Summary of Changes in

ASME Section IX, 2007 Edition, 2009 Addenda

As published in the *Welding Journal*, October, 2009

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, 2009 Addenda

The following is a summary of the changes that appear in 2007 Edition, 2009 Addenda of ASME Section IX. Significant changes and related discussion are reported by Walter J. Sperko, P.E., Vice-chairman of Subcommittee IX; minor changes, such as editorial corrections, are readily identified in the "Summary of Changes" which begins on page (c) of the Addenda. Readers are advised that the opinions expressed in this article are those of Mr. Sperko and not the official opinion of Standards Committee IX. These changes become mandatory January 1, 2010.

Changes to QW/QB-422 – The P-Number Table

If you work with Section IX regularly, the first thing you noticed when you inserted the blue pages was that QW/QB-422 is different: the columns for S-numbers are gone! S-numbers, you may recall, were assigned to certain materials that were permitted by the ASME B31 Code and select Code Cases but were not adopted as Boiler Code materials (i.e., S-number materials were not "SA" or "SB" materials). Previous ASME policy was that only materials that were "SA" or "SB" materials were allowed to be assigned P-numbers. That policy changed recently, and Standards Committee IX made life easier for everyone by converting all materials with S-numbers designations to P-number designations

A parallel but more subtle and expansive change was made in QW-420; previously, materials were manufactured to the ASTM version of a specification could be considered as having the same S-number as the corresponding "SA" or "SB" material's assigned P-number (i.e., ASTM A-312 TP304 could be considered S-8 since ASME SA-312 TP 304 was assigned to P-8), this revision allows all materials that have the same UNS number as any material that is assigned a P-number to be considered as having the same P-number as the listed material. That is, ASME SA-312 TP 304 is listed as UNS S30400; therefore *all* materials manufactured to any specification in which the material is identified as UNS S30400 may be considered as P-8. This provision also applies to group number assignments.

When taking advantage of this change, however, the materials used for the test coupon have to be materials that are assigned P-numbers by Section IX; continuing with the above example, readers should use ASME SA-312 TP304 (which is listed) and not ASTM A-312 TP304 (which is not listed) for test coupons. For materials not assigned a UNS number and not listed in QW/QB-422, QW-424.1 applies.

These changes, of course, do not mean that you can construct ASME boilers, pressure vessels or nuclear components with former S-number materials or with materials assigned a P-number using the UNS number; they still have to be constructed using materials that are listed in ASME Section II, Part D, i.e., they have to be built from materials that are made to "SA" or "SB" specifications, and piping has to be constructed using materials that are permitted by the applicable section of the ASME B31 Code for Pressure Piping.

For purposes of reducing the number of Procedure qualifications when materials were similarly weldable, base metals were assigned P-numbers in the first edition of Section IX published in 1941. In those days, a welding power supply (motor-generator) was known as a "welder," and the person who did the welding was known as a "welding operator." For purposes of reducing the number of Operator qualifications when materials were similarly weldable, base metals were assigned O-numbers. The Operator grouping system was dropped in the early 1950s, leaving only P-numbers which are used today for both procedure and performance qualification purposes. Both P-numbers and O-numbers were just numbers in the old days; however, by the 1960s, Subcommittee IX started using alphanumeric designations such as P-9A, P-10C, P-11A, etc. and the rules typically required that separate qualification was required for each number-letter combination. In these addenda, QW-420 specifically states that P-numbers are considered alphanumeric designations even though they are called "P-numbers." This means that P-11A and P-11B are considered separate P-numbers without further identifying them as such in the

variables, the tables and in other locations throughout Section IX. This allowed deletion of QW-403.13 which addressed P-5, 9 and 10 with their separate alpha designations, and it eliminated the need to address alpha designations in a new P-number family, P-15.

Creep-strength Enhanced Ferritic Alloys: P-number 15

The power industry has been using a creep-strength enhances ferritic alloy (CSEFA) identified as "Grade 91" for elevated temperature service for over two decades. Although Grade 91 is based on Cr-Mo steels that have been used for decades, industry has discovered that its microstructure and associated creep behavior is way more sensitive to fabrication and installation practices than predecessor Cr-Mo steels such as 2-1/4 Cr-1Mo. As the result of some failures in Grade 91 installations, special rules have been written for this material such as the postweld heat treatment requirements for P-5B, Group 2 in Section I, paragraph PW-39, and in B31.1, Table 136. While the industry has learned to deal with Grade 91's idiosyncrasies, more CSEFAs are on the way: Grades 92, 911, 122, 23, 24 and others. It is anticipated that they will exhibit similar idiosyncrasies to Grade 91 and possibly some of their own. In order to make it easier for the construction codes to deal with these idiosyncrasies as they arise, Section IX has designated a new P-number family for CSEFAs – P-15. Assignments will be as follows:

P-15A Open
P-15B 1-1/4Cr
P-15C 2-1/4Cr (e.g. 23, 24)
P-15D Open
P-15E 9Cr (e.g. 91, 92, 911)
P-15F 12Cr (e.g. 122, VM12)

Grade 91 materials currently assigned to P-5B, Group 2 will become P-15E. Existing WPS and supporting PQRs that permit welding P-5B Group 2 materials must be reviewed to see if the WPSs are still qualified for welding materials under P-15E. If a PQR shows that the test coupon base metal was one of those assigned to P-No. 15E, the WPS may be revised to allow welding of P-15E. If a PQR shows that the test coupon base metal was *not* one of those assigned to P-No. 15E, the WPS may only permit welding of materials currently assigned that P-number.

When the PQR shows that the test coupon base metal was one of those assigned to P-15E, the PQR may be revised to P-15E, or it may remain as P-5B, Group 2 since:

1) the base metal that was welded was P-5B, Group 2 at the time that the test coupon was welded, and
2) it is the *base metal* that was welded that determines the P-number that may be specified on the WPS, not the historically assigned P-number shown on the PQR.

In the writer's experience, however, not changing PQRs to the new P-number will result in negative comments from reviewers of WPSs who are not aware of the above subtlety. If you choose to revise PQRs to show the new P-number assignments, be sure to recertify the record and annotating that the base metal P-number assignment was revised due to a code change

The old WPS and PQR are still valid for ongoing and repair work to previous editions of the Code where the applicable construction code assigned Grade 91 to P-5B, Group 2.

Readers may note that the above description of how to deal with reassigned P-numbers is slightly different from my previous advice which said that the PQR had to be revised. Due to feedback from some readers, this matter was recently vetted in committee and the above is consistent with recent interpretations. This advice is applicable not only to the CSEFAs but also to other materials such as those base materials with revised P-numbers in the nickel-base family.

Corresponding changes were also made in various paragraphs and tables where ranges such as "P-1 through P-11" have been changed to "P-1 through P-15F." This means that, since QW-423 was revised as described above, welders who were previously qualified to weld on P-1 through P-11 base metals are now qualified to weld on P-1 through P-15F base metals. Although Section IX does not specifically address revisions to welder qualification records, the provisions of QW-200.3 which address revisions to PQRs could reasonably be applied to welder qualification records, allowing PQRs to be revised when there is a relevant code change; accordingly, one could revise previous welder qualification records by changing the base metal range qualified from P-1 through P-11 to P-1 through P-15F, recertifying the record and annotating that the base metal range qualified was revised due to a code change.

ISO Material Grouping Assignments

After you received your Addenda sheets, you should have been notified that revised QW/QB-422 tables should be downloaded from the ASME web site:

http://cstools.asme.org/csconnect/pdf/CommitteeFiles/29447.pdf

When you downloaded that table, you saw that there were more changes to the table! A new column "ISO/TR 15608 group" was added. This column lists assignments of materials to group numbers in accordance with the criteria of ISO/TR 15608:2005, *Welding — Guidelines for a metallic materials grouping system*, and it is consistent with the assignments found in ISO/TR 20173:2008, *Grouping systems for materials — American materials*. While this listing is provided as a convenience to users worldwide, it is provided for information only. Section IX does not refer to this grouping as a basis for establishing the range of base metals qualified for either procedure or performance qualification. There are two other ISO standards that assign ISO 15608 group numbers to European and Japanese materials, ISO/TR-20172 and ISO/TR-20174 respectively. The availability of the ISO base metal grouping assignments will make it easier to evaluate the similarity of materials for welding purposes.

"Condition(s)"

While there appear to be a lot of revisions when reviewing the listing of changes, most are editorial and the rest are simplifications. Biggest number changes were associated with an action in which a senior SC IX member examined how the word "condition" and its variants were used. It turns out there were many ways the term was used, and some were inappropriate. Some examples:

- QW-100.3, "conditions" was changed to "rules."
- QW-321, "conditions" was changed to "provisions."
- QW-322.2(a), "conditions" was changed to "requirements."
- QW-322.1, "conditions" was deleted.
- QW-407.1, "conditions" was deleted (several of these)
- QW/QW-492, "conditions" was changed to "parameters" for *active fluxes*.

So if you are reading a paragraph marked with "09" in the margin and the change is not obvious, look it up in the change summary and you will probably find that "condition" was modified.

Welding Procedure (QW-200) Changes

Beyond the changes in S-numbers and addition of P-15, there were a couple of changes to the procedure qualification rules worth noting.

QW-442, the A-number table, changes rarely. In these addenda, the transition point for chromium between A-4 and A-5 was changed from 5% to 4% so that the transition in chromium content matched the same transition between base metals assigned to P-5A (2-1/4 Cr and 3% Cr-Mo) and those assigned to P-5B (nominally 5 through 12% Cr-Mo steels). This allows WPSs qualified using any P-5B base metal to be written so that the chemical composition of the filler metal can match that of any other P-5B base metal, whereas previously, a PQR showing that a 5% Cr-Mo steel was used for both the test coupon and the filler metal could only support a WPS written for welding 5% Cr-Mo base metals using 5% Cr-Mo filler metals. Readers might want to review their existing P-5B WPSs to see if they can take advantage of this change.

QW-404.23, which is an essential variable for GTAW and PAW for both procedure and performance qualification, was modified to add use of flux-coated rod in addition to requiring separate qualification when using flux cored, powder, metal cored and solid wires. The most commonly used filler meal product form qualified with either process is solid wire, and when solid wire is used to weld a test coupon, that also qualifies metal cored wires and vice-versa, but no other product form. Flux cored and flux covered rods are most commonly used as an alternate to using gas backing when welding stainless steel, and this variable requires separate qualification of both WPSs and welders when this these product forms are used. The use of separately-applied backing flux is not addressed by Section IX; readers who use such fluxes would be smart to run a procedure qualification test to satisfy themselves that these fluxes do not affect the properties of the weld and advise their customers that there may be residual flux in the piping.

Welder Qualification (QW-300) Changes

There were no significant changes to welder qualification other than those resulting from P-number changes discussed above.

Base Metals and Filler Metals

Beyond the extensive changes described above regarding S-numbers and P-15, the regular collection of new base metals was added and editorial corrections were made. One notable addition was the addition of ASME B16.50, *Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings* as brazing P-number 107. Fittings made to this specification are made from the same copper alloys as B16.22 solder-joint fittings, but B16.50 permits the fittings to have shallower cups that are more suitable for brazed joints than the deep cups that are needed for soldered joints.

Brazing (QB) Changes

Other than the addition of B16.50, two small changes were made to clarify the variables associated with overlap length of brazed joints.

QB-408.1 says that, for lap or socket joints, the brazer is qualified to braze using an overlap length up to 25% greater than that used on the performance qualification test coupon. This recognizes that, as the overlap length increases, it becomes more difficult to make a sound braze joint, but it says nothing about decreasing the overlap. To clarify that decreasing the overlap from that used on the test coupon was acceptable, a parenthetical clarification was added saying that a decrease in overlap is permitted without requalification.

QB-408.4 says that, for lap or socket joints, the BPS is qualified to braze using an overlap length no greater than that used on the procedure qualification test coupon. This recognizes that, as the overlap length decreases, the unit stress through the joint increases, but it says nothing about increasing the overlap. To clarify that increasing the overlap from that used on the test coupon was acceptable, a parenthetical clarification was added saying that an increase in overlap is permitted without requalification since that decreases the unit stress through the joint.

Inquiries

It was a pretty dull year for inquiries. One curious inquiry was IX-07-11 which asked if a person making adjustments of the volts, amps, wire feed speed or other settings at the direction of a qualified welder or welding operator had to also be a qualified welder or welding operator. The reply was no. It's always reassuring to know that if a welder hollers: "Joe, gimme 5 more amps!" that Joe does not have to be qualified to weld.

Coming Attractions

Over the last several decades, electronic controls have moved into welding power supplies and controls. Motor-generators that produced nearly pure DC current were replaced with transformers and rectifiers. Most of these power supplies produced DC current with some waveform ripples, but the wave form was highly regular, and ordinary volt and ammeters could be used to measure the energy accurately. Modern power supplies use inverters and electronic controls to control volts and amps independently; this allows the power supply to control the volts and amps waveforms to minimize spatter, control penetration, bridge gaps and the like to make welding easier and more consistent; these controls operate at 5 to 10 MHz, and the heat input used to make a weld cannot be measured correctly using either averaging or RMS meters to determine the heat input. Conveniently, the electronics that control the waveform can also be used to measure the arc energy accurately by sampling the volts and amps at the same frequency as the controls operate, and those measurements can be integrated over time to provide a meter reading of cumulative joules over the time the arc is on or Joules per second (watts). When such a reading is recorded along with the travel speed, heat input can be accurately recorded on the PQR and controlled during welding. How this will be incorporated into Section IX will be revealed next year in the Welding Journal and will appear in the 2010 edition.

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, FAX at 336-674-0202 and by e-mail at: sperko@asme.org.