Summary of Changes in

ASME Section IX, 2013 Edition

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Changes to ASME Section IX, 2013 Edition

The following is a summary of the changes that appear in 2013 Edition of ASME Section IX. Significant changes are discussed in this article by Walter J. Sperko, P.E.; all changes can be readily identified in the "Summary of Changes" found in the front matter of Section IX. Readers are advised that the opinions expressed in this article are those of Mr. Sperko, not the official opinion of BPV Standards Committee IX. These changes become mandatory January 1, 2014.

Administrative Changes

The 2013 Edition of Section IX is the first in a new biennial publishing cycle for the BPV Code. There will be no 2014 addenda – rather, the next publication will be a new edition published in July of 2015.

The big change in Section IX 2013 is the introduction of two new Parts: QG *General Requirements*, and QF *Plastic Fusing*. While QF is new and will be discussed later, Part QG is nothing more than an extract of the general and administrative requirements found in Parts QW *Welding* and QB *Brazing*; these requirements would have been repeated a third time in Part QF *Fusing* had Part QG not been created. That is, the statement:

> QW-100.1 A Welding Procedure Specification (WPS) is a written document that provides direction to the welder or welding operator for making production welds in accordance with Code requirements.

can also be found in Part QB (except that it says "brazing", not "welding") and would have been repeated again in QF (except it would have said "fusing.") This and other administrative requirements have been removed from QW and QB, creating:

> QG-101 Procedure Specification. A procedure specification is a written document providing direction to the person applying the material joining process.

About 3 pages of common requirements were extracted to create Part QG with no significant changes in those requirements. One notable change, however, was replacement of the often-repeated phrase "manufacturer or contractor" with "organization". That definition is sufficiently important that it is defined in QG-109.2:

> "Organization: as used in this Section, an organization is a manufacturer, contractor, assembler, installer, or some other single or combined entity having responsibility for operational control of the material joining methods used in the construction of components in accordance with the Codes, standards and specifications which reference this Section.

While "organization" is now used throughout Section IX in place of "manufacturer or contractor," this definition is no different from the historical working definition of a manufacturer or contractor -- the organization that has to comply with the rules in Section IX is the organization that has responsible operational control of joining of Code components.

The following subjects are now located in QG:

- Relationship of Section IX requirements to the Code, standard, or specification that invoked Section IX.
- Procedure and performance qualifications conducted under earlier editions of Section IX and new qualifications.
- Supervision and control by the organization having responsible operational control during welding of test coupons.
- Use of joining procedure specifications and performance qualifications by companies of different names when they are part of the same corporate ownership.
- Use of procedure specifications and performance qualifications when ownership changes.
- Simultaneous performance qualification by more than one organization.
- Definitions for welding and brazing formerly in QW-492; fusing definitions are in Part QF.

While these requirements have been relocated, there was no intention of changing the administrative rules, so any practices that were acceptable or prohibited under the previous editions of Section IX are intended to be acceptable or prohibited in this edition.

The committee has also added guidance for other standards developers and engineers who want to invoke the requirements of Section IX on the proper way to do so as a new Appendix K. Many standards and specification writers do not understand that Section IX only addresses writing and qualifying welding, brazing and fusing procedures and those who will apply them, nothing more. It also notes that, when the referencing standard or specification wants to impose impact testing, it needs to specify the test temperature, extent of testing and acceptance criteria. Appendix K provides model words to assist those invoking Section IX to help them get it right.

Plastic Fusing – Part QF

Part QF has four Articles that parallel the organization of Parts QW and QB:

QF-100 -- General Requirements
QF-200 – Procedure Qualifications
QF-300 – Performance Qualifications

QF-400 – Data (Variables)

While the present rules only cover hot plate fusion of high-density polyethylene (HDPE), Part QF has an open structure to allow the addition of other plastic fusing applications such as electro-fusion which is currently on the BPV IX agenda.

As with the welding and brazing rules, the plastic fusion rules do not cover production-related issues such as nondestructive examination of production joints, qualification of equipment, quality assurance requirements for material, supplementary written tests for operators, data log evaluation, and preproduction testing; such requirements are found in the construction codes.

QF-200 defines the requirements for preparing a Fusing Procedure Specification (FPS) and for fusing procedure qualification. A table of essential and nonessential variables for hot plate fusing is given just like as is done for the welding and brazing processes. There are requirements for recording and evaluating data taken during fusing of the test coupon; visual examination of the coupon; elevated temperature sustained pressure testing of the coupon; full section bend and side bend testing; and high speed tensile impact testing.

Although, qualification rules are included in QF-200, QF-221.1 provides a Standard Fusing Procedure Specification (SFPS) that, if followed, does not require qualification.

QF-300 provides rules for qualification of operators of fusing equipment. The variables include position, diameter, material and the fusing equipment manufacturer.

QF-400 lists all the variables for procedure and performance qualification, and it shows diagrams of fusing positions, test specimens, test fixtures and gives acceptance standards for fusing procedure and performance qualification. It also contains definitions unique to fusing as well as blank forms.

In short, if you know how to follow the rules for qualification of welders and welding procedures, you already know how to follow the rules for fusion.

Welding Procedure (QW-200) Changes

Three new welding processes have been added. Hybrid Plasma-GMAW and Hybrid Laser-GMAW use both welding processes in a single weld pool, increasing welding speed and reducing the amount of weld metal required. Both will be highly automated processes. Friction Stir Welding has an immediate application in aluminum plate heat exchanger fabrication and will see wider application as that technology develops.

The last line of QW-451 requires qualification of WPSs for welding base metals over 8 inches (200 mm) thick to be qualified using similarly thick test coupons. While thin materials are forged heavily and have fairly uniform grain structure through the thickness, very thick materials do not get as much forging and, as a consequence, grains mid-plane are more coarse and the material is less uniform as compared to thinner sections. These larger, nonuniform grains do not exhibit the same ductility and toughness that is found in thinner sections. In the 1970s, Section IX committee drew the line at 8 inches and required that organizations that will weld on thick materials gain experience with the nonuniform properties of thick materials by welding test coupons made from thick material.

As QW-451 currently reads, however, nothing prevents a manufacturer from procuring a 10 inch (250 mm) thick test coupon and only depositing ¾ inches (19 mm) of weld metal with a single welding process without welding the full thickness of the test coupon. Such a PQR supports welding on base metal up to 13.33 inches (338 mm) thick and depositing the same thickness of weld metal with that process. That obviously does not achieve the objective of gaining experience with welding of thick materials; to preclude that, a note has been added to QW-451 specifying that test coupons over 6 inches (150 mm) must be welded for their full thickness.

Everyone knows that a groove weld qualification qualifies a WPS for all sizes of fillet welds, all thicknesses of base metal and all diameters of pipe and tube. This is true -- except when impact testing is a requirement. Readers should note that supplementary essential variables, when applicable, override the standard qualification limits, including the above general rule. Specifically, QW-403.6 (The minimum thickness qualified is the thickness of the test coupon or 5/8 in (16 mm), which ever is less.) and QW-410.9 (single pass qualifies multiple pass welding, but not vice versa) restrict the above general rule for fillet weld qualification by groove weld test. A note has been added to QW-451.4 pointing out that fillet welds qualified by groove weld test are subject to restrictions imposed by supplementary essential variables when qualification of the WPS with impact testing is a requirement.

When using turned (cylindrical) tension test specimens, there has always been a tolerance on the diameter of the specimens in QW-462.1(d). This is because the dimensions in this figure are standard test specimen dimensions taken from SA-370, a common reference standard for mechanical testing. Unknown to most, however, is that SA-370 allows use of a nominal area instead of requiring measurement of the specimen diameter (See SA-370, Figure 4, Note 6). That is, when the specimen was a standard “0.505” specimen, instead of calculating the area based on diameter measurement, you can just use 0.200 in^2 or simply multiply the failure load by 5 to get the tensile strength. As of this edition, specimens that violate the machining tolerances in QW-462.1(d) may be accepted provided the actual diameter is used to calculate the area of the specimen.

In temper bead welding, users have reported difficulties complying with the 0.010 in. spacing between Vickers hardness impressions since the specified 10Kg load creates a large impression in soft materials. When hardness impressions are too close together, the plastic deformation from one impression can affect subsequent hardness readings, so ASTM E92 specifies a minimum spacing between impressions of 2.5 times the impression maximum dimension of the nearby impressions. This revision of QW-290 specifies a minimum number of readings in critical locations rather than equally spaced hardness traverses. Provisions were also added to allow the use of instrumented indentation testing (IIT) per ASTM E2546 to perform hardness measurements. This is a novel test method where an impression is made by successively loading and unloading an indenter with progressively higher loads and measuring the springback of the material with each unloading cycle. Not only can hardness data be obtained, but some measure of tensile strength, yield strength, toughness and residual stress can be extracted from the data.

If you weld to corrosion-resistant weld metal overlay, a new paragraph QW-424.2 allows you to weld directly to the overlay following a WPS in which the overlay is represented by a P-number base material that nominally matches the chemical analysis of the buildup or overlay. No additional qualifications are required.

In stud welding, there was a conflict between QW-409.8 which allowed amperage to be changed at will and QW-410.10 which limited amperage to ±10% of that used on the test coupon. The ±10% tolerance was determined to be the correct requirement, and QW-409.8 was deleted from the table of variables.

Welder Qualification (QW-300) Changes

While there were no significant changes in the rules for personnel qualification, Code Case 2757 was issued for qualifying welding operators by sectioning and etching of mockups when the welding equipment does not produce parts that can be radiographed or bend tested.

Base Metals and Filler Metals

172 new line entries were added to the P-number tables, including 20 new ASME material specifications containing 39 grades, 12 new ASTM specifications containing 19 grades, an update of API 5L containing 79 new grades and 5 new foreign material specifications containing 16 new grades.

Historically, only materials that were permitted for construction by the ASME Boiler and Pressure Vessel Code were allowed to be assigned P-numbers. In 2009, materials listed in the B31 Codes were also allowed to be assigned P-numbers. As of the 2011 addenda, the rules changed to allow any material to be assigned a P-number, and the information required to be submitted to the Committee is given in

Appendix J which was added in this edition.

Further, QW/QB-422, the P-number table, has not listed ASTM versions of a specification if the ASME version was listed; this has always caused confusion since it meant that the ASTM version of a specification was not obviously assigned a P-number even though the ASTM specification was the basis for (and most of the time is identical to) the ASME specification. The 2013 edition has modified the format of the table to "A/SA-XXX" and "B/SB-XXX" so that both the ASTM and ASME versions of specifications are clearly assigned the same P-number.

The A-number table of weld metal compositions has always contained ellipses (…) for some elements. While the historical interpretation of these ellipses has been that those elements are not supposed to be purposely added to the weld metal at more than tramp level, the 2013 table shows limits for all listed elements. Fortunately these limits are based on the limits in the SFA specifications, so meeting them should not be a problem. In addition, a column for aluminum has been added. Readers should keep in mind that A-numbers, F-numbers and even P-numbers are optional if the WPS specifies the same filler metal and base metal as was used to prepare the PQR test coupon; A-numbers, F-numbers and P-numbers simply allow the WPS to specify filler metals and base metals that are different from what was used on the test coupon without performing additional testing.

Some revised filler metal specification were updated:

- SFA-5.21/SFA-5.21M, *Electrogas Welding Filler Metals*
- SFA-5.14/SFA-5.14M, *Nickel Alloy Welding Electrodes*
- SFA-5.23/SFA-5.23M:2011 *Low Alloy Steel Submerged Arc Welding Fluxes and Electrodes*
- SFA-5.8/SFA-5.8M:2011 *Filler Metals for Brazing and Braze Welding*

SFA-5.36/SFA-5.36M:2012, *Carbon and Low-Alloy Steel Flux Cored Electrodes and Metal Cored Electrodes for Gas Metal Arc Welding* was also added and will replace SFA 5.20 *Carbon Steel Flux Cored Electrodes* and SFA-5.29 *Low Alloy Flux Cored Electrodes* within the next five years. Other than revised formats for many AWS classifications, the biggest change is that metal-cored electrodes are now in SFA-5.36. While they will also remain in SFA-5.18 and 5.28 for the next several years, they will eventually be removed. This will allow you to update your WPSs in an orderly fashion to the new SFA-5.36 classifications since electrode manufacturers will eventually stop making product to the existing specifications.

The Committee rejected a revision to SFA-5.32, *Shielding Gas* which was an adoption of ISO 14175. The proposed version allowed an increase in impurities in the gas and an increase in the dew point; the Committee rejected those changes and notified AWS of its concerns.

Brazing (QB) Changes

No significant changes were made in the brazing rules.

Inquiries

While most of Section IX's inquiries were routine, an old question resurfaced: when Section IX says that all the variables listed for a given process have to be "described," does that mean that the table of variables should be blindly used as a checklist when writing or reviewing a WPS and PQR, or, perhaps, can a less-rigid approach be taken? A series of interpretations were issued under IX-13-03 that are worth reading; they essentially say that some variables can be "described" indirectly and that some variables are conditional; however, the Committee went further and prepared a white paper that was used for training ASME's consultants who perform Code stamp audits so they would know what to look for when auditing welding activities. That white paper "Auditing Welding Under ASME Section IX" has been posted on the Section IX committee's home page, and it can be most easily found by doing a web search for the paper by its title.

Interpretations be found at: http://cstools.asme.org/Interpretations.cfm

Coming Attractions

I have already mentioned that electro-fusion of plastic pipe will be added in 2015. Also, given the unpredictability of the number of combinations of hybrid welding possibilities, the committee will develop a more generic approach to qualification of hybrid processes in which all the variables of each process will have to be addressed plus those that relate to interfacing between processes such as spacing between processes and process sequence.

Readers are advised that ASME Code Committee meetings are open to the public; the schedule is available on the writer's web site and at www.asme.org. Errata and editorial corrections will be posted at http://www.asme.org/kb/standards/publications/bpvc-resources so that Code users can readily see revisions and corrections.

Mr. Sperko is President of Sperko Engineering, a company that provides consulting services in welding, brazing, metallurgy, corrosion and ASME Code issues located at www.sperkoengineering.com. He also teaches publicly offered seminars sponsored by ASME on how to efficiently and competently use Section IX. He can be reached at 336-674-0600 and by e-mail at: sperko@asme.org.