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! Send your questions or comments to solutions@aisc.org.

ASTM A500 Rounds

A steel subcontractor on our project says he has a U.S.-made A500 Grade B round HSS. I believe that this material only comes in square and rectangular shapes. Can you confirm the availability of these shapes?

Round HSS are routinely produced to meet the requirements of ASTM A500 Grade B; it is in fact the usual material specification for round HSS in the U.S. The mechanical properties are slightly different than rectangular/square, but it is still A500 Grade B.

For square/rectangular shapes the minimum yield stress for ASTM A500 grade B is 46ksi, and the minimum tensile stress is 58ksi.

For round HSS in ASTM A500 grade B, the minimum yield stress is 42ksi, and the minimum tensile stress 58ksi.

This can be verified by consulting Table 2-3 of the 13th edition AISC *Steel Construction Manual*. Availability can also be verified by using the availability database on the AISC web site, which lists several domestic producers: **www.aisc.org/availability**.

As a general rule of thumb, ASTM A500 HSS cross sections that match up with ASTM A53 pipe cross sections are available. For other cross sections, check with a fabricator, steel service center, or mill.

Martin Anderson

A325SC Bolts?

How are ASTM A325SC bolts designed and installed? In past projects we typically used A325N and we are now using A325SC. Do both of these types of bolts need to be checked for bearing?

When dealing with high-strength bolted connections, it is probably best to consider the difference in terminologies pertaining to the bolt type versus that of the connection type. The A325 example refers to the bolt type, while the SC or N refers to required installation details for the connection type and geometry respectively.

Bolt Types

The most common types of bolts used in structural steel applications meet either the ASTM A325 or A490 Standard. There are also twist-off types of bolts, which are equivalent to these bolt types: ASTM F1852 equivalent to ASTM A325, and ASTM F2280 equivalent to ASTM A490. The property requirements are the same for a particular bolt type regardless of the type or details of the connection in which it is to be used.

Connection Types

There are three basic connection types used in structural steel applications: Snug-Tightened, Pretensioned, and Slip-Critical. Descriptions of these connection types and installation requirements can be found in the RCSC *Specification* (a free download at **www.boltcouncil.org**). In all joint types the connection is required to be checked for bearing, which could occur at some time during the life of the structure.

Snug-Tightened Connections: In this connection type, it is required that the faying surfaces of the connection be brought into firm contact. While some pretension of the bolts is required to bring the surfaces into firm contact, there is no specific requirement for a level of pretension that must be induced into the bolts. Thus, while there is some level of clamping force in the connection as a result of the installation requirement to bring the surfaces into firm contact, this type of connection is assumed to provide the least level of safety against slip. The bolts in these connection types are always assumed to be in bearing against the base material, and thus the connection is defined as a bearing connection.

Pretensioned Connections: This type of connection generally is just like a snug-tightened joint, except it also requires that a specified pretension be applied to the bolts in the connection, once the firm contact of faying surfaces has been achieved. It is still a bearing-type joint, and the shear strength design parameters are identical to those of the snug-tightened joint.

Slip-Critical Connections: This connection type is just like a pretensioned connection with the addition of surface preparation requirements to provide the required level of slip resistance. To achieve this goal, there is a specified level of friction coefficient required for the faying surfaces in the connection. After the faying surfaces are brought into firm contact, the bolts are required to be installed to a specified level of pretension, which is the same as that required for a pretensioned connection. Thus, the bolt installation procedure for slip-critical connections is identical to that required for pretensioned connections, the difference being in the preparation requirements for the faying surfaces of the respective connection types.

Threads In or Out of the Shear Plane

One parameter that we have not discussed to this point is the N designation cited in your example. This designation is an indication of where the threads of a bolt are assumed to be located with respect to the shear plane(s) in a connection. The N assumes that the threads of the bolt will be located within the shear plane; an X assumes that the plies are detailed to exclude the threads from the shear plane. The shear strength is reduced if the plies are detailed such that the threads are located within the shear plane.

Kurt Gustafson S.E., P.E

Connecting a Cambered Truss

We have a 120-ft-long, 12-ft-high truss made up of wide-flange beams for the upper and lower chords. The truss will be fabricated with a 5-in. camber. At the worse loading condition, the truss will still be 1 in. above flat. How is the connection made from the member end to the column? Will the fabricator detail the member so the bolt holes in the cambered member are vertical and in line to the connection plate or angles holes, or do they offset the bolt holes? If the

truss is to rotate downward 4 in., should oversized holes be used in both the plate and member to allow for rotation?

The truss will be detailed taking into account the camber that you specify. The connection to the column will be detailed such that the holes follow the geometry of the cambered truss. The connection of the bottom chord to the column (assuming this truss member is essentially a zero force member at the column) is often made using long slotted holes. The bolts often are left loose until all of the dead load is applied and much of the camber has come out. The bolts are then tightened. What I have just described is a common approach, but you should ensure that this approach is suitable to the specifics of your case. Also, whatever decision is made, you need to make sure your intention is clearly conveyed to the fabricator and erector.

Larry S. Muir, P.E.

Welding Anchor Rods to Rebar

Can anchor rods be welded to the reinforcing bars to be embedded in the slab to be cast? I cannot find anything in the codes in reference to this subject. Can you help?

The AISC *Specification* does not address the subject of welding of anchor rods to reinforcing steel. However, if for some reason the responsible design professional intends to weld the anchor rods to rebar, it first would be advisable to make sure that a weldable grade of rebar and anchor rod is used. The weld details used probably would have to be qualified, but this is possible and not entirely uncommon today. You may need to reference a combination of the provisions in AWS D1.1, *Structural Welding Code—Steel* and AWS D1.4, *Structural Welding Code—Reinforcing Steel.*

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

Base Metal/Fastener Compatibility

Where can I find information pertaining to compatibility when using different types of base metal and fasteners in a connection?

Table 2-6 in the 13th edition AISC *Steel Construction Manual* provides information pertaining to *Metal Fastener Compatibility to Resist Corrosion*, which you may find helpful.

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

Beam "Sweep"

Where can I find information for the allowable amount of beam sweep in an erected building?

The term "sweep" implies curvature about the weak axis of beams. This generally is a tolerance that is addressed in mill requirements, rather than after erection, and is covered by tolerances given in ASTM A6/A6M. A summary of this information is included in the 13th edition AISC *Steel Construction Manual* on page 1-117.

The tolerance limitations for beams that are erected are given in the AISC *Code of Standard Practice for Steel Buildings and Bridges*. However, these limitations deal more with alignment tolerances between work points rather than actual "sweep" between working points.

David Wickersheimer, S.E.

Double-Concentrated Forces

Section J10 of the AISC *Specification* addresses double-concentrated forces. Could you please explain the meaning, or give an example of a double-concentrated force as it applies to this section?

Double-concentrated forces is defined in the AISC *Specification* as "two equal and opposite forces that form a couple on the same side of the loaded member." A moment connection of a beam-to-column flange, where one of the beam flanges is applying a tension force while the other flange is applying a compression force, would be one example.

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

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Steel Interchange is a forum 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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