IF YOU'VE EVER ASKED YOURSELF "WHY?" about something related to structural steel design or construction, *Modern Steel Construction*'s monthly Steel Interchange column is for you!

HSS Slot Tolerance

This question originally appeared in the October 2006 Steel Interchange. AISC received follow-up correspondence from a fabricator to supplement the original response.

What is the recommended width tolerance of a slot in a tube shape that is to receive a plate? 1/8 in. larger? 1/16 in. larger?
Question sent to AISC's Steel Solutions Center.

The answer depends on several factors. The first concern is the fabrication tolerance on the cut. Normally, the shop realizes that the slot width is a "keep" dimension, so the thermal cut is outside the line, and the kerf will tend to increase the slot width. Thermal cutting, however, tends to distort the material and can cause the slot to close slightly. This may require some heat spots to restore the slot to a parallel condition. Both the layout of the slots at each end and the orientation of the gusset plates must be in the same plane, or additional clearances will be required, because the HSS is very stiff in torsion. There can be some overrun in plate thickness, but this is seldom a concern.

Our company's practice is to detail the slot 1/16 in. wider than the plate. On very long slots in heavy HSS we may increase the slot to 1/8 in. over the plate thickness. Our fabricated dimension is usually slightly wider than the detailed dimension. We always check the slot using a plate of the proper width. This has worked well for typical HSS braces.

The question of weld sizing was addressed in the previous reply. Some engineers oversize the weld to compensate for possible gaps. This is not necessary if AWS D1.1 fillet weld requirements are followed in the field where gaps larger than 1/16 in. automatically require an appropriate increase in leg size.

Larry Kloiber, P.E.
LeJeune Steel Co.

High-Strength Bolts in 1956

I am analyzing a building constructed in 1956. The plans specify high-strength bolts for the lift-slab columns, but don't give an ASTM designation. Do the A325 and A490 designations go back to 1956? Do you have any other suggestions for approximating design strength of these bolts without testing?
Question sent to AISC's Steel Solutions Center

The answer to the first question could be yes or no. The actual ASTM A325 Standard was in the tentative review process as early as 1949, but was not officially approved as a consensus standard until 1964.

High-strength bolts were beginning to be used in lieu of rivets in the 1950s, but may not have carried the ASTM A325 or A490 designation. The AISC specification at the time included design parameters for "turned bolts," as well as for "unfinished bolts." There was no distinction as to whether the threads were located in the shear plane or not. Allowable loads were listed in the AISC manual of the time.

Allowable working loads for ASTM A325 bolts were first listed in the 1961 AISC manual—making the distinction as to the installed thread location with regards to the shear plane. At that time, ASTM A325 bolts with threads included in the shear plane were designed based on an allowable working shear stress of 15 ksi (single shear), the same as permitted for turned bolts. If the threads were installed excluded from the shear plane in a bearing type connection, the allowable working shear stress was 22 ksi (single shear). One benefit of testing might be the use of more modern design values if the fasteners meet the more current requirements.

There is also a historical discussion on bolts in the *Guide to Design Criteria for Bolted and Riveted Joints*, available as a free download at **www.boltcouncil.org**. A soft-cover copy can be purchased at **www.aisc.org/bookstore**.

Kurt Gustafson, S.E., P.E.
American Institute of Steel Construction

Pile Shape?

We specified HP12×53 for a pile foundation system. However, the contractor wishes to use W12×53 instead of HP12×53 due to the limited availability of HP12 shapes. Is there any technical reason not to permit the W12 substitution?
Question sent to AISC's Steel Solutions Center

Yes, the cross-sectional properties of wide-flange shapes will be different than HP shapes for the same weight and depth. Hence, in terms of structural capacity, there will be a difference. You may want to investigate how the thinner web in W shapes will compare to HP shapes when subjected to the driving installation method.

Sergio Zoruba, Ph.D., P.E.
American Institute of Steel Construction

Historic Non-ASTM Shapes

I am currently working on modifications to an existing ship unloader at a terminal in the U.S., built around 1980. The design was done by a German company that has since gone out of business. The task at hand is to determine a demolition plan for part of the structure so that modifications can be made. The existing mechanical and structural drawings are all in German, but conversion of dimensions and loads are easy. However, many of the structural shapes are designated in a form that is not recognizable to us. We are accustomed to using metric equivalents used in modern construction; however, these members are designated in a non-standardized metric system notation.

For example, some wide-flange sections are noted as HEA 200; it seems obvious that this represents a 200-mm (about 8-in.) beam. Scaling the drawings confirms the depth, assuming they are properly to scale. Scaling flange width and flange thickness, it appears that this shape is nearly equivalent to a W8×35. I'm a bit nervous relying on scaling to confirm member sizes for strength and weight. There are other

members designated HEB 200, HEA 500, etc. Is AISC aware of a steel reference that indicates these member sizes and section properties?

Question sent to AISC's Steel Solutions Center

Like you, I would be very nervous about scaling drawings for determining section properties. The British Constructional Steelwork Association (BCSA) has a book, *International Structural Steelwork Handbook*, that lists all these shapes. It is available at **www.steelconstruction.org**.

Kurt Gustafson, S.E., P.E.
American Institute of Steel Construction

Steel Availability

What is a steel service center? Where can I find the names and phone numbers to some of the closest steel service centers to a particular location?

Question sent to AISC's Steel Solutions Center

Service centers buy large amounts of structural steel directly from the producing mills and hold this material in inventory until it is sold for a project. Service centers act as a warehouse for the structural steel industry, not only supplying steel as it is needed but also working in collaboration with their customers to provide value-added, specialized services such as cutting to length, cambering, tee splitting, plate burning and miter cutting. Every steel fabricator in the country will buy at least some steel from a service center. In fact, an estimated 70% of all the structural steel used in construction projects in the United States flows through service centers. The majority of service center fabricator customers are focused in the under five-story building market. Typically, these projects range from less than 200 tons up to 1,000 tons, but it's worth remembering that this is the area that represents nearly 80% of the overall building market (and that's more than 6 million tons of structural steel consumed annually). To find a list of AISC member service centers, please visit **www.aisc.org/servicecenter**.

Sergio Zoruba, Ph.D., P.E.
American Institute of Steel Construction

Welding Carbon Steel to Stainless Steel

Could you please advise on any special requirements for welding carbon steel to stainless steel? I have a condition where I have stainless steel plates that are to be welded to the end of HSS carbon steel sections, and want to make sure this is possible. Are there any references available that you could recommend on this topic?

Question sent to AISC's Steel Solutions Center

Carbon and stainless steels can typically be welded together. You will want to look at AWS A5.4, which has approved filler metals for welding stainless to mild-carbon steel. We would also recommend that you contact AWS or a manufacturer such as Lincoln Electric technical support (**www.lincolnelectric.com**). Lincoln should be able to help with locating code or welding provisions, as well as proper filler metals. For additional information, visit **www.lincolnelectric.com/knowledge/articles/content/stainlesssteel.asp**.

Kurt Gustafson, S.E., P.E.
American Institute of Steel Construction

Slip-Critical Bolts?

I was recently performing fabrication inspection on a project, and the fabricator informed me that Type X bolts are slip-critical and Type N bolts are not. Is this true in general?

Question sent to AISC's Steel Solutions Center

That may be a true statement pertaining to the bolts on that particular project, but it's not true in general. Neither AISC nor RCSC specifications require that slip-critical connections use bolts with threads excluded from the shear plane (Type X).

Sergio Zoruba, Ph.D., P.E.
American Institute of Steel Construction

Galvanizing High-Strength Steel

Is there a problem with hot-dip galvanizing high-strength structural steels?

Question sent to AISC's Steel Solutions Center

The term "high-strength" is relative, but most typical structural steels, such as ASTM A992, are commonly galvanized. If you are talking about high-strength tempered products such as ASTM A490 Bolts, these are not permitted to be hot-dip galvanized, because embrittlement can occur as the 200 ksi stress range is approached.

Kurt Gustafson, S.E., P.E.
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Steel Interchange is a forum for *Modern Steel Construction* readers to exchange useful and practical professional ideas and information on all phases of steel building and bridge construction. Opinions and suggestions are welcome on any subject covered in this magazine.

If you have a question or problem that your fellow readers might help you solve, please forward it to us. At the same time, feel free to respond to any of the questions that you have read here. Contact Steel Interchange via AISC's Steel Solutions Center:

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