



International Specialty Conference on Cold-Formed Steel Structures

(2004) - 17th International Specialty Conference on Cold-Formed Steel Structures

Oct 26th, 12:00 AM

The 2002 AISI Cold-formed Steel Design Manual

Richard C. Kaehler

Helen Chen

Follow this and additional works at: <https://scholarsmine.mst.edu/isccss>



Part of the [Structural Engineering Commons](#)

Recommended Citation

Kaehler, Richard C. and Chen, Helen, "The 2002 AISI Cold-formed Steel Design Manual" (2006). *International Specialty Conference on Cold-Formed Steel Structures*. 5. <https://scholarsmine.mst.edu/isccss/17iccfss/17iccfss-session6/5>

This Article - Conference proceedings is brought to you for free and open access by Scholars' Mine. It has been accepted for inclusion in International Specialty Conference on Cold-Formed Steel Structures by an authorized administrator of Scholars' Mine. This work is protected by U. S. Copyright Law. Unauthorized use including reproduction for redistribution requires the permission of the copyright holder. For more information, please contact scholarsmine@mst.edu.

The 2002 AISI Cold-Formed Steel Design Manual

Richard C. Kaehler, P.E.¹ and Helen Chen, Ph.D., P.E.²

Abstract

The 2002 edition of the AISI Cold-Formed Steel Design Manual has been released. The new edition includes additional industry standard cross sections, updated examples and design aids as well as new example problems, design aids and AISI Test Standards.

Introduction

The American Iron and Steel Institute (AISI) has recently released the 2002 edition of its venerable Cold-Formed Steel Design Manual (manual). The manual was produced for AISI by Computerized Structural Design, S.C. under the direction of Subcommittee 26 – Design Manual of the AISI Committee on Specifications.

Editions of the Cold-Formed Steel Design Manual have been published by AISI for more than fifty years. From early on, each manual has provided worked example problems, tabulated and graphed design aids, AISI test standards and other supplemental information for use by designers, students, educators and code officials.

Overview of Changes

This new edition is based on the 2001 *North American Specification for the Design of Cold-Formed Steel Structural Members (NA Specification)*, a joint publication of AISI, the Canadian Standards Association and CANACERO. Like the 1996 edition of the *AISI Specification*, the 2001 *NA Specification* covers both Load and Resistance Factor Design and Allowable Strength Design with equal emphasis. New in this edition are joint provisions and country

¹ Vice President, Computerized Structural Design, S.C., Milwaukee, WI

² Senior Structural Engineer, American Iron and Steel Institute, Washington, D.C.

specific provisions applicable to Canada, Mexico and the U.S. In addition, provisions are provided in dimensionless terms where possible or in US customary units and two separate metric systems where that is not possible.

This large increase in the scope of the *NA Specification* presented the specter of a manual increased greatly in size to adequately cover its provisions for all of its users in three countries. In the interest of creating a document of manageable size appealing to the majority of potential users, all example problems and other calculated values are presented in US customary units using the US country specific provisions. Manuals with Canadian or Mexican country specific provisions or metric units are not available at this time.

All of the tables and charts have been updated according to the provisions of the *NA Specification*. New tables were added to incorporate new design provisions wherever appropriate. In this edition, a large emphasis was placed on example problems. All existing example problems were reviewed and updated to improve presentation of the material, incorporate standard cross sections where possible and illustrate new and revised *NA Specification* provisions. Four new example problems were added to further illustrate new and revised *NA Specification* provisions.

For the first time, the *Specification* and *Commentary* are not included as chapters in the manual, due to space limitations. Both are available as part of the Cold-Formed Steel Design Manual Set. The *Specification* and the *Commentary* should be used in conjunction with the manual. Highlights of the features and changes in the other sections of the manual follow.

Part I – Dimensions and Properties

The table of referenced ASTM steels has been updated to reflect recent changes in steels approved for cold-forming.

Many of the design aids and example problems are based on the “representative cross sections” that are tabulated in Part I. In past editions, the lack of industry standardization made it impossible to list cross sections that might be expected to be commercially available; hence the term “representative”. Recent industry standardization has now made it possible to include commercial cross sections for such shapes as C- and Z-sections.

A substantial number of the most commonly used standard track and stud sections produced by Steel Stud Manufacturers Association (SSMA) members are now included. These shapes are produced at a large number of facilities across the US and should be readily available to contractors. SSMA cross sections are referenced using the SSMA standardized section designations. A sample page from the SSMA Stud Gross Section Properties table is provided in Figure 1. The Gross Section Properties tables provide section designation, cross section dimensions, area, weight, properties for bending about x-x and y-y axes, and torsional properties.

C- and Z-sections commonly used in the metal building industry are less standardized than those in the stud industry, but a significant number of manufacturers are producing shapes conforming to the standards of the Light Gage Structural Institute (LGSi). A selection of shapes very similar to their most commonly used cross sections is also included in this edition of the manual. In the case of the Z-sections, the LGSi cross sections have slightly unsymmetrical flange widths to facilitate nesting. In the interest of simplifying the sample calculations, these flange widths were averaged to produce symmetrical shapes with approximately the same properties. A sample page from the Z-Section Gross Section Properties table is provided in Figure 2.

Part II – Beam Design

In keeping with the practices of the SSMA, the effect of cold work of forming according to the provisions of *NA Specification* section A7 is included in the tables and charts for tracks and studs, where applicable. See Figure 3 for a sample page from the Beam Property Tables. The effect of cold work of forming is not considered for other cross sections, where it is less commonly used.

The effects of standard factory punchouts (web openings) in SSMA studs are included in the flexural strength tables and graphs as well as in the combined shear and flexural strength tables. The standard punchouts included are shown in Table 1.

Table 1: SSMA Standard Factory Punchouts

Flange Width, b_f , Section Depth, d	Punchout Depth x Width
$b_f \leq 1.625$ in. (31.3 mm), $d \geq 3.5$ in. (88.9 mm)	1.5 in. x 4.5 in. (38.1 mm x 114 mm)
$b_f \leq 1.625$ in. (31.3 mm), $d < 3.5$ in. (88.9 mm)	0.75 in. x 4.5 in. (19.1 mm x 114 mm)

In the Nominal Flexural Strength charts, solid lines are used to represent the most economical sections for a given strength and unbraced length while dashed lines are used to represent the nominal strength of other sections. See Figure 4 for a sample page from the Nominal Flexural Strength charts. These charts can be used to visually determine the flexural strength of members with different unbraced lengths.

Two new tables have been added for determining the web crippling strength of studs with web openings. These tables provide reduction factors for different loading conditions, stud depths, hole depths, and distances between edge of hole and edge of load bearing.

A new example problem, C-Section with Openings, covering the effects of web openings on the flexural, shear and crippling strengths of beams, has been added.

Part III – Column Design

For SSMA stud sections, standard factory punchouts are considered in determining the axial compression strength.

A new example problem, Unbraced Equal Leg Angle with Lips – Compression, has been added illustrating the design of a single angle in compression, including the effects of minimum required eccentricity. Another new example, I Section – Built-Up from Channels, demonstrates how to determine the axial strength of built-up members using the new design provision for intermittently connected shapes in the *NA Specification*.

Part IV – Connection Design

In this edition, all of the design tables have been revised to incorporate the changed and new provisions for arc spot welds, resistance welds, and bolted connections.

A new example, Bolted Connection with Consideration of Shear Lag, illustrates the new provisions for shear lag in bolted connections.

Part V – Supplemental Information

A feature that has been absent from the manual for several editions has returned. There is once again a cross reference table showing where each illustrated provision of the *NA Specification* can be found in the example problems.

The graphs that were present in many previous editions, giving torsional-flexural coefficients, have been removed in recognition that such calculations are now easily and commonly done on personal computers.

Part VI – Test Methods

All existing and new test standards have been given identifying numbers to make references to them more convenient. For example, the test method Rotational-Lateral Stiffness Test Method for Beam-To-Panel Assemblies can now be referenced as AISI TS-1-02, where the '1' indicates the sequence of assignment of test numbers and '02' indicates the year of the edition. All existing test standards were given an edition year of '02' regardless of the year of adoption. The edition year designation will be updated as amendments to the standards are adopted.

Several previously included standards have been revised and two new test standards have been added to this edition:

AISI TS-4-02: Standard Test Method for Determining the Tensile and Shear Strength of Screws. This test standard provides procedures for determining the strength of screw fasteners.

AISI TS-6-02: Standard Procedures for Panel and Anchorage Structural Tests. This standard provides refinements to the ASTM-1592 test procedures as well as additional methods for test evaluation.

Availability

The 2002 AISI Cold-Formed Steel Design Manual Set, which includes the 2002 Cold-Formed Steel Design Manual, the *NA Specification* and the *Commentary*, can be obtained from the AISI e-store at: <http://www.steel.org>.

Conclusion

The 2002 AISI Cold-Formed Steel Design Manual represents a refinement and updating of the previous edition. It is expected that the changes will make the manual both more convenient and useful to the range of users it serves.

Appendix - References

American Iron and Steel Institute, *Cold-Formed Steel Design Manual*, Washington, D.C., 2002.

American Iron and Steel Institute, *North American Specification for the Design of Cold-Formed Steel Structural Members*, Washington, D.C., 2001.

American Iron and Steel Institute, *Specification for the Design of Cold-Formed Steel Structural Members*, Washington, D.C., 1996.