A look at what's inside the new
AISC Steel Design Guide 24: *Hollow Structural Section Connections.*

A How-To for HSS

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EVERYONE WHO DESIGNS hollow structural section (HSS) connections should be aware of the new AISC Steel Design Guide 24, *Hollow Structural Section Connections* now available at **www.aisc.org/epubs**. Authored by Jeffrey Packer, P.Eng., Ph.D., Donald Sherman, P.E., Ph.D., and Maura Lecce, Ph.D., the publication acts as a supplement to Chapter K of the 2005 AISC *Specification for Structural Steel Buildings* (ANSI/AISC 360-05) and the 13th Edition *Steel Construction Manual*.

The design guide includes discussions on welding (Chapter 2), mechanical fasteners (Chapter 3), moment connections (Chapter 4), tension and compression connections (Chapter 5), branch loads on HSS (Chapter 6), line loads and concentrated forces on HSS (Chapter 7), HSS-to-HSS truss connections (Chapter 8), and HSS-to-HSS moment connections (Chapter 9). An introduction provides general discussion on the advantages of using HSS and other considerations, such as notch toughness, galvanizing issues, and internal corrosion. Users will find this design guide valuable for the clarity of presentation of the *Specification* provisions, the detailed design examples provided, and the additional information about HSS connection design it includes.

Before getting into the various connection configurations addressed in Chapter K of the 2005 *Specification*, the design guide gives an excellent general overview of the various welding and fastener issues, and limit states applicable to moment, tension and compression connections that are encountered in designing with HSS. The authors discuss the types of welds and mechanical fasteners specific to HSS. They review the applicable nondestructive testing methods for welds and explain the concepts of effective weld size and effective weld length.

Design examples given for both welds and bolts focus on the topics discussed in those chapters, including a skewed joint, transverse welded plate, through-bolts in shear, and threaded studs and bolts in tension. Chapter 4 includes several types of moment connections: W-shaped beams to HSS columns, continuous beams over HSS columns, through-plate connections, and directly welded connections. For W-shaped beams connected to HSS columns, the design guide references Part 12 of the 13th Edition *Manual* and discusses how to select the best configuration. Chapter 5 focuses on limit states that are applicable in various types of end connections on HSS when used as bracing, such as end tee connections, slotted HSS/gusset connections, end plates on round HSS, and end plate on rectangular HSS with bolts on two or four sides. Design examples included in both Chapters 4 and 5 demonstrate the design of these connections.

Chapter 6, Branch Loads on HSS–An Introduction, is brief and intended to serve as an introduction to Chapters 7, 8 and 9. Failure modes of HSS welded connections are discussed and the chapter provides "a physical understanding of the limit states that are to be checked in the following chapters and, importantly, allows the user of this design guide to understand HSS connection behavior and extrapolate 'engineering judgment' to other connection types that are beyond the scope of this design guide." This is an example of how *Design Guide 24* provides additional information that is not apparent in the 2005 *Specification*.

Chapters 7, 8 and 9 address specific configurations of HSS connections. These chapters of the design guide present the 2005 *Specification* Chapter K provisions in a tabular format, specifically for line loads and concentrated forces on HSS, HSS-to-HSS truss connections, and HSS-to-HSS moment connections. *Design Guide 24* tabulates the provisions for these connection types in an

Table 8-2 (continued). Nominal Strengths of Rectangular HSS-to-HSS Truss Connections

Connection Type	Connection Nominal Axial Strength*
Gapped K-Connections	Limit State: Chord Wall Plastification, for all β $P_r \sin\theta = F_y t^2 \left(9.8 \beta_{eff} \gamma^{0.5}\right) Q_f$ (K2-20) $\phi = 0.90$ (LRFD) $\Omega = 1.67$ (ASD)
	Limit State: Shear Yielding (Punching), when $B_b < B - 2t$ Do not check for square branches. $P_r \sin\theta = 0.6 F_y t B \left(2\eta + \beta + \beta_{eff}\right)$ (K2-21) $\phi = 0.95$ (LRFD) $\Omega = 1.58$ (ASD)
	Limit State: Shear of Chord Sidewalls in the Gap Region. Determine $P_r \sin\theta$ in accordance with Spec. Sect. G5. Do not check for square chords.
	Limit State: Local Yielding of Branch/Branches Due to Uneven Load Distribution. Do not check for square branches or if $B/t \geq 15$ $P_r = F_{yb} t_b \left(2H_b + B_b + b_{eff} - 4t_b\right)$ (K2-22) $\phi = 0.95$ (LRFD) $\Omega = 1.58$ (ASD) $b_{eff} = \frac{10}{B/t}\left(\frac{F_y t}{F_{yb} t_b}\right) B_b \leq B_b$ (K2-23)

Fig. 1: Table excerpt from Design Guide 24.

organized manner, including diagrams to clarify the connection and force configuration, and references the applicable *Specification* section or equation.

Figure 1 exemplifies the format of the tables for rectangular HSS-to-HSS truss connections, including the diagram, as well as the applicable limit states for axial and shear loads. Similar tables are provided for plate-to-round and plate-to-rectangular HSS connections, and HSS-to-HSS moment connections. This format brings additional clarity to and understanding of *Specification* Chapter K. Additionally, the limits of applicability of the provisions are given at the bottom of each table.

Design Guide 24 is a valuable reference on HSS connection design in that it references the 2005 AISC *Specification* and 13th Edition *Steel Construction Manual* and expands on and clarifies the information provided in those publications. AISC members can download the document for free at **www.aisc.org/epubs** and nonmembers can purchase it for $60.

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