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THE AISI COMBINED ASD/LRFD SPECIFICATION

The 1996 Edition of the Specification for the Design of Cold-Formed Steel Structural Members (AISI, 1996a) will be published by American Iron and Steel Institute in May 1997 as Part V of the new Cold-Formed Steel Design Manual (AISI, 1996c; Kaehler and Seaburg, 1996). This technical bulletin presents a summary of the revised and new provisions. The reasoning behind and the justification for the revisions and additions are discussed by Brockenbrough (1996) and Yu (AISI, 1996b).

A. General Provisions

A1.1 Scope and Limits of Applicability
A new paragraph was added to permit the use of either LRFD or ASD method for the design of cold-formed steel structural members.

A1.2 Terms
Definitions were added or modified for ASD, Design Strength, Local Buckling, LRFD, Nominal Loads, Nominal Strength, Required Strength, Resistance Factor, and Torsional-Flexural Buckling.

A3.1 Applicable Steels
(1) ASTM Specifications for A441 and A446 were deleted.
(2) ASTM Specification for A653 was added to replace A446. High Strength Low Alloy (HSLA) Grades 50, 60, 70, and 80 were added.
(3) ASTM Specification for A283 was added.
(4) Grades 70 and 80 were added for A715 Steel

A3.3. Ductility
(1) ASTM A446 Grade E steel was replaced by ASTM A653 Structural Grade 80 with minor editorial revisions.
(2)The last paragraph in Section A3.3.2 of the 1986 Specification was deleted.

A4 Loads
The design provisions for dead load, live load, snow load, impact load, wind load, and earthquake load were rewritten. The definitions of all types of loading were included in a single section under the title of Nominal Loads.

A5 Allowable Stress Design
This is a new section for allowable stress design. It includes new ASD provisions for design basis, strength requirements, load combinations, reduction of wind or earthquake loads, and other loads.

A6 Load and Resistance Factor Design
This is a revised section for load and resistance factor design. These LRFD design provisions are dealing with design basis, strength requirements, load factors, load combinations, and other loads. .

A7 Yield Point and Strength Increase from Cold Work of Forming
This section was renumbered with minor editorial revision in Section A7.1.

A8 Serviceability
The revised provision for serviceability is now included in Section A8.

A9 Reference Documents
The list of reference documents was updated and extended.

B. Elements

B4.2 Uniformly Compressed Elements with an Edge Stiffener
For Case II of Section B4.2(a), the design equations for I_a/t^4 and local buckling coefficient k were revised. Because D/w is meaningless for stiffeners other than simple lip stiffeners, different design equations are used for simple lip stiffeners and other types of edge stiffeners.

B6.2 Shear Stiffeners
Equations B6.2-3 and B6.2-4 were revised to be dimensionless.

C. Members

C2 Tension Members
This section was revised to include both Ω_t and ϕ_t.

C3.1 Strength for Bending Only
(1) The introduction paragraph was revised to cover Section C3.1.4.
(2) Section C3.1.1 was revised to include both Ω_b and ϕ_b.

C3.1.2 Lateral Buckling Strength
(1) Section C3.1.2 was revised to include both Ω_b and ϕ_b.
(2) The revised provision permits the use of yield plateau design provisions for singly-symmetric sections.
(3) The design equation for bending coefficient C_b was revised to be suitable for straight line and non-uniform moment diagrams.

C3.1.3 Beams Having One Flange through-Fastened to Deck or Sheathing
(1) Both Ω_b and ϕ_b were included in this section.
(2) For continuous span systems using channel sections, the distance from center of support to the end of lap was reduced from 3d to 1.5d.

C3.1.4 Beams Having One Flange Fastened to a Standing Seam Roof System
This is a new section for designing beams with standing seam roof systems using the Base Test Method.

C3.2 Strength for Shear Only
Minor changes were made for Equation C3.2-1 and the safety factors for shear yielding and elastic shear yielding.

C3.4 Web Crippling Strength
(1) Editorial revisions were made for general requirements. Both Ω_w and ϕ_w were included in this section.
(2) Added new provisions for two nested Z-sections.
(3) The equation for k was rewritten to a nondimensional form. A new equation for m was added for using metric units.
(4) A new term C_9 was added for the use of dual units.
(5) A footnote was added for Equations C3.4-1, C3.4-2, and C3.4-6.

C4 Concentrically Loaded Compression Members
(1) The equations for determining the nominal column buckling stress, F_n, were revised to be the same as the AISC LRFD Specification.
(2) The safety factor for the ASD method was changed to 1.80.
(3) The equation for determining the nominal axial strength for C- and Z-shapes, and single-angle sections with unstiffened flanges (Equation C4-5 of the 1986 ASD Specification) was deleted.
(4) Both Ω_c and ϕ_c were included in this section.

C4.2 Doubly- or Singly-Symmetric Sections Subjected to Torsional or Torsional-Flexural Buckling
A new provision was added for doubly-symmetric sections subjected to torsional buckling.

C4.4 Compression Members Having One Flange Through-Fastened to Deck or Sheathing
This is a new section for determining the axial strength of simple span or continuous C- or Z-sections when these members are concentrically loaded along their longitudinal axis with only one flange attached to deck or sheathing with through fasteners.

C5 Combined Axial Load and Bending
(1) New provisions were added for combined tensile axial load and bending.
(2) For the ASD method, the expressions for the design strengths were written as $R_a=R_n/\Omega$
(3) For the LRFD method, the equations for α_x and α_y were modified.

C6.1 Bending
Both Ω_b and ϕ_b were included in this section.

C6.2 Compression
The equations for determining the nominal column buckling stress, F_n were revised to be consistent with the revised Section C4 with the inclusion of both Ω_c and ϕ_c.

D. Structural Assemblies

D1.1 Sections Composed of Two C-Sections
Minor editorial clarifications were made for symbols q and P_s.

D3.2.1 Anchorage of Bracing for Roof Systems Under Gravity Load with Top Flange Connected to Sheathing
(1) Editorial revision was made by including the use of standing seam roof systems.
(2) The specific requirement for diaphragm stiffeness was deleted from Section D3.2.1(b).
(3) Minor editorial clarifications were made for the symbol W.

D3.2.2 Neither Flange Connected to Sheathing
The requirements for attaching braces at intervals not greater than one-quarter of the span length were deleted.

D4 Wall Studs and Wall Stud Assemblies
(1) Extensive revisions were made to permit the use of wall studs having either solid or perforated web. Specific limitations are included in the revised provisions for the size and spacing of perforations. The symbol q_0 was replaced by Q_0 with the change of units.
(2) Both Ω_b and ϕ_b were included in Section D4.2.

D5 Floor, Roof, or Wall Steel Diaphragm Construction
This section was rewritten to include both the ASD and LRFD methods. Safety factors and resistance factors are provided in the revised provisions for the design of diaphragms subjected to various types of loading.

E. Connections and Joints

E.2 Welded Connections
(1) Editorial revisions were made in this section.
(2) Both Ω and ϕ were included for the design of welded connections.

E2.2 Arc Spot Welds
(1) Minor revision of Equation E2.2.1-1 was made for calculating the nominal shear strength of arc spot welds.
(2) For using Equation 2.2.1-6, the limiting F_u/F_{sy} ratio was changed from 1.15 to 1.08 to be consistent with Section A3.3.1.
(3) New design provisions were added for determining the nominal tension load for arc spot welds.

E2.5 Flare Groove Welds
New figures (Figures E2.5D, E2.5E, E2.5F, and E2.5G) were added for the design of flare bevel groove welds.

E3 Bolted Connections
(1) ASTM Specifications were updated.

(2) Both Ω and ϕ were included for the design of bolted connections

E3.1 Shear, Spacing, and Edge Distance
(1) The limiting F_u/F_{sy} ratio was changed from 1.15 to 1.08.
(2) Minor editorial changes were made for the purpose of clarification.

E3.3 Bearing
The limiting F_u/F_{sy} ratio was changed from 1.15 to 1.08.

E3.4 Shear and Tension in bolts
(1) Table E3.4-1 was revised to provide safety factors and resistance factors for the determination of tensile and shear strengths of bolts.
(2) Tables E3.4-4 and E3.4-5 were added for metric units.

E4 Screw Connections
This section provides new design criteria for screw connections.

F. Tests for Special Cases

F1.1 Load and Resistance Factor Design
(1) The required number of tests was changed from four tests to three tests because of the change of Equation F1.1-3 for correction factor, C_p
(2) The permissible deviation of any individual test result from the average value obtained from all tests was changed from ± 10% to ± 15%.
(3) The equation for computing the correction factor C_p was modified for improvement.
(4) The limiting value of V_p was reduced from 10% to 6.5%.
(5) The statistical data for determining the resistance factor of screw connections were added in Table F1.

F1.2 Allowable Stress Design
This section provides the revised ASD provisions for using tests to determine the allowable design strength.

REFERENCES:

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

American Iron and Steel Institute (1996b), *Commentary on the 1996 Edition of the Specification for the Design of ColdFormed Steel Structural Members,* by Wei-Wen Yu, Washington, D.C., 1996.

American Iron and Steel Institute (1996c), *Cold-Formed Steel Design Manual,* Washington, D.C., 1996.

Brockenbrough, R.L. (1996), "The 1996 AISI Specification," *Proceedings of the 13th International Specialty Conference on Cold-Formed Steel Structures,* University of Missouri-Rolla, October 1996.

Kaehler, R. and Seaburg, P.A. (1996), "A New AISI Cold-Formed Steel Design Manual," *Proceedings of the 13th International Specialty Conference on Cold-Formed Steel Structures,* University of Missouri-Rolla, October 1996.

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