FAQ #13

WPS AND WELDER QUALIFICATION FOR STEEL REINFORCING BARS

I am a structural engineer who makes an attempt at reviewing welding submittals (such as WPSs and welder qualifications) including those for rebar. I find that for rebar the submittals are almost always off the mark, indicating that the fabricators do not quite fully understand the requirements of AWS D1.4 for welding of reinforcing steel. I am not even sure I fully understand just what is required by D1.4, particularly with respect to the subtle differences between procedure qualification and welder qualification. Can you help with a succinct summary?

Response Submitted by Neal Kanaya, PE

Unlike the more familiar AWS D1.1 which provides for WPSs to be prequalified if the selected joint, welding process, and other parameters meet the applicable code requirements, AWS D1.4 requires all WPSs be qualified by testing - except for fillet welds. WPSs for fillet welds are considered prequalified and exempt from testing, unless welded with the GMAW-S or GTAW process.

AWS D1.4 requires a WPS qualified by testing for each type of joint, and for each production welding position. A PQR, documenting passing test results, is required to support the WPS.

AWS D1.4 does not require a WPS qualified by testing for each rebar specification and grade of steel - provided the welding parameters are within the limits given in Table 8.2.

For WPS qualification, a noteworthy change to the 2018 edition of AWS D1.4 is qualification based on rebar sizes. Previously, AWS D1.4 stated the largest bar size to be production welded shall be used for qualification. For example, a passing test on a No. 8 rebar would qualify a WPS for No. 8 rebars and smaller.

However, AWS D1.4-2018 has now established three "bar diameter groups" in Table 8.2, item (13): Group A for No. 6 rebar and smaller, Group B for No. 7 to No. 11, and Group C for Nos. 14 and 18. A passing test on one size in any of the three groups qualifies the WPS for all bar sizes within that group.

Sometimes overlooked is the AWS D1.4 requirement that the WPS shall be qualified using a bar with a carbon equivalent (C.E.) at least equal to the highest C.E. to be encountered in production. The WPS is then qualified for that C.E. value and lower. The C.E. is derived by using the carbon equivalency formulas given in AWS D1.4 and the chemical composition in the rebar mill certificate (material test report).

Welder performance qualification (sometimes incorrectly called “certification”), has a different set of requirements. AWS D1.4 still states the smallest bar size used in the welder performance qualification test qualifies the welder for that bar size and larger. However, the applicability of the qualification test with respect to position and to the type of joint, is more complex. AWS D1.4 Table 8.5, lists qualified production welding positions for each test position for each of these types of joint: direct butt, indirect butt, T-joint complete penetration, and fillet welds. The table is too large to reproduce here (and there are a couple of typos*), but the bullet points below point out a few key items.

Welder Qualification

- A fillet weld test in the 5F fixed position qualifies for all fillet weld positions.
- Tests on the other joint types generally qualify for the corresponding fillet weld position, except for the 5F fixed position.
- Generally, a test in the vertical position will not qualify for the overhead position, and vice versa.
- Tests on indirect butt joints qualify for the same positions in lap joints.

*See excerpt from Table 8.5 on the next page

It is important to note that the bullet points above are a simplification. To properly review WPSs and welder qualification tests for rebar, review of Clause 8, Qualification, in AWS D1.4-2018 is essential.

AWS STANDARDS AND TERMINOLOGY

AWS D1.1 - Structural Welding Code - Steel
AWS D1.4 - Structural Welding Code - Steel Reinforcing Bars
WPS - Welding Procedure Specification
PQR - Procedure Qualification Record
GMAW-S - gas metal arc welding with short-circuiting transfer
GTAW - gas tungsten arc welding
5F Fixed position – the end of the bar welded to a vertical plate

Neal Kanaya is the principal at BEAR Testing Laboratory, which provides materials engineering and testing services. He can be reached at nkanaya@beartest.com.

Published by STRUCTURAL ENGINEERS ASSOCIATION OF NORTHERN CALIFORNIA
CONSTRUCTION QUALITY ASSURANCE COMMITTEE

The views or opinions of our guest/authors are their own, and do not necessarily represent those of SEAONC. Information presented is not intended as and should not be considered engineering advice.

Got a question, comment or tip?
E-mail it to: cqa@SEAONC.org
Excerpt from Table 8.5 of AWS D1.4, Structural Welding Code – Steel Reinforcing Bars

Errata not published by AWS are shown in red above.

**Summary:** A Welder Qualification test using the Direct Butt Joint in the 3G (Vertical) position qualifies the welder for production welding of fillet welds in the Flat, Horizontal, and Vertical positions.

A Welder Qualification test using the Direct Butt Joint in the 4G (Overhead) position qualifies the welder for production welding of fillet welds in the Flat, Horizontal, and Overhead positions.