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Qual i f i cat ion Standard for Welding, Braz ing, and Fusing Procedures; Welders; Braseros; and welding, braz ing, and fusing operators section IX Welding, Braz ing, and Fusing Qual i f i cat ions ASME BPVC, IX-2017 2017 ASME Boiler and Pressure Vessel Code An International Code Markings such as ASME, ASME Standard, or any other marking including ASME, ASME Logos, or Certification Mark should not be used on any item that is not built in accordance with all of the applicable requirements of the Code or Standard. Use of ASME's name, logos, or Certification Mark requires formal ASME certification; if no certification program is available, such ASME markings may not be used. (For Certification and Accreditation Programs, see Articles produced by parties not formally certified by ASME may not be described, either explicitly or implicitly, as ASME certified or approved in any code form or other document. STANDARD FOR WELDING, BRAZING, AND FUSING PROCEDURES; Welders; BRASEROS; AND WELDING, BRAZING, AND FUSING OPERATORS ASME Boiler and Pressure Vessel Committee Brazing, and Fusing AN INTERNATIONAL CODE 2017 ASME Boiler and Pressure Vessel Code 2017 Edition July 1, 2017 Two Park Avenue New York, NY 10016 USA Date of Issuance: July 1, 2017 This international code or standard was developed under accredited procedures as meeting U.S. national standards and is a U.S. national standard. The Standards Committee that approved the code or standard was balanced to ensure that competent and relevant persons of interest had the opportunity to participate. The proposed code or standard has been made available to the public for public review and to provide an opportunity to obtain additional input from industry, academia, regulators and the general public. ASME does not approve, evaluate or approve any element, construction, proprietary device or activity. 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The American Society of Mechanical Engineers Two Park Avenue, New York, NY 10016-5990 Copyright 2017 by The AMERICAN SOCIETY OF MECHANICAL ENGINEERS All rights reserved for the list of articles. . x Foreword . xi Statement of the policy on the use of the certification mark and code authorization in advertising . 14 Throdation of the ASME Marking Policy to identify manufactured items. xiv Submittal technical investigations to the standards committees of boilers and vessels under pressure . 16th Person. xviii Introduction . xxvii Summary of Changes . xl List of changes to the file number order . xlvii Cross-Reference and stylistic changes in the Code of boilers and ships under pressure . i Part HQ General Requirements . 1QG-100 Range . 1QG-109 Definitions . 4 Part QW Welding . 15 Article I Welding General Requirements . 15QW-100 Range 15QW-110 Welded Orientation . 15QW-120 Test positions for groove welds. 15QW-130 Test stations for net welds. 16QW-140 Types and purposes of testing and examinations . . 16QW-150 Tension Tests . 17QW-160 Guided Bend Tests . 18QW-170 Toughness Tests . 19QW-180 Filler Weld Tests . 19QW-190 Other tests and examinations . 21 Article II Welding Procedure Qualifications . 28QW-200 General . 28QW-210 Preparing the test coupon . 31QW-220 Variables of the hybrid welding procedure. 32QW-250 Welding Variables . 33QW-290 Character Bead Welding . 66 Article III Welding Performance Qualifications . . 70QW-300 General . 70QW-310 Qualifying Test Coupons . 72QW-320 Tests and qualification renewal. 73QW-350 Welding Variables for Welders . . 74QW-360 Welding Variables for Welding Operators. 75QW-380 Special Processes . 76 Article IV Welding Data . . 78QW-400 Variables 78QW-410 Technique . 88QW-420 Base metal groups . 92QW-430 FN numbers . 163QW-440 Welded Metal Chemical Composition . 174QW-450 Species . 175QW-460 Graphics . 180ii QW-470 Essential processes and reagents . 224 Article V Standard Welding Procedure Specifications (SWPSs) . 4 comments 0 gostaram Estat-sticas Notas Seja a primeira pessoa a gostar disto 1. T there significant changes that ap-pear in ASME Boiler and Pressure Vessel Code, Section IX, 2017 Edition, are discussed here. All changes can be easily identified in the Change Sum at the front of Section IX. These changes become mandatory on January 1, 2018 for the new qualifications. Global Editorial Reviews Changes to paragraphs or figures in this edition of Section IX can be quickly identified by 17 in the margins; while most changes are easy to discern when reading a paragraph, in this edition there are more than 100 cases where affected heat has been changed to heat affected, reverse slash (/) has become or and armored metal arch has become armored metal arc. In addition, because there are hardness measurement methods other than Charpy testing (e.g., drop weight and crack tip opening displacement (CTOD), the words impact test and notch hardness have been generally changed to simply robustness test. Part HQ, General Requirements Codes, Standards and Specifications that incorporate the reference to Section IX by sometimes have different requirements than those in Section IX; HQ-100 indicates documents that refer to Article IX take pre-dence on Article IX requirements. The last two paragraphs of HQ-101 were deleted because they had this upside down. They incorrectly stated that Section IX can be used with other sections of the Boiler Code and ASME B31, Pressurized Piping Code, and merely suggested that all the rules of these standards of re-garding welding qualification be taken into account. For those involved in the simultaneous qualification of welders, HQ-106.3 has been revised editorially to make it easier to read; no significant changes have been made. An definition for leak gas has been added to HQ-109: Trailing Gas: a gas used to produce a atmosphere that extends be-yond the welding pool in the direction oppo-detravel site. This addition has resulted in some mid- or editorial changes to some of the QW-408 variables. In the last sentence of HQ-105.5, the 2015 edition stated the requalification 42 WELDING JOURNAL / AUGUST 2017 What's New in the ASME Boiler and Pressure Vessel Code Section IX This summary details the changes made to the 2017 edition of A welder using the Putnam road pass. BY WALTER J. SPERKO 2. was necessary if a modification was made to the variables of the special welding processes of the overlay resistant to corrosion or corrosion. This incorrectly stat-ed that essential and non-essen-tial variables should be requalified if they were modified. Since QW-251.4 already correctly states that only changes in essential variables require requalification, the last sentence of HQ-105.5 has been deleted. Welding Procedure (QW-200) Changes QW-200.4(b) provides some relief to QW-200.4(a) requirements to comply with the base metal thickness range and the thickness limits of QW-451 welded metals. This paragraph allows you to write, for example, a combined WPS supported by a qualified PQR for the first 3 base metal joint processes 16 to 8 inches thick, and a second PQR for a second qualified process on a test coupon at least 1/2 inch thick to support a WPS that allows both processes to be used to weld base metals from 16 to 8 inches thick. QW-200.4(b) was also misinterpreted as a requirement in addition to the QW-451 requirements. To make it clear that QW-200.4(b) is an exception to QW-451 re-quirements, the following sentence was moved from the middle of QW-200.4(a) at the beginning of QW-200.4(b): Alternatively, the qualification of WPS for root deposits only can be made in accordance with (b). There are occasions when corro-zionist welding metal overlay has been added to one part and the construction requires welding another part to this overlay following a different WPS. Since the overlay has no p-number assigned to it, a new paragraph has been added to the QW-211 al-lowing welding metal overlay to be con-sidered as the same P-Number as any base metal having a nominally match-ing chemical analysis as the overlay. Although there are many editorial changes to the tables in QW-250, the nonessential variable QW-409.8 has been added to special process tables for overlay welding. This variable requires that the current type and polarity be dressed on the STP. Those who weld repair moulds and those who weld on other thick compo-nents QW-407.4 has been removed. This variable limited the thickness of the qual-ified base metal to 1.1 times the thickness of the test coupon if the weld is treated with heat above the upper tem-perature (e.g., standardized) processing. QW-407.1 already requires that any thermal thermal treatment the upper processing temperature is qualified, so 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, low-density (LLBW) laser beam welding, has been added as QW-264.2, and details have been added in various other para-graphics, including a process definition and a new method of measuring heat input during its use. Although similar to ordinary laser beam welding (LBW), in LLBW the beam does not develop a keyhole and penetrates deep into the material. On the contrary, the beam is of low power and behaves more like gas tungsten arc welding than laser beam welding. The welds are made by adding heated filling metal to the resistance; the process will be used in the construction of the ship with a deep and very narrow groove, reducing the distortion as well as the amount of welding metal needed to do the job. For those who do temper the bead-ing weld, a fourth column C has been added to the temperamental bead variables in table QW-290.4 for use where the construction code specifies neither hardness test nor hardness test. When the character beads rules were added to Dry iXin 2001, it was expected that the sections I and B31.1 committees would specify the hardness requirements when they light up the character beads, but this never happened. Temperature and interpass warm-up requirements for each pass, as required by QW-406.8 and QW-406.9, have been removed. The committee decided that these requirements were excessive. The QW-290.5(d) requirements were removed to test character bead coupons when impact tests were specified. The revision di-rects now the qualifier for the impact test rules in the building code or design specification. QW-403.6 is an additional es-sential variable that limits the mini-mum thickness of qualified base metal to the thickness of the test coupon or 5-8in., depending on the least. For thicknesses less than 1/4 inch (6 mm), the minimum qualified thickness is 1/2 the thickness of the base metal (i.e. 1/2 T). The test coupon had to be less than 1/4 inch (6 mm) to take advantage of the 1/2T rule; it-fore, organizations would resort to purchasing 1/4-in.- (6-mm-) thick material and machining or grinding 0.010 inches (0.25 mm) or more on a surface to make the test coupon 0.24 inches (5.75 mm) thick. To address the need for this nonsense, QW-403.6 has been revised to say 1 inch (6 mm) or less. 4 When performing a voltage test we-ing a rectangular, the width of the test sample in the IXis section specified as about 3/4in. (16 mm); this is different from many other standards such as AWS D1.1 and ISO 15614-1, which specify that the width of the specimen is 1 inch (25 mm) wide in the rededuce section. If an organization wants to qualify to meet Section IX re-quirements and also other Stan-dard requirements on a single test coupon, an additional set of voltage tests had to be prepared. In this edition, voltage test samples that meet the dimensional requirements of any of the following standards may be used; however, the stan-dard acceptance 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) FR-ISO 4136 g) JIS Z3121 h) GB/T2651 j) NAVSEA S9074 AQG B010/248. You will find that QW-402.30, QW-403.31, and QW-404.54 have been removed and you will have a hard time knowing which process was affected. Looking at the 2015 edition will not answer this question because they were variables that were part of the QW-268 table, but were part of the QW-269 table, with the preparation of the weld on the hull, head or operating hose), the qualified range of Table QW-452.3 must be based on the hull, the head or operating hose O.D. QW-322 on the continuity of qualification (i.e. the six-month rule) has been facilitated to read, but there is no change in requirements — welders and welding operators still have to use a process and the organization must document it every six months — or all of its qualifications for this process expire. Base metals and filling materials Some 26 new specifications and 82 new material categories were assigned p-numbers. A new metal filling specification has been added: SFA-5.36, Carbon and Low-Alloy Steel Electrodes for Flux Cored ArcWelding and Metal Cored Elec-trodes for Gas Metal ArcWelding. This standard will replace SFA 5.20 and 5.29 classifications, and contains an entirely new and more informative system for the allocation of AWS classifications. Nei-ther SFA-5.20 or SFA-5.29 will be withdrawn for five years since many manufacturers and suppliers have materi-als made to these specifications in stock and give the industry an op-portunity to familiarize itself with the new classification system and incorporate them into existing wpps. Meanwhile, electrode manufacturers will identify their products with the two clas-sification systems in order to you can get used to the new classification system. When you have ASME Section II, Part C in hand, read the foreword to sfa-5.36 for an in-depth discussion of the new classification system. Brazing Changes (QB) The only technical change in brazing was a revision of the QB-1 variable. Instead of postbrazing thermal treatment (PBHT) QB-1. Instead of reading the same welding rules as he did for decades, only two conditions 1) Adding or removing a postbrazing heat treatment. 44 WELDING JOURNAL / AUGUST 2017 Altered curvature test specimen. 4. 2) Change in post-brazing thermal treatment temperature over ± 25 degrees F (± 14 degrees Fahrenheit) or a change in post-brazing thermal treatment time of more than 15 minutes or 10% of the post-brazing thermal treatment time recorded on the PQR. Plastic Fusion (QF) Changes Paragraph QF-143 and Figure QF- 463 have been modified to correct the curvature angle for lateral curvature specimens. This angle has been changed from a maximum included angle of 60 ± 10 deg to 90 ± 10 deg to be compatible with the ASTM F3183 specification, standard practice for guided lateral curvature assessment of polyethylene pipe butt-fusion joints. Interpretations of the Inquiry are no longer published as part of the edition; they can be found at Interpretations.cfm. Possible Coming Attractions Low-energy discharge welding (LECD) is added to Section IX. Lecd welding is used for at-tach thermocouple leads to piping to document preheating temperatures and post-anneal heat treatment. The rules re-quire that a WPS be prepared, but the qualification of the WPS is not re-quired, nor will the operators have to be qualified. There is an ongoing move to add more detailed visual examination re-stretches for welder test coupons. The current requirements are that incom-plete fusion, incomplete penetration, and cracks are not allowed. Section IX does has no additional requirements because organizations work according to different building codes, and the criteria for visual acceptance vary from code to code. This leaves the door open for organizations to impose acceptance criteria on their welders that are consistent with what welders will need to achieve when working on these other codes. The driving force behind this change is that some or-ganizations do not consider crite-ria, except what is in section IX, resulting in welders who are qualified but not very qualified. This proposal is very resilient. Readers are informed that ASME Code Committee meetings are open to the public; The schedule is available on the author's website and asme.org. Errata and editorial corrections are displayed asme.org/kb/standards/publications/bpvc-resources so that code users can easily see revisions and corrections. WJ WALTER J. SPERKO, P.E. (sperko@asme.org), is President, Sperko Engineering Services Inc. (sperkoengineering.com), Greensboro, N.C. He is also a general director of AWS. Readers are informed that the opinions expressed in this article are those of Sperko, and not the official opinion of ASME BPV Standards Committee IX. For more information, visit aws.org/dindex August 2017/ WELDING JOURNAL 45 45 45

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