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1996 AISI Cold-Formed Steel Design Manual

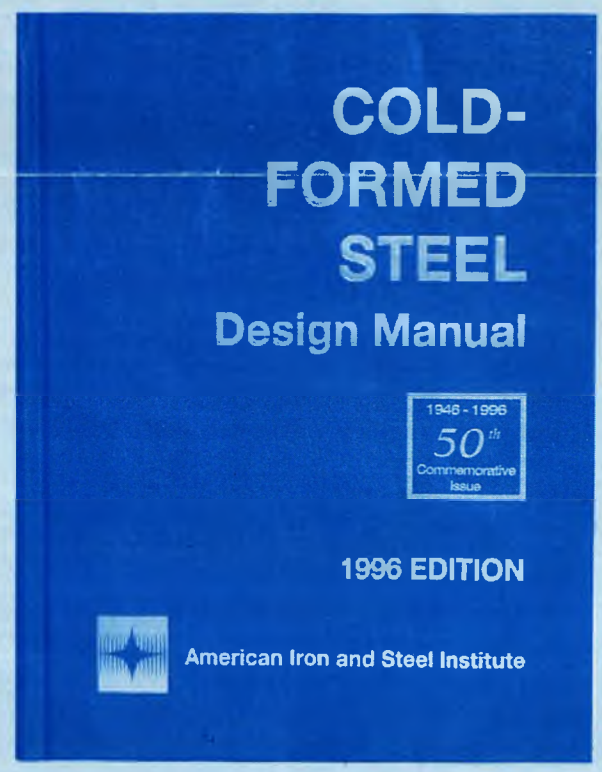
In 1946, the American Iron and Steel Institute published the first edition of the *Specification for the Design of Light Gage Steel Structural Members.* This allowable stress design specification was revised subsequently by the AISI Committee in 1956, 1960, 1962, 1968, 1980 and 1986 to reflect the technical developments and the results of continuing research. In 1991, AISI published the first edition of the *Load and Resistance Factor Design Specification for Cold-Formed Steel Structural Members.* Both AISI allowable stress design (ASD) and load and resistance factor design (LRFD) specifications were combined into a single document in 1996.

In addition to the issuance of the design specification, AISI also published the first edition of the *Light Gage Steel Design Manual* in 1949. This allowable stress design manual was revised in 1956, 1961, 1962, 1968, 1977, 1983, and 1986. In 1991, the *LRFD Design Manual* was published for the load and resistance factor design criteria. In 1996, AISI celebrated the 50th anniversary of the specification and published the new *Cold-Formed Steel Design Manual.* The new edition of the Design Manual has made significant strides with new features and improvements which make it an invaluable design and educational tool.

The 1996 edition of the Design Manual combines the ASD and LRFD methods into one document, uses new format consistent with the AISC *Manual of Steel Construction*, and includes C-sections and other types of practical sections. Eight chapters are included in the Manual. The contents of each chapter and the new features are summarized in subsequent sections.

Part I - Dimensions and Properties. The gross section properties are tabulated in this chapter for the representative C-sections, Z-sections, angles, hat sections, and deck sections. Descriptive names are used to identify each tabulated section. Informative examples and explicit formulas are provided for the calculation of the gross and effective sectional properties.

Part II - Beam Design. Many design tables and charts are provided in this chapter for C-and Z-sections. The Beam Table provides the nominal moments and shears, the effective moments of inertia, and the effective section moduli. The maximum effective moments for the fully effective flanges or web are also listed in the Table. Unbraced Beam Chart includes the nominal moments with respect to different unbraced lengths. Combined Bending and Shear Table lists the moment and the corresponding shear which satisfies the combined bending and shear check. The Table of Crippling Strength of C- and Z-Sections with lips provides the crippling strengths for forces acting at different loca-



tions. Purlin design examples with both ASD and LRFD approaches cover the design aspects of flexure, shear, web crippling and bracing anchorage forces. Additional examples are dealing with the beam design of C-sections, hat sections and cylindrical tubular sections.

Part III - Column Design. The Table of Column Properties for C-sections lists the effective axial capacities for yield strengths of 33 and 55 ksi, and the maximum axial capacity for the sections having fully effective flanges or web. The Table for Nominal Axial Strength of Columns provides the axial capacities with respect to different unbraced lengths, and to different numbers of braced points. Examples are provided to guide the user on how to apply the tables in design.

Part IV - Connection Design. Four sections are included in this chapter: Welds, Bolts, Screws, and Example Problems. Since the material in this new section is independent of the cross-sectional shapes, it is proven to be a very useful section to many designers. The design tables cover weld strengths of 60 and 70 ksi, various grades of bolts, and material ultimate strengths of 45 and 65 ksi. Tables included are for (a) fillet and arc spot weld capacities (b) bolt tension, shear and bearing capacities for commonly used bolt sizes, and (c) the new screw provisions for shear and pull-out. Many practical examples are provided to help designers effectively utilize those tables.

Part V - Specification for the Design of Cold-Formed Steel Structural Members. The 1996 Edition of the *Specification for the Design of Cold-Formed Steel Structural Members* is included in this Manual. The new version combines ASD and LRFD methods into one document. This provides the design engineers the opportunity to become familiar with both methods, and facilitates the use of the preferred method. All design tables, charts, and design examples in the *Cold-Formed Steel Design Manual* follow this Specification.

Part VI - Commentary on the 1996 Edition of the Specification for the Design of Cold-Formed Steel Structural Members. This chapter provides a Commentary on the 1996 Edition of the *Specification for the Design of the Cold-Formed Steel Structural Members*. Using the consistent chapter and section numbering system with the Specification, the Commentary provides valuable background material and related-technical references for each section in the Specification.

Part VII - Supplementary Information. This chapter includes a number of design aids carried over from previous editions, plus a newly revised version of "Suggested Cold-Formed Steel Structural Framing Engineering, Fabrication, and Erection Procedures for Quality Construction."

Part VIII - Test Methods. Several new test methods are now included in this chapter: (1) Standard Methods for Determination of Uniform and Local Ductility, (2) Test Methods for Mechanically Fastened Cold-Formed Steel Connections, (3) Cantilever Test Method for Cold-Formed Steel Diaphragms, and (4) Base Test Method for Purlins Supporting a Standing Seam Roof System.

This new edition of the *Cold-Formed Steel Design Manual* will be a valuable design tool. Copies of the new Design Manual can be purchased from USA Fulfillment/AISI, Box 4237, Chestertown, MD, 21690 at $95 per copy. Telephone 1-800-277-3850; Fax: 1-410-810-0910.

New Publication on Standing Seam Roof System

A new design guide is available from the American Iron and Steel Institute that targets members supporting standing seam roofs. This publication, "*A Guide for Designing With Standing Seam Roof Panels,*" was authored by Dr. James M. Fisher of Computerized Structural Design, Inc. and Dr. Roger A. LaBoube of the University of Missouri-Rolla, under the direction of the AISI Committee on Specifications for the Design of Cold-Formed Steel Structural Members. The Guide was co-sponsored by AISI and the Metal Building Manufacturers Association.

The chapters in the guide are titled: Introduction and Background; Explanation of Systems and their Components; Panel Design; Review of Cold-Formed Steel Purlin Design; The Base Test; Standing Seam Roof Systems Subjected to Gravity Loading; Standing Seam Roof Systems Subjected to Uplift Loading; Standing Seam Roof Systems Subjected to In-Plane Forces; Standing Seam Roofs on Steel Joists; Roof Top Units and Hanging Loads; and Design Examples. Two appendices are also included containing the Base Test Method for Purlins Supporting a Standing Seam Roof System which is part of the 1996 AISI Cold-Formed Steel Design Manual, and a suggested Base Test Method for Strut Purlins Supporting a Standing Seam Roof System.

The Design Guide CF97-1 is available from AISI at a cost of $25.00 per copy. This publication will provide guidance on the application of the AISI Specification for the Design of Cold-Formed Steel Structural Members to standing seam roof systems. Copies of the publication can be purchased from the USA Fulfillment/AISI, Box 4237, Chestertown, MD, 21690. Telephone: (800) 277-3850; Fax: (410) 810-0910. Please refer to the publication number CF97-1 when you order the Guide.

Nominal Tensile Strength of Arc Spot Welds

Arc spot welds are often used for connecting steel roof deck to supports. In August 1993 the CCFS Technical Bulletin published a table for the allowable tensile strength of arc spot welds for wind uplift forces on roof deck, which was based on the Deck Design Data Sheet of United Steel Deck, Inc.

In view of the fact that additional design equations are now included in the newly revised 1996 edition of the AISI Specification for determining the nominal tensile strength of arc spot welds, a new table has been prepared by Mr. Richard B. Heagler of United Steel Deck, Inc. as shown below. The tabulated nominal tensile strength can be used for either ASD or LRFD method by applying the appropriate safety factor or resistance factor according to the AISI Specification.

United Steel Deck, Inc.

TENSILE STRENGTH OF ARC PUDDLE WELDS - Wind Uplift Forces on Roof Deck - Lbs.

Case 1. Single deck thickness.		Case 2. Two layers of deck such as at an end lap.				Case 3. At a side lap into structual steel (or bar joist).							
													
Steel	Base Metal Thickness (in.)	(1) Visible Weld Dia. (in.)				(2) Visible Weld Dia. (in.)				(3) Visible Weld Dia. (in.)			
		0.5	0.625	0.75	1.0	0.5	0.625	0.75	1.0	0.5	0.625	0.75	1.0
A653 Grade 33	0.0295	910	1150	1400	1880	710	940	1170	1640	640	810	980	1320
F_y=33 ksi	0.0358	1090	1390	1680	2270	800	1090	1370	1930	760	970	1180	1590
F_u=45 ksi	0.0474	1410	1500	2190	2970	2030	1300	1670	2420	990	1260	1630	2080
	0.0598	1730	2220	2710	3690	1370	3140	1920	2870	1210	1550	1900	2590
A653 Grade 40	0.0295	550	690	840	1130	870	1150	1440	2000	360	490	590	790
F_y=40 ksi	0.0358	660	830	1010	1360	980	1330	1670	2360	460	550	710	950
F_u=55 ksi	0.0474	850	1060	1310	1780	1130	1590	2050	2960	590	760	920	1250
	0.0598	1040	1330	1630	2220	1200	1780	2350	3500	730	930	1140	1550
A653 Grade 50	0.0295	630	800	970	1300	1030	1360	1700	2370	440	560	680	910
F_y=50 ksi	0.0358	760	960	1160	1570	1160	1570	1980	2790	530	670	810	1100
F_u=65 ksi	0.0474	980	1250	1520	2050	1340	1880	2420	3500	680	870	1060	1440
	0.0598	1200	1540	1880	2560	1420	2100	2780	4140	840	1080	1310	1790
A611 grade C	0.0295	970	1230	1490	2010	760	1010	1250	1750	680	860	1040	1400
F_y=33 ksi	0.0358	1160	1480	1790	2420	860	1160	1460	2060	820	1030	1250	1690
F_u=48 ksi	0.0474	1500	1920	2330	3160	2030	1390	1790	2580	1050	1340	1630	2220
	0.0598	1840	2370	2890	3940	1370	3140	2050	3060	1290	1660	2020	2760
A611 Grade D	0.0295	750	950	1150	1540	820	1090	1360	1890	520	660	800	1080
F_y=40 ksi	0.0358	900	1140	1380	1860	930	1260	1580	2230	630	800	970	1300
F_u=52 ksi	0.0474	1160	1480	1800	2440	1070	1500	1930	2800	810	1030	1260	1710
	0.0598	1420	1820	2230	3030	1370	1680	2220	3310	990	1280	1560	2120

The weld tensile strengths in pounds shown in the table are achieved by using the formulas shown in the new (1996) AISI Specification. The strengths are the nominal (ultimate) values. For LRFD apply a ϕ factor of 0.6; for ASD use a safety factor of 2.5. For ASD it may be appropriate to take advantage of the 1/3 increase allowed for temporary wind loading.

CALENDAR

September 11, 1997
AISI 3-hour Light Weight Steel Framing Seminar
New Orleans, LA
Contact: (202) 452-7117

September 12, 1997
AISI 6-hour Light Weight Steel Framing Lecture Series
New Orleans, LA
Contact: (202) 452-7117

September 22-24, 1997
International Conference on Experimental Model Research and Testing of Thin-Walled Structures
Prague, Czech Republic
Contact: (607) 255-3760

September 22-26, 1997
VIIIth Symposium on Stability of Structures
Zakopane, Poland
Contact: (0-48-42) 31 22 14

October 6-9, 1997
UMR Short Course on Cold-Formed Steel Structures
St. Louis, MO
Contact: (573) 341-4132

October 28-30, 1997
MetalCon International
Georgia World Congress Center
Atlanta, GA
Contact: (312) 201-0193

February 18-21, 1998
Meeting of the AISI Committee on Specifications
Tucson, AZ
Contact: (202) 452-7130

May 11-13, 1998
2nd World Conference on Constructional Steel Design
San Sebastian, Spain
Contact: (44) 1344 23345

September 21-23, 1998
SSRC Annual Technical Session and Meeting
Atlanta, GA
Contact: (610) 758-3522

October 15-16, 1998
14th International Specialty Conference on Cold-Formed Steel Structures
St. Louis, MO
Contact: (573) 341-4132

December 2-4, 1998
2nd International Conference on Thin-Walled Structures
Singapore
Contact: (+65) 772-2288

June 20-23, 1999
4th International Conference on Steel and Aluminum Structures
Espoo, Finland
Contact: (+358) 9 451 3780

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