

01 Aug 1993

CCFSS Technical Bulletin August 1993

Wei-Wen Yu Center for Cold-Formed Steel Structures

Follow this and additional works at: https://scholarsmine.mst.edu/ccfss-technical_bulletins



Part of the [Structural Engineering Commons](#)

Recommended Citation

Wei-Wen Yu Center for Cold-Formed Steel Structures, "CCFSS Technical Bulletin August 1993" (1993).
CCFSS Technical Bulletins (1993 - 2020). 30.
https://scholarsmine.mst.edu/ccfss-technical_bulletins/30

This Technical Report is brought to you for free and open access by Scholars' Mine. It has been accepted for inclusion in CCFSS Technical Bulletins (1993 - 2020) 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.

ALLOWABLE TENSILE STRENGTH OF ARC SPOT WELDS

Arc spot welds are often used for connecting steel roof deck to supports. The following table gives the allowable tensile forces of arc spot welds in pounds for wind uplift forces on roof deck, which were published in Deck Design Data Sheet No. 18 of United Steel Deck (Ref. 1). This table is reprinted by permission of United Steel Deck with modifications.

**TENSILE STRENGTH OF ARC SPOT WELDS
WIND UPLIFT FORCES ON ROOF DECK**

Case *	Base Metal Thickness (in.)	(1)				(2)				(3)			
													
		Visible Weld Dia. (in.)				Visible Weld Dia. (in.)				Visible Weld Dia. (in.)			
Steel		0.5	0.625	0.75	1.0	0.5	0.625	0.75	1.0	0.5	0.625	0.75	1.0
A446 grade A** $F_y = 33$ ksi $F_u = 45$ ksi	0.0295	230	300	360	480	440	560	680	930	160	210	250	340
	0.0358	280	350	430	580	520	670	820	1120	200	250	300	410
	0.0474	360	460	560	760	650	840	1040	1440	250	320	390	530
	0.0598	440	570	690	940	730	1020	1270	1770	310	400	490	660
A446 grade C $F_y = 40$ ksi $F_u = 55$ ksi	0.0295	280	360	440	590	530	690	840	1140	200	250	310	410
	0.0358	340	430	520	710	630	810	1000	1360	240	300	370	500
	0.0474	440	560	680	930	790	1030	1280	1760	310	390	480	650
	0.0598	540	690	850	1150	730	1240	1550	2160	380	490	590	810
A446 grade D $F_y = 50$ ksi $F_u = 60$ ksi	0.0295	310	390	480	640	580	750	910	1240	220	280	330	450
	0.0358	370	470	570	770	690	890	1090	1490	260	330	400	540
	0.0474	480	610	750	1010	860	1130	1390	1920	340	430	520	710
	0.0598	590	760	920	1260	730	1350	1690	2360	410	530	650	880
A611 grade C** $F_y = 33$ ksi $F_u = 48$ ksi	0.0295	250	310	380	510	470	600	730	990	170	220	270	360
	0.0358	300	380	460	620	550	710	870	1190	210	260	320	430
	0.0474	380	490	600	810	690	900	1110	1540	270	340	420	570
	0.0598	470	610	740	1010	730	1080	1350	1890	330	420	520	710
A611 grade D $F_y = 40$ ksi $F_u = 52$ ksi	0.0295	270	340	410	560	500	650	790	1080	190	240	290	390
	0.0358	320	410	500	670	600	770	940	1290	230	290	350	470
	0.0474	420	530	650	880	750	980	1210	1670	290	370	450	610
	0.0598	510	660	800	1090	730	1170	1460	2040	360	460	560	760

* (1) Single metal thickness values. (2) Double metal thickness values - end laps. (3) Edge laps (at supports).

** Roof deck is generally specified to meet ASTM A446 grade A (galvanized) or A611 grade C (painted).

All table values for cases 1 and 2 were determined from the formulas given in the AISI Specification for the Design of Cold-Formed Steel Structural Members (Ref. 2). The Safety factor is 2.5 with the 33% increase of allowable values for wind loading. For the edge lap condition (Case 3), the allowable values have been reduced by 30% to adjust for eccentric loading of the weld as recommended by UMR research (Ref. 3). AWS procedures for making arc spot welds are to be followed. A minimum electrode strength of 60 ksi is required.

References:

1. United Steel Deck, Inc., "Tensile Strength of Arc Puddle Welds - Wind Uplift Forces on Roof Deck," Deck Design Data Sheet No. 18, AISC Modern Steel Construction, December 1992.
2. American Iron and Steel Institute, "Specification for the Design of Cold-Formed Steel Structural Members," 1986 Edition with the 1989 Addendum.
3. LaBoube, R. A. and Yu, W. W., "Behavior of Arc Spot Weld Connections in Tension," Journal of Structural Engineering, ASCE, Vol. 119, No. 7, July 1993.

AVAILABLE PUBLICATIONS

AISI PUBLICATIONS ON COLD-FORMED STEEL DESIGN AND RESIDENTIAL CONSTRUCTION

The following AISI publications are available for the design of cold-formed steel and the use of steel in residential construction:

A. Cold-Formed Steel Design

1. Cold-Formed Steel Design Manual, 1986, with the 1989 Addendum [SG-673], \$60.00/copy

A complete allowable stress design (ASD) handbook for cold-formed steel including the nationally recognized AISI Specification for the Design of Cold-Formed Steel Structural Members, Commentary, Supplementary Information, Examples, Design Aids, Computer Aids and Test Procedures.

2. Specification & Commentary for the Design of Cold-Formed Steel Structural Members, 1986 edition, with 1989 Addendum [SG-671 & SG-672], \$25.00/copy

The Specification provides the technical information required to design cold-formed steel structural members. Commentary provides useful information to aid the user and also includes an extensive reference list.

3. LRFD Cold-Formed Steel Design Manual, 1991 [SG-913], \$60.00/copy

The Load and Resistance Factor Design Manual is a complete designer's handbook for cold-formed steel design using LRFD methodology. The manual includes a Specification, Commentary, Supplementary Information, Examples, Design Aids, Computer Aids and Test Procedures.

4. Load and Resistance Factor Design Specification and Commentary for Steel Structural Members, 1991 [SG-911 & SG-912], \$25.00/copy

The LRFD Specification provides the technical information required to design cold-formed steel structural members using the LRFD methodology. Commentary provides useful information to aid the user and also includes an extensive reference list.

5. Preliminary Design Guide for Cold-Formed Steel C-and Z-Members, 2nd Edition, 1993 [CF 93-1A], \$5.00/copy

The guide provides a mechanism for the casual user to quickly verify the adequacy of a cold-formed steel member. The guide includes a commentary and design aids

such as charts, tables, graphs and examples.

6. Shear Resistance of Walls with Steel Studs, 1992 [CF 92-2], \$5.00/copy

The report contains detailed test results and a summary table of shear values for steel stud framing with gypsum wallboard, plywood and steel lath plaster.

B. Residential Construction

1. Information Kit, [RG-920], No charge

Provides general information on the AISI Steel in Residential Construction Program. Contains a list of activities and recent articles promoting the use of steel framing in housing.

2. Build It With Steel, [RG-922], \$20.00/copy

An introductory video illustrating the attributes of steel for homes.
12 minutes, VHS Format.

3. Directory of Manufacturers of Steel Building Products for Residential Construction, [RG-923], No charge

Suppliers of steel building products and systems in the United States and Canada. Arranged by product classification. (Also included in the Residential Framing Manual) [RG-930].

4. Residential Steel Framing Manual for Architects, Engineers and Builders, [RG-930], \$40.00/copy

A manual on residential steel framing. Includes RG-931 through RG-934, plus fire performance information, Steel Beam and Column Load-Span Tables, and Directory of Manufacturers. Future additions will include cold-formed section load-span tables, acoustic performance, thermal performance and more. (The enclosures of the Manual may be ordered separately).

5. Build It With Steel - Introduction to Residential Steel Framing, [RG-931], \$5.00/copy

This publication provides an introduction to the use of steel

framing for residential construction. It includes information on the environmental benefits that come with the use of steel. Also includes case studies of steel residential construction.

6. Fasteners for Residential Framing, [RG-933], \$5.00/copy

Brochure describing the fasteners commonly used and where they should be used. It includes guidance on load carrying capacities of fasteners.

7. Low-Rise Residential Construction Details, [RG-934], \$20.00/copy

Over 70 common engineering details used in steel framing that can be easily incorporated into construction documents. Includes Residential Construction Guidelines (RG-934a) a companion document in specification format that provides guidance on design and detailing.

8. Low-Rise Construction Details on Computer Disks, [RG-935], \$25.00/copy

3-1/2" and 5-1/4" computer disks containing the details included in RG-934 will be available in AutoCAD® Release 11 or 12 format. (AutoCAD is a registered trademark of Autodesk, Inc.).

9. Residential Steel Beam and Column Tables, [RG-936], \$10.00/copy

These tables are designed to simplify the selection of center beams and columns for homes with one, two and three supported floors. A wide range of wide flange beams and pipe and tube columns are included for dead loads ranging from 10 to 20 pounds per square foot.

10. Fire Resistance Rating of Load-Bearing Steel Stud Walls, [Z-4], No charge

Summary of test data and calculation procedures to evaluate fire resistance of steel stud walls with gypsum wallboard.

C. Standing Seam Roofing

1. Standing Seam Metal Roofs: A Four Season Solution to Roof Problems and Maintenance, 1992, [SSMR-1], No charge

Provides life-cycle cost information on actual standing seam metal roof installations and other comparative materials.

2. Standing Seam Metal Roofs, 1992, [SSMR-2 (8 pages), SSMR-3 (4 pages)], No charge

An 8-page brochure is available featuring 13 schools across the country which use Standing Seam Metal Roofs. A life-cycle cost analysis is also included. Copies of a recent 4-page brochure are also available on recent public, commercial and manufacturing buildings with Standing Seam Metal Roofs.

D. Automotive Design

1. Automotive Steel Design Manual, 1986 with revisions in 1987, 1988, 1991, and 1993. [AU-739], \$50.00/copy

Contains the latest information on materials, design, and manufacturing. Encourages simultaneous engineering by providing the product design engineer with information on materials and manufacturing processes as well as structural design techniques. Fatigue, crash energy management, and corrosion are included. Case studies are provided.

The above listed AISI publications can be ordered from American Iron and Steel Institute, 1101 17th Street, NW, Suite 1300, Washington, DC 20036-4700 (Attn: Construction Market). All orders must be accompanied with check or money order.

SDI PUBLICATIONS ON STEEL DECK

The following SDI publications are available for the design of steel deck:

1. Design Manual for Composite Decks, Form Decks, and Roof Decks, 1992, [SDI No. 28], \$15.75/copy

This Manual includes (1) Specifications and Commentary for Steel Roof Deck, (2) Specifications and Commentary for Composite Steel Floor Deck and Non-Composite Steel Form Deck, (3) Specifications and Commentary for Cellular Metal Floor Deck with Electrical Distribution, and (4) Information on Deep Rib Deck, Acoustical Deck and Long Span Deck, Pour Stop and Cantilevers.

2. Diaphragm Design Manual (Second Edition), 1990, [SDI No. DDM02], \$45.00/copy

A user friendly design manual for practicing Engineers and Architects covering the practical design of steel deck diaphragms. It includes sixteen clearly illustrated and explained design examples.

3. Composite Deck Design Handbook, 1993, [SDI No. CDD1], \$45.00/copy

Standard load tables for 1.5", 2", 3" steel deck. Quick selection tables with normal and light weight concrete deck with and without studs for spans to 16 feet. Example

problems showing design with heavy concentrated loads including impact. Written in language for Design Engineers and Design Professionals.

The above listed SDI publications can be ordered from Steel Deck Institute, P.O. Box 9506, Canton, OH 44711. Telephone: 216-493-7886.

MBMA PUBLICATIONS ON METAL BUILDINGS

The following MBMA publications are available for the design and construction of metal buildings:

1. MBMA Fact Book, 1993, \$4.00/copy

The MBMA Fact Book provides a general introduction to the metal building industry. It is an eight-page, four-color publication with photos that illustrate the wide range of architectural appearances possible with metal building system construction. Member manufacturer names, addresses and telephone numbers are provided.

2. Low Rise Building Systems Manual, 1986 Edition with the 1990 supplement, \$25.00/copy (\$5.00/copy for supplement alone)

This publication offers architects and engineers the most comprehensive review of current design practices for all types of low-rise non-residential construction. It includes the calculation of floor loads and seismic loads with the design data for crane buildings. The appendix reviews the MBMA research programs and has a unique compilation of climatological data on wind velocities, ground snow loads, seismic zones and rainfall data for every U.S. county.

The above listed MBMA publications can be ordered from

**Center for Cold-Formed Steel Structures
University of Missouri-Rolla
Rolla, MO 65401-0249 USA**

Metal Building Manufacturers Association, 1300 Sumner Avenue, Cleveland, Ohio 44115-2851. All orders must be prepaid. Prices include shipping and handling. Telephone: 216-241-7333.

BSI PUBLICATIONS ON BUILDING SYSTEMS

The following BSI publications are available for the design and construction of building systems:

1. Metal Building Systems Book, 2nd Edition, 1990, \$25.00/copy

This book is an excellent reference for building systems and includes an overview of all facets of the industry. It includes: the origin and growth of the industry; building systems nomenclature; the "systems" concept; general design principles; energy considerations; life cycle costing; foundation design; codes and design specifications; contractual considerations; specifying building systems; construction considerations; and insurance and fire resistance ratings.

2. Building Systems - Architectural Design & Planning Guidelines, 2nd Edition, 1990, \$4.00/copy

This brochure assists building owners, architects, builders, developers, and planning and design review officials achieve the highest quality of building systems design while benefiting from the significant advantages offered by the "systems" approach.

The above listed BSI publications can be ordered from the Building Systems Institute, 1300 Sumner Avenue, Cleveland, Ohio, 44115-2851. All orders must be prepaid. Prices include shipping and handling. Telephone: 216-241-7333.

Non Profit Org.
U.S. Postage

Paid

Permit No. 170
Rolla, MO

UMR

Missouri's Technological University