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steel interchange

Special Inspections and NDT

The following questions all relate to the requirements of Chapter N of the *Specification*:

1. **Must special inspections be performed when AISC Certified fabricators perform the work?**
2. **Are AISC Certified fabricators allowed to perform special inspections with their own personnel?**
3. **Are AISC Certified fabricators allowed to perform nondestructive testing (NDT) with their own personnel?**
4. **If fabricators are allowed to perform NDT with their own personnel, are the qualifications for these personnel any different than those of a typical third-party special inspector?**
5. **Do AISC Certified fabricators typically retain people in-house to perform NDT, or is this work typically done by a third party retained by the owner?**

The following answers are provided:

1. This is not a yes or no question. The AISC *Specification for Structural Steel Buildings* (ANSI/AISC 360), available at **www.aisc.org/specifications**, does not require special inspections. Requirements related to special inspections are defined in the building codes, such as the *International Building Code*. The *IBC* permits authorities having jurisdiction to approve fabricators, and some or all special inspection requirements can be waived when the work is performed by approved fabricators.
2. The fabricator can, at the discretion of the authority having jurisdiction, use their own personnel to ensure the quality of the project without outside inspections.

   Quality control (QC) is defined as "controls and inspections implemented by the fabricator or erector, as applicable, to ensure that the material provided and work performed meet the requirements of the approved construction documents and referenced standards." Quality assurance (QA) is defined as "monitoring and inspection tasks to ensure that the material provided and work performed by the fabricator and erector meet the requirements of the approved construction documents and referenced standards. Quality assurance includes those tasks designated 'special inspection' by the applicable building code."

   Both QC and QA are intended to ensure conformance with the approved construction documents and referenced standards. QC is performed and documented by the fabricator. Section N5.3 allows cooridinated inspection meaning QC tasks need not be repeated as QA tasks. The waiving of special inspections represents the approval of the engineer of record and the authority having jurisdiction for coordinated inspection. If special inspections are not waived, a third party will perform special inspections. These tasks can be seen by examining the tables provided in Chapter N.
3. Yes. Section N6 of the AISC *Specification* specifically allows approved fabricators to perform NDT. It also indicates that when NDT is performed by the fabricator, a QA agency shall review the fabricator's NDT reports.
4. No. Section N4.3 defines NDT Personnel Qualifications. The requirements do not vary based on the party performing the work.
5. Practice varies. My understanding is that most fabricators do not employ personnel trained to perform NDT. If the fabricator cannot perform the NDT, then I believe it is more common for the owner to contract the NDT tasks.

Larry S. Muir, PE

Shear Center of Channel

I am designing a single-plate shear connection to a channel section for a stair. The plate of the single-plate shear connection attaches to the back of the channel, the side opposite the flanges. The structural engineer on the project is concerned about torsion on the channel because the load is eccentric to the shear center of the channel. Is this a valid concern?

We cannot make design decisions or arbitrate. Ultimately, the engineer of record will have to set the requirements.

The preamble to Chapter F in the AISC *Specification* states: "Chapter F applies to members subject to simple bending about one principal axis of the cross section. That is, the member is loaded in a plane parallel to a principal axis that passes through the shear center. Simple bending may also be attained if all load points and supports are restrained against twisting about the longitudinal axis."

The design procedures for shear connection in Part 10 of the AISC *Steel Construction Manual* (**www.aisc.org/publications**) are developed to deliver the load to the face of the web of a wide-flange, which is offset by half the web thickness to the shear center.

This is virtually the same condition of attaching to a channel with a single-plate shear connection. In the case of a channel, the eccentricity will actually be smaller than the distance between the welds and the bolts (or eccentricity assumed in Part 10 of the *Manual*) since the shear center for a channel will be on the side opposite the flanges, closer to the location of the bolts in your connection. Designing the single-plate shear connection using the procedure in Part 10 of the *Manual* will actually overestimate the eccentricity, so the concern seems to be unnecessary.

Carlo Lini, PE

Removable Steel

I am designing a connection for a steel platform that will be repeatedly installed and removed from the side of a building. The bolts used will be pretensioned during each installation. Additionally, there will be no access to the back side of the connection once the steel is erected, so it has been proposed that the nut should be tack welded in place to accommodate later installation of the bolted connection.

I have the following questions:

1. **Section 2.3.3 of the RCSC *Specification* allows black ASTM A325 bolts to be reused. Does this reuse allow the type of repeated installation and removal that I have described?**
2. **Is it a good idea to weld the captive nut to allow for pretensioning of the bolt?**

What has been proposed may not be a good solution. There are several issues that need to be considered. I have addressed both questions below.

1. No. The Commentary to the RCSC *Specification for Structural Joints Using High-Strength Bolts* (available at **www.aisc.org/specifications**) states: "Black ASTM A325 bolts, however, possess sufficient ductility to undergo more than one pretensioned installation as suggested in the *Guide* (Kulak et al., 1987). As a simple rule of thumb, a black ASTM A325 bolt is suitable for reuse if the nut can be run up the threads by hand." The *Guide to Design Criteria for Bolted and Riveted Joints* referenced above states: "A325 bolts can be reused once or twice, providing that proper control on the number of reuses can be established." The reuse described in the RCSC *Specification* does not intend that the bolt be reused in the manner you describe, as the owner will likely not want to keep track of the reuses. It may be of some benefit to not pretension the bolts in this application. The RCSC *Specification* states, in Section 4.2:

Pretensioned joints are required in the following applications:

(1) Joints in which fastener pretension is required in the specification or code that invokes this *Specification*
(2) Joints that are subject to significant load reversal
(3) Joints that are subject to fatigue load with no reversal of the loading direction
(4) Joints with ASTM A325 or F1852 bolts that are subject to tensile fatigue
(5) Joints with ASTM A490 or F2280 bolts that are subject to tension or combined shear and tension, with or without fatigue

If the connection does not meet these conditions, you may consider not pretensioning the bolts for your use.

2. Though not explicitly prohibited, welding to high-strength bolts and nuts is generally discouraged. Section 4.5.2 of AISC Design Guide 21: *Welded Connections—A Primer for Engineers* (a free download for members at **www.aisc.org/dg**) provides further information. Beyond the technical concerns described in the Design Guide, there are also practical considerations. Though it is not uncommon for both engineers and contractors to consider tack welding of captive nuts, I have heard many more anecdotes of problems related to this practice than successes. If for some reason the nut is not where expected when the bolt is to be installed or the tack weld fails to hold—both of which are real possibilities—developing a fix can be difficult.

Larry S. Muir, PE

Stainless Steel Fills in Slip-Critical Joints

Will placing stainless steel filler on the contact surface of a slip-critical joint reduce the slip resistance of the joint?

Section 3.2.2 The RCSC *Specification* requires the filler to be prepared in the same manner as the other faying surfaces in a slip-critical joint. Neither the AISC *Specification* nor the RCSC *Specification* address stainless steel. I am not aware of any organization that addresses stainless steel slip-critical connections. AISC Design Guide 27: *Structural Stainless Steel* (a free download for members at **www.aisc.org/dg**) simply states, in section 9.3.1: "The recommendations only apply to connections where the shear forces are transferred by bearing between the bolts and the connected parts. No recommendations are given for connections in which shear is transferred by frictional resistance, as in slip-critical connections…" In addition, section 9.3.2 states: "Slip coefficients for stainless steel faying surfaces are likely to be lower than those for carbon steel faying surfaces." No further guidance is given.

The stainless steel fill will likely have some effect of the slip resistance. I do not know of a way to quantify the effect.

Larry S. Muir, PE

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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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