Summary of Changes to

ASME Section IX, 2019 Edition

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(with bonus material. . .)
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Changes to ASME Section IX, 2019 Edition

The following article by Walter J. Sperko, P.E. discusses the significant changes that appear in ASME Section IX, 2019 Edition; all changes are readily found in the "Summary of Changes" in the Front Matter of Section IX. Readers are advised that the opinions expressed in this article are Mr. Sperko's, not the official opinion of ASME BPV Standards Committee IX. These changes become mandatory for new qualifications January 1, 2020.

Part QG, General Requirements

QG-100(b) says that the requirements of the Codes, standards and specifications that refer to Section IX take precedence over those of Section IX. This paragraph has been misinterpreted by some to require that, when a referencing code has a requirement such as preheating P-5A materials to 300°F, one has to preheat the procedure qualification test coupon to 300°F. It was not the intent of the committee that the rules for *construction* apply to the *qualification* of WPSs. Codes, however, occasionally impose additional requirements for qualification of WPSs, and those must be followed. For example, B31.3, paragraph 331.1.1(b) specifically requires that the postweld heat treatment specified in Table 331.1.1 be used during procedure qualification. QG-100(b) has been modified to clarify that it applies only to requirements that are specifically imposed on the *qualification* process.

Reference to the Authorized Inspector (AI) has been deleted in several places. Over the last couple of decades other terms have been used for persons responsible for third-party oversight during code construction and repair, making the "AI" a moving target; further, a lot of work following Section IX is done without an such an authority. While the Authorized Inspector has been removed from QW-101, it still requires that the WPS be available at the site where the work is being done.

QW-101 says that all the essential and nonessential variables listed in QW-250 for any welding process have to be addressed in the WPS. Some have taken that requirement to mean that each variable listed in the QW-250 tables has to be individually addressed – like a checklist. The white paper "*Auditing Welding under ASME Section IX*" that Section IX committee published in July, 2012[1], explained that this approach was overkill. This edition codifies that understanding by adding the following to QW-101:

> When a variable is outside the scope of a WPS (e.g., the variable applies to a P-Number not included on the WPS) or is addressed by another variable (e.g., the AWS Classification specifies the filler metal product form), that variable need not be specifically addressed on the WPS or PQRs that support the WPS.

While Section IX has long required that organizations provide supervision and control over welders when they weld qualification test coupons, there have never been any qualification requirements for that person. It has been noted at Committee meetings that the janitor could supervise and control the welding of a test coupon, and that that would satisfy Section IX requirements. No more. QG-106 was revised to require that individuals who provide supervision and control over the joining of qualification coupons be qualified by education, experience or training in knowledge of Section IX and the scope, complexity and special nature of the activities over which oversight is to be provided. While these new requirements do not detail specifically what is required, each organization will have

[1] From asme.org, search on "auditing welding" to download the file.

to define in writing requirements as appropriate for their organization. This will be an audit point for those renewing their code stamps after January 1, 2020.

Welding Procedure (QW-200) Changes

Footnotes. ASME and other standards writing bodies policies specify that footnotes should be informative, not mandatory, i.e., requirements are not supposed to be in the footnotes. Anybody who has qualified a WPS for overlay knows that all the requirements are in the footnotes of Table QW-453. No longer. They have been distributed to the appropriate places in the body of the code. The same was done many other with footnotes. The following surprising footnote from QW-466.1 has been moved to QW-161, the paragraph that covers bend test sample preparation:

> For materials with less than 3% elongation, a macro-etch specimen shall be used in lieu of bend test at each bend test location. Acceptance criteria shall be in accordance with QW-183(a).

This paragraph, previously hidden in the footnotes, will be very helpful to anyone qualifying very low-ductility materials.

The variables for tube-to-tubesheet procedure qualification have been reformatted into tables and consolidated. No significant technical changes were made. The rules for qualifying personnel for making tube-to-tubesheet welds have made more rational; previously the test piece and variables for personnel qualification were nearly the same as for procedure qualification. The revised rules still require welding a workmanship sample of 5 tubes, but now the essential variables in QW-350 and QW-360 for welder and operators respectively apply, plus a new but brief collection of essential variables in QW-388 specific to welding tubes to tubesheets.

Bonus Material

The new tables in QW-288 were modified by the editor and are incorrect; it appears that some of the subparagraph numbers are offset by one digit (i.e. QW-402.31 should be QW-402.30). The changes are as follows:

Paragraph QW-402.20 was deleted and will be restored to: "A change in the joint configuration."
Paragraph QW-402.30 is redesignated at QW-402.31.
Paragraph QW-402.31 is redesignated at QW-402.32.
Paragraph QW-403.31 is redesignated at QW-403.32.
Paragraph QW-403.2 is redesignated at QW-403.33.
Paragraph QW-403.33 is redesignated at QW-403.34.
In Table QW-288.1, the line ".33 < Cladding thickness" is deleted.
In Table QW-288.1, the line "QW-404.34 Ø P-number" will refer to QW-403.33 instead of QW-403.34
In Table QW-288.3, the line "QW-403.35 Ø Tube thickness" will refer to QW-403.34 instead of QW-403.35

A discussion began in the industry to better define how to measure arc energy when QW-409.1 added rules in 2010 for measuring power when using waveform-controlled power sources, One conse-

quence was development of ISO 18491, *Guidelines for measurement of welding energies*, which is currently being adopted by AWS as B2.5, *Specification for Measurement and Calculation of Welding Energy*. While incorporation of that standard into Section IX is in the future, new definitions of instantaneous energy and instantaneous power have been added to Section IX.

For the last 15 years, QW-350 has said that, when determining the thickness (t) of weld metal in a welder test coupon, you can't count the reinforcement. Somebody asked about reinforcement on procedure qualification test coupons, so QW-202.1 was modified to say the same thing for procedure qualification test coupons.

New rules were also added to QW-202.2 to address using test coupons where the thicknesses of the members were different. When different base metal thicknesses are used, the thickness (T) of each member individually determines the base metal thickness range qualified.

The following supplementary essential variable was deleted.

> QW-405.2, A change from any position to the vertical position uphill progression. Vertical-uphill progression (e.g., 3G, 5G, or 6G position) qualifies for all positions.

This variable has been in Section IX since the early 1970s, predating the presence of heat input control variables. While conventional wisdom is that welding in the vertical position using uphill progression results in high heat input that degrades the weld toughness a lot. This is not true; if one welds vertically using a wide weave to qualify high heat input, a lot of interbead tempering occurs, and the toughness properties will be surprisingly good. Such a high-heat input qualification, unfortunately, can support using a stringer bead technique where one makes large beads with little interbead tempering resulting in degraded toughness. QW-405.2, then, was misleading.

Heat input, as one can see from the above, is not the key factor that controls toughness. In *Weldability of Steels*, Stout and Doty showed in 1971 that both too high heat input and too low heat input degraded toughness. Recognizing that controlling heat input is not the crux of controlling toughness, Section IX committee has formed a task group to look at the whole question of how welding parameters and bead shape affect toughness and how to address them better. Any data from readers of this article is welcome.

The term "composite materials" has been used in QW-217 for years, but its meaning was never obvious. In 2019, it will be replaced by "clad materials," and this new definition will replace "composite material":

> Clad or cladding: weld metal overlay or bonded corrosion resistant material added to a metal surface.

Low-energy capacitance discharge welding (LECD) was added to Section IX. LECD welding is used to attach thermocouple leads to components to track preheat and PWHT temperatures. The rules require that a WPS be prepared, but qualification of the WPS is not required, and operators do not have to be qualified.

Welder Qualification (QW-300) Changes

There has been a conflict between QG-104 and QW-301.4 since QG was first published in 2013. QG-104 has required that the "Range Qualified" column on the welder qualification record be completed, and QW-301.4 has only required that the thickness and diameter ranges qualified be recorded in the "Range Qualified" column. This edition has moved to the latter. While the welder qualification form still shows spaces for all the variables in the "Range Qualified" column, only thickness and diameter are required to be shown. Smart code users, however, will continue to complete the entire "Range Qualified" column since the data in that column, when properly completed, describes concisely what that welder is qualified to do; this makes it easy for supervision, QC and a welder to check his qualification ranges without being intimate with Section IX.

When does a welder's continuity begin? The date that the results are known? The date the record was signed. The date the welder completed the weld? QW-300.1 now says that a welder's qualification continuity begins from the date he completed welding the test weld. Ultimately this was based on the fact that a welder can be qualified on a production weld; obviously his clock must start running on that day.

More Bonus Material!

While QW-452.3, "Groove-weld Diameter Limits," has been with us for decades, it has never addressed when a welder must be qualified to make small-diameter nozzle welds; instead, we have lived with 40-year old interpretation, IX-80-67. The change is in QW-403.16 which is the variable that invokes QW-452, and it says that if the nozzle is beveled, the diameter restrictions apply, but if the header or vessel wall is beveled, the welder does not have to be qualified for small-diameter if the nozzle is 2-7/8 inches OD or smaller. Any groove weld qualification qualifies him if the nozzle is attached by fillet welding per QW-452.6.

And even More Bonus Material!

Certifications.
(a) All personnel performing volumetric examinations for welder and welding operator qualifications shall be qualified and certified in accordance with their employer's written practice.
(b) The employer's written practice for qualification and certification of examination personnel shall meet all applicable requirements of Section V, Article 1.
(c) If the weld being examined is a production weld, the examiner may be qualified and certified in accordance with the requirements of the referencing code as an alternative to the requirements of this paragraph.

Base Metals and Filler Metals

Among others, a collection of 23 Canadian (CSA) base metals were assigned to P-number 1. Section IX committee will assign P-numbers to any material that is submitted with the appropriate supporting weldability information as described in Mandatory Appendix J: *Guideline for Requesting P-Number assignment for Base Metals Not Listed in Table QW/QB-422*.

Section IX, Appendix K, provides suggested wording for activating in another standard or a specification optional provisions in Section IX such as toughness testing and tube-to-tubesheet welding.

The 2019 edition adds suggested wording for code cases allowing materials to be assigned P or F-numbers.

Testing (QW-400)

When performing a tension test, QW-462 now allows one to use any tension specimen geometry that meets a welding standard provided the cross section is measured to determine the ultimate tensile strength. All processes and filler metals to be qualified must still be included in the specimens. This allowed the committee to delete the ever-growing list of standards that specified other tension test dimensional requirements.

The bend test fixture dimension tables in QW-466.1 were changed beyond recognition by an ASME editor in the 2017 edition; this was corrected by errata shortly after it was published. Those tables have been restored in the 2019 edition. If you have a 2017 edition, you should draw a big X through those tables and make a note to use the 2013 or 2019 edition instead.

A committee member asked what the basis was for the tensile strength requirements for spot and projection welds in Tables QW-462.10(a) through (c); despite extensive research, that could not be determined, so these tables were replaced with a simple logical formula:

Strength = load to failure/area of the nugget.

The minimum strength has to equal or exceed the minimum tensile strength shown in QW/QB-422 for the metals being tested. In this case, simpler is definitely better, plus, the new method is rational.

Historically Section IX did not require that radiographers be qualified; all that was required was that the radiographs exhibit the required image quality. This edition requires that anyone performing volumetric examination be qualified in accordance with their employers written practice and that that practice must meet the requirements of Section V, Article 1 (e.g., SNT-TC-1A or similar).

Brazing (QB) Changes

A new column has been added to QW/QB-422 – the P-number table. The AWS C2 committee conspired with the AWS B2.2 committee to develop a new grouping system for base metals for brazing qualification that recognizes that small additions of elements like aluminum and titanium to copper, stainless steel and nickel alloys can affect the surface morphology so much that you can no longer braze those metals using the flux qualified -- or even the same process. The brazing subgroup liked this system and added a new column "B2.2 BM" using the new numbering system to QW/QB-422 (the P-number tables). The brazing subgroup did not delete the existing system but elected to introduce the new grouping system over two years. The old system will be deleted in the 2021 edition.

Variables QB-409.2 and QB-409.3 which were incorporated decades ago based on welding rules have been deleted. These variables which address PBHT time at temperature and limit the base metal thickness range qualified to 1.1 times the test coupon thickness, should have been deleted in 2017 when QB-409.1 was modified. The PBHT rules now make sense.

The variables in QB-407 on brazing flow positions have been cleaned up. Qualification is still required for each flow position, with vertical downflow still qualified by any other flow position, but if there is no major flow of the filler metal (i.e., is it preplaced in the joint and covers the faying surfaces, qualification in any position qualifies all positions.

Plastic Fusing (QF) Changes

Side-wall fusion was added. This is used for attaching fittings to the surface of a pipe by applying a heater to the pipe external surface and to the end of the fitting, heating to a measured temperature for a controlled time, then removing the heater and pressing the parts together.

Rules for manual butt fusing of NPS 6 and smaller polyethylene pipe was added. As opposed to using mechanized equipment, this is done using manually applied torque or hydraulic pressure; most natural gas pipelines are made using this method, and this provides that industry with a codified method of joining polyethylene gas lines.

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.

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.