

The following is a heads-up for those who use AWS Standard Welding Procedures as permitted by Section IX, Article V; readers are advised that the opinions expressed in this presentation are those of Mr. Sperko and not the official opinion of Subcommittee IX.

Standard Welding Procedure Specifications

One of the 2000 Addenda changes, -- Standard Welding Procedure Specifications (SWPSs) -- has caused some confusion in the industry and is worth discussing briefly.

Section IX, Article V, requires the potential user of an SWPS to make a "Demonstration Test Weld" following that SWPS before using it in production welding; the objective of this demonstration weld is to show that the manufacturer has the ability to follow the SWPS *exactly as the SWPS is written*. A manufacturer who does not follow the SWPS exactly fails the demonstration -- and should not be permitted to use any SWPS until he demonstrates his ability to follow the SWPS exactly as it is written. The following are some examples of failures to meet this requirement.

An SWPS was submitted to an engineer for review with a welder qualification record as the demonstration test record; although the welder qualification was acceptable, it was incomplete as a demonstration of the manufacturer's ability to follow the SWPS since all the information required by QW-510(d) was not recorded:

- The applicable fabrication documents were not identified on the SWPSs
- The groove design was not recorded
- The method of cleaning was not recorded
- The electrode size was not recorded
- The preheat temperature was not recorded
- The deposit thickness for each electrode type was not recorded
- The interpass temperature was not recorded
- Whether or not PWHT was done was not recorded
- The demonstration test identification number was not recorded on the SWPS (QW-540)

In another case, a contractor submitted SWPS B2.1-8-025-94 that is not among those SWPSs listed in Section IX, Appendix E. In addition, the same contractor used a production weld as a demonstration weld rather than a test coupon as is required by QW-510; this contractor failed the demonstration test.

In a third case, the contractor welded the demonstration test piece using only E7018 while alleging to have followed an SWPS that specified E6010 followed by E7018. The contractor did not demonstrate his ability to follow the SWPS he had elected to demonstrate because he failed to weld the "test coupon following the SWPS" as required by QW-510 (d).

In yet another case, the manufacturer followed an SWPS that was written primarily for pipe. The SWPS permitted only single-sided groove designs, but the manufacturer performed the demonstration weld on plate using a double-vee groove joint design. Since the SWPS did not permit use of a double-vee groove, the manufacturer failed the demonstration test.

The user of SWPSs needs to comply with the requirements of QW-500 to use SWPS. Just like any other code-required record, the Demonstration Record needs to document the information required by Section IX, and that data *needs to fall within the parameters of the SWPS* that was followed during welding of the demonstration piece. A convenient (but nonmandatory) form for documenting the demonstration weld is included in Section IX, Appendix B as Form QW-485; a comparable form is available on the writer's web site. It should be noted that the Demonstration Test has met opposition among various ASME Subcommittees, and it's continued desirability is being debated; nevertheless, those using SWPSs must continue to weld the demonstration test coupon until QW-510 is revised.

Properly documenting the demonstration test data should not be confused with what is required to be documented during procedure qualification. For example, documenting preheat and interpass temperature have caused difficulty for some.

Interpass temperature is defined as the maximum temperature of the previously deposited weld metal immediately before beginning the next pass. When qualifying a WPS, one should measure the interpass temperature layer by layer and record on the PQR the temperature achieved while welding the test coupon.

Conversely, when following a WPS that specifies a maximum interpass temperature, the welder needs to be sure that the previously deposited weld metal is not hotter than the maximum specified interpass temperature before he starts the next pass. He does not need to record the actual interpass temperature. This is easily done by providing the welder with an appropriate temperature measuring crayon.

Demonstrating one's ability to follow an SWPS is like following an ordinary WPS; that is, if the SWPS specifies an interpass temperature of 400F, is only necessary to direct the welder to use a temperature-measuring crayon that melts 400°F. Accordingly, recording interpass temperature as "<400°F" on the demonstration record is adequate.

Documentation of preheat temperature (the minimum temperature of the base metal) follows a similar argument -- one only needs to document the lowest temperature of the demonstration coupon during welding. If the coupon will normally heat up once welding begins, tracking pass-by-pass temperature is not necessary provided the preheat stays above the minimum required by the SWPS. The preheat temperature expressed in degrees (not as "ambient" or "none") should be recorded on the demonstration record.

It should be noted that, although QW-500 does not specifically address qualifying a welder and welding a demonstration test simultaneously, the cost-conscious manufacturer can accomplish both tasks by completing the required records using

forms QW-484 (for the welder) and QW-485 (for the demonstration weld) upon successful testing of the coupon.

Using Other SWPSs after Completion of the Demonstration Test

After welding and testing one demonstration test coupon following an SWPS, many other SWPSs may be used without further demonstration. Additional demonstration tests are required if the new SWPS is outside the limits listed in QW-520, subparagraphs (a) thorough (h). Under these limits, all the SWPSs listed in Appendix E may be used with only 4 demonstration welds.

Using SWPSs in production

QW-540 specifies additional conditions for using SWPSs. The conditions basically emphasize that only what is permitted by the SWPS is allowed.

The appropriate Demonstration Test(s) must be welded, tested and appropriate documentation generated before an SWPS may be used. The appropriate Demonstration Test Number must be recorded on each SWPS to be used

All variables and welding conditions in the SWPS are “essential” -- one may not deviate from them. Unlike “ordinary” WPSs, nonessential variables do not exist for SWPSs; therefore, what can be changed to satisfy a production need by a simple revision to a nonessential variable when following an ordinary WPS may not be done when following SWPSs. This fact will require more up-front attention by the manufacturer since revision or requalification of an SWPS will not be an option when correcting a nonconformance.

Unlike the ordinary rules in Article II (QW-200) where more than one WPS or welding process may be used in a single production joint, only one SWPS is permitted in a single production joint. When a multi-process SWPS is selected, the processes specified by that SWPS must be used in the order specified by the SWPS, and both processes must be used. That is, welds made following an SWPS specifying E6010 followed by E7018 must be made using E6010 followed by E7018; the weld may not be made using only E7018. If the manufacturer wants to weld using only E7018, he should follow an SWPS that specifies only E7018!

- Supplemental direction may be provided to the welder, but that direction may not be outside the ranges of conditions given in the SWPS. For example, a contractor may limit welding to one groove design for an SWPS that permits many, but the contractor may not add a new or revised groove design.
- No combinations of SWPSs with ordinary WPSs are permitted (i.e., an SWPS specifying GTAW followed by SMAW may not be used in a joint that is completed using the manufacturer’s WPS for SAW.)

The rules for SWPSs are not the same as the rules for ordinary WPSs! The flexibility that is permitted when writing and qualifying one’s own WPSs is not permitted when using SWPSs. Manufacturers and contractors who want to do something different from

what is specified on an SWPS (e.g, a groove design that is not included in the SWPS) must write and qualify their own WPSs in accordance with QW-200.

SWPSs and Contract Dates for Construction

The historical provisions of Section IX (QW-100) have -- for decades -- required that all *new qualifications* be performed in accordance with the “*current edition and addenda*.” This establishes the precedent that any new WPS has to meet the requirements of the current edition of Section IX (e.g., the 2000 addenda rules), even if the “new” WPS is going to be used on construction to built to “old” (e.g., 1995 edition of Section VIII) rules.

This philosophy and precedent applies equally to use of SWPS since SWPSs require a “Demonstration Test” to be welded. This is a form of a “new qualification,” making the “current edition and addenda” concept applicable to SWPSs. Since a new WPS qualified under the “old rules” would have to be qualified in accordance with current Section IX rules, it is consistent, therefore, to consider use of SWPSs in a like manner on old contract-date work. Subcommittee IX has an inquiry in the works to clarify this position.

Also, QW-201 says that if, within an organization, companies of different names exist, the companies involved shall describe in their QA programs the operational control of procedure qualification. In this case, separate qualifications are not required. A similar approach should be applied to Demonstration Tests for adoption of SWPSs; however, it should be noted that AWS has copyright restrictions that must be observed, and these may preclude use of SWPSs by companies of different names. Subcommittee IX has a code change in the works to clarify this point also.