

Separate Provisions Unite

Provisions for the design of HSS and single-angle members have been reincorporated into AISC's main *Specification* for 2005.

Provisions for HSS

By Richard C. Kaehler, P.E.

The provisions for Hollow Structural Sections (HSS) in the 2005 AISC *Specification for Structural Steel Buildings* (the *Specification*) are greatly expanded compared to previous versions of the specification.

In 1997, AISC published the *Specification for the Design of Steel Hollow Structural Sections* (HSS *Specification*) as a supplement to the 1993 *LRFD Specification*. This document contained detailed provisions for the design of HSS, including information on the design of HSS-to-HSS truss connections. A companion manual, the *Hollow Structural Sections Connection Manual*, was published by AISC in 1997. This manual contains design examples, tables, and other practical data useful in the design of HSS construction. The *HSS Specification* was updated in 2000.

With the new 2005 *Specification*, the provisions from the *HSS Specification* have been integrated in to the main AISC specification, superseding all previous editions of the *HSS Specification*.

There are numerous updates and additions to the HSS provisions incorporated into the 2005 *Specification* including:

- a. The format of all provisions has been changed for compatibility with the new ASD/LRFD 2005 *Specification*. This allows the HSS provisions to be used for both ASD and LRFD.
- b. The compact section b/t limit for HSS webs in flexure has been reduced significantly.
- c. The compact and noncompact section b/t limits for HSS webs in combined flexure and axial compression have been eliminated.
- d. The effective width calculation for square and rectangular HSS columns with slender elements has been modified to eliminate the use of the design load, P_u .
- e. Chapter K now deals exclusively with HSS connections. Updates to this section include:
 1. Revisions to the provisions for HSS-to-HSS truss connections and concentrated loads on HSS.
 2. New provisions for overlapped HSS-to-HSS K-connections
 3. The addition of a major new section on the design of HSS-to-HSS moment connections

An HSS by Any Other Name...

As used in the 2005 *Specification*, HSS is a general classification that refers to any square, rectangular, or round shape
continued on p. 43

Provisions for Single Angles

By LeRoy A. Lutz, Ph.D., P.E., S.E.

Prior to 1989, no provision specific to the design of single angles existed in either the AISC ASD or LRFD specifications—except for the Q_s term addressing strength reduction due to local buckling under axial load. To provide an aid for designing structures that use single angles subjected to axial load with eccentricity or general flexure plus axial load, a specification dedicated to the design of single angles using allowable stress design was developed in 1989. This was developed as a separate specification document with commentary that was included in the AISC *ASD Manual of Steel Construction*, ninth edition.

This specification addressed tension, compression, flexure, and shear on both equal-leg and unequal-leg single angles. These provisions considered loading about the geometrical axis of equal-leg angles, as well as minor and major axis flexure of any single angle. Provisions for compression buckling, flexural-torsional buckling, and local buckling under either axial or flexural loads were provided. An interaction expression was provided to address combined axial and flexural effects.

Subsequently, in 1993, an LRFD version of the single-angle specification and commentary was produced and included as a separate document in the second edition of the AISC *LRFD Manual*. This specification, with several modifications, appeared as a separate document in the *LRFD Manual*, third edition.

These single-angle design provisions have been incorporated into AISC's 2005 *Specification for Structural Steel Buildings*. These provisions are essentially the same as those that appear in the third edition *Manual*. They are simply organized to fit the format of the new *Specification*.

There is, however, one significant addition to the single-angle provisions in the 2005 *Specification*: A procedure is introduced to address the design of single-angle compression struts that are attached at their ends to one of the angle legs. These struts, which are typically web members of planar or space trusses, can now be designed as axially loaded members using an appropriately modified slenderness ratio. Some engineers may be familiar with a similar design approach used in the design of transmission towers. This procedure, which considers the influence of end restraint on slenderness and strength, provides an economical and greatly simplified approach for the design of this type of single-angle member. ★

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“produced in accordance with a pipe or tubing specification.” Tables in the AISC design manuals use the term HSS as part of the names of certain square, rectangular, and round tubular sections, such as “HSS10×10×¼”, but it should be kept in mind that the HSS provisions in the *Specification* also apply to “steel pipe” and other similar products.

The Skinny on Thickness

Also noteworthy is the requirement for the use of a “design wall thickness” in calculations of HSS strength. To account for typical practices by tube and pipe producers, the design wall thickness of electric resistance welded (ERW) tubes and pipes must taken as 93% of the nominal wall thickness. ★

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