standards have a very significant importance beyond merely their function as documents referenced within the building codes. They are a legally binding contract between producer and customer as to the details of what has been produced for sale to the customer. The wording of these standards is very specific; the following headings are taken directly from ASTM A1003/A1003M-02a for coated steel sheet:

1. Scope
2. Referenced Documents *Within the building codes, ASTM standards are reference documents. ASTM standards also contain additional references to other documents, mostly related to the testing standards required to verify material and product characteristics. In the particular case of ASTM A1003, it also references other sheet steel standards that may be used for cold-formed steel framing).*
3. Terminology

4. Classification *Many standards define more than one product within a common grouping of products).*
5. Order Information *(This section outlines the various specific terms for ordering material and what will be supplied in the absence of specific ordering information).*
6. Materials and Manufacture
7. Chemical Composition
8. Mechanical Properties
9. Coating Properties
10. Number of Tests
11. Retests and Resamples
12. Certification
13. Product Marking
14. Keywords

This ASTM A1003 standard has six pages of fine print and three tables, and defines a product in detail. If steel sheet material is supplied by a producer to this specific ASTM standard number, it constitutes a guarantee that the product meets the requirements of what has been specified in the order. It is for this reason that the ASTM standards are referenced in the building codes - it guarantees that what is purchased meets or exceeds a minimum standard of compliance.

ASTM Performance Standards

Just as architectural specifications may give either material or performance requirements, ASTM standards may specify a minimum level of performance for a product or system. (For example, the height of a steel-framed wall system can span under a specified load and still meet a given deflection criterion.) In some case, material and performance criteria are intermixed. (A product manufacturer may be given the opportunity to either produce a product to strict material dimensions or to a specified minimum performance requirement.)

ASTM Test Standards

These standards define the physical equipment, operating procedures and reporting protocol for tests conducted on both materials and assemblies of materials. One such example is ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials,* which defines in detail all the operational protocols of conducting fire tests on materials and assemblies used for construction and subjected to structural loading.

ASTM Application or Procedure Standards

These standards define procedures such as the repair of products manufactured to other ASTM standards. One such example is ASTM A780, *Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.* This standard defines, in detail, three different and acceptable ways of repairing damage to a galvanized coating on steel substrate.

REFERENCING ASTM STANDARDS

Some care needs to be taken as to which version of a standard is referenced in any particular building code or contract documents. ASTM identifies the current standards by the term "Active Standard," defined as "...the current, official version of an ASTM standard. An Active Standard supersedes previous historical versions of a standard." By its own internal regulations, ASTM will not permit a standard to pass a five-year anniversary, unchanged, without being reviewed and re-balloted. By this means, ASTM standards are considered to represent "best current practice."

Building codes operate on a similar cycle of review and renewal, but in typical increments of three to five years. Since there is no official coordination between the updating of ASTM standards and the building codes that reference them, the building code may (and probably will) contain a referenced standard that is not the current, Active version. It would be convenient if the building codes referenced standards as the "latest version." but since the building code is a legal document it cannot contain reference to some future document that was not in the public domain at the time of adopting the building code. Specification writers, architects and engineers should be cautioned against the same issue, since revisions to existing standards may be issued during the course of a project.

PRINCIPAL STANDARDS FOR COLD-FORMED STEEL FRAMING

The following list of ASTM standards is not all encompassing, but represents the key ones applicable to cold-formed steel framing. They have been prioritized (bold type) for their importance to a designer or contractor, principally along the lines of their need for either the selection (or purchase) of materials or their guidelines for a construction practice. They key standards for testing materials for compliance with a materials standard, such as the standard for determining the weight of a galvanized coating, are listed without recommendation for their inclusion in a designer's or contractor's library of standards.

For more details on any of the standards listed below, information on the full scope of the standard as well as referenced documents cited by the standard may be found free of charge at the ASTM web site. The complete text of any standard is available only by purchase from ASTM or from a reprint that has been made with ASTM's written permission.

The numbering system for ASTM standards follows specific rules, using as an example the above mentions steel sheet standard ASTM A1003/A1003M-02a:

- The "A" is for a grouping of standards, in this case Iron and Steel Products.

- The number “1003” is the specific number of the standard. Standards are numbered in the sequence of their development so the number has little significance other than the standard’s location within an ASTM published volume or CD-ROM.
- The “A1003M” designation indicates that the standard is published in both Inch-Pound and SI Units.
- The “02” is the year that the standard was issued.
- The “a” indicates that an editorial change has been made since the latest issue of the standard. If additional editorial changes are made prior to a revised issue of the standard, letters “b” and higher will be used as needed.

THE FOLLOWING STANDARDS COVER THE SHEET STEELS THAT, BY SUBSEQUENT OPERATIONS, CAN BE FORMED INTO FRAMING MEMBERS

ASTM A1003/A1003M - , *Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.*

This specification covers the coated steel sheet used specifically for the manufacture of cold-formed framing members, including but limited to studs, joists, purlins, girts and track. ASTM A1003 was developed to include and reference sheet steel standards ASTM A653, A792, A875, A876 and A463, provide additional options for supplies, and be consistent with the material requirements of the AISI *North American Specification for the Design of Cold-Formed Steel Structural Members.* **NOTE TO SPECIFIERS:** This standard is most likely the one you should cite for the sheet steel used for cold -formed steel framing.

ASTM A463/A463M -, *Standard Specification for Steel Sheet, Aluminum Coated, by the Hot-Dip Process.*

This specification covers steel sheet in coils and cut lengths available with two types of aluminum coating and several different coating weights applied by the hot -dip process.

ASTM A500 -, *Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.*

This specification covers carbon steel round, square, rectangular or special shaped structural tubing for buildings, bridges and other general structural purposes.

ASTM A653/A653M -, *Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron-Alloy-Coated (Galvannealed) by the Hot-Dip Process.*

This specification covers steel sheet in coils and cut lengths and produced to a large number of designations, grades and classes designed for compatibility with various application requirements.

ASTM A755/A755M -, *Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.*

This specification covers coated steel sheet furnished in coils, cut lengths and formed cut lengths, including corrugated and various types of roll and brake-formed configurations. The base steel sheet can be metallic-coated by a number of different hot-dip process and the prepainting can be many combinations of primer and single or multiple additional coatings of a wide range of paint systems.

ASTMA792/A792M -, *Standard Specification for Steel Sheet, 55% Aluminum-Zinc-Alloy-Coated by the Hot-Dip Process.*

This specification covers the proprietary product commonly know as Galvalume® which may occasionally be used for steel sheet base for exterior applications of roofing and siding. The corrosion resistance of this product is significantly higher than that of an equal coating thickness of zinc (galvanizing).

ASTM A875/A875M -, *Standard Specification for Steel Sheet, Zinc-5% Aluminum Alloy-Coated by the Hot-Dip Process.*

This specification covers the proprietary product commonly known as Galfan® , which, as for Galvalume, is principally used for exterior applications. The corrosion resistance of this product is similar to that of galvanized steel sheet, but its forming characteristics are superior to both galvanized and Galvalume.

ASTM A924/A924M -, *Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.*

This specification covers the general requirements that apply to steel sheet in coils and cut lengths that are metallic coated on continuous lines by the hot-dip process. These products are intended for applications requiring corrosion resistance and the specifications contain the requirements for specific strength levels, heat resistance, paintability, or formability, or any combination thereof.

THE FOLLOWING STANDARDS COVER THE FRAMING MEMBERS ONE THEY ARE FORMED INTO STUDS AND TRACKS

They include tolerances on length, bow, camber and twist; plus some performance and marking requirements.

ASTM C645, *Standard Specification for Nonstructural Steel Framing Members.*

This covers non-structural members used for interior construction assemblies only. It covers material that either has a bare steel minimum thickness of 0.0179 inches, or members that meet the limiting height requirements of ASTM C754. It also requires members to have a G40 or equivalent protective coating and be manufactured form steel meeting the requirements of ASTM A1003/1003M.

ASTM C955, *Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.*

This specification covers the steel studs, runners (tracks), and bracing or bridging for screw application of gypsum panel products and metal plaster bases for load-bearing structural assemblies. It covers material having a bare steel minimum thickness of 0.0329 in., members having a minimum CP60 (G60) protective coating and requires the members to be manufactured from steel meeting the requirements of ASTM A1003/ A1003M.

THE FOLLOWING STANDARDS ARE FOR THE INSTALLATION OF FRAMING MEMBERS

ASTM C754 -, *Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Light Steel Framing Components, but principally used as the Gypsum Panel Products.*

This specification covers the installation of interior non-structural steel framing designed to receive screw-attached gypsum panel products. The steel framing members in this standard are limited to those complying with ASTM C645.

ASTM C1007 -, *Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Assemblies.*

This specifications covers the installation requirements for load bearing steel studs and their related accessories within the based metal thickness range of 0.0329 to 0.1120 inches. Note: material covered by this standard must comply with ASTM C955.

THE FOLLOWING STANDARDS ARE FOR SCREWS AND GYPSUM PANEL PRODUCTS

ASTM C1396/C1396M -, *Standard Specification of Gypsum Board.*

This specification covers nine different varieties of gypsum board.

ASTM C954 -, *Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs form 0.033 (0.84mm) to 0.112* (*2.84mm) in thickness.*

This specification covers the minimum requirements for the described screws, including their required physical properties and the test methods for determining those properties.

ASTM C1002 -, *Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.*

This Specification covers the minimum requirements for the described screws for use in fastening gypsum plaster products and metal plaster bases to wood members and cold-formed steel studs of less than 0.033 inches in thickness.

ASTM C1513 -, *Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.*

This specification covers steel self-drilling and self-piercing tapping screws for the connection of members manufactured to the specifications of ASTM C645 and C955 (listed above), including the test methods for determining performance requirements and physical properties.

The following ASTM standards are not for products, but for the methodology to perform the tests required to evaluate compliance with the product standards. Details at ASTM.org.

ASTM A90/A90M -, *Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.*

ASTM A370 -, *Standard Test Methods and Definitions for Mechanical Testing of Steel Products.*

ASTM A754/A754M -, *Standard Test Method for Coating Weight [Mass] of Metallic Coatings and Steel by X-Ray Flourescence.*

ASTM A1004/A1004M-99, *Standard Practice for Establishing Conformance to the Minimum Expected Corrosion Characteristics of Metallic, Painted-Metallic, and Nonmetallic-Coated Steel Sheet Intended for Use as Cold-Formed Framing Members.*

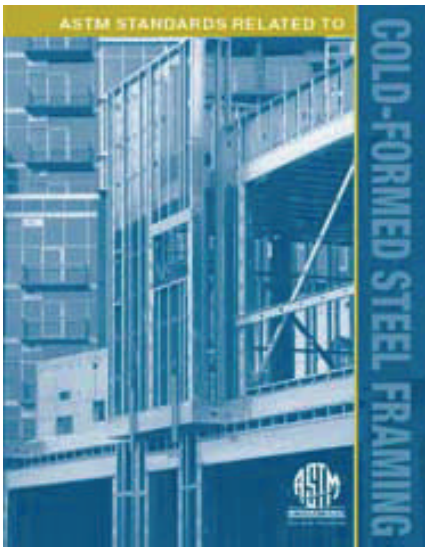
THE FOLLOWING STANDARD IS FOR THE REPAIR OF GALVANIZED SURFACES

ASTM A780-01, *Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.*

Three methods of repair are given, but the zinc-rich paint option is most commonly used for steel framing. Note: ASTM C1007 calls out the Military Specification MIL-P-21035)Paint, High Zinc Dust Content, Galvanizing Repair), whereas ASTM A780 does not specify a minimum requirement for the paint.

PURCHASE OF ASTM STANDARDS

Purchase of any of these standards is relatively simply and can be done via the Internet for either a printed or downloadable (PDF) version. Log onto www.astm.org, click on "standards search," and enter the ASTM standard letter and number in the search box. This will lead to a screen showing both Active and previous standards of that title. Note also that ASTM is very protective of its copyrighted documents; they are its principle source of funds. Multiple standards can be purchased in either compilations relating to a specific product or industry, or by selecting specific volumes. Many of the sheet steel standards listed above are included in Volume 01.06, Coated Steel Products, and many of the application/installation standards are included in Volume 04.01, Cement Lime, Gypsum. A compilation specific to the Cold-Formed Steel framing industry has been developed and is available from the ASTM Web site., www.astm.org.



Compilation of ASTM Standards related to Cold-Formed Steel

Primary author of original Tech Note:

Roger Wildt, P.E.

Author of Revised Tech Note:

Roger Laboube, Ph.D, P.E., Wei Wen Yu Center for Cold-Formed Steel Structures

Technical Review and Updating:

Maribeth Rizzuto, CFSEI

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