The Why and How of Calibration

BY DAN KAUFMAN

Don't neglect this often-overlooked area, or you may come up short.

THE SUBJECT OF CALIBRATION comes up repeatedly, in questions submitted to the AISC Steel Solutions Center, in deficiencies in a certification applicant's documentation, and as the subject of AISC Certification audit Corrective Actions Requests (CARs). Questions range from "Why do we have to do that?" to "Where do I get a certified square?" while the corrective actions normally involve not having records of completed calibrations for the proper inspection tools.

The *why* question is asked not only about the reasoning behind including calibration as part of the certification program, but also why the program requires traceability to a national standard. Because the intent of AISC Certification is to make steel the material of choice, it is important for project owners and specifying agencies to know that certain standards will be met, and that they can expect their job will be executed exactly as it has been planned. Accurate measurements are at the heart of the fabrication and erection processes, so the ability of a fabricator or erector to measure correctly is a key issue. Some jobs require bolting, some require welding, but all require measurements. Therefore, AISC Certification has to include a positive indication that the capability of making measurements correctly is present.

In terms of AISC Certification, calibration falls within Element 14, Calibration of Inspection, Measuring, and Test Equipment (IMTE), of the *Standard for Steel Building Structures*. This is another area where the fabricator and erector prove they are doing what they say they are doing. This section requires that a fabricator has developed and implemented documented procedures that control, calibrate and maintain the equipment in this area.

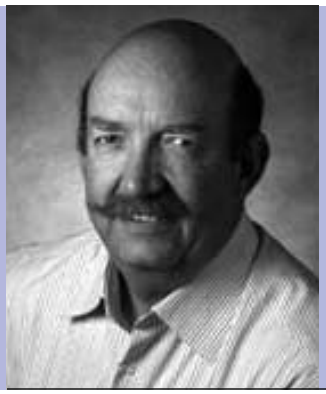
We often receive questions on why we rely on a national standard and require a chain of evidence back to it. The National Institute of Standards and Technology (NIST) provides comparison standards that are the legal basis for measurements in the United States and are the only national standards with regard to measurements. Typical construction work has tolerances in the 1/16 in. to 1/8 in. range, leading to the question, "Why do the calibrations have to be so tight?" The NIST standards are much more precise than construction tolerances because there are other products and industries that require very precise standards, and if NIST provides a very tightly controlled base, all the coarser standards can originate from it.

Traceability to a national standard does not imply that you have to use the same precision. When you buy a certified measuring device, such as a certified tape measure, it was likely compared at the factory where it was made to a certified standard that had a corresponding certificate. That standard was in turn compared to another standard and so on until a comparison was made with the national standard. The connections from your tape back to the national standard can be seen on the certificates, and that is traceability. One big difference between your certified tape and the national standard is that the national standard is far less likely to get stolen. You can't use the national standard to measure fence boards, as it is not a tape measure, so keep your certified tape safe.

Squares, gauges and welders

Three types of equipment typically generate many of the questions and concerns we come across. You or your staff may have wondered about these same things, so we hope the following commentary provides some insight.

When I am asked where one can get a certified square or weld fillet gauge, I ask if the company has a certified tape. I know we aren't supposed to answer questions with questions, but we are auditors, so apologies for that. You can establish your own certification of additional devices by using your certified tape. For example, the weld gauge can be given a number and checked, with a record made of that check. A square can be certified with your tape as well using the



Dan Kaufman is the QMC director of auditing. He can be reached at kaufman@qmconline.org or at 312.670.7523.

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3-4-5 rule, or if you really want, by using the Pythagorean Theorem. Here's a tip I saw that isn't widely known: you can adjust a square. If your square is too tight (i.e., less than 90 degrees), you can open it up by using a punch to make an indentation close to the inside of the corner. The deformation will cause the surrounding metal to expand and push the legs apart. If the legs are too far apart, make an indentation near the tip of the heel. It doesn't take too much of an indentation to make this work.

Another measuring device frequently involved in questions and CARs is the paint thickness measurement device. The common name for this is the DFT gauge, for dry film thickness. The main calibration issue is how frequently they must be checked. SSPC: The Society for Protective Coatings says that DFT gauges need to be checked daily when in use.

In the case of DFT gauges, especially the magnetic variety, they are not calibrated by you; rather, they are verified. These words are sometimes used in the wrong context. This isn't surprising because they are not well defined in references. Verification is checking to see how close a device is to the standard, but not making any adjustments to it. Calibration normally consists of checking a device and then adjusting it so that it measures correctly according to the standard. Of course, some DFT gauges cannot be adjusted without sending them to the manufacturer or a qualified lab.

Another measurement, but one that is not so easily seen, involves the operation of welding machines. We can read volts and amps from a meter readout on most welding machines, amps on some, and nothing on some. Furthermore, none of this is in the final product, so what's the fuss?

AISC Certification requires the use of AWS D1.1 or D1.5. Welding quality is heavily influenced by the process parameters: volts, amps, wire feed speed, etc. Weld Procedure Specifications (WPSs) are required for all structural steel welding. While most welders (the people) are confident that they know how to set these parameters to get a good weld, there can be defects that are not visible to the eyes of the welder but caused by the settings used—therefore, there are WPSs required as defined by AWS to dictate the settings and conditions required for a specific weld type. Shouldn't we be checking the machines to guard against welding outside the ranges set for a weld type? What does AWS say about this?

The condition of welding machines is addressed with the same sentence in both documents. In D1.1, it is Clause 5.11—Welding and Cutting Equipment; and in D1.5 it is Clause 3.12—General Requirements:

"All welding and thermal-cutting equipment shall be so designed and manufactured, and shall be in such condition, as to enable designated personnel to follow the procedures and attain the results described elsewhere in this code."

AISC and QMC are not going to provide an interpretation of AWS rules, because AWS is the welding expert. You will need to look at your situation and establish how you are going to show that you are following the AWS requirement.

A final tip would be to thoroughly review calibration reports that you receive from outside calibration laboratories for such items as a Skidmore Bolt Tension Calibrator, etc. I once reviewed a fabricator's calibration reports and realized the laboratory had *failed* the specific machine. The fabricator thought he was in the clear, because he had received an "official report," although he didn't actually review it. Now is a great time to review your shop's calibration reports and requirements to make sure you are up to date.

Calibration doesn't have to be difficult, but if you let it get out of hand, you can end up in a tough spot. Doing a calibration takes a lot less time and effort than investigating why parts don't fit, or going out to the jobsite to handle a claim. One claim can also lead to much higher expenses than meeting a simple calibration standard. MSC