

Is That Welder Qualified?

Welder performance qualification testing is a fundamental part of a CWI's job, but conflicting code requirements can make it a difficult one

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What seems to be a simple question — is that welder qualified — often requires a very detailed review by the assigned AWS Certified Welding Inspector. Many CWIs find welder performance qualification to be one of their key functions, yet it can also be a confusing assignment, because there seem to be as many different requirements for welder performance qualification as there are base materials. However, there are certain fundamental requirements applicable to the construction and manufacturing industries as stated in appropriate welding codes, standards, and/or project specifications. While this article cannot address every requirement, it does provide some general information regarding welder performance qualification testing and points out some of the redundancies and potential oversights of the codes.

The article is also intended to inform readers about AWS QC4-89, *Standard for Accreditation of Test Facilities for AWS Certified Welder Program*, and AWS QC7-93, *Standard for the Certification of Welders*, which have been in place for more than 10 years to help ensure quality and consistency with regard to welder performance qualification testing. The standards help minimize errors in testing, eliminate redundancy, and have the potential for saving hundreds of thousands of dollars across numerous industries by providing a database of nationally recognized AWS Certified Welders tested to any nationally recognized code, standard, or customer-specified requirement.

Variations in Codes and Standards

When it comes to welder performance qualification, the intent of all the welding codes and standards is fairly basic: the tests are meant to determine “the welder’s ability to produce sound welds.”

There are many different types of tests for welder performance qualification based upon the materials, welding process, position, application, suitability, etc. However, the welder must always test to a qualified and/or prequalified welding procedure specification (WPS).

The AWS D1.1, B2.1, D17.1, D1.5, D1.6, ASME *Boiler and Pressure Vessel Code* Section IX, API 1104, EN287, and many other welding-related codes and standards contain specific requirements that often vary from one to another with regard to welder performance qualifications. Therefore, when reviewing documentation or administering welder performance qualification tests, the CWI or other test supervisor should extensively review the code that is being used.

Some examples that illustrate the variations in welder performance qualification tests based upon the stated code, stan-

dard, or governing specification follow.

AWS B2.1-2000, *Specification for Welding Procedure and Performance Qualification*, paragraph 3.6.1.1, currently accepts welder performance qualification for the flux cored arc welding (FCAW) process if the welder is qualified in the gas metal arc welding (GMAW) process in the spray, pulsed spray, or globular transfer modes.

Table 4.9 of AWS D1.1-2002, *Structural Welding Code — Steel*, gives all-position welder qualification (with limitations per notes) for the 3G and 4G test positions, which includes plate and pipe over 24 in. On the other hand, ASME IX QW-461.9.2 for the same positions, 3G and 4G, does not permit horizontal position welder qualification, but does permit flat position welding of pipe of more than 2%in. O.D.

For CWIs working on a project in areas prone to seismic activity, consider the requirements for welders qualified for welding moment connections or welds classified as seismic welds under FEMA 353, *Recommended Specifications and Quality Assurance Guidelines for Steel Moment-Frame Construction for Seismic Applications*. They have supplemental welding personnel qualification requirements, as stated in FEMA 353, Part I, Section 3.3.1, i.e., Appendix B of Part I FEMA 353 and Fig. B-1. This specifies and depicts the test plate assembly (special test joint mock-up), which actually requires a 12-in. test assembly, and a minimum of three transverse side bends if not radiographically tested per AWS D1.1 Section 6. FEMA 353, Part I, 3.3.1, also has specific requirements exceeding that of Section 4 of AWS D1.1, to include but not be limited to the fact the FCAW-G (gas-shielded flux cored arc welding) and FCAW-S (self-shielded flux cored arc welding) processes are considered to be separate processes for welding performance qualification and that testing shall be performed with the WPS set at the highest deposition rate to be used in the work.

The ASME B31.3 Code, Chapter V, 328.2.3, actually states that transfer of welder qualification is acceptable as long as the inspector specifically approves, which also applies to several other welding codes. Note the definition of the inspector, however, in Chapter VI, 340.4, which does not include a representative of the fabricator, manufacturer, or erector.

The new AWS D17.1:2001, *Specification for Fusion Welding for Aerospace Applications*, is intended to replace MIL-STD-1595A and MIL-STD-2219. Section 4.2.1 of the code has general physical requirements for aerospace welder performance qualifications: a vision exam and visual acuity of 20/30 or better in *either* eye and shall be able to read the Jaeger No. 2 eye chart at 16 in. This is required every two years and corrected vision may be used to achieve eye test requirements. That requirement might lead you

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to ask the question “Does this mean 20/30 vision is required in *only* one eye?” I can assure you it does not, but this is just another example of why it’s so important to carefully review and understand the codes or standards you are working with.

The AASHTO-approved AWS D1.5, *Bridge Welding Code*, paragraph 5.21.5.1, actually limits the cleaning between weld passes to hand chipping and hand wire brush during a welder performance qualification test. Does this mean the welder should be tested on how to use the grinder in production?

Recently a shipbuilder working under ABS rules and AWS D1.1:2002 was required to restore base metal to the inside of a worn stern tube pipe. The customer considered this weld cladding under ABS rules, not base metal repair or restoration under AWS D1.1 or ASTM A6. The procedure and welder were qualified under AWS B2.1, in the 6C position per Section 3.4.6, and the test position was per Table 3.5. AWS B2.1, Section 3.1.15, permits “welders qualified on groove welds to be qualified to perform weld buildup on surfaces to replace or repair base material with similar composition weld metal.” Based upon this allowance, the customer only had to qualify one welder who performed the welding of the WPS/PQR. The other welders had current AWS D1.1 groove weld, 6G welder performance qualifications. Although this alternative required approval by the customer, this is an example of where researching the welding codes and standards to meet the customer request resulted in no redundant welder performance qualification testing and had no impact on overall project cost and schedule.

I could continue describing the many variations in codes and standards for several pages, but you get the idea — it’s important to review and understand the codes. There is also another option available for welder performance qualification testing — using an AWS Accredited Test Facility.

AWS Accredited Testing Facilities: A Notch Up

Although some CWIs or other personnel may have the necessary skills and experience to properly administer and conduct welder performance qualification testing, many do not. In addition, many CWIs do not work every day with multiple codes.

Since there are many intricate details involved in welder performance qualification testing, it is good practice to only have experienced and capable test supervisors who carry current AWS CWI certification conduct welder performance qualification testing. While there is no specific endorsement certification for CWIs that acknowledges this experience at this time, you can find CWIs with this type of experience at any of the more than 65 AWS Accredited Test Facilities (ATF).

In discussing the benefits of the ATF program, Steve Dowings, AWS ATF facility representative and AWS CWI/CWE test supervisor for the Shreveport, La., campus of Louisiana Technical College, recently said, “The use of AWS standard Welding Procedure Specifications and the college’s ability to turn out true AWS qualified/certified welders to meet local industry needs has resulted in increased private sector enrollment at the college, increased job placement of students to local manufacturers through the college, and we are now more than a welding education facility, we turn out AWS qualified/certified welders.”

AWS QC4-89, *Standard for Accreditation of Test Facilities for AWS Certified Welder Program*, outlines the requirements for a facility to become an ATF. While originally established to perform the testing for the AWS Certified Welder Program, these days ATFs perform a wide variety of qualification testing.

The standard that outlines the requirements of the AWS

Certified Welder Program is AWS QC7-93. The aim of the Certified Welder Program is to provide welders with transportable qualifications that industry can accept and that will eliminate redundant qualification testing. Although in existence for more than 13 years, industry has not yet accepted the Certified Welder Program to the level to which it was intended and that I believe it should. Currently, 1555 welders have participated in the AWS Certified Welder Program.

The concept of cost-effective, transferable welder qualification/certification is not new, said Stan Raymond, International Training Institute, and chair of the AWS QC4-89/QC7-93 subcommittees. “It just hasn’t been accepted (Ref. 1).”

Facilities applying for accreditation are required to submit to AWS for review and approval a complete, detailed, written and documented as-implemented quality system covering all aspects of welder performance qualification testing conducted by the facility and/or any subcontracted work, i.e., NDE. They undergo an independent, third-party audit triannually and an internal audit on an annual basis for compliance to the established quality system and requirements of the AWS QC4 standard.

The standard requires stringent controls on testing, base and filler metals, calibrated equipment, and test results (both NDE and destructive). The facility may utilize employer-provided WPSs or standard AWS WPSs, the use of which is also permitted by the ASME Code Section IX.

The program currently has established supplements to the QC7 document, i.e., Supplement G for generic testing to any recognized code or standard, or the employer may submit an alternative written acceptance criteria to the facility. Currently two other supplements exist: Supplement C for sheet metal welding based upon AWS D9.1 and Supplement F, which is intended for the types of welding positions and situations encountered for petrochemical and refinery process piping per ASME B31.3, which references ASME IX. There has been discussion as to whether Supplements C and F are actually needed since Supplement G allows qualification to any recognized code or standard.

For personnel, paragraph 3.3(2) of AWS QC4 does require a current AWS CWI with experience to be the test supervisor. AWS D1.1, B2.1, ASME Section IX, and many other codes do not require a current CWI to administer, witness, or even be involved with a welder performance qualification test.

Continuity logs, which are documented evidence that the welder has not been disengaged in the qualified welding process for a period typically exceeding six months, often are not maintained by field welding crews and many contractors and fabricators. Specifications requiring requalification if a welder has not qualified within six months are observed in most welding codes and/or specifications.

Of course, while the provision for accepting previous welder performance qualification from employer to employer exists in ASME Section IX, B31.1, AWS D1.1, AWS D14.6, AWS D1.6, and many other welding codes, it is most often not taken advantage of for one or more reasons.

The AWS QC4 Accredited Testing Facility program has many benefits for the welding and construction industries because it makes the welder rather than individual companies responsible for maintaining his or her welder qualification/certification. The welder may be considered qualified indefinitely as stated in each supplement, most all welding codes, and in Section 11 of the AWS QC7 Standard, which requires the welder to complete the required maintenance forms and submit them to AWS every six months to maintain uninterrupted qualification/certification.

Additionally, having audited many of the AWS ATFs, the level of quality control/assurance and adherence to specified welding

procedures and acceptance criteria during welder performance qualification testing appears to me, in most all cases, more consistent than what many independent testing laboratories and/or contractors currently provide.

Acceptance of the AWS QC4 and QC7 standards by several trade unions (Ref. 1), state departments of transportation, and the National Steel Bridge Alliance is now a reality. The American Welding Society is responsible for a national registry of welders tested at the more than 65 accredited welder testing facilities nationwide, the application and welder qualification test records are on file and maintained by AWS, as well as the maintenance of certification record, i.e., equal to a continuity log with any decertification action reports related to a specific welder. Everything from the heat number of the base material to the grind direction/marks of the test coupons is verified during a welder performance qualification test at an AWS ATF.

Looking Forward

As with any code, standard, accreditation, or certification program, certain revisions need to be made to the governing documents to account for and implement current industry practices. The AWS QC4 and QC7 standards are no exceptions. Currently, QC4-89 and QC7-93 standards are under revision and are expected to ballot in 2004. Stan Raymond of International Training and Testing is the current chairman of the subcommittees working on the revisions.

One of the portions of QC7-93 that is being examined is paragraph 4.3, which places a restriction on an AWS CWI test super-

visor testing an applicant that he or she had previously trained. What if that person is the only CWI in that small town, area, company, college, or vo-tech who trains and tests? The CWI adopted a code of ethics, per AWS QC1-96, *Standard for the Certification of AWS Certified Welding Inspectors*, and instructors and teachers administer tests to students daily nationwide. This should not be an issue of restriction for an AWS ATF that employs a welding instructor.

The ATF on-site audit checklist does have some redundancy as well and is also in the process of being revised to reflect current industry practices. Other sections of the standards are also being examined for possible revision.

Even though the current AWS QC4 and QC7 standards are under a revision by the subcommittee volunteers, overall it seems clear that the AWS ATF program is a logical, cost-effective, consistent route for providing transferable welder performance qualification for industry to consider and implement.

Travis Moore, facility representative and AWS CWI test supervisor for Inspection Specialists, Inc., Marrero, La., said during a recent reassessment/audit, "The AWS QC4 ATF participation and acceptance of the QC4 and QC7 standards are all dependent on industry acceptance and educating the clients, contractors, etc., to the benefits of using AWS ATFs and the capability of using transferable welder qualifications." ❖

Reference

1. Johnsen, M. R. 2003. Agreement cuts DOE construction costs. *Welding Journal* 82(9): 44-46.