Summary of Changes to

ASME Section IX, 2017 Edition

As published in the *Welding Journal*, August, 2017

Prepared by

Walter J. Sperko, P.E.
Sperko Engineering Services, Inc
4803 Archwood Drive
Greensboro, NC 27406 USA
Voice: 336-674-0600
FAX: 336-674-0202
e-mail:sperko@asme.org
www.sperkoengineering.com

Changes to ASME Section IX, 2017 Edition

The following article by Walter J. Sperko, P.E. discusses the significant changes that appear in ASME Section IX, 2017 Edition; 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 ASME BPV Standards Committee IX. These changes become mandatory January 1, 2018 for new qualifications.

Global Editorial Revisions

Changes to paragraphs or figures in this edition of Section IX can be quickly identified by "17" in the margins; while most of the changes are easy to discern when reading a paragraph, in this edition, there are over 100 instances where "heat affected" was changed to "heat-affected," backslashes (/) became "or" and "shielded metal arc" became "shielded-metal arc." Also, since there are methods of measuring toughness other than Charpy testing (e.g., drop weight and CTOD) the words "impact testing" and "notch toughness" were globally changed to simply "toughness testing."

Part QG, General Requirements

Codes, standards and specifications that incorporate Section IX by reference sometimes have requirements that are different than those of Section IX; QG-100 says that documents that refer to Section IX take precedence over Section IX requirements. The last two paragraphs of QG-101 were deleted since they had this backwards. They incorrectly stated that Section IX may be used with other Sections of the Boiler Code and B31 and merely suggested that the one should take into account any rules in those standards regarding welding qualification.

For those who are involved with simultaneous qualification of welders, QG-106.3 was editorially revised to make it easier to read; no significant changes were made.

A definition for trailing gas was added to QG-109:

> Trailing Gas: a gas used to produce a protective atmosphere that extends beyond the weld pool in the direction opposite of travel.

This addition resulted in some minor editorial modifications to some of the QW-408 variables.

In the last sentence of QG-105.5, the 2015 edition stated that requalification was required if a change was made in the variables for the special welding processes of hardfacing or corrosion-resistant overlay. This incorrectly stated that both essential variables and nonessential variables had to be requalified if they were changed. Since QW-251.4 already correctly states that only changes in essential variable require requalification, the last sentence of QG-105.5 was deleted.

Welding Procedure (QW-200) Changes

QW-200.4(b) provides a tad of relief to the requirements in QW-200.4(a) to comply with the base metal thickness range and weld metal thickness limits of QW-451. That paragraph allows one to write, for example, a combination-process WPS supported by one PQR qualified for the first process joining base metal from 3/16 to 8 inches in thickness and a second PQR for a second process qualified on a test coupon at least ½ inch thick to support a WPS that allows both processes to be used to weld base metals from 3/16 to 8 inches in thickness. QW-200.4(b) has also been misinter-

preted as being a requirement over and above the requirements of QW-451. To make it clear that QW-200.4(b) is an exception to QW-451 requirements, the sentence: "Alternatively, qualification of WPSs for root deposits only may be made in accordance with (b)." has been moved from the middle of QW-200.4(a) to the beginning of QW-200.4(b).

There are occasions when corrosion-resistant weld metal overlay has been added to a part and the construction requires welding of another part to that overlay following a different WPS. Since the overlay does not have a P-Number assigned to it, a new paragraph was added to QW-211 allowing weld metal overlay to be considered as the same P-Number as any base metal having a nominally matching chemical analysis as the overlay.

While there are many editorial changes to the tables in QW-250, nonessential variable QW-409.8 was added to the special process tables for overlay welding. This variable requires that current type and polarity be addressed on the WPS.

Those who weld repair castings and those who weld on other thick components will rejoice that variable QW-407.4 has been deleted. This variable limited the base metal thickness qualified to 1.1 times the thickness of the test coupon if the weld is heat treated above the upper transformation temperature (e.g., normalized). Since QW-407.1 already requires that any heat treatment above the upper transformation temperature be qualified, there was no rational basis for limiting the thickness to 1.1 times the thickness of the test coupon.

A new welding process, Low-Power Density Laser Beam Welding (LLBW) was added as QW-264.2, and details were added in various other paragraphs including a definition of the process and a new method for measuring heat input when using this process. While similar to ordinary laser beam welding, in LLBW the beam does not develop a keyhole and penetrate deeply into the material. Rather, the beam is low-power and behaves more like GTAW than LBW. Welds are made adding resistance-heated filler metal; the process will be used in vessel construction with a deep and very narrow groove, reducing distortion as well as the amount of weld metal required to make the joint.

For those who do temper bead welding, a fourth column "C" has been added to the temper bead variables in Table QW-290.4 for use where the construction Code specifies neither toughness testing nor hardness testing. When the temper bead rules were added to Section IX in 2001, it was anticipated that Section I and B31.1 committees would specify hardness requirements when using temper bead welding, but that never happened. The requirements for measuring interpass temperature and preheat for each pass as required by QW-406.8 and QW-406.9 were deleted; the committee decided that these requirements were excessive.

The requirements in QW-290.5(d) for testing temper bead coupons when impact testing has been specified have been deleted; the revision now directs the qualifier to the impact testing rules in the construction Code or the design specification.

QW-403.6 is a supplementary essential variable that limits the minimum thickness of base metal qualified to the thickness of the test coupon or 5/8 inches, whichever is less. For thickness less than ¼ inch (6 mm), the minimum thickness qualified is ½ the base metal thickness (i. e., ½T). Since the test coupon had to be less than ¼ inch (6 mm) to take advantage of the ½T rule, organizations would resort to buying ¼ inch (6 mm) thick material and machining or grinding 0.010 inches (0.25

mm) or so off one surface to make the test coupon 0.24 inches (5.75 mm) thick. To eliminate the need for this silliness, QW-403.6 was revised to say "1/4 in. (6 mm) or less."

When performing a tension test using a rectangular specimen, the width of the test specimen in Section IX is specified as approximately ¾ inch (16 mm); this is different from many other standards such as AWS D1.1 and ISO 15614-1 which specify that specimen width be 1 inch (25 mm) wide in the reduced section. If an organization wanted to qualify to meet Section IX requirements and also some other standard's requirements on a single test coupon, an additional set of tension tests specimens had to be prepared. In this edition, tension test specimens meeting the dimensional requirements any of the following standards may be used; however, the acceptance standard of Section IX still applies:

(a) AWS B2.1
(b) AWS D1.1
(c) AWS D1.2
(d) AWS D1.3
(e) AWS D1.6
(f) EN-ISO 4136
(g) JIS Z 3121
(h) GB/T 2651
(i) NAVSEA S9074 AQ GIB 010/248

You will find that QW-402.30, QW-403.31, and QW-404.54 have been deleted and you will struggle to find out what process was affected; looking at the 2015 edition won't answer that question since they were variables that were part of table QW-268 which was for hybrid LBW/GMAW. That table and table QW-269 was deleted in 2015 and replaced by generic rules in QW-220 that apply when using more than one welding process in the same weld pool.

Welder Qualification (QW-300) Changes

When radiographing a weld, QW-191 said that demonstration of acceptable density and image quality on production or technique radiographs shall be considered satisfactory evidence of compliance with Section V, Article 2. The term "density" was removed from this paragraph, not because the correct density is no longer required, but because it was redundant -- density is an integral part of Section V's image quality requirements.

When ultrasonic examination of welder test coupons was introduced to Section IX in 2010, there was concern that ordinary technicians would not be able to reliably identify flaws if the test coupon was too thin, so, with the guidance of Section V committee, Section IX limited use of ultrasonic examination to test coupons ½ inch thick and over. Due to advances in ultrasonic examination equipment and with updated guidance by Section V committee experts, the committee decided to allow welders and welding operators to be qualified using test coupons down to ¼ inch in thickness. While the last two paragraphs of QW-191.2.2 imposing ASNT SNT-TC-1A and other personnel qualification and certification requirements has been deleted, those requirements did not go away since QW191.2.2(b) was revised and now refers to ASME Section V, Article 1 which imposes those requirements.

Footnote 1 of Table QW-452(b) has been revised to align it with the existing rules in QW-306. The previous note said that the weld metal thickness "t" that one used to determine the thickness of weld metal qualified was based on the individual thickness of weld metal deposited by each welder, by each process and by each filler metal F-Number. QW-306 has always been broader; it requires one to considered individually each welder or welding operator, each welding process and whenever there is a change in an essential variable. Footnote 1 was revised to match QW-306; this means that one must consider not only a change in welder, process and filler metal F-Number individually in determining the thickness qualified, but one must also consider, when applicable, a change in progression, position, GMAW transfer mode, and GTAW current type when determining the thickness qualified

There was a major effort to develop rules for welders to qualify for making tack welds only; that effort was failed, but various paragraphs have been revised to state that welders qualified to make groove welds or fillet welds are also qualified to make tack welds. Further, a note was added to QW-461.9, the table that ties the test position to the welding positions qualified to read:

> Tack welds are not limited by pipe or tube diameters when their aggregate length does not exceed 25% of the weld circumference."

This allows a welder qualified on plate to tack weld on pipe in whatever positions he is qualified.

For branch connections, the relationship of the groove design to welder qualification diameter limits has been clarified in QW-403.16:

> "*(a)* For a groove weld attaching a set-on nozzle or branch (with the weld preparation on the nozzle or branch), the range qualified from Table QW-452.3 shall be based on the nozzle or branch pipe O.D.
>
> *(b)* For a groove weld attaching a set-in nozzle or branch (with the weld preparation on the shell, head, or run pipe), the range qualified from Table QW-452.3 shall be based on the shell, head, or run pipe O.D."

QW-322 on continuity of qualification (i.e., the six-month rule) has been made easier to read, but there is no change in the requirements – welders and welding operators still have to use a process and the organization has to document it every six months -- or the qualification expires.

Base Metals and Filler Metals

Some 26 new specifications and 82 new grades of materials were assigned P-numbers. One new filler metal specification was added: SFA-5.36, *Carbon and Low-Alloy Steel Electrodes for Flux Cored Arc Welding and Metal Cored Electrodes for Gas Metal Arc Welding.* This standard will be replacing SFA 5.20 and 5.29, and it contains an entirely new and more informative system for assigning the AWS classifications. Neither SFA-5.20 nor SFA-5.29 will be withdrawn for five years since many fabricators and suppliers have materials made to those specifications in stock and to give the industry an opportunity to become familiar with the new classification system and incorporate them into existing WPSs. Meanwhile, electrode manufacturers will identify their products with both classification systems so that you can get used to the new classification system. When you have ASME Section II,

Part C in hand, read the foreword of SFA-5.36 for an in-depth discussion of the new classification system.

Brazing (QB) Changes

The only technical change in brazing was a revision to the post-braze heat treatment (PBHT) variable QB-409.1. Instead of reading the same as the welding rules as it has for decades, only two conditions will apply:

1) The addition or deletion of a post-braze heat treatment
2) A change in the postbraze heat treatment temperature more than ±25°F (±14°C) or a change in postbraze heat treatment time of the greater of 15 min or 10% of the postbraze heat treatment time recorded on the PQR

Plastic Fusing (QF) Changes

Paragraph QF-143 and Figure QF-463 were changed to correct the bend angle for side bend specimens. This angle was changed from a maximum included angle of 60 +/- 10 degrees to 90 +/- 10 degrees to be consistent with the recently published ASTM Specification F3183, *Standard Practice for Guided Side Bend Evaluation of Polyethylene Pipe Butt Fusion Joints.*

Inquiries

Interpretations are no longer being published as part of the edition; they can be found at: http://cstools.asme.org/Interpretations.cfm

Possible Coming Attractions

Low-energy capacitance discharge welding (LECD) is being added to Section IX. LECD welding is used to attach thermocouple leads to piping to document preheat and PWHT temperatures. The rules require that a WPS be prepared, but qualification of the WPS is not required, nor will operators have to be qualified.

There is a movement afoot to add more detailed visual examination requirements for welder test coupons. Current requirements are that incomplete fusion, incomplete penetration and cracks not are permitted. Section IX does not have additional requirements because organizations work to different construction Codes, and the visual acceptance criteria vary significantly between codes; this leaves the door open for organizations to impose acceptance criteria on their welders that are consistent with what the welders will have to achieve when working to those other codes. The driver for this change is that some organizations do not consider any criteria except what is in Section IX, resulting in welders who are qualified -- but not very skilled. There is significant resistance to this proposal.

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 are 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.