

THIS EDITION OF THE AISC STEEL INTERCHANGE is published in memory of Kurt Gustafson, AISC Director of Technical Assistance, who passed away suddenly and unexpectedly on Saturday, June 19, 2010. It is composed entirely of answers that Kurt wrote. We will miss him greatly. See the article on page 19.

Tension Control Bolts

Per AISC 358-05 Section 4.1, “Bolts shall be pretensioned high-strength bolts conforming to ASTM A325 or A490. Twist-off type tension control bolt assemblies of equivalent mechanical properties and chemical composition may be substituted for A325 or A490 fastener assemblies.” Do ASTM F1852 bolts have mechanical properties and chemical compositions comparable to A325 and A490 bolts?

Yes, for ASTM A325; no, for ASTM A490. ASTM F1852 is the tension-control bolt equivalent to the ASTM A325 conventional bolt. This is discussed in the Commentary to Section 2.7.2 of the 2004 RCSC *Specification* (a free download at www.boltcouncil.org). That Commentary also discusses the use of tension-control bolts with mechanical properties equivalent to ASTM A490 bolts. Subsequent to the publication of the 2004 RCSC *Specification*, ASTM developed the ASTM F2280 standard as a TC equivalent to the ASTM A490 conventional bolt.

Kurt Gustafson, S.E., P.E.

Beam-to-Column Orientation

Does the AISC *Specification* require that moment-connected beams can only frame orthogonally to column flanges in moment frames?

The AISC *Specification* does not require that the moment frames must be aligned in any specific orientation. Assumptions as to framing layout and alignment are made by the responsible design professional. Any eccentricities, offsets, or non-orthogonal orientation must be accounted for in the design.

If you are designing moment frames for high-seismic applications, however, and intend to use prequalified moment connections, there are no prequalified connections for framing configurations other than to the flange of W-shape or built-up I-shape columns. Alternative prequalified connections include using boxed wide-flange, built-up box or cruciform columns. See ANSI/AISC 358 (a free download at www.aisc.org/freepubs) for prequalified connection details.

Kurt Gustafson, S.E., P.E.

Partially Engaged Nuts

Is there any guidance or wisdom on quantifying the strength of a bolted connection when the nut is not fully engaged on the bolt?

If you are referring to bolted steel-to-steel connections, this condition is not permitted. A fully engaged nut is required in Section 2.3.2 of the RCSC *Specification* (a free download at www.boltcouncil.org) as follows:

“The bolt length used shall be such that the end of the bolts extends beyond or is at least flush with the outer face of the nut when properly installed.”

Kurt Gustafson, S.E., P.E.

Historic Shape

I am trying to find section properties of a floor beam from a building built in 1931. The designation for the beam is BI 30×137. I tried using the AISC shapes search and had no luck in finding that particular shape. Can you help me identify the shape?

The B designation likely indicated that this was a Bethlehem shape from the era. The “I” was not an official AISC *Manual* designation, but probably referred to the common I-beam nomenclature of the time. There was a 30-in.-deep Bethlehem beam weighing 137 plf produced starting in 1909.

AISC has developed two sources of information pertaining to historic shapes. AISC *Steel Design Guide 15* is a reference for historic shapes and specifications. This document also describes the common ASTM material standards in effect during different eras. There also is an AISC Shapes Database v13.1.1 and 13.1H, where the H stands for Historic. Both of these resources are available as free downloads for AISC members at www.aisc.org/epubs, or can be purchased by others.

Kurt Gustafson, S.E., P.E.

Snug-Tightened Connection

What is a snug-tightened connection?

Section 8.1 of the RCSC *Specification* (a free download at www.boltcouncil.org) describes snug-tightened joints as follows:

“The snug-tightened condition is the tightness that is attained with a few impacts of an impact wrench or the full effort of an ironworker using an ordinary spud wrench to bring the connected plies into *firm contact*.”

The definition of *firm contact* is given in the Glossary of the RCSC *Specification* as follows:

Firm Contact: The condition that exists on a faying surface when the plies are solidly seated against each other, but not necessarily in continuous contact.

Kurt Gustafson, S.E., P.E.

Flexure of Z-Shape

I would like to design a “Zee” shaped member. A “Zee” has no axis of symmetry, though the principal axis does pass through the center of the vertical web. Therefore, I believe this should be treated as a solid symmetric shape, like a rectangular bar, bent about the major axis. Is this appropriate? The Zee is not bent about its major principal axis.

The basic principals of flexure are described in engineering texts, rather than any version of the AISC *Specification*. When the loading plane of a beam does not coincide with either of the principal planes, but the loading causes no torsion, bending occurs along both principal axes, which is bi-axial bending. So, for your case, flexure of unsymmetrical shapes is covered in Section F12 of the 2005 AISC *Specification*. Look to the Commentary of Section F12 for further discussion and additional references.

Kurt Gustafson, S.E., P.E.

steel interchange

BF in Table B3.2

I cannot find the definition for the column labeled “BF” in Table B3.2. What is this tabulated value?

The explanation of Table 3-2 is shown on page 3-8 of the 13th Edition AISC *Steel Construction Manual*. Therein, the use of the term BF is shown as a simplification of *Specification* Equation (F2-2) for use in determining the flexural strength of a W-shape when the unbraced length, L_b , is such that $L_p < L_b \leq L_r$.

Kurt Gustafson, S.E., P.E.

1987 Moment Frame

I have an existing moment frame building built in 1987. I need to know if this could be a special moment-frame building. What year was the special moment frame added to the code?

It is unlikely that a moment frame constructed in 1987 would have been considered a special moment frame. The distinction of moment frame types with different ductility requirements was first published in the AISC *Seismic Provisions* in 1992. There was much work done after the 1994 Northridge earthquake, with the moment frame requirements significantly upgraded—especially for SMF—since then.

Kurt Gustafson, S.E., P.E.

Member Splices

What are the AISC requirements for floor beams and columns splice locations? What is the minimum distance that can be used between member splices?

The AISC *Specification* does not define where splices may occur in framing members; that is at the discretion of the responsible design professional. The AISC *Code of Standard Practice* requires that shop drawings be prepared to completely and accurately reflect the information shown on the design drawings. Splices not shown on the design documents should not be used, unless authorized by the EOR.

Note, however, that column splices usually are made at about 4 ft above the deck to inherently provide for safety cables where OSHA requirements specify that they must be used, as well as to make splices easier to erect.

Kurt Gustafson, S.E., P.E.

Torch Cutting

We often must torch cut steel in the field to correct errors. Does torch cutting have an effect on the properties of steel? Is the type of steel a factor?

Thermal cutting is a normal operation of structural steel fabrication. The heat from the cutting operation generally will not be detrimental to the base material, although it can have an effect on the mechanical properties of heat-treated products such as high-strength bolts. If this is a concern, perhaps due to a bolted joint in close proximity to the cutting, for example, temperatures can be monitored.

Kurt Gustafson, S.E., P.E.

Flare Groove Weld

Is a flare groove weld prequalified, and if so, how should the effective throat be calculated?

Yes. Section J2.1a and Table J2.2 of the AISC *Specification* define the effective weld size for flare groove welds. This also is covered in Section 2.3.1.4 of AWS D1.1.

Kurt Gustafson, S.E., P.E.

Window Washing Davits

Do you have any info on the design of davits for window washing equipment? I understand there is a required factor of safety of 4. How does this work when using the LRFD load combinations?

In my experience, most erection and window washing support evaluations historically have been made using unfactored load assumptions, and then a higher safety factor is applied than defined for the AISC *Specification* limit states. Since there is a consistent relationship between Ω (the safety factor used in ASD) and ϕ (the resistance factor used in LRFD), it is possible to use LRFD if you wish with some engineering judgment and numerical manipulation.

Remember that the two load approaches are equilibrated when the live load to dead load ratio is 3.0, resulting in the relationship wherein $\Omega = 1.5/\phi$. If your case is such that the live load is much more than 3 times the dead load, you may need to rederive this relationship. See the Commentary to Section B3.4 in the AISC *Specification*.

Kurt Gustafson, S.E., P.E.

Moment Splice

We have a W36 beam that requires a full moment splice. We're planning to use CJP groove welds at the top and bottom flanges with a joint designation of B-U2a. Is there a thickness limit when utilizing this detail due to the 1/16-in.-thick flanges?

You can find the requirements for the B-U2a SMAW weld on page 8-38 of the 13th Edition AISC *Steel Construction Manual*. The base metal thickness is designated as “unlimited” for this particular weld.

Kurt Gustafson, S.E., P.E.

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