

Summary of Changes to
ASME Section IX, 2021 Edition

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Changes to ASME Section IX, 2021 Edition

The following article by Walter J. Sperko, P.E., discusses the significant changes that appear in ASME Section IX, 2021 edition; a list of all changes is in the “Summary of Changes” in the front matter of Section IX. 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, 2022.

Part QG, General Requirements

In 2019, QG-106 introduced a requirement that anyone who supervised the welding¹ of either procedure or personnel qualification test coupons had to be qualified. It also required that persons with such qualifications be designated by the organization with responsibility for certifying qualification documents. Many organizations assign responsibility for certifying documents to the Quality Control Manager, not to the foreman who gives welders tests. This revision deleted mention of who signs qualification records and just requires the organization to designate those who will be responsible for supervision of welding of qualification test coupons. *Note: Due to a printing error, the sentence that says that the welder who welds the test coupon needs to be your employee is still in the 2021 edition. It has been deleted by errata, so you can line out that sentence when you get your copy.)*

For decades, Section IX has required that the welder who welds a procedure qualification test coupon be an employee of the organization or be an independent contractor. Since organizations must now have qualified supervision over the welder who welds any test coupon, that requirement was removed in this edition.

A new paragraph QG-106.4 was added allowing more than one organization to simultaneously qualify the welding of procedure qualification test coupons when expressly permitted by the construction code (i.e., Section VIII, B31.3, etc.). These rules are like those in QG-106.5 for simultaneous qualification of welders.

QG-108 addresses qualifications made to previous editions of Section IX. That paragraph says that says that you can continue to use WPSs qualified as far back as 1962, and that they do not need to be updated to the latest edition of Section IX. While that is generally understood, some miss that they also must also meet the qualification requirements of the construction code. For example, Section VIII, Division 1, paragraph UW-13(f) has special procedure and welder qualification rules when welding corner joints. This revision clarifies that, even though an old WPS may be acceptable to Section IX without revision, one still must satisfy all construction code qualification requirements.

The phrase “Quality Control System or Quality Assurance System” has been used in many places throughout the code. Since many organizations that follow Section IX do not have such programs, that phrase was replaced by a more generic term “quality program,” and a definition for “quality program” was added.

In QG-109, the definition of “interpass temperature” was revised to permit measuring it on the base metal within an inch of the weld bevel. Also, the definition of “backing” was revised to remove the phrase “so as to facilitate complete joint penetration.” Backing” is now defined only as “a *material* placed at the root of a weld joint for the purpose of supporting the molten weld metal.”

¹ While “welding” is used here, these paragraphs also apply to brazing and fusing.

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Welding Procedure (QW-200) Changes

This is the biggest change in this edition is the following: When using GMAW in the short-circuiting transfer mode, the qualification limit of 1.1 times the base metal and 1.1 times the weld deposit thickness was removed. These limits were imposed decades ago because GMAW in the short-circuiting transfer mode is notorious for having lack-of-fusion flaws, and that likelihood of getting such flaws increases as thickness increases. The committee belatedly recognized that the committee's criteria for designating a variable as essential is that changing it has to affect the mechanical properties of the weld -- and the 1.1 times the thickness limitation is about soundness, not mechanical properties. (*QW-403.10 is still in QW-400, but it is no longer referenced in QW-255, so it no longer applies. It will be deleted in the next edition.*)

On the other hand, qualifying welders is about depositing sound weld metal, so welders will remain limited to 1.1 times the thickness of weld metal they deposit in their test coupons when using GMAW in the short-circuiting transfer mode.

The toughness of P-No. 8, P-No. 21 through 26 and P-No. 41 through 49 materials is not affected by cooling rate like carbon and alloy steels are. This edition exempts those materials from the variables that affect cooling rate: interpass temperature, minimum thickness and heat input.

Note: Variables QW-409.4 (current type and polarity) and QW-410.9 (change from multiple passes per side to single pass per side) were affected by this change, and they say that you do not have to address either when welding P-No. 8, P-No. 21 through 26 and P-No. 41 through 49. The committee failed to consider that these variables are also nonessential variables for the common welding processes; as a result, the 2021 says that you do not have to address current type and polarity or single/multiple passes per side in your WPS when welding P-No. 8, P-No. 21 through 26 and P-No. 41 through 49 materials under any circumstances. Oops. Section IX will be issuing an intent interpretation reinstating QW-409.4 and QW-410.9 in their previous form as nonessential variables without the exceptions and give the current versions with the exemptions new variable numbers as supplementary essential variables.

Bottom line is you have to address current type and polarity and use of single pass per side or multiple passes per side (or both) in your WPS when QW-409.3 and QW-410.9 are nonessential variables even though the current wording exempts them when welding P-No. 8, P-No. 21 through 26 and P-No. 41 through 49 materials.

QW-200.4(b) gives an exception to QW-451 that allows you to write a WPS using a process to make a root pass on groove weld and complete the weld with a second process even though the process used for the root weld is not qualified for the base metal thickness for which the second process is qualified. The paragraph was reformatted to make it easier to understand. (We hope).

QW-217(a) on joining of clad metals was reformatted to make the requirements easier to understand; there were no technical changes except for addressing unassigned materials.

In the 2019 edition, many notes in many tables were moved into the body of the code. A note clarifying that supplementary essential variables also apply to fillet welds when supplementary essential variables are invoked was deleted but not added to the body of the code. This revision adds that requirement to QW-251.2. A note was also added to Table QW-451.1 noting that supplementary essential variables may limit thickness ranges in that table. (*This means that, when toughness qualification is*

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applicable, there is a minimum thickness of base metal limit when making fillet welds and that single-pass fillet welds are not permitted unless the WPS has been qualified by groove welding using a single pass-per-side test coupon.)

QW-215.4 was added to allow one to expand the range of qualification of LBW and EBW partial penetration groove welds using workmanship coupons. Unlike other processes, the welding parameters and thickness limits qualified when using LBW and EBW are very restrictive. The new option requires the user to have a WPS qualified by groove welding with all the required mechanical tests and also a workmanship coupon representing production parts. The organization may then use the welding parameters of the workmanship coupon to make welds on production parts represented by the workmanship coupon.

When qualifying LBW, the committee decided that allowing welding of all materials within a P-number was too open. Since a higher carbon equivalent increases the risk of cracking, a further restriction was added to limit the carbon equivalent of materials to be welded to the carbon equivalent of the test coupon material. The committee also reviewed AWS C7.4, *Process Specification and Operator Qualification for Laser Beam Welding*. This resulted in several changes to the LBW and LLBW variables to better reflect current laser welding technology and controls.

QW-404.7 addressing SMAW electrodes over 1/4 inch and QW-410.12 addressing plasma arc welding operating modes are supplementary essential variables. These variables predate the heat input controls in the code today and no longer serve a purpose, so they were deleted.

While it has been standard practice for welding consumable manufactures to use the test assemblies in the filler metal specifications when analyzing the composition of weld metal to determine the A-number, the methods used when a filler metal does not meet a filler metal specification was not specified. QW-404.5 now requires using the filler metal specification test assemblies for that purpose.

The introductory paragraph to the P-number table, QW-420, has expanded over the years to cover many subjects related to P-number assignments. This edition grouped the subjects and gave them headers to make them easier to find and to follow. We made no technical changes.

Standard Welding Procedures (SWPSs) were added to Section IX in the 2000 addenda. While new SWPSs are added to Appendix E regularly, old ones were periodically updated. QW-500 was revised to make it clear that previous editions of SWPSs that an organization had adopted may continue to be used even though a later edition is shown in Appendix E. Introductory paragraphs were added to Appendix E to provide guidance on adopting SWPSs, and the table listing the SWPSs was reformatted to make it easier to find the desired SWPS. SWPSs are good procedures, they are inexpensive, and are not likely to be questioned when submitted to a customer for approval; more organizations should use them.

Welder Qualification (QW-300) Changes

Section IX has always allowed welders and operators using GTAW to qualify by volumetric examination when welding titanium. This edition extends that to zirconium.

When QG-106 was revised in 2019 to add requirements that those who supervise welding of test coupons needed to be qualified, the words "supervision and control" in QW-322 led some users to

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think that those who updated continuity records also had to be qualified. That was never intended, so "supervision and control" was removed from QW-322. However, the paragraph now requires that welding operators who are qualified to use both machine welding and automatic welding with the same welding process be tracked separately for continuity purposes.

Base Metals and Filler Metals

The following were assigned to P-No.1:

AS 1548, CSA-G40.21, GB 713, IS 2062, JIS G3118, JIS G4303, NF A 36-215, and EN10025-2 Grades S275J2, S355JR and S355J2

UNS S31655 was assigned to P-No. 8.

The following were assigned to P-No. 10H in several product form specifications:

UNS S32506, S82011, J93345, J93404, J93371, J93372, J93379

SB-674, UNS N08354 was assigned to P-No. 45

The following AWS welding consumable specifications were updated as SFA specifications:

A5.01M/A5.01:2019, Filler metal procurement guidelines
A5.17/A5.17M:2019, Carbon steel submerged arc electrodes and fluxes
A5.34/A5.34M:2018 Nickel alloy flux cored and metal cored electrodes

A5.39/A5.39M:2020 *Flux and Electrode Combinations for Submerged Arc and Electroslag Joining and Surfacing of Stainless Steel and Nickel Alloys* was added and is new to our industry; anyone who welds stainless steel or nickel alloys using SAW should consider updating their PQRs and WPSs.

SFA 5.36, a specification for carbon and low-alloy flux cored and metal cored electrodes, was adopted in 2017. It presented a new system for identification of these electrodes that code users found unnecessarily complicated. The specification was withdrawn, *never to be seen again. We hope.*

Appendix D, a listing of Base Metals by P-number, was deleted since electronic searching of Section IX and other resources such as www.pnumbers.com made it superfluous.

Testing (QW-400)

The bend test fixture dimensions in Table QW-466.1 looks different. Columns "C" and "D" were revised to specify those dimensions as a function of the thickness of the specimen and the values in columns "A" and "B" rather than as exact values. This makes the table easier to understand. There were no technical changes to the dimensions -- only in the way the dimensions are expressed.

A paragraph was added to QW-162.1 stating that the bend radius-to-specimen-thickness ratios given in QW-466.1 are maximums. That means that you can make face and root bends on NPS 6 Schedule 80 (0.432 inch wall) using a standard $\frac{3}{4}$ inch radius fixture without reducing the specimen thickness to $\frac{3}{8}$ inches -- *if you want to*. That will save some grinding time.

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Since the 2013 edition of Section IX, tension specimens meeting the dimensional requirements of various AWS and international standards have been acceptable. This edition makes bend test specimens prepared according to ISO 5173 acceptable provided the ratio of bend radius-to-specimen thickness complies with the requirements of QW-466.1. This brings Section IX and EN ISO 9606 for welders and EN ISO 14732 for welding operators into closer alignment.

When qualifying welders using fillet weld tests, QW-184(a) permitted acceptance of linear indications such as cracks and incomplete fusion that were less than 1/32 in. long at the root of the macro examination specimen. This was removed since QW-183 for fillet weld procedure qualification did not permit any indications at the root.

Brazing (QB) Changes

Brazing operators (QB-360) were required to be qualified using procedure qualification test coupons or workmanship test coupons, but there were no qualification limits. This edition imposes the essential variables of QB-350 on brazing operators. A reference to the workmanship coupon in QB-182 was added to QB-305(a) and a reference to QB-452 was also added so that the type and number of test specimens was specified. Finally, QB-305(b) was added requiring section specimen to be visually evaluated to the acceptance criteria is in QB-182.

Coming Attractions

Committee members are exceedingly disappointed that in-person meetings will not be resuming until May of 2022.

A code case for using GMAW for additive manufacturing is being developed.

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; search for "committee meetings."

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 AWS 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.