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THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

NATIONAL BOARD SUBCOMMITTEE REPAIRS AND ALTERATIONS

MINUTES

Meeting of July 17th, 2019
Kansas City, MO

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The National Board of Boiler & Pressure Vessel Inspectors
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1. **Call to Order**
   Chairman Rob Trout called the meeting to order at 8:03 AM.

2. **Introduction of Members and Visitors**

   The attendees are identified on the attendance sign in sheet (**Attachment 1**). With the attached attendance listing, a quorum was established.

3. **Announcements**
   Announcements were made to the Subgroup by Secretary, Terrence Hellman.

4. **Adoption of the Agenda**
   a. The Agenda was amended by the following:
      - **i.** Added Action Item 19-55
      - **ii.** Added PM's to all Interpretation Items
      - **iii.** Added Keith Cummins for reappointment to TG Graphite
      - **iv.** Added Kathy Moore to Membership Nominations for TG Historical
      - **v.** Changed the Description of Action Item 19-53 from "Record Retention".
      - **vi.** Added Officer Appointments of G. Mark Ray (Chair) and Rick Musser (V. Chair) for TG Loco.

   The above revisions were made to the agenda and a motion was made to adopt the agenda as revised. The motion was seconded and unanimously approved

5. **Approval of the Minutes of the January 16th, 2019 Meeting**

   A motion was made to approve the minutes from the January 16th, 2019 NBIC meeting. The motion was seconded and unanimously approved.

6. **Review of Rosters (Attachment 2)**
   a. **Membership Nominations**
      - **i.** Patricia Becker – SC Repairs and Alterations (Interest Category – Manufacturer)
      - **ii.** Michael Quisenberry – SC Repairs and Alterations (Interest Category – Certificate Holder)
      - **iii.** John Siefert – SC Repairs and Alterations (Interest Category – General Interest)
      - **iv.** Paul Shanks – SG & SC Repairs and Alterations (Interest Category – AIA)
      - **v.** Tim McBee – SG & SC Repairs and Alterations (Interest Category – AIA)
      - **vi.** Robert Underwood – SG Repairs and Alterations (Interest Category – AIA)
      - **vii.** Nolan Lee and Richard Bulgin – SG Graphite
      - **viii.** John Eihusen, Brian Linnemann, Allen Beckwith, and Bill Holtzlaw – TG FRP
      - **ix.** Kathy Moore – TG Historical

   The Subcommittee discussed the nominees and a motion was made to approve all nominations. The motion was seconded and unanimously approved.

b. Membership Reappointments

- **i.** Mr. Jim Pillow and Mr. Ray Miletti both have memberships to SC R&A that expire on 7/31/2019.
- **ii.** Mr. Francis Brown and Ms. Debra McCauley are up for reappointment to TG FRP. Their reappointments were approved by a vote at the subgroup level.
- **iii.** Mr. Linn Moedinger and Mr. Matthew Janssen are up for reappointment to TG Locomotive.
- **iv.** Mr. Francis Brown, Mr. Justin Clemens, and Mr. Keith Cummins are up for reappointment to Subgroup Graphite. Their reappointments were approved by a vote at the subgroup level.

The Subcommittee discussed the nominees and a motion was made to approve all nominations. The motion was seconded and unanimously approved.

c. Officer Appointments

- **i.** TG Locomotive elected G. Mark Ray as Chair and Rick Musser as Vice Chair at their meeting.

7. Interpretations

Item Number: 17-143	**NBIC Location: Part 3**	**Attachment 3**
General Description: Can an "R" stamp certified shop manufacture and use parts for use on the pressure boundary to complete the repair of a boiler? **Subgroup:** Repairs and Alterations **Task Group:** Paul Welch (PM), Linn Moedinger **Nazo January 2019 Meeting Action:** Progress Report: Mr. Moedinger gave a progress report that work is still being done on the item and it will be put out to Letter Ballot to Repair and Alteration SG. **Meeting Action:** Mr. Moedinger presented.. After discussion on the reference to Part 3 3.2, the proposal was revised and then motioned, seconded, and unanimously approved.		

Item Number: 18-34	**NBIC Location: Part 3, 8.4**	**Attachment 4**
General Description: Does an R certificate holder assume responsibility for safety/integrity of a vessel outside the scope of repair? **Subgroup:** Repairs and Alterations **Task Group:** Nathan Carter (PM(, Michael Quisenberry **January 2019 Meeting Action:** Progress Report: Mr. Nathan Carter reported that the Task Group is awaiting comment from the National Board's legal representation on this Item. **Meeting Action:** Mr. Hellman presented National Board's legal response that this is outside the scope of the NBIC. A proposal to respond to the inquirer that this is outside the scope of the NBIC with reference to Interpretations 95-17 and 95-14 to be made under line (off record) was motioned, seconded, and unanimously approved.		

Item Number: 18-53	NBIC Location: Part 3	Attachment 5

General Description: Is changing the corrosion allowance noted on the original Manufacturer's Data Report considered an alteration per NBIC, when this task is performed solely for the purpose of establishing minimum required thicknesses on an internal Owner / User mechanical integrity database?

Subgroup: Repairs and Alterations

Task Group: Brian Boseo (PM)

January 2019 Meeting Action: Progress Report: Mr. Boseo presented that there has been no response from the inquirer for more information. Mr. Boseo stated that one more attempt will be made to request more information, and if no response is received by the July 2019 meeting, this item will be closed.

Meeting Action: Mr. Boseo stated that there has been no response from the inquirer. A motion to close with no action was made, seconded, and unanimously approved.

New Interpretation Requests:

Item Number: 19-4	NBIC Location: Part 3, 3.2	Attachment 6

General Description: Use of Different Editions of the Construction Code for Repair or Alteration

Subgroup: Repairs and Alterations

Task Group: M. Quisenberry – PM

Explanation of Need: Try to resolve if there should be a restriction to different editions of the code of construction.

Meeting Action: Mr. Quisenberry presented, and after discussion, the inquirer (G. Galanes) withdrew the question. A motion to close with no action was made, seconded, and unanimously approved.

Item Number: 19-5	NBIC Location: Part 3, 3.2.6	Attachment 7

General Description: Reference to Other Codes and Standards

Subgroup: Repairs and Alterations

Task Group: B. Morelock – PM

Explanation of Need: Repair Methodology proposed by user is rejected by AI as there are no codes, standards, and practices available to support repair method.

Meeting Action: Mr. Rick Sturm presented. Mr. Paul Edwards commented that Q1 was consulting and focus should only be on Q2. After much discussion, the proposal was revised, motioned, seconded, and unanimously approved.

Item Number: 19-10	NBIC Location: Part 3, Introduction, paragraph on Interpretations	Attachment 8

General Description: Allow interpretations to be used in any edition, provide the same wording

Subgroup: Repairs and Alterations

Task Group: Kathy Moore – PM

Explanation of Need: NBIC currently limits each interpretation to the edition it was issued for. However often time the words in question do not change from one edition to another. At present a new interpretation would be needed for each edition of the NBIC to address the same issues, this is a delay to field work and a drain on NBIC committee time.

Meeting Action: Ms. Kathy Moore presented the item. Mr. Paul Edwards referenced Interpretation 95-20 as answering this item. A motion was made to approve this Item and send to Subcommittees for Part 1, Part 2, and Part 4 for their comment. The motion was seconded and unanimously approved.

Item Number: 19-17	NBIC Location: Part 3, S1.2.11.3	Attachment 9

General Description: Wastage at Mudring: If the majority of the wastage is on the fireside, and there minimal wastage on the waterside, does this section still govern repairs?

Subgroup: Locomotive

Task Group: L. Moedinger – PM

Explanation of Need: This question is in regards to a CFR 230, 1472 day boiler inspection on a 1927 built Baldwin 4-8-4 steam locomotive. The door sheet (aka back sheet) in the firebox has sustained wastage at the mudring on the fireside, caused by the proximity of the firebrick. In the figure S1.2.11.3, the drawing indicates a wastage on the waterside, yet the text of section S1.2.11.3 does not specify if it is referring to the waterside, the fireside, or both. Please see attached diagram of the wastage in question.

Meeting Action: Mr. Moedinger presented. After discussion, the proposal was amended, motioned, seconded, and unanimously approved.

Item Number: 19-20	NBIC Location: Part 3, 3.3.4.2 e)	Attachment 10

General Description: Use of Heli-Coils for repairs and alterations of PRI's

Subgroup: Repairs and Alterations

Task Group: N. Carter – PM

Explanation of Need: Paragraph 3.3.4.2e) states that defective bolting shall not be repaired but shall be replaced with suitable material that meets the specification of the original code of construction. When a bolt head is broken off leaving the bolt threaded in the RPI, a Heli-Coil is normally used to fix the problem. The problem with a Heli-Coil, is that there types made of different materials. NBIC requires material used to be in accordance with the Code of Construction. Also, needed to be taken into consideration would be threading calculations to verify acceptable pressure retention of the RPIs MAWP.

Meeting Action: Mr. Tim McBee presented. A motion was made to respond to the inquirer with reference to Interpretation 04-19 and close. The motion was seconded and unanimously approved.

Item Number: 19-25 **NBIC Location: Part 3, 4.4.2 c)** **Attachment 11**

General Description: NDE methods to do in lieu of Hydro test

Subgroup: Repairs and Alterations

Task Group: J. Seifert – PM

Explanation of Need: For ASME BPV Section VIII Division 2 Vessel is under Alteration with Re-rate of lowering MAWP & increasing of Design Temperature & there is no physical alteration in the Vessel but only change is in the Alteration design report because of different design stress intensity value at higher design temperature.

Meeting Action: Mr. J. Siefert presented. A motion to accept the proposal was made, seconded, and unanimously approved.

Item Number: 19-26 **NBIC Location: Part 3, 3.3.2** **Attachment 12**

General Description: Clarification on welding repairs on appendages

Subgroup: Repairs and Alterations

Task Group: P. Shanks – PM

Explanation of Need: The original submitter of this item will sometimes need to perform a welding repair on an appendage (not on the tank itself) in order for the complete process of refurbishment to be done for their customers' expectations. There appears to be no direct reference to these types of minor welding repairs for the refurbishment process in the NBIC code.

Meeting Action: Mr. P. Shanks presented. After discussion, the proposal was revised, and a motion to accept the amended proposal was made, seconded, and unanimously approved.

Item Number: 19-34 **NBIC Location: Part 3, 3.2.2 e)** **Attachment 13**

General Description: Is it the intent of Part 3, 3.2.2 e) that the reference to the original code of construction is for determining the hydrostatic test pressure?

Subgroup: Repairs and Alterations

Task Group: P. Edwards – PM

Explanation of Need: NBIC Part 3 Section 3 paragraph 3.2.2 e) (shown below) states that replacement parts shall receive a pressure test as required by the original code of construction. The original submitter is concerned that this clause is not being interpreted consistently by all users of the NBIC. The words in question are "…as required by the original code of construction." ASME issued interpretation I-16-1 (shown below) and revised PW-54 to clarify that Section I does not contain requirements for the hydrostatic testing of replacement parts provided for an existing unit. Based on this, the words "… as required by the original code of construction." Could be interpreted to mean that pressure testing of the parts is not required because Section I does not require testing of replacement parts. The submitter does not think that was the Committee's intent when clause e) was added to 3.2.2. Linking the words "original code of construction" to the test pressure would eliminate the potential interpretation that testing is only required when the original code of construction specifically requires testing of replacement parts.

Meeting Action: Mr. P. Edwards presented and stated he would open a new Action Item to revise paragraph 3.2.2 e). The proposed reply for this Interp. Item was motioned, seconded, and unanimously approved.

Item Number: 19-35	**NBIC Location: Part 3, 2.5.2 and 3.4**	**Attachment 14**

General Description: POST WELD HEAT TREATMENT- ALTERATION-Part 3- 3.4 & 2.5.2

Subgroup: Repairs and Alterations

Task Group: J. Pillow – PM

Explanation of Need: An R Certificate Holder is Doing Repair Work on the Shell Side of Heat Exchanger, which was not PWHT Earlier. As per Client Request, Welded Joints are Post weld Heat Treated and Consider as Alteration, Client wants Shell Side to Under Go Full Post weld Heat Treatment Including areas not repaired. NDE is being Carried out for Complete Equipment and Client wants PWHT for Welds which are in Services and without any repairs.

Meeting Action: Mr. Rick Sturm presented a response to the inquirer with reference to Interpretation 13-06. A motion to send the response and close the Item was made, seconded, and unanimously approved.

Item Number: 19-36	**NBIC Location: Part 3, 3.3.2 & 3.3.5**	**Attachment 15**

General Description: Routine Repairs of VIII Div 2 and Div 3 PV

Subgroup: Repairs and Alterations

Task Group: J. Pillow – PM

Explanation of Need: Para 3.3.2 talks about requirements for and examples of routine repairs. It does not specify any restrictions on pressure retaining items construction Code. It states that Routine repairs are repairs for which the requirements for in-process involvement by the Inspector and stamping by the "R" Certificate Holder may be waived as determined appropriate by the Jurisdiction and the Inspector. It states that all other applicable requirements of this code (NBIC) shall be met. Para 3.3.5.1 of NBIC states that the following requirements shall apply for the repair of pressure vessels constructed to the requirements of Section VIII, Division 2 or 3, of the ASME Code. This calls for properly Certified repair plan to be submitted to the Inspector who will make acceptance inspection and sign R-1 Form.

Meeting Action: Mr. P. Edwards presented. After discussion, the proposal was revised, and a motion to accept the amended proposal was made, seconded, and unanimously approved.

Item Number: 19-42	NBIC Location: Part 3, 3.3.3 s) & 3.4.4 g)	Attachment 16

General Description: 3.3.3 s design intent clarification vs 3.4.3 g

Subgroup: Repairs and Alterations

Task Group: P. Shanks – PM

Explanation of Need: The design requirement in 3.3.3 s) is not well defined and is allowing potentially unsafe material changes to be conducted as repairs without adequate assessment.

Meeting Action: Progress Report: Mr. P. Shanks presented a progress report.

Item Number: 19-44	NBIC Location: Part 3, 1.6.6.2,1.6.7.2, 1.6.8.2	Attachment 17

General Description: ISO/IEC 17025 Revision

Subgroup: Repairs and Alterations

Task Group: R. Troutt – PM

Explanation of Need: Many, if not all calibration labs are already accredited to ISO/IEC 17025:2017 and will be required to by 2020. No lab will bother accreditation to 2005 after that, so finding a calibration house will be difficult.

Meeting Action: Mr. P. Edwards presented, and a motion to accept the proposal was made, seconded, and unanimously approved.

8. Action Items

Item Number: NB15-1405	NBIC Location: Part 3, 1.2	Attachment 18

General Description: Impact testing of P-11B Material

Subgroup: Repairs and Alterations

Task Group: N. Carter (PM), P. Davis, G. Galanes, P. Shanks

History: In January 2015 Mr. Wielgoszinski provided a report. After consideration, Mr. Wielgoszinski decided to withdraw the inquiry (IN14-0401) and requested a new item to address impact testing of P11B material. A motion was made to close this interpretation and open up an action Item.
The new action item will be: **NB15-1405 Part 3-Impact testing of P-11B Material,** (From IN14-0401) This Item has not been included in the minutes or agendas since July 2015. On 01/15/2019, this item was put back on the SG R&A Agenda and a new task group was formed.

January 2019 Meeting Action: Progress Report: On 01/15/2019, this item was put back on the SG R&A Agenda and a new task group was formed.

Meeting Action: Progress Report: Mr. G. Galanes presented a progress report.

Item Number: NB15-2208	NBIC Location: Part 3	No Attachment

General Description: Develop supplement for repairs and alterations based on international construction standards

Subgroup: Graphite

Task Group: Greg Becherer (PM)

January 2019 Meeting Action: Progress Report: No information was received from Graphite Subgroup at the time of this meeting. No action taken.

Update from SG Graphite: A proposal is still in development for this item.

Meeting Action: Progress Report: Mr. Monty Bost presented a progress report.

Item Number: NB16-1402	NBIC Location: Part 3	Attachment 19

General Description: Life extension for high pressure vessels above 20 years

Subgroup: FRP

Task Group: M. Gorman (PM)

January 2019 Meeting Action: Progress Report: No information was received from FRP Subgroup at the time of this meeting. No action taken.

Update: Item was approved by Subgroup FRP and is awaiting review and approval from the subcommittee.

Meeting Action: Mr. Trout motioned to have this item sent to SC Repairs and Alterations via Letter Ballot for a vote. The motioned was seconded and unanimously approved.

Item Number: NB16-1403	NBIC Location: Part 3, S4	Attachment 20

General Description: Add information on repair of high pressure vessels.

Subgroup: FRP

Task Group: N. Newhouse (PM)

January 2019 Meeting Action: Progress Report: No information was received from FRP Subgroup at the time of this meeting. No action taken.

Update: This item was approved by SG FRP via letter ballot in June.

Meeting Action: Mr. Trout motioned to have this item sent to SC Repairs and Alterations via Letter Ballot for a vote. The motioned was seconded and unanimously approved.

Item Number: NB16-1502	NBIC Location: Part 3	No Attachment

General Description: Develop supplement for repairs and alterations based on international construction standards

Subgroup: SG Repairs and Alterations

Task Group: International Repair Supplement Task Group, Chuck Withers (PM)

January 2019 Meeting Action: Progress Report: Mr. Withers was not present and could not present the item. No action taken.

Meeting Action: Progress Report: Mr. Withers was not present and could not present the item. No action taken.

Item Number: 17-134	NBIC Location: Part 3, Section 5	No Attachment

General Description: Proposed Revision for registration of Form R-1 with the National Board containing ASME pressure part data reports attached.

Subgroup: Repairs and Alterations

Task Group: P. Shanks (PM), Rob Troutt, Joel Amato, Kathy Moore, Paul Edwards

January 2019 Meeting Action: Progress Report: P. Shanks gave a progress report.

Meeting Action: Progress Report: P. Shanks gave a progress report.

Item Number: 17-137	NBIC Location: Part 3, S4.18.2	Attachment 21

General Description: Remove "sand" blasting and replace with "abrasive" in Part 3, S4.18.2

Subgroup: FRP

Task Group: Terry Cowley

January 2019 Meeting Action: Progress Report: No information was received from FRP Subgroup at the time of this meeting. No action taken.

Meeting Action: Progress Report: Title on the Attachment shows “18-41”. This will be sent back to FRP TG to verify the attachment is correct for Item 17-137.

Item Number: 17-166	NBIC Location: Part 3, S3	Attachment 22

General Description: Remove nozzle replacement and tube replacement from graphite routine repair list.

Subgroup: Graphite
Task Group: Francis Brown (PM)

January 2019 Meeting Action: Progress Report: No information was received from Graphite Subgroup at the time of this meeting. No action taken.
Update: Item was approved unanimously by Subgroup Graphite at their March 2019 meeting.

Meeting Action: Mr. M. Bost presented. After discussion, the proposal was revised, and a motion to accept the amended proposal was made, seconded, and unanimously approved.

Item Number: 17-167	NBIC Location: Part 3, S3.2 d)	No Attachment

General Description: Clarify repair inspection requirements for machined only graphite parts.

Subgroup: Graphite

Task Group: Aaron Viet (PM)

January 2019 Meeting Action: Progress Report: No information was received from Graphite Subgroup at the time of this meeting. No action taken.

Update: Work is still being done to develop a proposal for this item.

Meeting Action: Progress Report: M. Bost gave a progress report.

Item Number: 18-12	NBIC Location: Part 3	Attachment 23

General Description: Adding Weld Buildup to WM #6

Subgroup: SG Repairs and Alterations

Task Group: John Siefert PM, George Galanes

January 2019 Meeting Action: Mr. George Galanes presented that this Item was opened at the January 2018 meeting and the proposed revision to Welding Method 6 to limit weld build up to 100 square inches on only Grade 91 tubes. A motion was made to put the proposal out to Subgroup Repairs & Alterations and Subcommittee Repairs & Alterations for Review and Comment. The motion was unanimously approved.

Meeting Action: Mr. J. Siefert presented. After discussion, the proposal was revised, and a motion to accept the amended proposal was made, seconded, and unanimously approved.

Item Number: 18-13	NBIC Location: Part 3	Attachment 24

General Description: Weld Methods 7 addition for dissimilar weld metal-Gr. 91.

Subgroup: SG Repairs and Alterations

Task Group: John Siefert PM, George Galanes

January 2019 Meeting Action: Mr. George Galanes presented that this Item was opened at the January 2018 meeting and the proposed addition of a Welding Method 7. Welding Method 7 is being introduced to permit dissimilar metal weld repair with no PWHT between Grade 91 boiler tubes to austenitic steels and low alloy ferritic steels. This action permits DMW of Grade 91 tubes within the boiler setting following welding method 6 with no PWHT. A motion was made to put the proposal out to Subgroup Repairs & Alterations and Subcommittee Repairs & Alterations for Review and Comment. The motion was unanimously approved.

Meeting Action: Mr. J. Siefert presented this Item has already been through a SC R&A Review and Comment Letter Ballot. Mr. Siefert motioned to have this submitted to SC R&A for a vote via Letter Ballot concurrent with a Review and Comment Letter Ballot to Main Committee. The motion was seconded and unanimously approved.

Item Number: 18-65	NBIC Location: Part 3, Section 3	No Attachment

General Description: Draft rules for "used" material in repairs and/or alterations.

Subgroup: SG Repairs and Alterations

Task Group: Jamie Walker – PM, Marty Toth, Pat Becker, Michael Quisenberry, Issac Osborn, Paul Shanks, R. Underwood

January 2019 Meeting Action: Progress Report: Mr. J. Walker presented a progress report. As a result of Interpretation Item 18-30, the SG decided to open this Item to draft rules for "used" material utilized in repairs and/or alterations.

Meeting Action: Progress Report: Mr. Jamie Walker gave a progress report.

Item Number: 18-66	NBIC Location: Part 3, Section 5	No Attachment

General Description: Move Report Forms to a new Supplement.

Subgroup: SG Repairs and Alterations

Task Group: Marty Toth – PM, Ben Schaefer

January 2019 Meeting Action: Progress Report: B. Schaefer presented a Progress Report on ongoing work to move the Reports of Repair and their instructions to a new Supplement.

Meeting Action: Progress Report: Mr. B. Schaefer gave a progress report.

Item Number: 18-75	NBIC Location: Part 3	Attachment 25

General Description: Flush patches in stayed and un-stayed areas of tubesheets

Subgroup: SG Repairs and Alterations

Task Group: Michael Quisenberry (PM), Kathy Moore, Marty Toth, Rick Sturm

January 2019 Meeting Action: M. Quisenberry presented a revision to Part 3, Section 3, paragraph 3.3.4.6 incorporating verbiage from Supplement 1.2.11.2 for historic boilers to address flush patches and using NDE alternatives to volumetric methods. A motion was made and unanimously approved to have this proposal submitted via Letter Ballot for Review and Comment to Subgroup Repairs & Alterations and Subcommittee Repairs & Alterations.

Meeting Action: Mr. M. Quisenberry presented. After discussion, the proposal was revised, and a motion to accept the amended proposal was made, seconded, and unanimously approved.

Item Number: 18-84	NBIC Location: Part 3, S1.2.8	No Attachment

General Description: Additional subparagraph in Part 3, S1.2.8 about the use of patch bolts being in accordance with ASME BPVC

Subgroup: Locomotive

Task Group: (R. Musser – PM)

Meeting Action: Mr. L .Moedinger presented the proposal, and a motion to accept the proposal was made, seconded, and unanimously approved.

Item Number: 18-85	NBIC Location: Part 3, 2.3 and Table 2.3	Attachment 26

General Description: For the SWPS AWS B2.1-1-233:2006, is the root or 1st pass using GTAW-S (Short Circuiting Transfer mode) allowed to be used in all positions?

Subgroup: Repairs and Alterations

Task Group: Jim Sekely (PM)

January 2019 Meeting Action: Mr. Sekely presented a revision to the SWPS summary verbiage in Table 2.3, satisfying the Inquirer's question. The interpretation was withdrawn by the Inquirer (Mr. Terrence Hellman) and a motion was made to have Item 18-85 presented to Subcommittee Repairs & Alterations as an Action Item to approve the proposed revision. The motion was unanimously approved.

Meeting Action: Mr. T. Hellman presented the proposal, and a motion to accept the proposal was made, seconded, and unanimously approved.

Item Number: 18-93	NBIC Location: Part 3, S3.2, S3.4 4.4.2 6)	No Attachment

General Description: Test Duration

Subgroup: Graphite

Task Group: J. Clements (PM)

January 2019 Meeting Action: Progress Report: No members from the Graphite Subgroup were present at the time of this meeting. No action taken.

Update: Work is being done to develop a proposal for this item.

Meeting Action: Progress Report: Mr. M. Bost presented a potential change of "30 minutes" to "10 minutes", but work was still being done on this Item.

Item Number: 18-94	NBIC Location: Part 3, S3.2 f), h); S3.4 a), b), c) etc.	No Attachment

General Description: G-mark Requirements for Various Repairs/Alteration to Graphite

Subgroup: Graphite

Task Group: C. Cary (PM)

January 2019 Meeting Action: Progress Report: No members from the Graphite Subgroup were present at the time of this meeting. No action taken.

Update: Work is being done to develop a proposal for this item.

Meeting Action: Progress Report: Mr. M. Bost presented a Progress Report.

Item Number: 18-95	NBIC Location: Part 3, S1.1.4	Attachment 27

General Description: Revision to Part 3, S1.1.4 to account for new rules for riveted construction

Subgroup: Locomotive

Task Group: (L. Moedinger – PM)

January 2019 Meeting Action: Progress Report: Mr. Moedinger presented work is still be done on this item. No action taken.

Meeting Action: Mr. Moedinger presented. After discussion, the proposal was revised, and a motion to accept the amended proposal was made, seconded, and unanimously approved.

Item Number: 18-100	NBIC Location: Part 3, 3.3.2	Attachment 28

General Description: Revision adding heat exchanger tubes with an outside diameter of ¾" or smaller to NBIC Part 3.3.2 Routine Repairs

Subgroup: Repairs and Alterations

Task Group: (David Martinez – PM), B. Schaefer, N. Carter

January 2019 Meeting Action: Progress Report: Mr. Martinez reported on a this item and presented interpretations (98-04 and 98-29) that may satisfy the revision request, however after a presentation from TEiC regarding the use of explosive welding of tubes to be considered as a routine repair, Mr. Martinez recommend this be considered progress report to continue working to address explosive welding as a Routine Repair.

Meeting Action: Mr. D. Martinez presented. After discussion regarding in progress ASME Code Case 17-2813, the proposal was revised, and a motion to accept the amended proposal was made, seconded, and unanimously approved.

Item Number: 18-102	NBIC Location: Part 3, Table 2.3	Attachment 29

General Description: Revise Table 2.3 in Part 3 to add the listed SWPSs that were revised by the AWS B2 Committee in 2018

Subgroup: Repairs and Alterations

Task Group: (Jim Sekely – PM)

January 2019 Meeting Action: Progress Report: Mr. Sekely presented a proposed addition of 8 SWPS into Table 2.3 that were revised by the AWS B2 Committee in 2018. After discussion, there was confusion regarding the formatting of the submitted revision. Mr. Sekely agreed to submit this as a Progress Report to allow formatting and metrification changes to be addressed prior to next meeting.

Meeting Action: Mr. T. Hellman presented and a motion to accept the proposal was made, seconded, and unanimously approved.

New Items:

Item Number: 19-11	**NBIC Location: Part 3, 9.1**	**Attachment 30**

General Description: Clarify Definition of Authorized Nuclear Inspection Agency (ANIA)

Subgroup: Repairs and Alterations

Task Group: Paul Edwards

Explanation of Need: An ANIA cannot be an Inservice AIA since Endorsements for nuclear inspectors are issued only to new construction AIA's. The requirements for qualified Authorized Nuclear Inspectors/Supervisors are clearly specified in NB-263, RCI-1. Therefore revision to the Glossary definition is needed to clarify this requirement for the NR Accreditation Program.

Meeting Action: Mr. Edwards presented changes to paragraph 1.6.3 in lieu of changes to the glossary that better clarified the definition of an ANIA. The proposal was motioned, seconded, and unanimously approved.

Item Number: 19-12	**NBIC Location: Part 3, 1.6.3 b)**	**Attachment 31**

General Description: Paragraph 1.6.3 – revise text to clarify Quality Assurance Program reqs

Subgroup: Repairs and Alterations

Task Group: Paul Edwards

Explanation of Need: Revise text to clarify Quality Assurance Program requirements for NR Cert holders.

Meeting Action: Mr. Edwards presented that the proposal passed the NR TaskGroup Letter Ballot. A motion to accept the proposal was made, seconded, and unanimously approved.

Item Number: 19-13	**NBIC Location: Part 3, 1.6.6.2 s), 1.6.7.2 s), & 1.6.8.2 s)**	**Attachment 32**

General Description: Revise text to clarify responsibilities for performing audits

Subgroup: Repairs and Alterations

Task Group: Paul Edwards

Explanation of Need: Revise text to clarify responsibilities for performing audits between the Certificate Holder and the AIA.

Meeting Action: Mr. Edwards presented that the proposal was revised and passed the NR TaskGroup unanimously. A motion to accept the proposal was made, seconded, and unanimously approved.

Item Number: 19-15	**NBIC Location: Part 3, 3.3.5.2 a)**	**Attachment 33**

General Description: ASME Section VIII Division 2 Class 1/Class 2 Distinction

Subgroup: Repairs and Alterations

Task Group: Paul Shanks

Explanation of Need: Engineering certification for repairs is an unnecessary cost when engineering certification is not required by the original code of construction.

Meeting Action: Mr. Shanks presented. After discussion, the proposal was revised, and a motion to accept the revised proposal was made, seconded, and unanimously approved.

Item Number: 19-16	**NBIC Location: Part 3, 3.3.2 e)**	**Attachment 34**

General Description: Reword to provide clarity; contradictory requirement Part 3; 3.2.2 e)

Subgroup: Repairs and Alterations

Task Group: T. White

Explanation of Need: This wording of this clause is causing confusion. The original submitter has had multiple instances where owners have requested to purchase welded replacement parts directly and read this clause with the belief that they can purchase a replacement part for in some cases a welded pressure part for an ASME Section I boiler and safe money by having the fabricator not Hydro test as per Section I even when it was not impractical to have the testing performed.

Meeting Action: Progress Report: Mr. White presented and referenced Interpretations 04-05 and 04-11, but he will continue to work on this Item.

Item Number: 19-19	**NBIC Location: Part 3, S4.2**	**Attachment 35**

General Description: Reword to provide clarity; contradictory requirement Part 3; 3.2.2 e)

Subgroup: FRP

Task Group: None assigned

Explanation of Need: The current use of the term "inspector" in S4.2 does not mean a Commissioned Inspector as defined in Section 9. Clarification is needed.

Update: A proposal is in development for this item.

Meeting Action: Mr. T. Hellman presented replacing the word “inspector” with “designee” as referenced in S4.2 to remove any confusion that the “designee” is not a NB Commissioned Inspector. A motion was made, seconded, and unanimously approved.

Item Number: 19-21	NBIC Location: Part 3, S2.11 a)	Attachment 36

General Description: Additional wording to S2.11 a).

Explanation of Need: The changes in the proposal were made in a document passed by SG Historical in July 2018, and somehow left off of the document that was submitted to R&A and to MC.

Subgroup: SG Historical

Task Group: B Underwood – PM

Meeting Action: Mr. Underwood presented and a motion to accept the proposal was made, seconded, and unanimously approved.

Item Number: 19-24	NBIC Location: Part 3, S6.16.4 b) 1)	Attachment 37

General Description: Supplement 6 to record the "R" number assigned to either R-1 or R-2.

Subgroup: Repairs and Alterations

Task Group: K. Moore
Explanation of Need: Paragraph S6.16.4 b) 1) currently only requires "R-1" forms to be registered with the National Board, however the paragraph should be for EITHER R-1 Forms OR R-2 Forms.

Meeting Action: Ms. Moore presented and a motion to accept the proposal was made, seconded, and unanimously approved.

Item Number: 19-27	NBIC Location: Part 3, S2.13.14.3-a	Attachment 38

General Description: Fusible Plug Repair Using Half Coupling Figure

Subgroup: SG Historical

Task Group: J. Amato

Meeting Action: Mr. J. Amato presented and a motion to accept the proposal was made, seconded, and unanimously approved.

Item Number: 19-31	NBIC Location: Part 3, Table 2.3	Attachment 39

General Description: Part 3 - Table 2.3 - Thickness Range Corrections

Subgroup: Repairs and Alterations

Task Group: J. Sekely

Explanation of Need: Thickness listed in Table 2.3 had different values than the AWS Standards.

Meeting Action: Mr. Hellman presented and a motion to accept the proposal was made, seconded, and unanimously approved.

Item Number: 19-32	NBIC Location: Part 3, 3.3.2 & 3.4.4	Attachment 40

General Description: Heater treater and or re-heater fire tubes

Subgroup: Repairs and Alterations

Task Group: R. Valdez

Explanation of Need: When heater treaters and some other similar equipment is constructed in accordance with section VIII div.1 an item called a fire tube is often removable (bolted) and should be part of the code boundary. In use these items are consumables and are replaced often with items not bearing the code markings or manufactured to code practices. This practice places the users and public in jeopardy and should be curtailed.

Meeting Action: Mr. Valdez presented that this Item failed SG R&A and motioned this Item be Closed with No Action. The motion was seconded, and unanimously approved.

Item Number: 19-43	NBIC Location: Part 3, 1.6.6.2, 1.6.7.2, & 1.6.8.2	Attachment 41

General Description: ISO/IEC-17025 Edition referenced in NR Section of Part 3

Subgroup: Repairs and Alterations

Task Group: Paul Edwards

Explanation of Need: References to "ISO/IEC-18025:2005" need to be changed to "ISO/IEC-18025:2017" to align with ASME Section III requirements in the following paragraphs: 1.6.6.2 m) 1), 1.6.6.2 m) 4) a), 1.6.6.2 m) 5) a), 1.6.7.2 m) 1), 1.6.7.2 m) 4) a), 1.6.7.2 m) 5) a), 1.6.8.2 m) 1), 1.6.8.2 m) 4) a), and 1.6.8.2 m) 5) a)

Meeting Action: Mr. P. Edwards presented and the proposal was revised during discussion. A motion to accept the proposal as amended was made, seconded, and unanimously approved.

Item Number: 19-47	NBIC Location: Part 3, 1.5.1 k)	No Attachment

General Description: Specify Welding, NDE and Heat Treatment requirements in 1.5.1 of Part 3

Subgroup: Repairs and Alterations

Task Group: R. Miletti

Explanation of Need: The Quality Control Elements of "welding, NDE, and Heat Treatment" need to have clear controls. Currently the paragraph really only references welding. NDE and Heat Treatment are only referenced by the last sentence in the paragraph, "Similar responsibility for nondestructive examination and heat treatment shall be described in the manual." Minimum controls or requirements for NDE or Heat Treatment need to be expressed in order for these elements to be auditable.

Meeting Action: Mr. Miletti presented that this Item and Item 19-48 should be “Closed with No Action” and that a new Action Item will be opened to address *all* elements listed within Part 3, 1.5.1. The motion to Close with No Action was seconded, and unanimously approved.

Item Number: 19-48	NBIC Location: Part 3, 1.5.1 l) & m)	No Attachment

General Description: Calibration, Examinations and Tests - 1.5.1 of Part 3

Subgroup: Repairs and Alterations
Task Group: B. Boseo – PM, P. Davis,

Explanation of Need: A review of all QC Elements in Section 1.5.1 in Part 3 of the NBIC needs to be done to verify that auditable controls and minimum requirements are understood and referenced within an "R" Cert. Holder's Quality System.

Meeting Action: Mr. Miletti presented that this Item and Item 19-47 should be "Closed with No Action" and that a new Action Item will be opened to address *all* elements listed within Part 3, 1.5.1. The motion to Close with No Action was seconded, and unanimously approved.

Item Number: 19-50	NBIC Location: Part 3, 3.3.4.3 e) 3) l)	Attachment 42

General Description: Revising Part 3, 3.3.4.3 e) 3) l) to match rules of ASME PCC-2

Subgroup: Repairs and Alterations
Task Group: P. Shanks – PM

Explanation of Need: There are a couple of typos in the paragraph as it does not match up with the rules of ASME PCC-2 for External Weld Metal Buildup.

Meeting Action: Mr. Shanks presented and the proposal was revised. A motion to accept the proposal as amended was made, seconded, and unanimously approved.

Item Number: 19-52	NBIC Location: Part 3, 4.2 a)	Attachment 43

General Description: Part 3, Section 4 - 4.2 a) Alternative NDE requirements

Subgroup: Repairs and Alterations
Task Group: T. Hellman – PM

Explanation of Need: Clarification is needed that if alternative NDE methods acceptable to the Inspector and Jurisdiction meet ALL the requirements listed elsewhere in Section 4 of Part 3. New verbiage is adding ", provided all other requirements of this section are met." to the last sentence.

Meeting Action: Mr. T. Hellman presented and the motion to accept the proposal was made, seconded, and unanimously approved.

Item Number: 19-53	NBIC Location: Part 3, S2.12	Attachment 44

General Description: Record Retention

Subgroup: SG Historical

Task Group: Robert Underwood – PM

Explanation of Need: Supplement 2 does not sufficiently address record retention as required by Part 3, 1.5.1(t).S2.12 states that owners "should" retain permanent records, but it is not mandatory. Paragraph 1.5.1(t) and Table 1.5.1 require all records be retained for 5 years.

Meeting Action: Mr. Underwood presented and the motion to accept the proposal was made, seconded, and unanimously approved.

Item Number: 19-55	NBIC Location: Part 3, Section 4	Attachment 45

General Description: Change the maximum test pressure requirement when performing liquid pressure tests of repair activities.

Subgroup: Repairs and Alterations

Task Group: Robert Underwood – PM

Explanation of Need: To change the maximum test pressure requirement when performing liquid pressure tests of repair and alteration activities. This proposal was initially part of item NB16-2603, which proposed changes to 4.4.1 a) 1) and 4.4.2 a) 1). However, only the changes to 4.4.1 a) 1) made it into the 2019 NBIC.

Meeting Action: Mr. Underwood presented and the proposal was revised. A motion to accept the proposal as amended was made, seconded, and unanimously approved.

9. Future Meetings

Chairman Trout reviewed the future meetings with the Subcommittee:

- January 13th -16th, 2020 – San Diego, CA
- July 13th-16th, 2020 – Louisville, KY

10. Adjournment

A motion was made to adjourn the meeting at 2:00 p.m. The motion was seconded and unanimously approved.

Respectfully submitted,

Terrence Hellman
SC Repairs and Alterations Secretary

NBIC Subcommittee R&A Attendance - 7/17/2019

First Last	Email	Company	Phone #	Signature	Attending Reception?
Brian Boseo	brian_boseo@graycor.com	Graycor	630 684-7300		✓
Craig Hopkins	chopkins@seattleboiler.com	Seattle Boiler Works	206 762-0737		
Ray Miletti	RLMILETTI@BABCOCK.COM	Babcock & Wilcox	330 860-2589		✓
James Pillow	jgpillow@comcast.net		860 539-9160		
James Sekely	jsekely@comcast.net	Consultant	412 389-5567		
Paul Edwards	edwardsp4@asme.org	Stone & Webster	617 483-5315		✓
Wayne Jones	Wayne.Jones@tuvsud.com	ARISE	251 937-6225		
Brian Morelock	morelock@eastman.com	Eastman Chemical Company	423 229-1205		
Robby Troutt	rob.troutt@tdlr.texas.gov	State of Texas	512 539-5720		✓
Joel Amato	joel.amato@state.mn.us	State of Minnesota	651 284-5137		✓
Kathy Moore	kathymoore@joemoorecompany.com	Joe Moore & Company, Inc.	919 832-1665		✓
Benjamin Schaefer	bschaefer@aep.com	AEP	614 716-1843		✓
Marty Toth	mtoth@boiscotraininggroup.com	~~Boiler Supply Company~~	615 504-9064		✓
Linn Moedinger	linnwm@supernet.com	Strasburg Rail Road Company	717 575-4478		✓
Rick Sturm	rsturm@utah.gov	State of Utah	801 554-9600		✓
Terrence Hellman	thellman@nationalboard.org	The National Board	614 431-3234		✓
Timothy McBee	Timothy.McBee@tuvsud.com	ARISE	217-412-9300		
GW Galanes	ggalanes@dimensiontechnicalservices.com	DTS	815-634-2727		✓
JOHN SIEFERT	jsiefert@epri.com	EPRI	704 595 2886		✓
WALT SPERKO	SPERKO@ASME.ORG	SPERKO INC	336 674 0600		
MARTY RUSSELL	MRUSSELL@TEISERVICE.COM	TEIC	864-345-5621		✓
Louis Dutra	LDutra@BayCityBoiler.com	BAY City Boiler	925 348 2881		✓

NBIC Subcommittee R&A Attendance - 7/17/2019

First Last	Email	Company	Phone #	Signature	Attending Reception?
Thomas White	thomas.white@nrg.com	NRG	281-782-4972		Y
Rick Valdez	rvaldez@prim.com	ARB	661 331 6024		N
Scott Chestnut	stchestnut@marathonpetroleum.com	MPC	925 348 6301		N
Don Cook	dcook@dir.ca.gov	State CA	510 622-3080		Y
Dave Martinez	david.martinez@fmglobal.com	FM Global	757-274 6104		Y
James Walker	JWALKER@HAHNMECHANICAL.COM	Hahn Mech.	773. 510-585		Y
Monte Bost	monte_bost@hsb.com	HSB	937 620 3676		Y
Robert Underwood	robert_underwood@hsb.com	HSB	618 593-6231		No
Michael Quisenberry	michael@allentri.com	ATSM, Inc	(806) 316 7174		Y
Paul Shanks	Paul.Shanks@onecis.com	onecis	832 316 4269		N.
Dan Holt	drholt@babcock.com	B&W	330-860 1080		✓
Eric Cutlip	evcutlip@babcock.com	B&W	330 860 2637		✓

Subcommittee Repairs/Alterations

Last Name	First Name	Interest Category	Role	Exp. Date	More
Troutt	Robby	Jurisdictional Authorities	Chair	08/30/2021	Details
Moore	Kathy	National Board Certificate Holders	Vice Chair	01/30/2022	Details
Hellman	Terrence		Secretary	12/30/2099	Details
Amato	Joel	Jurisdictional Authorities	Member	01/30/2021	Details
Boseo	Brian	National Board Certificate Holders	Member	08/30/2021	Details
Edwards	Paul	National Board Certificate Holders	Member	08/30/2021	Details
Hopkins	Craig	National Board Certificate Holders	Member	01/30/2022	Details
Jones	Wayne	Authorized Inspection Agencies	Member	01/30/2021	Details
Miletti	Ray	Manufacturers	Member	07/30/2019	Details
Moedinger	Linn	Users	Member	01/30/2022	Details
Morelock	Brian	Users	Member	03/30/2020	Details
Pillow	James	General Interest	Member	07/30/2019	Details
Schaefer	Benjamin	National Board Certificate Holders	Member	01/30/2022	Details
Sekely	James	General Interest	Member	08/30/2021	Details
Sturm	Rick	Jurisdictional Authorities	Member	07/30/2020	Details
Toth	Marty	National Board Certificate Holders	Member	01/30/2022	Details

Michael J. Quisenberry

806.316.7174 6117 Yale St. Amarillo, TX 79109 mosit21@gmail.com

Education:

West Texas A&M University Canyon, TX
~ Bachelor of Business Science in Finance
~ Bachelor of Business Science in Economics
Pi Gamma Mu Honor Society (Economics)
Omnicron Delta Epsilon Honor Society (Finance)

Qualifications:

- ~ Microsoft Office Certified (Extensive Experience with Excel, Word, and Power Point)
- ~ Experience working in manufacturing and building trades environment
- ~ Skilled in managing employees and delegating responsibilities
- ~ Adept in sourcing equipment and materials and issuing / tracking purchasing documentation
- ~ Extensive Project Management experience with a focus on repair / maintenance jobs
- ~ Tradesman Limited Plumbing License – State of Texas
- ~ Texas State Certified Class III Water Treatment Specialist

Experience:

Allen's Tri-State Mechanical, Inc

Deputy Division Manager – Boiler Division

Manage crew of plumbers, pipefitters, and welders. Work in a division that focuses on serving large commercial, industrial, and institutional mechanical systems. Extensive knowledge in steam plant piping and design; intimately familiar with Scotch Marine Boilers, packaged water-tube boilers, and ancillary boiler room equipment. Knowledgeable in domestic potable water piping, closed loop systems, condensate return systems, air handler units (AHU's) and roof top units (RTU's). Extensively experienced in water treatment systems such as water softeners, Reverse Osmosis (RO) machines, carbon filters, green sand filters, and sediment filtration.

Bid and quoted schedule work for customers on a regular basis, always coming in on budget. Manage large teams of technicians to respond to unscheduled and emergency repairs. Coordinate subcontractors, material procurement, labor schedules, and out of town travel accommodations (i.e. per diem, lodging, and travel expenses)

ASME /NBIC Code Welding Quality Control Manager

Manage crew of NBIC and ASME qualified code welders who repair and alter ASME rated pressure vessels. Developed from the ground up and implemented new quality control program with certified manual. Conducted and passed Joint Reviews from both the National Board of Boiler and Pressure Vessel Inspectors (NBIC) and the American Society of Mechanical Engineers (ASME). Currently a sitting committee member of the National Board Code Committee which develops

and implements new legislation for construction, repair, and alteration of boilers and pressure vessels.

Plains Plumbing Co., LLC — Amarillo, TX

Purchasing Agent / Service Manager

Source and procure materials for construction and service jobs. Maintain relationships with numerous vendors in the manufacturing and building trades industries. Proactively search for best prices and anticipate needs of the company to perform upcoming work. Schedule work to be performed for customers and dispatch service technicians to jobsites. Ensure that projects meet deadlines and expected budgetary constraints.

Tradesman Limited Licensed Plumber

Managed crew of men in bid project work as well as service and repair work on piping and large mechanical systems. Worked primarily on steam and domestic potable water applications in large commercial, industrial, and institutional applications. Took rotational on-call schedule with other technicians and ensured that jobs came in on time and within budget.

Plumber's Apprentice

Worked various Journeyman plumbers in plan built construction, design build construction, and service and repair capacities. Learned fundamental principles of plumbing and pipefitting. Became knowledgeable in all manner of mechanical systems including engineered equipment such as SMFT boilers, centrifugal chillers (screw & scroll), closed loop piping systems, water treatment equipment, and both process heating and cooling as well as environmental.

Ruby Tequila's Mexican Kitchen — Amarillo, TX

Assistant Manager

Oversaw staff of over 50 employees. Managed day to day financials of the company. Responsible for anticipating inventory needs and ordering accordingly. Learned to develop and foster relationships with individuals to increase revenues for the company.

Leal's Mexican Restaurant — Amarillo, TX

Bar and Assistant Manager

Responsible for anticipating the needs of the bar area and ordering inventory as needed. Managed small staff of 3-5 bartenders and shift scheduling. Developed new recipes for the bar and supplemented other management staff when needed.

Michael J. Quisenberry

806.316.7174 6117 Yale St. Amarillo, TX 79109 michael@allentri.com

References:

Simmie Callahan
ERAC Services
110 S Ong St.
Amarillo, TX 79106
806-679-6450
Supervisor - 8 years

Gary Guinn
Energy Service Project Manager
DOE and DOHS Security Clearance
Noresco / Pantex
6203 Rutgers
Amarillo, TX 79109
806-336-4281
Business Associate & Friend, 10 years

Dr. Anne Macy
Professor in the College of Business
West Texas A&M University
2501 4th Ave. CC 215C
Canyon, TX 79016
806-651-2523
Former Professor, 3 years

Libby Leal
General Manager
Leal's Mexican Restaurant
1619 S Kentucky
Amarillo, TX 79102
806-444-6860
Manager - 2 years

Name: Paul T Shanks

Education

Lancaster University

2001 – 2005

MEng (Hons) Mechanical Engineering

National Board

December 2017

Authorized inspector Commission Corse (AI)

Experienced with following specifications

ASME VIII div.1, IX, VIII div.2, PED, SDB-63, Navsea 250/1500

Location

Houston, TX

Years with Bureau Veritas

4 Years

Total Years of Experience

12 years

Lead technical consultant within the BV/OnecCIS technical staff I have direct responsibility in assisting authorized inspectors and supervisors in understanding the requirements and needs of any and all design and repair code utilized by our clients. I frequently work directly with certificate holders in determining the best code compliant technical solutions to the challenges posed in the pressure equipment market place.

I hold PED Level 3 status and conduct design reviews directly and audit design reviews for level 2 staff as required.

I am key contact for all code calculation questions including those that fall outside normal code scope- for example FEA.

I have been the BV/OneCIS representative for NBIC meetings since January of 2017 currently scheduled to start attending ASME code meetings as of July 2018.

My ASME and general engineering technical knowledge has been used directly to win new business by verification of support, expertise and competence.

Prior to joining Bureau Verities I worked for three (3) years working in a government sponsored exchange program between B&W Barberton and Rolls Royce submarines. The role required me to specialize in the manufacturing engineering of components for nuclear steam raising plant.

As I was embedded within another business I had to use a diplomatic skill set to build relationships that enabled the free flow of technical information as well as allow influence over design decisions and none conformance resolution.

Name: Paul T Shanks

	A key point of emphasis for me was ensuing that decisions made during fabrication would not adversely affect the ship yard equipment installation or the production of the through life safety case which influences maintenance procedures, the key input being the results from inspections and the repairs made when required. The output of this role was a variety of daily, weekly and milestone related formal reports as well as video conferences and email. Prior to this I worked for five (5) years in engineering directly designing pressure vessels, pressure accessories as well as load bearing structures and a range of hydraulic closure devices, manipulation systems as well as specifying engineering plant systems. I have been involved with Engineering design, material selection and evaluation based on metallurgical properties and specific design requirements, inspection of machining, welding, dimensions. This has been involving Pressure Vessels, Pressure Accessories and various safety accessories manufactured with ferrous and non-ferrous materials. Throughout my career I have worked alongside welding engineers selecting the most appropriate weld methods for given joints as well as non-destructive examination engineers to select the best combination of inspection methods to find the likely defects present in welds.

Name: Paul T Shanks

Project Experience

I was responsible for the technical specification of a 2 megawatt electric furnace suitable for heat treating a variety nuclear steam raising plant. The furnace included heating and cooling gas recirculation flow through components and a control system capable of keeping temperature deltas below 100^{o}F.

Employment History

OneCIS a Bureau Veritas company, Technical Consultant

June 2014 to present

Rolls Royce PLC

Manufacturing Engineering Liaison - embedded within Babcock & Wilcox Barberton

May 2011- May 2014

Rolls Royce Submarines, Design Engineer

December 2009 – April 2011

Wellman Hunt Graham, Head of Engineering

November 2009 – December 2009

Powder Systems Limited, Lead Design Engineer

August 2006 - October 2009

Patricia Becker

Pressure Vessel Design Engineer

AREAS OF EXPERIENCE

***Codes & Standards**:*
Pressure Vessel Engineering & Design
ASME BPV Codes & Standards (SG Committee Member)
NBIC (Nat'l Board Inspection Code) Advisory Committee Member
B&W Internal Standards (Code SME)

***Manufacturing**:*
Pattern Equipment (for Steel Castings)
Machining Jigs & Fixtures Design
Fabrication Solutions & Support

Pressure Part Engineering & Design
Engineering Specifications
Estimating
Proposal Preparation
Pressure Part Calculations
Fabrication & Mfg Drawings
Mentoring & Training
Weld Schedules
Familiarity and use of related programs including, PLM, Compress, Solidworks, AutoCAD, Microsoft Excel, Word, Powerpoint, Outlook, etc.

***Quality Control**:*
Standards Development & Preparation
Checking of Mfg Drawings & Specifications
ASME Audit Preparation including Quality Manual Content Support

Conference Participation
ASME, EPRI, NBIC, PVP

PROFESSIONAL MEMBERSHIP

ASME Boiler Pressure Vessel Code
AWS (American Welding Society)

PERSONAL SKILLS

Self-Motivated
Problem Solver
Mentor/Teacher
Good Communicator
Hard Worker

PERSONAL DETAILS

Patricia Becker
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Norton, OH 44203

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W: (330) 860-2807

WORK HISTORY

Engineering - The Babcock & Wilcox Co. **Barberton, OH**
PRESSURE VESSEL DESIGN ENGINEER 2006-Present

Responsibilities Include:

- Header & Drum Design for new and replacement pressure part related components
- ASME compliant Calculations, Engineering drawings and Fabrication Specifications
- Process improvement activities related to PVE, Standards Support & Development
- Pressure Part Project experience including checking Engineering & Mfg. Releases
- Represent B&W as a member of Section I on the Boiler & Pressure Vessel Code SG General Requirements & Piping and SG Fabrication & Exam. Also a Member of the National Board Advisory Committee.
- QA and peer support, answering questions related to all aspects of pressure part releases including Code & Standards Compliance, and PVE programs.

Manufacturing - Anger Pattern Inc. **Canal Fulton, OH**
PATTERNMAKER 1999-2004

- Supervision and Training of apprentices, building of pattern equipment.
- Checked, estimated, quoted and supported all facets of shop functions including developing problem solving solutions for manufacturing issues.

Manufacturing - American Pattern & Machine, Inc. **Barberton, OH**
PATTERNMAKER 1990-1998 2004-2006

- Built Pattern Equipment and gating. Managed shop work load and training of apprentices including defining/developing apprentice program.
- Foundry support, mold planning/gating, layouts, checking, inspection and quality management. Customer relations and liaison between engineering and shop.

Manufacturing - Welch Pattern, Inc. **Barberton, OH**
PATTERNMAKER 1983-1989

- Part owner/operator of a family-run business.
- Patternmaker for steel casting industry. Building pattern equipment, quoting and estimating, accounts payable and receivable, training of apprentices.

EDUCATION

Stark State College of Technology 2003-2006
Associates of Applied Design Engineering Technology
Akron University Studied 1982-1984
English (Honors)
Apprenticeship/Journeyman Patternmaker 1982-1985

PERSONAL SUMMARY

Hard working with good communication and organizational skills. Self-motivated with a strong attention to detail and keen interest in learning and expanding knowledge base related to all areas affecting inherent duties and responsibilities. Driven by a desire to provide on time, safe, and effective solutions for engineering and manufacturing challenges. Experienced in collaborative efforts including key Code and Standard developments with an aim of providing innovative, yet practical guidance, including consideration of 'real' life influences and limitations. Desire to work on improvements affecting product quality, consistency, and cost. Proficient in roles requiring decision points based on gathering and weighing technical information, peer input, and probable outcome. A Teacher at heart, determined to pass on knowledge and pertinent information affecting the longevity of a role or position; often asked to train and/or work with less experienced co-workers. Always interested in positions which will afford an opportunity to make a difference...

REFERENCES (References Available Upon Request)

John A. Siefert

jsiefert@epri.com

Home Contact Information:
13104 Serenity St.
Huntersville, NC, 28078
(704) 804-4579

Work Contact Information:
1300 West W. T. Harris Blvd.
Charlotte, NC, 28262
(704) 595-2886

OBJECTIVE

Welding engineering occupation applying hands on problem solving, leadership, and teamwork skills; no geographic limitations

EDUCATION

The Ohio State University, Columbus, OH — Graduation Date: March 16, 2008
Bachelor of Science in Welding Engineering — GPA upon Graduation: 3.24

Loughborough University, Leicestershire, United Kingdom — Graduation Date: March 2019
Doctor of Philosophy through the Department of Materials
First year report approved July 2016
Second year report approved 2017

EXPERIENCE

Electric Power Research Institute (EPRI), July 2011 – Present

Principal Technical Leader – responsibilities include managing approximately ten projects per year through Program 87 Fossil Materials and Repair, Technology Innovation and Supplemental Projects. Project execution includes conducting and coordinating efforts within EPRI using facilities such as the machine shop, metallography lab, welding lab, heat treatment lab and generation lab. Contractors are utilized when EPRI facilities or expertise are not available to properly complete a given project; coordination with contractors includes interaction with testing labs (i.e. destructive evaluation), universities, independently employed individuals and engineering-based organizations. Project management skills also required included budgeting, reporting, task layout of projects with key goals and objectives, planning/road-mapping, basic knowledge of SAP, reporting of results to membership, etc.

1. ***Program 87 Fossil Materials and Repair*** – Program 87 assists membership organizations in the welding, corrosion, high temperature behavior and characterization of fossil fired power plant materials. Within this program, responsibilities are generally focused in the management of day to day welding activities and coordinating projects within EPRI's state-of-the-art facilities. Past projects and efforts include: development of EPRI P87 filler metal, assembling the creep strength enhanced ferritic welding guide, leading the effort to address innovative report delivery in the form of a specialized web application, residual stress examination in bainitic and martensitic creep strength enhanced ferritic (CSEF) steels, and assessing the weldability of advanced stainless steels.
2. ***Technology Innovation*** – Technology Innovation provides EPRI membership with long-term research and development separate from the efforts in the base programs. Past projects include the examination of wear behavior of candidate Co-free hardfacing materials, assessing the integrity of powder metallurgy and hot isostatic pressed (PM/HIP) components for stainless steel 316L and CSEF steel Grade 91, materials scouting for EPRI Materials Strategic Program, behavior of 10-12Cr high oxidation resistant CSEF steels in creep, stress relaxation cracking behavior across multiple alloy systems and dissimilar metal welds between ferritic and austenitic stainless steels.
3. ***Supplemental Projects*** – Supplemental projects are established at EPRI to involve non-traditional members in critical projects and provide a second funding mechanism in the case that insufficient funds are available in a base program. There has been substantial participation and coordination in several projects including: Weld Repair of Grade 91 Piping and Components; Life Management of Boiler and Piping Components fabricated from Grade 92 Steels; Non-Destructive Methods for Detection of High-Temperature Damage in Creep Strength Enhanced Ferritic Steels and Cracking and Disbonding of Hardfacing Alloys in Combined Cycle Plant Valves and Weld Repair of Conventional CrMo Steels to New Code Requirements. Managed several projects including: Tempering Behavior and Characterization of Grades 23/24 Steels; and Application of Well-Engineered Weld Repairs for Grade 91 and other Creep Strength-Enhanced Ferritic (CSEF) Steels.
4. ***DOE-sponsored Projects*** – In rare cases, EPRI will submit proposals for government funding. One such project, "Optimization of Advanced Steels for Cyclic Operation through an Integration of Material Testing, Modeling and Novel Component Test Validation" involved the project management and coordination of ~$900k in funding across three institutions in the 2015 to 2018 timeframe.

Babcock and Wilcox Research Center (BWRC), April 2008 – June 2011

Welding Engineer – Project management responsibilities include running the welding lab on a day-to-day basis (including the welding of necessary weldments), and tracking multiple research projects including the results, purchase orders, additional paperwork, reporting/project updates and costs. The goal of the welding lab is to adequately and arduously research and develop the necessary welding process(es) to join new, emerging and existing alloys regardless of the technical challenge, timeframe or project cost restriction. A couple of key projects spanning the listed timeframe at BWRC are described below:

1. ***Development of EPRI P87 solid wire*** – 'EPRI P87' is the trade name for an improved, nickel-base filler metal, which has primary use in dissimilar metal weldments (DMWs). Following EPRI's development of a SMAW product, B&W approached EPRI and co-developed a solid wire product with EPRI and Euroweld, LTD. The details of this work were reported in several papers and conferences, and an EPRI report was authored by B&W, EPRI and Euroweld detailing this several years effort.
2. ***A-USC*** – The department of energy (DOE) has sponsored the advanced ultrasupercritical (A-USC) project for several years. BWRC has been intimately involved in this research and the welding lab has been responsible for solving welding issues associated with thick-section, nickel-based, solid-solution strengthened and gamma prime strengthened alloys. The welding lab successfully solved welding issues associated with INCONEL® 740 and welded many other alloys as a part of this project including HAYNES® 230®, INCONEL® 617, and HAYNES® 282®.
3. ***Waterwall Panel Research*** – BWRC did preliminary investigations into new waterwall panel materials for existing boiler designs as well as for future A-USC boilers. This initial research resulted in the fabrication and on-site management of a full-sized production waterwall panel section constructed over the course of four weeks in Beijing, China at the Babcock and Wilcox Beijing Company facility. Following the production of the waterwall panel, it was shipped back to BWRC where it was dissected and analyzed for flaws and defects. A large piece of the panel was kept intact to develop PWHT procedures that would be applicable in the field construction of large waterwall panels.
4. ***Welding Process Development*** – New processes or approaches to the welding of existing parts in boilers are developed at BWRC. Full penetration stub to header welds was developed over the course of a year and involved the selection of adequate equipment, procedures and acceptable welding parameter windows to be applied in B&W fabrication shops. This project was conducted as B&W normally welds a stub to a header utilizing a socket weld, but Europeans and other utilities in Asia require full penetration stub to header welds if the plant is to be cycled often. Full penetration welds help reduce failure due to a corrosion fatigue mechanism caused by an oxide penetration and frequent cycling of the plant.

Construction and Repair Code Activities

ASME B&PV Code. Participation or membership in ASME B&PV Code activities requires attendance at four meetings per year. As a part of active, future and relevant research within EPRI, it is typical to make presentations and provide technical guidance at key meetings to the relevant working groups, subgroups, task groups or main committees in ASME B&PV Sections I and II.

1. Secretary, WG-Creep Strength Enhanced Ferritic Steels (since 2014).
2. Participation, SG-Strength of Weldments (since 2015)
3. Participation, B&PV Section I SG-Design (since 2015)
4. Participation, B&PV Section I SG-Fabrication and Examination (since 2014)
5. Participation, B&PV Section I SG-Materials (since 2015)
6. Participation, B&PV Section I TG-Modernization (since 2015)

National Board Inspection Code (NBIC). Participation in the NBIC requires attendance at two meetings per year. As a part of active, future and relevant research within EPRI, it is typical to make presentations and provide technical guidance at key meetings to Part 3 Repairs and Alterations and the Main Committee.

1. NBIC Part 3 Repairs and Alterations Subgroup Repairs and Alterations (since 2012)
2. NBIC Part 3 Repairs and Alterations Subcommittee Repairs and Alterations (since 2012)

Awards and Recognition

Electric Power Research Institute Technology Transfer Award – 2009
For "P87 Weld Filler Metal for Dissimilar Metal Weld Joints"

Performance Recognition Award – 2011
"For an immediate impact at EPRI in updating and substantially improving the Creep Strength-Enhanced Ferritic (CSEF) steel welding guide"

Performance Recognition Award – 2012
For "Successful creation of the EPRI CSEF Welding App"

Performance Recognition Award – 2013
For "Outstanding generation council presentation on the CSEF welding web application demonstrating an improved approach to transferring EPRI technology"

Performance Recognition Award – 2014
"For above and beyond support of EPRI member engagement and Program 87 European members"

Performance Recognition Award – 2014
For "Exemplifying research excellence in the development and publication of the effect of optimization in Vickers hardness parameters for micro- and macro- indentation of Grade 91 steel and receiving the ASTM international 2013 Committee on publications award for outstanding article in the Journal of Testing and Evaluation"

ASTM International Committee on Publications 2013 Award for Outstanding Article in the Journal of Testing and Evaluation – 2014
"For your outstanding manuscript JTE20120290, Optimization of Vickers Hardness Parameters for Micro- and Macro-Indentation of Grade 91 Steel"

EPRI Chauncey Award – *2016*
"Development and Industry Implementation of Innovative Repairs for Advanced 9Cr Steels"

EPRI Chauncey Award – *2017*
"Powder Metallurgy-Hot Isostatic Pressing Manufacturing Technology"

SUMMARY OF PUBLICATIONS

Type of Publication	Number
Trade Journal Articles	7
Refereed Conference Publications	35
Journal Articles	20
EPRI Reports – Primary Author	16
EPRI Reports – Contributing Author or Managed	44
EPRI Success Stories – Primary Author	5
Total	127

TRADE JOURNAL ARTICLES

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2. J. P. Shingledecker, D. Purdy, **J. A. Siefert,** J. Tedesco and A. Szafarczyk. “Advantages of 3D Laser Scanning Confocal Microscopy.” *Advanced Materials and Processes 174* (10), 2016. pp. 22 to 25.
3. **J. A. Siefert** and J. D. Parker. “Improved Weld Repair Options for Grade 91 Steel.” *Energy Tech Magazine*, September 2015.
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6. J. D. Parker, K. Coleman, **J. A. Siefert** and J. P. Shingledecker. “Challenges with NDE and Weld Repair of Creep-Strength Enhanced Ferritic Steels.” *Advanced Materials & Processes 170* (10)*, 2012.* pp. 20-23.
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8. W. F. Newell, J. P. Shingledecker, **J. A. Siefert.**, and J. M. Tanzosh. “EPRI P87: A Promising New Filler Metal for Dissimilar Metal Welding.” *Welding Journal 90* (3), 2011. pp. 30-37.

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1. Y. Takahashi, H. Shigeyama, **J. A. Siefert** and J. D. Parker. “Creep Deformation Analyses for Grade 91 Steels Considering Heat-to-Heat Variation.” *Proceedings of the ASME 2018 Pressure Vessels and Piping Conference*, July 2018. PVP2018-85058.
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4. **J. A. Siefert**, J. D. Parker, R. C. Thomson. “Microstructure Features Contributing to Heat Affected Zone Damage in Grade 91 Steel Feature Type Cross-weld Tests.” *Proceedings of the ASME 2018 Elevated Temperature Application and Materials Conference*, April 2018. ETAM2018-6709.
5. G. Pritchard, I. Perrin, J. D. Parker and **J. A. Siefert**. “Application of a Physically-based Creep Continuum Damage Mechanics Constitutive Model to the Serviceability Assessment of a Large Bore Branch Connection.” *Proceedings of the ASME 2018 Elevated Temperature Application and Materials Conference*, April 2018. ETAM2018-6719.
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12. **J. A. Siefert** and J. D. Parker. “Well-Engineered Weld Repair of Grade 91 Steel.” *Proceedings to the 11th EPRI International Conference on Welding and Repair Technology for Power Plants.* Naples, FL. June 25-27, 2014. EPRI, Palo Alto CA: 2014. Paper F5.

13. S. J. Pawel and **J. A. Siefert**. “Stress Corrosion Cracking of Ferritic Materials for Fossil Power Generation Applications.” *Proceedings to the 11th EPRI International Conference on Welding and Repair Technology for Power Plants.* Naples, FL. June 25-27, 2014. EPRI, Palo Alto CA: 2014. Paper F11.

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15. D. Purdy, J. P. Shingledecker and **J. A. Siefert**. “Experiences in Valve Hardfacing Disbonding.” *Proceedings to the 11th EPRI International Conference on Welding and Repair Technology for Power Plants.* Naples, FL. June 25-27, 2014. EPRI, Palo Alto CA: 2014. Paper G8.

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2. J. D. Parker and J. A. Siefert. "The Creep and Fracture Behaviour of Tempered Martensitic Steels." *Materials at High Temperatures* 35 (6), 2018. pp. 491 to 503.
3. X. X., G. West, **J. A. Siefert**, J. D. Parker and R. Thomson. "Microstructural Characterisation of the Heat Affected Zones in Grade 92 Steel Welds: Double Pass and Multi-Pass Welds." *Metallurgical and Materials Transactions A*, manuscript E-TP-16-1684-A submitted March 21, 2017.
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7. D. H. Bechetti, J. N. DuPont, **J. A. Siefert** and J. P. Shingledecker. “Microstructural Evolution and Creep-Rupture Behavior of A-USC Alloy Fusion Welds.” *Metallurgical and Materials Transactions A* 47 (9), 2016. pp. 4502 to 4518.
8. **J. A. Siefert**, J. P. Shingledecker, J. N. DuPont and S. A. David. “Weldability and Weld Performance of Candidate Nickel Base Superalloys for Advanced Ultrasupercritical Fossil Power Plants Part II: Weldability and Cross-weld Creep Performance.” *Science and Technology of Welding and Joining* 21 (5), 2016. pp. 397 to 427.
9. J. D. Parker and **J. A. Siefert**. “Evaluation of the Creep Cavitation Behavior in Grade 91 Steels.” *International Journal of Pressure Vessels and Piping* 138 (2), 2016. pp. 31 to 44.
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11. J. P. Galler, J. N. DuPont and **J. A. Siefert**. “Influence of Alloy Type, Peak Temperature and Constraint on Residual Stress Evolution in Satoh Test.” *Science and Technology of Welding and Joining* 21 (2), 2016. pp. 106 to 113.
12. S. A. David, **J. A. Siefert**, J. N. DuPont and J. P. Shingledecker. “Weldability and Weld Performance of Candidate Nickel Base Superalloys for Advanced Ultrasupercritical Fossil Power Plants Part I: Fundamentals.” *Science and Technology of Welding and Joining 20* (7), 2015. pp. 532 to 552.
13. **J. A. Siefert**, B. M. Leister and J. N. DuPont. “Considerations in the Development of CCT Diagrams for Complex Ferritic Materials.” *Materials Science and Technology*, 31 (6), 2015. pp. 651 to 660.
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18. S. A. David, **J. A. Siefert**, and Z. Feng. “Welding and Weldability of Candidate Ferritic Alloys for Future Advanced Ultrasupercritical Fossil Power Plants.” *Science and Technology of Welding and Joining 18 (8), 2013*. pp. 631 to 651.
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28. *Well-Engineered Weld Repair of Grade 91 Steel: Performance of Repair Welds Manufactured in an Ex-service Grade 91 Steel Header*. EPRI, Palo Alto, CA: 2016. 3002004479.

29. *Well-Engineered Weld Repair of Grade 91 Steel: Welding Procedure Qualification to ASME B&PV Code Section IX and Supporting Data for Alternative Weld Repair Procedures*. EPRI, Palo Alto, CA: 2016. 3002004482.

30. *Well-Engineered Weld Repair of Grade 91 Steel: Welding Procedure Qualification to ASME Boiler and Pressure Vessel Code Section IX, Part II*. EPRI, Palo Alto, CA: 2016. 3002007233.

31. *Well-Engineered Weld Repair of Grade 91 Steel: Analysis of the Effect of Welding Geometry on Creep Performance and a Summary of Lessons Learned*. EPRI, Palo Alto, CA: 2016. 3002004484.

32. *Factors Affecting Performance of Dissimilar Metal Welds: Creep Performance of Screening Dissimilar Metal Welds Between Grade 91 Steel and Stainless Steel 347H.* EPRI, Palo Alto, CA: 2016. 3002007216.

33. *Factors Affecting Performance of Dissimilar Metal Welds: Residual Stress Analysis of Welds Between Grade 91 Steel and Stainless Steel 347H.* EPRI, Palo Alto, CA: 2016. 3002007217.

34. *Factors Affecting Performance of Dissimilar Metal Welds: Fabrication and Metallurgical Assessment of Screening Dissimilar Metal Welds Between Grade 91 Steel and Stainless Steel 347H.* EPRI, Palo Alto, CA: 2016. 3002007218. EPRI, Palo Alto, CA: 2016. 3002007218.

35. *An Informed Perspective on the use of Hardness Testing in an Integrated Approach to the Life Management of Grade 91 Steel Components*. EPRI, Palo Alto, CA: 2016. 3002007320.

36. *Alternative Well-Engineered Weld Repair Options for Grade 91 Steel Girth Welds in Piping Systems and Thick-Walled Components*. EPRI, Palo Alto, CA: 2016. 3002007322.

37. *Alternative Well-Engineered Weld Repair Options for Grade 91 Steel Fabricated Fittings and Laterals in Thick-walled Piping Systems*. EPRI, Palo Alto, CA: 2016. 3002007323.

38. *30-Plus Years of Long-seam Weld Failures in the Power Generation Industry – Perspective and Continuing Challenges with Life Management.* EPRI, Palo Alto, CA: 2017. 3002011587.

39. *Life Management of 9%Cr Steels - Evaluation of Metallurgical Risk Factors in Grade 91 Steel Parent Metal*. EPRI, Palo Alto, CA: 2017. 3002009678.

40. *Creep Performance of Screening Dissimilar Metal Welds between Grade 91 Steel and Stainless Steel 347H: 2017 Update*. EPRI, Palo Alto, CA: 2017. 3002007219

41. *Guidelines and Specifications for High-Reliability Fossil Power Plants: Best Practice Guideline for Manufacturing and Construction of Grade 91 to Austenitic Stainless Steel Dissimilar Metal Welds*. EPRI, Palo Alto, CA: 2017. 3002007221.

42. *Life Management of 9%Cr Steels - Guidelines for the Assessment of Composition using Scoop or Bulk Samples.* EPRI, Palo Alto, CA: 2017. 3002009682.

43. *Alternative Well-Engineered Weld Repair Options for Grade 91 Steel Small Bore Welds*. EPRI, Palo Alto, CA: 2017. 3002009688.

44. *Alternative Well-Engineered Weld Repair Options for Grade 91 Steel Tube to Tube, Tube Attachment and Tube Pad Repairs*. EPRI, Palo Alto, CA: 2017. 3002009689.

EPRI REPORTS [Contributing Author or Managed]

1. *Cold Weld Repair of Ferritic Components – Case Studies of UK Power Stations.* EPRI, Palo Alto, CA: 2015. 3002006758.

2. *Evaluation of the Resistance of Creep Strength Enhanced Ferritic Steels (CSEF) to Stress Corrosion Cracking (SCC) in Various Environments*. EPRI, Palo Alto, CA: 2013. 3002001470.

3. *Evaluation of an Ex-service Ferritic to Ferritic Dissimilar Metal Weld between Grade 22 and Grade 91*. EPRI, Palo Alto, CA: 2015. 3002006227.

4. *Cracking in Thick-section Dissimilar Metal Welds – Case Studies.* EPRI, Palo Alto, CA: 2015. 3002006759.

5. *Evaluation of the Resistance of Creep Strength Enhanced Ferritic Steels to Stress Corrosion Cracking in Various Environments: Follow-On Studies Using the Jones Test*. EPRI, Palo Alto, CA: 2015. 3002006755.

6. *Program on Technology Innovation: Mechanical Analysis of Dissimilar Metal Welds, Part I: Insight into Potential Failure Modes*. EPRI, Palo Alto, CA: 2016. 3002007215.

7. *Factors Affecting Performance of Dissimilar Metal Welds: Microstructural Characterization and Modeling of In-Service Failures Involving Welds Between Grade 91 Steel and Austenitic Stainless Steel*. EPRI, Palo Alto, CA: 2016. 3002007222.
8. *Life Management of 9Cr Steels – Basic Approach to Risk Ranking Systems of Components*. EPRI, Palo Alto, CA: 2016. 3002009231.
9. *Life Management of 9Cr Steels – Development of a Creep Continuum Damage Mechanics Constitutive Model for Creep Strength Enhanced Ferritic Steels*. EPRI, Palo Alto, CA: 2016. 3002009232.
10. *Service Experience of Fabricated Wyes, Laterals, Branches and Seam Welded Components Manufactured from Grade 91 Steel*. EPRI, Palo Alto, CA: 2016. 3002007882.
11. *Life Management of 9%Cr Steels - Assessment of Grade 91 Steel Parent Metal and Simulated Heat Affected Zone Behavior in Creep.* EPRI, Palo Alto, CA: 2017. 3002009679.
12. *Grade 23 Handbook*. EPRI, Palo Alto, CA: 2017. 3002009201.
13. *Life Management of 9%Cr Steels - Assessment of Damage in Ex-service Grade 91 Steel Stub to Header Welds.* EPRI, Palo Alto, CA: 2017. 3002009234.
14. *Life Management of 9%Cr Steels - Damage Tolerance Assessment of Header End Cap Geometries.* EPRI, Palo Alto, CA: 2017. 3002011049.
15. *Life Management of 9%Cr Steels - Damage Tolerance Assessment of Novel Step Weld Geometry for Girth Welds in Thick-section Components.* EPRI, Palo Alto, CA: 2017. 3002011053.

EPRI SUCCESS STORIES [Managed]

1. *TVA Applies an Alternative Well-Engineered Weld Repair Method for Grade 91 Steel*. EPRI. Palo Alto, CA: 2014. 3002006394.
2. *AEP Successfully Applies Alternative Weld Repair Method for Grade 91 Steel Tubing*. EPRI. Palo Alto, CA: 2016. 3002008903.
3. *Florida Power and Light Leads the World in the Application of Alternative Weld Repair Methods in Grade 91 Steel Components*. EPRI. Palo Alto, CA: 2016. 3002008972.
4. *Prairie State Generating Company Demonstrates Large-Scale Application of Welding Method 6*. EPRI. Palo Alto, CA: 2016. 3002008973.
5. *Xcel Energy Performs First Alternative Weld Repair in Grade 91 Steel in Hot Reheat Stop Check Valve.* EPRI. Palo Alto, CA: 2016. 3002008974.

Tim McBee
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Herrick, Illinois 62431
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Cell: (217) 412-9300
Timothy.McBee@tuvsud.com

QUALIFICATIONS

Knowledgeable in the design, operation, maintenance and inspection of industrial gas and coal fired boilers, pressure vessels and power piping systems to ASME and National Board Inspection Code requirements.

National Board Inservice and New Construction Commissions with "B" and "R" endorsements.

AWS CWI #05060641

Prior Ultrasonic Inspection Level 1 certified to SNT-TC-1A and ALL Tri-R Inc. procedure.

Prior Liquid Penetrant Inspection certified to ALL Tri-R Inc. procedure

Operate and maintain heavy equipment.

Proficient computer skills.

Safety training, Confined space, lockout-tagout, first line break, hot work and personal protective equipment.

Positive Attitude, team player, leader. Willing to learn new skills to meet the company's needs.

EXPERIENCE

2017 to present – ARISE – Authorized Inspector/Code Inspector Supervisor. Duties include supervising, educating, mentoring and auditing assigned inspectors. Performing preaudit activities and reviews with assigned clients.

2011 to present – ARISE – Inservice Inspector, Repair Inspector and New Construction Commissioned Inspector. Duties include internal and external inspections of jurisdictional boilers and pressure vessels, inspection of repairs and alterations to NBIC requirements and inspection of new construction items to ASME Code.

1989 to 2011 - All Tri-R Inc. - 5 years as the Quality Control Manager. Duties include the following: Monitoring and implementing revisions to the Quality Control Program. Training and supervising Quality Control Inspectors and PWHT technicians. Approve and monitor materials, personnel, weld procedures, workmanship, NDE and PWHT requirements per ASME Sect I, IV,V, VIII-1, IX, B31.1, B31.3 and repair/alteration methods accepted by the Authorized Inspector, Jurisdiction and The National Board.

7 years as a Quality Control Inspector. Duties include inspecting materials and workmanship per ASME Sect I, IV, V, VIII-1, IX, B31.1, B31.3 and repair methods approved by the National Board.

4 years as a pipefitter/welder foreman. Supervise repair and fabrication of pressure vessels and piping per ASME codes.

4 years as a pipefitter/welder. Duties included repair and fabrication of pressure vessels and piping per ASME codes.

1987 - Marley Pump Company - inspector - integrity testing of waste water vessels. Gettysburg, Penn.

1985 - 1987 Don Heil farms - machinery repair and operations on a 1,000 acre row crop farm - Norborne, Mo. (part-time)

EDUCATION

2017 – 48 hr. National Board Inspector Supervisor (B) endorsement prep course and exam – Columbus, OH.

2011 – 72 hr. National Board New Construction Commission prep course and exam – Columbus, OH.

2005 - 40 hr. prep course for AWS CWI exam - St. Louis MO.

1999 - 40 hr. ultrasonic testing Level 1 course - Scott Zimmerman with Quality Testing - Decatur, IL.

1997 - 40 hr. course on management training - Don Butler and Associates - Decatur, IL.
1987-1989 - Attended Central Missouri State University. 2 yrs. aviation technology courses. Studies included private pilot, aircraft power plants, transport aircraft systems and applied electricity.

1987 - Graduated From Richmond High School. Studies included Vo-ag classes composed leadership training, business management and farm equipment fabrication and repair.

1986 - Attended Lex-La-Ray Vo-tech, Lexington Mo. 1yr. welding course

PERSONAL

Birthdate - March 19, 1969. I've been married twenty nine years to Linda and have four children, Mark - 28 years old, Stephanie - 26 years old, Emily - 18 years old and Hannah - 17 years old. I'm a member of First Baptist Church in Shelbyville Illinois where I have served as a teacher and deacon.

HOBBIES

In my spare time, I enjoy hunting, boating and vacationing with my family.

REFERENCES

Ron Occhino – ARISE District Manager, Proctor, MN. (218) 310-5849

Charles Foor – Former Supervisor of Quality Control, Richmond, MO. (816) 506-0375

Tim Yankee – Pastor of First Baptist Church, Shelbyville, IL. (231) 510-2529

Item 17-143 6-13-17

Allan Bornhorst
QC SUPERVISOR
allan@geotechindustries.com
(250) 246 - 4312

GEO-TECH INDUSTRIES INC is a “R” stamp holder (R-5577) and also a “U” stamp holder (27,481) which we have maintained for the past 20 years. We are looking to repair a 1920 Shay locomotive using the “R” stamp designation. The current boiler on the Shay locomotive is of riveted construction and we are wanting to perform the repair with welded construction. We have planned on reusing 2 pressure retaining backing plate in the boiler shell which supported the 1” pipe nipples that were threaded externally through the shell and backing plate plus riveted. Since originally these plate were riveted onto the interior of boiler shell, we would now attached the 2 backing plate parts as a welded connection. We were needing a code interpretation for the following.

Question: According to NBIC Part 3-Section 3: 3.2.2 Replacement Parts
Can the “R” stamp repair shop performing the necessary repairs of a boiler use a sub assembly part, which is of the pressure boundary, that is welded in house; i.e. (shell of boiler)?

The question arises because I was informed by the Safety Authority that according to BPV Code Section 1, any welded part used for repair of a boiler shall be manufactured by a “S” stamp certified shop.

The Sub Groups response: ~~Can~~ May an "R" stamp ~~certificate~~ Certificate ~~holder~~ Holder manufacture ~~and use~~ parts or sub-assemblies for the Certificate Holder to use as part of the pressure boundary in the repair of a ~~power boile~~ pressure retaining item ~~r~~? YES Reference Part 3, 3.2.2

To: Allan Bornhorst,QC Supervisor

Geotech Industries

From: NBIC Committee

The committee feels that providing any more information on your method of repair would be providing consulting services which is against NBIC committee protocol.

PROPOSED INTERPRETATION

Inquiry No.	**18-34**				
Source	**James Barlow jbarlow@performancepulsation.com**				
Subject	Scope of Work				
Edition	2017				
Question	**Background** We received a vessel for repair of a cracked nozzle weld. The repair was performed per Part 3. During this work a discussion was started concerning the scope of responsibility for the "R" Certificate Holder. One side of the team said we should only be responsible for the requested repair. That our scope of work is defined by the owner/user and completion of the requested repair meets the requirements of NBIC Part 3. The other side, that I am on, feels we have a responsibility to inspect the vessel to ensure that what we are sending back into service is safe. As a licensed Engineer I am struggling with balancing wanting to ensure the vessel integrity is sound with the wants of a customer who may think that a repair means "the vessel" and not just what was in our scope of work. **Question:** When an "R" Certificate Holder performs a repair on a vessel, does the Certificate Holder assume responsibility for the integrity or condition of the rest of the vessel outside the scope of the repair?				
Reply	No				
Committee's Question	When an "R" Certificate Holder performs a repair to a pressure retaining item, does the Certificate Holder assume responsibility for the integrity or condition of the rest of the pressure retaining item outside the scope of the repair?				
Committee's Reply	No				
Rationale					
SC Vote		No. Affirmative	No. Negative	No. Abstain	No. Not Voting
NBIC Vote		No. Affirmative	No. Negative	No. Abstain	No. Not Voting
Negative Vote Comments					

NBIC Item 18-34
Gary Scribner to: Terrence Hellman 05/21/2019 08:58 AM
Cc: Jonathan Ellis, Luis Ponce

Gary Scribner NBIC Item 18-34

Terry,

Interrelation 18-34 As the question;

Does an R certificate holder assume responsibility for safety/integrity of a vessel outside the scope of repair?

The following answer was recommended by legal

Responsibility for safety/integrity of a vessel outside the scope of a repair is outside the scope of the NBIC and is to be considered a legal issue.

I would recommend referring the inquirer to the definition of a repair in the glossary.

Regards,

Gary L. Scribner
Assistant Executive Director, Technical

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INTERPRETATION 95-41

Subject: RC-1110 Nondestructive Examination
1995 Edition with the 1995 Addendum

Question 1: When performing in-service inspection, radiographic examination uncovers indications in welds made by the original manufacturer that are in excess of that allowed by the original code of construction. Is it a requirement that these welds be repaired?

Reply 1: The decision as to whether or not to perform a repair of deficiencies discovered during in-service inspection is outside the scope of the Code. See RB-3280.

Question 2: When nondestructive examination of a repair weld reveals indications in excess of that allowed by the original code of construction, must the indication be removed or reduced to an acceptable size?

Reply 2: Yes.

INTERPRETATION 95-17

Subject: R-404 Authorization of Organizations Making Repairs

1992 Edition with the 1994 Addendum

Question 1: Is it the intent of the NBIC to permit documented repairs (Form R-1) regardless of whether documented or undocumented repairs have been performed in the past?

Reply 1: Yes, provided the original construction was to the ASME Code.

Question 2: When an "R" Certificate Holder performs a repair on a vessel, does the Certificate Holder assume responsibility for the work performed by others on the vessel?

Reply 2: No.

Action Item 18-53: Interpretation Request

Inquirer: Angel Rodriguez AGRodriguez@dow.com

Subject:
Definition of Alteration (NBIC Part 3, Section 9, 9.1)
Examples of Alteration (NBIC Part 3, 3.4.3)

Question:
Is changing the corrosion allowance noted on the original Manufacturer's Data Report considered an alteration per NBIC, when this task is performed solely for the purpose of establishing minimum required thicknesses on an internal Owner / User mechanical integrity database?

PROPOSED INTERPRETATION

Inquiry No. **19-4**	Part 3, Section 1, 1.2a Construction Standards for Pressure Retaining Items
Source	Inquirer: George Galanes NBIC Committee PM: Michael Quisenberry
Subject	Part 3, Section 1, 1.2a Construction Standards for Pressure Retaining Items
Edition	2017
Question	**Inquirer's Proposed Q and R** **Question 1:** May an earlier or later edition of the construction code be used for repair or alterations to a pressure retaining item? **Proposed Reply 1:** Yes
Reply	
Committee's Question	Q1; May an earlier edition of the construction code be used for repair or alteration of a pressure retaining item? Q2: May a later edition of the construction code be used for repair or alteration of a pressure retaining item?
Committee's Reply	R1: No. Earlier codes of construction may not be applicable to a pressure retaining item that had yet to be constructed. R2: Yes. Only if the later code of construction is **more** applicable that the original code of construction (See Part 3, 1.2(a) & (b).
Rationale	Earlier codes of construction may not represent the **most** applicable code of construction to the work at hand.
SC Vote	
NBIC Vote	
Negative Vote Comments	

BACKGROUND/INQUIRER'S REQUEST

Explanation of Need: Try to resolve if there should be a restriction to different editions of the code of construction.

Background Information: There are different Interpretations which have been issued on this topic.

NBIC EXCERPTS

1.2 CONSTRUCTION STANDARDS FOR PRESSURE-RETAINING ITEMS

a) When the standard governing the original construction is the ASME Code or ASME RTP-1, repairs and alterations to pressure-retaining items shall conform, insofar as possible, to the section and edition of the ASME Code most applicable to the work planned.

a) If the pressure-retaining item was not constructed to a construction code or standard, or when the standard governing the original construction is not the ASME Code or ASME RTP-1, repairs or alterations shall conform, insofar as possible, to the edition of the construction standard or specification most applicable to the work. Where this is not possible or practicable, it is permissible to use other codes, standards, or specifications, including the ASME Code or ASME RTP-1, provided the "R" or "NR" Certificate Holder has the concurrence of the Inspector and the Jurisdiction where the pressure-retaining item is installed.

INTERPRETATION 95-19

Subject: RC-1000 General Requirements

1995 Edition

Question: When the NBIC references "the original code of construction," is it required to use the edition and addenda of that code as used for construction?

Reply: No. The term "original code of construction" refers to the document itself, not the edition/addenda of the document. Repairs and alterations may be performed to the edition/addenda used for the original construction or a later edition/addenda most applicable to the work.

INTERPRETATION 95-20

Subject: Foreword

1995 Edition

Question: May the requirements of an earlier Edition and Addenda of the NBIC be used when performing a repair or alteration?

Reply: Yes.

This is in reference to the NBIC not the Code of Construction. Some jurisdictions have not adopted the latest edition of the NBIC and require an earlier edition to be followed for Repairs and Alterations.

INTERPRETATION 04-18

Subject: Part RD-3010

2004 Edition with 2005 Addendum

Question: Using the rules of RD-3010, is rerating of a pressure-retaining item designed by a proof test method permitted using a later edition/addendum of the original Code of Construction?

Reply: Yes, except as may be limited by Code of Construction requirements for satisfactory assurance of accuracy in computing the maximum allowable working pressure. This would include, for example, that all pressure boundary parts be inspected to ensure that each part's current thickness is greater or equal to the minimum or nominal thicknesses as listed on the Manufacturer's Data Report.

Interpretation IN19-5

Proposed Interpretation

Inquiry:	IN19-5
Source:	
Subject:	NBIC Part 3 Section Part 3, 3.2.6
Edition:	2017
General Description:	
Question 1:	Can user's opinion, categorization and proposed Repair methods be considered under NBIC Part 3, 3.2.6?
Reply 1:	No
Committee's Question 1:	Can a bolt hole in a SA350-LF2 flange be repaired using SA-105 material that is welded using a Welding Procedure Specification (WPS) that was qualified without postweld heat treatment (PWHT) and without impact testing?
Committee's Reply 1:	~~No.~~This is consulting.
Question 2:	Does AI have final authority to take decision under Part 3, 3.2.6 when jurisdiction does not exist?
Reply 2:	Yes
Committee's Question 2:	Does the ~~Authorized~~ Inspector ~~(AI)~~ have final authority for review and acceptance of a ~~completed~~ repair by a repair organization that has an "R" Certificate of Authorization under Part 3, 3.2.6 when jurisdiction does not exist?
Committee's Reply 2:	Yes.
Rationale:	NBIC Part 3, Section 3.2.6
SC Vote	
NBIC Vote	

Rationale:

3.2.6 REFERENCE TO OTHER CODES AND STANDARDS

Other codes, standards, and practices pertaining to the repair and alteration of pressure retaining items can provide useful guidance. Use of these codes, standards and practices is subject to review and acceptance by the Inspector, and when required, by the Jurisdiction. The user is cautioned that the referenced codes, standards and practices may address methods categorized as repairs; however, some of these methods are considered alterations by the NBIC.

In the event of a conflict with the requirements of the NBIC, the requirements of the NBIC take precedence.

Some examples are as follows:
a) National Board *BULLETIN* - National Board Classic Articles Series;
b) ASME PCC-1, Guidelines for Pressure Boundary Bolted Flange Joint Assembly;
c) ASME PCC-2, Repair of Pressure Equipment and Piping.

ASME Section IIA, SA-350/SA-350M, 2017 ED, SPECIFICATION FOR CARBON AND LOW-ALLOY STEEL FORGINGS, REQUIRING NOTCH TOUGHNESS TESTING FOR PIPING COMPONENTS
4. General Requirements
4.1 Product furnished to this specification shall conform to the requirements of Specification A 961, including any supplementary requirements that are indicated in the purchase order. Failure to comply with the general requirements of Specification A 961 constitutes nonconformance with this specification. In case of conflict between the requirements of this specification and Specification A 961, this specification shall prevail.
7.2 Impact Test:
7.2.1 Requirements — The material shall conform to the requirements for impact properties in Table 3 when tested at the applicable standard temperature in Table 4 within the limits of 7.2.4.2 and 7.2.4.3.
11. Rework and Retreatment
11.3.1 Repair by welding shall be made using welding procedures and welders qualified in accordance with ASME Section IX of the Code. The weld procedure qualification test shall also include impact tests of the weld metal and heat-affected zone. All impact test specimens shall have the longitudinal axis transverse to the weld and the base of the notch normal to the weld surface.

ASTM A 961: Standard Specification for Common Requirements for Steel Flanges, Forged Fittings, Valves, and Parts for Piping Applications
12. Impact Requirements
12.1 The part shall conform to the impact requirements prescribed in the product specification.

Background Information IN19-5 from the Inquirer:
Saudi Aramco Hawiyah Gas Plant (User) requested Repair to one of their Floating tube sheet Heat Exchanger (UHX-14.1(a)). The user requested repair organization to plug all bolt holes of floating tube sheet using Plug material SA-105 and close by welding. New holes were drilled at center of the ligament of previously drilled bolt holes as required by original drawing of the heat exchanger. No design has been performed and method classified as "Repair".

It is informed that the floating tube sheet has shrunk during service and due to which after dismantling it was difficult to reassemble the Floating tube sheet.

Tube Sheet Material is SA350 LF2 Class-1. WPS used to close holes is without PWHT and without impact.

National Board Inspector rejected the repair method with the following understanding:

1. Welding on SA-350 forging shall meet requirement for Repair of Base Material in accordance with SA 350 and Section 11.8.
2. Integrity of this Flange is compromised as it is Plugged with SA 105 Material and welded for 5 mm with Groove on both Side. This methodology of Repairing Base material is not approved as per Code

AIS Concurred and provided his Opinion to AI question as follows:

1. Welding on SA-350 forging shall meet requirement for Repair of Base Material in accordance with SA-350 and Section 11.8

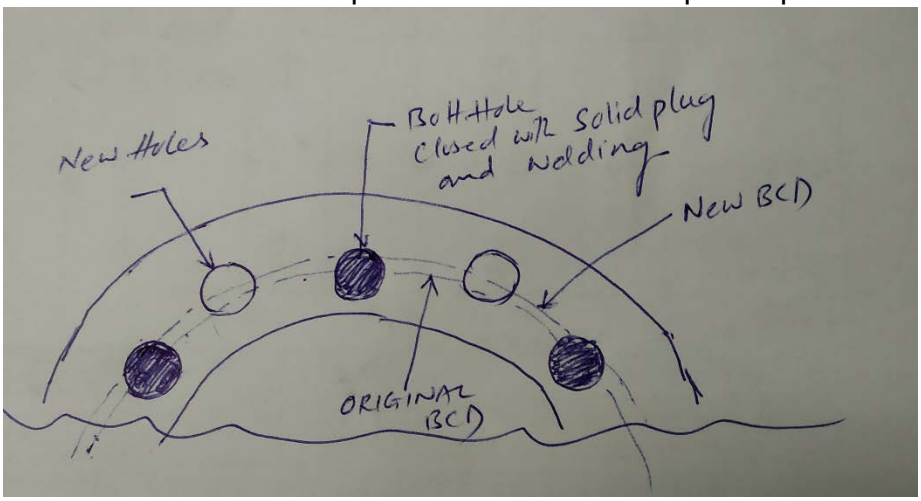
AIS Opinion: All types of repairs are not addressed in NBIC however para 3.2.6 shall be applicable and to be complied.

2. Integrity of this Flange is now compromised as it is Plugged with SA 105 Material and welded for 5 mm with Groove on both Side. This methodology of Repairing Base material is not approved as per Code

AIS Opinion: Refer my comments above, the user is cautioned in para 3.2.6 that the referenced codes, standards and practices may address methods categorized as repairs. These methods/Practices must be accepted by AI.

Questions:

1. Can user opinion, categorization and acceptance of Repair methods be considered under NBIC Para 3.2.6, Part 3?
2. Does NB consider this repair method as an acceptable practice?



PROPOSED INTERPRETATION

Inquiry No.	19-10
Source	Paul Shanks
Subject	Interpretations
Edition	2017
Question	May an interpretation issued to a past NBIC edition be used in any other NBIC edition when the words in the NBIC paragraph are the same? (See Part 3, Introduction, Interpretations for text reference)
Reply	Yes if the NBIC has not changed the requirements pertaining to the interpretation
Committee's Question	May an interpretation issued to ~~a~~an ~~past~~ earlier NBIC Edition be used for any other NBIC Edition when the requirements of the NBIC are the same?
Committee's Reply	Yes.
Rationale	NBIC currently limits each interpretation to the edition it was issued for. However, often time the words in question do not change from one edition to another. At present a new interpretation would be needed for each edition of the NBIC to address the same issues, this is a delay to field work and a drain on NBIC committee time. **Background Information:** Understandably each request for interpretation does not require a change to the words in the NBIC, but given the same NBIC words and consistent committee approach to resolving interpretations the same answer should be provided from one edition to the next. But this would cause a delay in working to a standard accepted practice and would consume time for the committee answering the same base question each year. Further the proposed approach is that which ASME currently employs and whilst NBIC and ASME are different they do operate within the same industrial sphere so the proposed interpretation is not unusual.
SC Vote	
NBIC Vote	

Negative Vote Comments	

Item 19-17: Interpretation of Part 3, S1.2.11.3

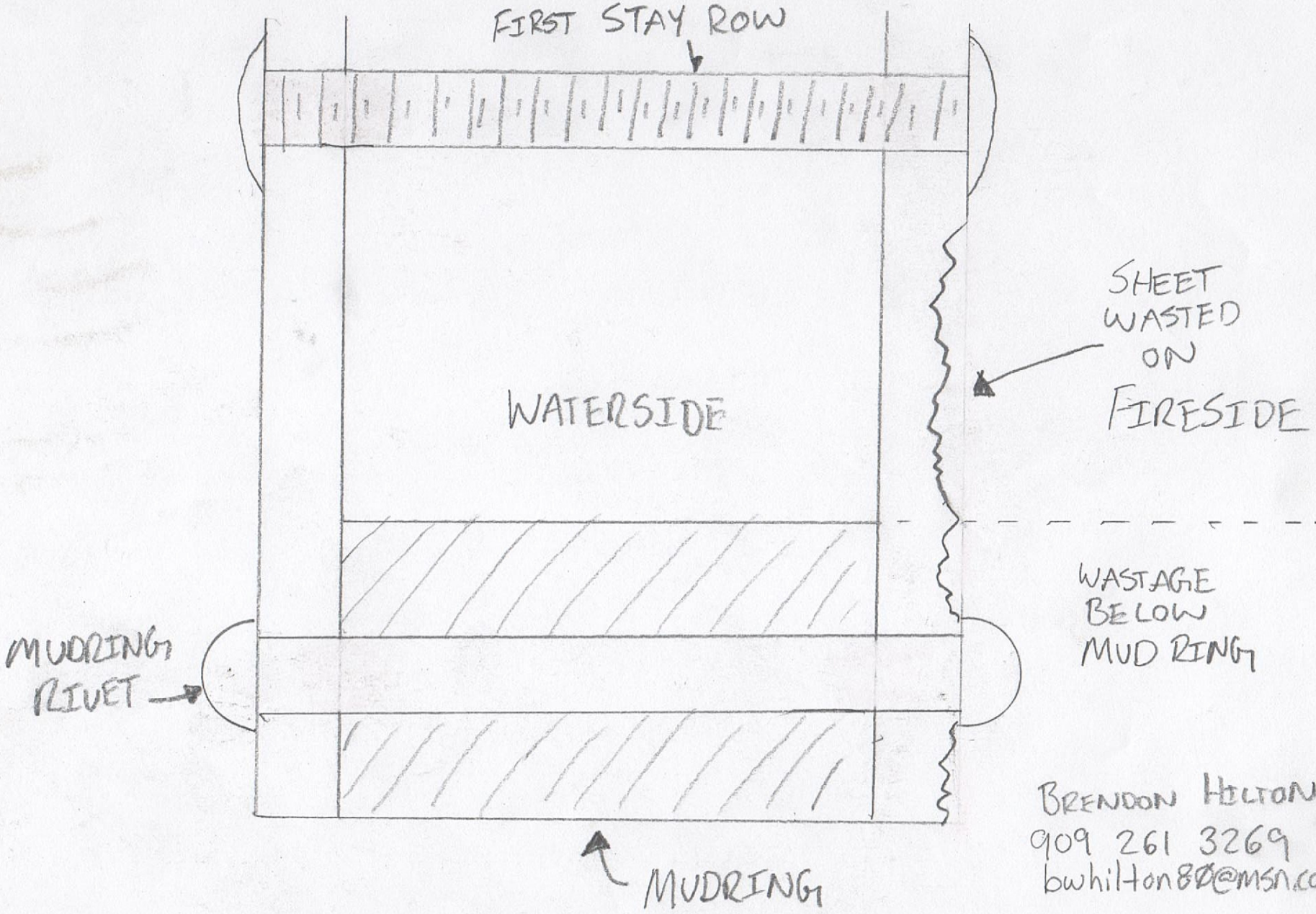
Submitted by: Brendon Hilton bwhilton80@msn.com

Background - This question is in regards to a CFR 230, 1472 day boiler inspection on a 1927 built Baldwin 4-8-4 steam locomotive. The door sheet (aka back sheet) in the firebox has sustained wastage at the mudring on the fireside, caused by the proximity of the firebrick. In the figure S1.2.11.3, the drawing indicates a wastage on the waterside, yet the text of section S1.2.11.3 does not specify if it is referring to the waterside, the fireside, or both. Please see attached diagram of the wastage in question.

Question - If the majority of the wastage is on the fireside, and there is minimal wastage on the waterside, does NBIC Part 3, 3.3.4.3-a govern repairs?

Answer - Yes

QUESTION: IF THE MAJORITY OF WASTAGE IS ON THE FIRESIDE, DOES RULE 5.1.2.11.3 STILL GOVERN REPAIR?



BRENDON HILTON
909 261 3269
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PROPOSED INTERPRETATION

Inquiry No.	**19-02** **NBIC Location: Part 3, 3.3.4.2 e)**
Source	Rob Troutt rob.troutt@tdlr.texas.gov Timothy McBee Timothy.McBee@tuvsud.com
Subject	Use of Heli-Coils for repairs and alterations of PRI's • When a bolt head is broken off, the normal way of correction is to drill out the bolt with a slightly larger size drill, thread the bigger diameter hole, install a Heli-Coil and replace the bolt. • Not only does this type of fix include adding material to the RPI, The hole diameter for the bolt is increased along with depending on the type of Heli-Coil used (may be non-threaded or threaded) pressure retention calculation should be provided for verification.
Edition	2017
Question	1. Is using a Heli-Coil considered a mechanical alteration? 2. If the answer to question 1 is no, then is it considered a mechanical repair?
Reply	1. Please see interpretation 04-19.
Committee's Question	
Committee's Reply	
Rationale	
SC Vote	
NBIC Vote	
Negative Vote Comments	

PROPOSED INTERPRETATION

Inquiry No.	Item 19-25
Source	M.A. Shah abmindustrialservices@gmail.com
Subject	This inquiry seeks an interpretation of NBIC Part 3, 4.4.2 c), which states the following: c) Nondestructive Examination NDE may be conducted when contamination of the pressure-retaining item by liquids is possible or when pressure testing is not practicable. Concurrence of the owner shall be obtained in addition to the Inspector, and where required, the Jurisdiction. Exclusive use of Visual Examination (VT) shall not be permitted. In all cases NDE methods or combination of methods used shall be suitable for providing meaningful results to verify the integrity of the alteration.
Edition	2017
Explanation of Need	For ASME BPV Section VIII Division 2 Vessel is under Alteration with Re-rate of lowering MAWP & increasing of Design Temperature & there is no physical alteration in the Vessel but only change is in the Alteration design report because of different design stress intensity value at higher design temperature.
Question	In lieu of a liquid pressure test, what kind of NDE methods or combination of methods used shall be suitable for providing meaningful results to verify the integrity of the alteration?
Reply	No further NDE shall be required as there is no Physical Alteration for the Vessel.
Committee's Question 1	An alteration to a Section VIII Div. 2 vessel is performed by lowering the MAWP and increasing the design temperature. No physical work was performed on the vessel. Calculations confirm that the hydrostatic test pressure for the new MAWP and design temperature would be higher than that of the original hydrostatic test pressure. Is a new hydrostatic test required after the alteration is completed?
Committee's Reply 1	Yes, except as provided in Part 3, 4.4.2.c.
Committee's Question 2	The NBIC Part 3, 4.4.2.c provides rules for performing NDE in lieu of a hydrostatic test of an alteration. Is it required that concurrence of the owner, the Inspector, and when required, the Jurisdiction be obtained regarding the NDE methods, or combination of methods, to be used to verify the integrity of the alteration?
Committee's Reply 2	Yes.
Rationale	NBIC Part 3, Section 3.3.4, Section 4.4.2. and Section 9.1
SC Vote	

NBIC Vote	
Negative Vote Comments	

Relevant Background

NBIC Section 3.4.4 clearly states that an example of an alteration is an increase in the design temperature for the pressure retaining item. Furthermore, the definitions section 9.1 states that nonphysical changes such as an increase in the design temperature shall be considered an alteration. Thus, in the background information provided by the requestor, it is clear that this scenario describes a vessel which has been altered.

Page 68, Section 3, Part 3

3.4.4 EXAMPLES OF ALTERATIONS (17)

a) An increase in the maximum allowable working pressure (internal or external) or temperature of a pressure-retaining item regardless of whether or not a physical change was made to the pressure-retaining item;

Page 237, Section 9, Part 3

Alteration — A change in the item described on the original Manufacturer's Data Report which affects the pressure containing capability of the pressure-retaining item. (See NBIC Part 3, 3.4.3, *Examples of Alteration*) Nonphysical changes such as an increase in the maximum allowable working pressure (internal or external), increase in design temperature, or a reduction in minimum temperature of a pressure-retaining item shall be considered an alteration.

The 'explanation of need' now links to the relevant Section 4.4.2 which requires that one of the following shall be applied to an activity considered to be an alteration: liquid pressure test; pneumatic test; or nondestructive examination. The NBIC does not describe which NDE methods are acceptable, merely that: *concurrence of the owner and inspector and possibly the jurisdiction shall be obtained; that visual examination is not sufficient; and the selected method shall be suitable to provide meaningful results verifying the integrity of the vessel*.

Page 73, Section 4, Part 3

4.4.2 TEST OR EXAMINATION METHODS APPLICABLE TO ALTERATIONS

Based on the nature and scope of the alterations activity, one or a combination of the following examination and test methods shall be applied to alterations and replacement parts used in alterations.

a) Liquid Pressure Test

b) Pneumatic Test

c) Nondestructive Examination

Relevant Interpretations

INTERPRETATION 93-5

Subject: Chapter III, R-503(d)

1992 edition

Question: If a pressure test required for a re-rated vessel is less than or equal to the hydrostatic test performed during construction, is a new pressure test required after the re-rating is completed?

Reply: No, provided no physical work is performed.

INTERPRETATION 98-15

Subject: RC-3022 & RC-3030(h) Pressure Testing Requirements Related to Re-rating Activities

1995 Edition with the 1996 Addendum

Question 1: If calculations and current thickness measurements indicate that a pressure retaining item may be altered by re-rating only (no physical work being done), may the original pressure test as recorded on the Manufacturer's Data Report be used to satisfy RC-3022(d), if the pressure test is at least equal to the calculated test pressure required to verify the integrity of said alteration, subject to the approval of the Inspector and the requirements of the jurisdiction?

Reply 1: Yes.

Question 2: If the maximum allowable working pressure (MAWP) of a pressure-retaining item must be reduced, due to wall thinning below the minimum wall thickness required to contain the MAWP stated on the manufacturer's data report and on the ASME stamped nameplate, but the maximum allowable temperature is increased, is it the intent of the NBIC that this be considered a re-rate?

Reply 2: Yes. Any increase in pressure or temperature is considered a re-rate in accordance with RC-3022.

Question 3: If the maximum allowable working pressure (MAWP) of a pressure-retaining item must be reduced, due to wall thinning below the minimum wall thickness required to contain the MAWP stated on the manufacturer's data report and on the ASME stamped nameplate, but the maximum allowable temperature is increased, is it the intent of the NBIC that this is, in effect, a derate and outside the scope of the NBIC?

Reply 3: No. Any increase in pressure or temperature is considered a re-rate in accordance with RC-3022.

INTERPRETATION 98-34

Subject: RC-3030 Examination and Testing

1995 Edition with the 1996 Addendum

Question: When the design rated capacity of a boiler is increased without physical work such that the design pressure and temperature are unaffected, is it required to perform a pressure test in accordance with the NBIC?

Reply: No.

Interpretation IN19-26

Proposed Interpretation

Inquiry:	IN19-26
Source:	Doug Biggar
Subject:	NBIC Part 3 Section Part 3, 3.3.2
Edition:	[Current/all]
General Description:	Repair of none pressure boundary parts
Question 1:	If a welding repair is done to an appendage of a horizontal ASME LPG pressure vessel such as a faulty leg or the raised data plate holder, is this considered routine and are we exempt to have an inspector present to witness it and/or fill out a specialized form?
Reply 1:	No inspector needs to be present as the welding is not performed on any part of the pressure vessel directly related to its performance under pressure.
Question 2:	What is the minimum length of an appendage we can weld onto without being an ASME/NBIC certified welder (only a standard welding ticket)?
Reply 2:	1/4”
Committee’s Question 1:	Are refurbishment activities such as shot blasting, thread cleaning and painting considered within the scope of the NBIC?
Committee’s Reply 1:	No
Rationale 1:	These activities should not affect the pressure retaining integrity of the item, per the introduction to the NBIC that (maintenance) is the function of the NBIC. Reasonably these activities fall outside the scope of the NBIC
Committee’s Question 2:	When welding activities are conducted on materials which are not pressure retaining items of a Pressure Retaining Item and those welding activities do not affect the original design of the Pressure Retaining Item including applied loads, is said welding within the scope of the NBIC?
Committee’s Reply 2:	No, provided welding is not done directly on the pressure retaining item.
Rationale:2	Assumed intent-TBC by committee
Committee’s Question 3:	
Committee’s	

Reply 3:	
Rationale:3	Paragraph 5.11 requires that, subject to the approval of the Jurisdiction, an Inspector shall make witness to such activities.
Rationale:	NBIC Part 3, Introduction, Section 3.3.2 e), 3.3.3, 3.4.4 & 5.11
NBIC Vote	

Include in response letter: NA

Rationale:

Having emailed the enquirer to determine the scope of their typical operations it was clear that there was a general misunderstanding about the purpose of the NBIC, the proposed questions are overly specific and as sure fail to grasp the crux of the issue hence the question re-write. Q3 was added to ensure that no misunderstand occurs. With the exception of a very hardline reading on Section 3.3.2 a) the NBIC addresses in the main body and the introduction the pressure retaining capability of the item and not work conducted elsewhere.

Sections 3.3.2 e), 3.3.3 & 3.4.4 address working (welding / replacing) on components which have a pressure retaining function. Pipes, tubes, heads, shell, and tube sheet are mentioned, integral parts without pressure retaining function such as legs and davit arms are not addressed.

Section 3.3.3 a) can be read as "Weld repairs ~~or replacement of pressure parts or~~ of (sic) attachments that have failed in a weld or in the base material;"

Section 5.11 requires Inspector witnessing and Jurisdiction approval for nameplate removal/replacement.

PROPOSED INTERPRETATION

Inquiry No.	**19-34**
Source	GE Power
Subject	NBIC Part 3, paragraph 3.2.2 e), Pressure Testing of Replacement Parts
Edition	2017
Question	NBIC Part 3 paragraph 3.2.2 e) states that the replacement part shall receive a pressure test as required by the original code of construction. ASME has issued an interpretation (I-16-6) clarifying that Section I does not provide rules for hydrostatic testing of parts supplied for repair or alteration of existing boilers. Is it the intent of 3.2.2 e) that the reference to the original code of construction is for determining the hydrostatic test pressure?
Reply	Yes
Committee's Question	NBIC Part 3 paragraph 3.2.2 e) states that the replacement part shall receive a pressure test as required by the original code of construction. Is it the intent of 3.2.2 e) that the reference to the original code of construction is for determining the pressure used for the hydrostatic test?
Committee's Reply	Yes
Rationale	ASME has issued interpretation I-16-1 and revised PW-54 to clarify that Section I does not contain requirements for the hydrostatic testing of replacement parts. Based on this, the language in 3-3.2.2 e) *"… as required by the original code of construction"* could be interpreted to mean that pressure testing of parts is not required because Section I does not require testing of replacement parts. On review, this was not the Committee's intent when clause e) was added to 3.2.2. The proposed intent interpretation and a supporting text revision is provided to clarify this issue. By linking the words *"original code of construction"* to the test pressure, it eliminates the potential interpretation that testing is only required when the original code of construction specifically requires testing of replacement parts.
SC Vote	
NBIC Vote	
Negative Vote Comments	

Background Materials Submitted by the Inquirer

NBIC Part 3 Section 3 paragraph 3.2.2 e) (shown below) states that replacement parts shall receive a pressure test as required by the original code of construction. We are concerned that this clause is not being interpreted consistently by all users of the NBIC. The words in question are *"…as required by the original code of construction."* ASME issued interpretation I-16-1 (shown below) and revised PW-54 to clarify that Section I does not contain requirements for the hydrostatic testing of replacement parts provided for an existing unit. Based on this, the words *"… as required by the original code of construction."* could be interpreted to mean that pressure testing of the parts is not required because Section I does not require testing of replacement parts. We do not think that was the Committee's intent when clause e) was added to 3.2.2. We submit the proposed intent interpretation and proposed revision for the Committee's consideration to clarify this issue. By linking the words "original code of construction" to the test pressure, it eliminates the potential interpretation that testing is only required when the original code of construction specifically requires testing of replacement parts.

Proposed Intent Interpretation:
Question: NBIC Part 3 paragraph 3.2.2 e) states that the replacement part shall receive a pressure test as required by the original code of construction. ASME has issued an interpretation (I-16-6) clarifying that Section I does not provide rules for hydrostatic testing of parts supplied for repair or alteration of existing boilers. Is it the intent of 3.2.2 e) that the reference to the original code of construction is for determining the hydrostatic test pressure?
Reply: Yes.

Associated Revision:
e) Replacement parts addressed by 3.2.2 c) or d) above shall receive a pressure test ~~as required by~~ at the pressure determined for the completed pressure equipment (boiler, pressure vessel, etc.) in accordance with the original code of construction. If replacement parts have not been pressure tested to this pressure ~~as required by the original code of construction~~ prior to installation they may be installed without performing the ~~original code of construction~~ pressure test provided the owner, the Inspector and, when required, the Jurisdiction accept the use of one or a combination of the examination and test methods shown in Part 3, Section 4, paragraph 4.4.1 (for repairs) or 4.4.2 (for alterations). The R Certificate Holder responsible for completing the R Form shall note in the Remarks section of the R Form the examination(s) and test(s) performed, and the reason the replacement part was not tested at the pressure determined for the completed pressure equipment in accordance with the original code of construction.

Background Information:

NBIC Part 3 Section 3 paragraph 3.2.2 e)

e) Replacement parts addressed by 3.2.2 c) or d) above shall receive a pressure test as required by the original code of construction. If replacement parts have not been pressure tested as required by the original code of construction prior to installation they may be installed without performing the original code of construction pressure test provided the owner, the Inspector and, when required, the Jurisdiction accept the use of one or a combination of the examination and test methods shown in Part 3, Section 4, paragraph 4.4.1 (for repairs) or 4.4.2 (for alterations). The R Certificate Holder responsible for completing the R Form shall note in the Remarks section of the R Form the examination(s) and test(s) performed, and the reason the replacement part was not tested in accordance with the original code of construction.

ASME Interpretation I-16-6

Standard Designation:	BPV I
Edition/Addenda:	2015
Para./Fig./Table No:	PW-54
Subject Description:	Section I Intent Interpretation, PW-54 Hydrostatic Testing of Section I Parts
Date Issued:	08/16/2016
Record Number:	13-942
Interpretation Number :	BPV I-16-6
Question(s) and Reply(ies):	Question: Is it the intent of Section I that the rules of PW-54 regarding hydrostatic testing apply to parts supplied for repair or alteration of existing boilers? Reply: No. Section I does not provide rules for hydrostatic testing of parts supplied for repair or alteration of existing boilers. Please be guided by Appendix A-64, Repair to Existing Boilers.

2017 Addition to PW-54

PW-54.4 Refer to A-64 as guidance for welded pressure parts supplied to the user of an existing boiler as replacement or repair parts. (17)

A-64

A-64 REPAIRS TO EXISTING BOILERS

Where repairs are necessary that in any way affect the working pressure or safety of a boiler, a state inspector, municipal inspector, or an inspector employed regularly by an insurance company, which is authorized to do a boiler insurance business in the state in which the boiler is used, shall be called for consultation and advice as to the best method of making such repairs; after such repairs are made they shall be subject to the approval of a state inspector, municipal inspector, or an inspector regularly employed by an insurance company that is authorized to do a boiler insurance business in the state in which the boiler is used.

PROPOSED INTERPRETATION

Inquiry No. **19-35**	19-35 Part 3, 2.5.2 and 3.4 PWHT of PV
Source	Jagadheesan Vellingiri Muthukumaraswamy jaga4021@hotmail.com NBIC TPM: Jim Pillow jgpillow@comcast.net
Subject	Part 3, 2.5.2 and 3.4 PWHT of Section VIII PV
Edition	2017
Question	**Inquirer's question and reply.** **Question 1:** An R Certificate Holder is doing repair work on the shell side of heat exchanger, which was not Post Weld Heat Treated earlier. As per client request, repair welded joints are Post Weld Heat Treated and considered an alteration as per 3.4. For Welded Joints not repaired can Post Weld Heat Treatment be done and responsibility can be taken by R Certification and considered an alteration? **Proposed Reply 1:** No. **Question 2:** If R Stamp Holder holds WPS for the vessel with PWHT can that Post Weld Heat Treatment be carried out as per approved WPS in order to meet alteration requirement? **Proposed Reply 2:** Yes.
Reply	
Committee's Question	
Committee's Reply	Send the inquirer the following existing interpretation. **INTERPRETATION 13-06** **Subject:** Part 3, 2.5.2 **Edition:** 2013 **Question 1:** An R-Certificate holder decides to perform post weld heat treatment (PWHT) of a vessel at the request of a client, where no PWHT was performed in the original construction. Is the performance of PWHT of the vessel considered an alteration and subject to documentation using a Form R2?

	Reply: Yes. **Question 2:** For the vessel described above, must the weld procedures used for construction of the vessel be qualified with PWHT? **Reply:** Yes. **Question 3:** Must the PWHT described above be performed by the R-Certificate holder? **Reply:** No, the PWHT may be subcontracted; however the R certificate holder retains the responsibility for the performance of the PWHT.
Rationale	The inquirer is to be instructed to follow up with the NBIC Committee if the interpretation does not satisfy the inquiry.
SC Vote	
NBIC Vote	
Negative Vote Comments	

BACKGROUND

Original inquiry:

Explanation of Need: Welds not repaired by R Stamp Holder and already existing on equipment if Post Weld Heat Treated, is not under the responsibility of the R Stamp Holder.

Background Information: An R Certificate Holder is doing repair work on the shell side of heat exchanger, which was not PWHT earlier. As per client request, welded joints are Post Weld Heat Treated and considered an alteration; client wants shell side to undergo full Post Weld Heat Treatment including areas not repaired. NDE is being carried out for complete equipment and client wants PWHT for welds which are in services and without any repairs.

Question 1: An R Certificate Holder is doing repair work on the shell side of heat exchanger, which was not Post Weld Heat Treated earlier. As per client request, repair welded joints are Post Weld Heat Treated and considered an alteration as per 3.4. For Welded Joints not repaired can Post Weld Heat Treatment be done and responsibility can be taken by R Certification and considered an alteration?

Proposed Reply 1: No.

Question 2: If R Stamp Holder holds WPS for the vessel with PWHT can that Post Weld Heat Treatment be carried out as per approved WPS in order to meet alteration requirement?

Proposed Reply 2: Yes.

PROPOSED INTERPRETATION

Inquiry No. **19-36**	Part 3, Section 3, 3.3.2 and 3.3.5, Routine Repairs of Section VIII Div.2 and Div.3 Pressure Vessels
Source	Inquirer: Narayanan Murugappan NBIC Committee PM: Jim Pillow
Subject	Part 3, Section 3, 3.3.2 Routine Repairs and 3.3.5 Repair of Section VIII Div.2 and Div.3 Pressure Vessels
Edition	2017
Question	**Inquirer's Proposed Q and R** **Question 1:** Is Routine Repairs defined para 3.3.2 applicable to pressure vessels constructed to ASME Section VIII Division-2 and 3? **Proposed Reply 1:** Yes. **Question 2:** If the answer to the above question is Yes, are requirements specified in Para 3.3.5 to be followed for routine repairs to pressure vessels constructed to ASME Section VIII Division-2 and 3? **Proposed Reply 2:** Yes.
Reply	
Committee's Question	Q1; Is a repair plan required for all repairs of an ASME Section VIII Div. 2 or Div. 3 pressure vessel? Q2: May the repair plan for an ASME Section VIII Div.2 or Div.3 pressure vessel be accepted by the Inspector in lieu of the Authorized Inspection Agency or the Owner-User Inspection Organization? Q3: Must the Authorized Inspection Agency's or the Owner-User Inspection Organization's Inspector make an acceptance inspection of the repair of an ASME Section VIII Div.2 or Div.3 pressure vessel? Q4: Are routine repairs defined in Part 3, Section 3, 3.3.2, applicable to pressure vessels constructed to ASME Section VIII Div.2 or Div.3?

Committee's Reply	R1: Yes. See Part 3, 3.3.5.2. R2: No. See Part 3, 3.3.5.2(b). R3: Yes. See Part 3, 3.3.5.2(b). R4: No. Inspection of the repair by the Inspector is required.
Rationale	The rules for routine repairs do not require in process involvement by the Inspector to inspect and accept the repair. The rules described in Part 3, 3.3.5.2(b) are clear that the Inspector must make an acceptance inspection of the repair.
SC Vote	
NBIC Vote	
Negative Vote Comments	

BACKGROUND/INQUIRER'S REQUEST

Explanation of Need: Para 3.3.2 talks about requirements for and examples of routine repairs. It does not specify any restrictions on pressure retaining items construction Code. It states that Routine repairs are repairs for which the requirements for in-process involvement by the Inspector and stamping by the "R" Certificate Holder may be waived as determined appropriate by the Jurisdiction and the Inspector. It states that all other applicable requirements of this code (NBIC) shall be met. Para 3.3.5.1 of NBIC states that the following requirements shall apply for the repair of pressure vessels constructed to the requirements of Section VIII, Division 2 or 3, of the ASME Code. This calls for properly certified repair plan to be submitted to the Inspector who will make acceptance inspection and sign R-1 Form.

Background Information: The recent interpretations issued by NBIC are reproduced below.

INTERPRETATION 17-17

Subject: Repair and alteration of Section VIII Division 2 items

Edition: 2017

Question: Is it permissible to perform a repair or alteration on an ASME Section VIII, Division 2 pressure vessel in accordance with the NBIC when the original User's Design Specification (UDS) and/or the Manufacturer's Design Report (MDR) is not available?

Reply: No. The Repair/Alteration Plan is required to be compatible with the UDS and MDR per the NBIC Part 3, Sections 3.3.5 and 3.4.5.

INTERPRETATION 17-08

Subject: Repair/Alteration Plans for ASME VIII, Division 2, Class 1 Pressure Vessels

Edition: 2017

Question: Does the NBIC require a Repair/Alteration Plan for an ASME Section VIII, Division 2, Class 1 vessel to be certified by an engineer when a Manufacturer's Design Report was not required to be certified under the original code of construction?

Reply: No.

NBIC EXCERPTS

3.3.5 REPAIR OF ASME SECTION VIII, DIVISION 2 OR 3, PRESSURE VESSELS

3.3.5.1 SCOPE

The following requirements shall apply for the repair of pressure vessels constructed to the requirements of Section VIII, Division 2 or 3, of the ASME Code.

3.3.5.2 REPAIR PLAN

The user shall prepare, or cause to have prepared, a detailed plan covering the scope of the repair.

a) Engineer Review and Certification
The repair plan shall be reviewed and certified by an engineer meeting the criteria of ASME Section VIII, Division 2 or 3, as applicable, for an engineer signing and certifying a Manufacturer's Design Report. The review and certification shall be such as to ensure the work involved in the repair is compatible with the User's Design Specification and the Manufacturer's Design Report.

Note: The engineer qualification criteria of the Jurisdiction where the pressure vessel is installed should be verified before selecting the certifying engineer.

b) Authorized Inspection Agency Acceptance
Following review and certification, the repair plan shall be submitted for acceptance to the Authorized Inspection Agency/Owner-User Inspection Organization whose Inspector will make the acceptance inspection and sign the Form R-1.

Item 19-42 – Interpretation Request
Submitted by: Paul Shanks paul.shanks@onecis.com

NBIC Location: Part 3, 3.3.3 s) and 3.4.4 g)

Explanation of Need: The design requirement in 3.3.3 s) is not well defined and is allowing potentially unsafe material changes to be conducted as repairs without adequate assessment.

Background Information: Most pressure vessel parts are design in isolation from those around them or connected to them, heads and shell for example. There are however some components which take strength from or are subject to stresses imposed form adjacent components. For example, body flanges and bolting or tube sheets and the tubes. 3.3.3 s) allows materials of high strength than originally used to be implemented in a repair, under the condition that they "satisfy the material and design requirements of the original code" it is intuitively obvious what is meant by the material requirements but the design requirements are unclear and a great many people thing stronger is more better. But in the case of tubes in a fixed tube sheet heat exchanger or bolting on a custom body flange this is not necessarily the case, upgrading the bolts or tubes could introduce an unsafe overstressed condition in the adjacent materials unless calculations are conducted this will not be known. 3.4.4 g) could be used to indicate that the some material 'upgrades' need to be an alteration but as it refers back to 3.3.3 s) and the design requirement is not well defined it becomes hard to justify a material 'upgrade' as an alteration.

Question 1: 3.3.3 s) includes the following "provided the replacement material satisfies the material and design requirements of the original code of construction" it is clear that the material must be one permitted by the original code of construction but in referring to the "design requirements" is it the intent of the NBIC that when higher strength material are use the new material must not introduce an overstress situation?

Reply 1: Yes.

Question 2: If the above answer is no please remove 3.4.4 g) as it is superfluous or reword it to address changing to materials with lower allowable stresses specifically.

PROPOSED INTERPRETATION

Inquiry No.	**19-44**
Source	Laura Fuhrmann, Laura.Fuhrmann@FoxValleyMetrology.com
Subject	NBIC Part 3, 1.6.6.2.m ~~M-5-Am)~~, 1.6.7.2.m ~~M-1m), 1.6.7.2 M-4-A, 1.6.7.2 M-5-A~~, 1.6.8.2.m ~~M-1, 1.6.8.2 M-4-A, 1.6.8.2 M-5-Am)~~
Edition	2019
Question	The listed paragraphs show service to be provided in accordance with ISO/IEC 17025:2005. The 17025 standard has been revised to the 2017 version, and all labs accredited as such have a 3 year transition window.
Reply	A change similar to ASME Section III, which does not list a specific revision, instead, wording it as "most current".
Committee's Question	The listed paragraphs show service to be provided in accordance with ISO/IEC 17025:2005. The 17025 Standard has been revised to the 2017 version, and all labs accredited as such have a 3-year transition window. Is it permissible to use either the 2005 or the 2017 edition of ISO/IEC 17025?
Committee's Reply	Yes
Rationale	The NR program accepts the ILAC accreditation of calibration and testing laboratories in accordance with ISO/IEC 17025:2005. The ISO/IEC 17025 Standard has been revised to the 2017 version, and all labs accredited as such will have the 3-year renewal for accreditation in accordance with the 2017 version. The NR Task Group has compared the two versions and recommends acceptance of 2017 under the NR program. A separate action item is being process under 19-43 to incorporate reference to the 2017 version. Since publication would not occur until 2021, this interpretation is being processed to recognize use of the 2017 version for ILAC accreditation of the labs permitted for use by NR Certificate holders.
SC Vote	
NBIC Vote	
Negative Vote Comments	

Information as Submitted by Inquirer

Interpretation Request
Submitted by: Laura Fuhrmann Laura.Fuhrmann@FoxValleyMetrology.com

NBIC Location: Part 3, 1.6.6.2, 1.6.7.2, and 1.6.8.2

Explanation of Need: Many, if not all calibration labs are already accredited to ISO/IEC 17025:2017 and will be required to by 2020. No lab will bother accreditation to 2005 after that, so finding a calibration house will be difficult.

Background Information: 2019 NBIC Part 3, 1.6.6.2 M-5-Am), 1.6.7.2 M-1m), 1.6.7.2 M-4-A, 1.6.7.2 M-5-A, 1.6.8.2 M-1, 1.6.8.2 M-4-A, 1.6.8.2 M-5-Am)

Question 1: The listed paragraphs show service to be provided in accordance with ISO/IEC 17025:2005. The 17025 standard has been revised to the 2017 version, and all labs accredited as such have a 3 year transition window.

Reply 1: A change similar to ASME section III, which does not list a specific revision, instead, wording it as "most current".

1.6.6.2, 1.6.7.2, and 1.6.8.2 QUALITY PROGRAM ELEMENTS

m) Control of Measuring and Test Equipment
The “NR” Certificate Holder may utilize calibration and test activities performed by subcontractors when surveys and audits are performed. As an alternative to performing a survey and audit for procuring Laboratory Calibration and Test Services, the “NR” Certificate Holder as documented in their Quality Program may accept accreditation of an International Calibration and Test Laboratory Services by the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (MRA) provided this alternative method is described in the “NR” Certificate Holder’s Quality Program and the following requirements are met:

1) The “NR” Certificate Holder shall review and document verification that the supplier of calibration or test services was accredited by an accredited body recognized by the ILAC MRA encompassing ISO/IEC-17025:20052017, “General Requirements for the Competence of Testing and Calibration Laboratories”;

2) For procurement of calibration services, the published scope of accreditation for the calibration lab-oratory covers the needed measurement parameters, ranges and uncertainties.

3) For procurement of testing services, the published scope of accreditation for the test laboratory covers the needed testing services including test methodology and tolerances/uncertainty.

4) The “NR” Certificate Holder’s purchase documents shall include:

a. Service provided shall be in accordance with their accredited ISO/IEC-17025:2005 2017 program and scope of accreditation;

b. As-found calibration data shall be reported in the certificate of calibration when items are found to be out-of-calibration;

c. Standards used to perform calibration shall be identified in the certificate of calibration;

d. Notification of any condition that adversely impacts the laboratories ability to maintain the scope of accreditation;

e. Any additional technical and/or quality requirements, as necessary, which may include tolerances, accuracies, ranges, and standards;

f. Service suppliers shall not subcontract services to any other supplier.

5) The “NR” Certificate Holder shall upon receipt inspection, validate that the laboratory documentation certifies that:

a. Services provided by the laboratory has been performed in accordance with their ISO/IEC-17025:2005 2017 program and performed within their scope; and

b. Purchase order requirements have been met.

n) Handling, Storage and Shipping

From 2019 ASME Section III, NCA:

LIST OF CHANGES IN RECORD NUMBER ORDER

Record Number	Change
11-1037	Revised Table NCA-3200-1, Document Distribution for Division 2 Construction.
11-2161	Added new definition "Certified Design Report Summary."
14-315	Revised Table NCA-7100-2 for TR-3 and TR-4 to the following: *(a)* TR-3 "2008 through 2017." *(b)* TR-4 "2008a through 2017."
15-2538	Revised editorially NCA-4134.17(d) to add lifetime record no. 20.
15-2539	Added reference to NC- and ND-6114.2(d) to NCA-8322.1(d).
16-363	Revised Table NCA-8100-1 to address appurtenances. Revised Form N-2 to address the certification of Nuclear parts and established a new Form N-2A for the certification of Nuclear appurtenances.
16-1827	Revised NCA-3820(c).
16-2116	Updated wording of NCA-3360(b) to show that the Certifying Engineer certifies the Construction Specification and Design Drawings on behalf of the Designer.
16-2145	Revised NCA-1274 to clarify that the inlet and outlet parts of rupture disk holders are to be considered as material, part, or appurtenance.
16-2204	Revised Table NCA-7100-2.
16-2964	Added the 2006 Edition of SNT-TC-1A as an acceptable Edition within Table NCA-7100-2, Table NCA-7100-3, and Table WA-7100-2.
17-650	Restructured and renumbered NCA-3551. Clarified that date of certification is the date(s) the Design Reports are certified with an alternative of the date the Summary is Certified.
17-1111	Revised NCA-3761(a).
17-2058	Revised Table NCA-7100-1 to update the referenced standards.
17-2149	Added reference to NCA-3127 in NCA-4134.7(g).
17-2210	Errata correction. See Summary of Changes for details.
17-2214	Errata correction. See Summary of Changes for details.
17-2295	Clarified the recent revision to the Forewords for Section III and Section XI to properly address all items that have nuclear rules addressing their structural integrity.
17-3081	Changed "Registered Professional Engineer" to "Certifying Engineer" in NCA-3784.2 and NCA-3784.5.
18-340	Revised Table NCA-7100-2 to reference NQA-1-2015. Revised NCA-4100 to clarify the use of NQA-1 Part II and the use of commercial grade dedication for software.
18-355	Added ISO/IEC 17025 reference editions 2005 and 2017 to Tables NCA-7100-2 and NCA-7100-3. Deleted 2005 reference edition from ISO/IEC 17025 in NCA-3126, NCA-3127, NCA-4354.3, NCA-4255.3(c), and NCA-4255.3(d).
18-402	Revised Table NCA-7100-3 to delete two references (PTI M50.1 and AASHTO LRFD Bridge Design Specifications) that are no longer needed based on changes approved in Record 17-718.
18-955	Errata correction. See Summary of Changes for details.
18-1446	Revised NCA-5125(i).
18-1669	Revised Table NCA-7100-3 to update the applicable reference editions.
18-2668	Revised Table NCA-7100-3.

Table NCA-7100-2
Standards and Specifications Referenced in Division 1

(19)

Standard ID	Published Title	Section III Referenced Edition
The American Society of Mechanical Engineers (ASME)		
ASME NQA-1	Quality Assurance Requirements for Nuclear Facility Applications	2015
ASME PTC 25	Pressure Relief Devices	2014
ASME QAI-1	Qualifications for Authorized Inspection	Latest
American Society for Nondestructive Testing (ASNT)		
SNT-TC-1A	Personnel Qualification and Certification in Nondestructive Testing	2006, 2011
American Society for Testing and Materials (ASTM)		
ASTM A275	Standard Test Method for Magnetic Particle Examination of Steel Forgings	2009a
ASTM A673	Standard Specification for Sampling Procedure for Impact Testing of Structural Steel	1977
ASTM E8	Standard Test Methods for Tension Testing of Metallic Materials	1969 through 2015
ASTM E23	Standard Test Methods for Notched Bar Impact Testing of Metallic Materials	2002a
ASTM E94	Standard Guide for Radiographic Examination	1977
ASTM E142	Standard Method for Controlling Quality of Radiographic Testing (Discontinued 2000, Replaced by ASTM E94)	1977
ASTM E185	Standard Practice for Design of Surveillance Programs for Light-Water Moderated Nuclear Power Reactor Vessels	1982
ASTM E186	Standard Reference Radiographs for Heavy-Walled [2 in. to 4½ in. (51 mm to 114 mm)] Steel Castings	1967, 1973, 1975, 1979, 2010
ASTM E208	Standard Test Method for Conducting Drop-Weight Test to Determine Nil-Ductility Transition Temperature of Ferritic Steels	1991
ASTM E213	Standards Practice for Ultrasonic Examination of Metal Pipe and Tubing	1979
ASTM E280	Standard Reference Radiographs for Heavy-Walled [4½ in. to 12 in. (114 mm to 305 mm)] Steel Castings	1968, 1972, 1975, 2010
ASTM E426	Standard Practice for Electromagnetic (Eddy-Current) Examination of Seamless and Welded Tubular Products, Titanium, Austenitic Stainless Steel and Similar Alloys	1988
ASTM E446	Standard Reference Radiographs for Steel Castings up to 2 in. (51 mm) in Thickness	1972, 1975, 1978, 2010
ASTM E571	Standard Practice for Electromagnetic (Eddy-Current) Examination of Nickel and Nickel Alloy Tubular Products	1982 (R1988)
ASTM E606	Standard Practice for Strain-Controlled Fatigue Testing	Latest
ASTM E883	Standard Guide for Reflected-Light Photomicrography	2002
ASTM E1921	Standard Test Method for the Determination of Reference Temperature, T_o, for Ferritic Steels in the Transition Range	2016
ASTM F788	Standard Specification for Surface Discontinuities of Bolts, Screws, and Studs, Inch and Metric Series	2013
ASTM F812	Standard Specification for Surface Discontinuities of Nuts, Inch and Metric Series	2012
American Welding Society (AWS)		
AWS A4.2	Calibrating Magnetic Instruments to Measure the Delta Ferrite Content of Austenitic and Duplex Ferritic-Austenitic Stainless Steel	1991
ISO/IEC 17025	General requirements for the competence of testing and calibration laboratories	2005, 2017
Plastics Pipe Institute (PPI)		
PPI TR-3	Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Hydrostatic Design Stresses (HDS), Pressure Design Basis (PDB), Strength Design Basis (SDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe	2008 through 2017
PPI TR-4	PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe	2008a through 2017

Table NCA-7100-3
Standards and Specifications Referenced in Division 2 (Cont'd)

Standard ID	Published Title	Section III Referenced Edition
International Organization for Standardization		
ISO/IEC 17025	General requirements for the competence of testing and calibration laboratories	2005, 2017
Post-Tensioning Institute (PTI)		
PTI M10.2	Specification for Unbonded Single Strand Tendons	2017
U.S. Army Corps of Engineers		
CRD-C 36	Method of Test for Thermal Diffusivity of Concrete	1973
CRD-C 39	Test Method for Coefficient of Linear Thermal Expansion of Concrete	1981
CRD-C 44	Method for Calculation of Thermal Conductivity of Concrete	1963

Item NB15-1405 (*formally IN14-0401*)

The following is a history of record number NB15-1405, formally inquiry record 14-0401, found in NBIC committee Minutes from inception in 2014.

January 2014 **(see attachment "A")**	**Main Committee Minutes:** **IN14-0401 - *Part 3, 1.2*** - Question 1: The NBIC Part 3 paragraph 1.2 states that a repair shall be carried out "insofar as possible to the section and edition of the ASME code most applicable to the work planned." If a vessel is constructed using SA-517-E (P-11B) material to ASME Section VIII Div. 1, where production and weld procedure impact tests were required during construction, would a repair to a crack in the shell require production and weld procedure impact testing under the NBIC? Proposed Reply 1: Yes. (No attachment) Question 2: If the answer to Question 1 is yes and there was no SA-517-E material from the original lot available, would the repair require the addition of new base material (e.g. a flush patch around the area of the crack) so that production impact tests could be performed with the original base metal to the new base metal? Proposed Reply 1: Yes. Question 3: If the vessel described in Question 1 was to be altered by adding an SA-675 (P-1) pump flange to the shell, would production and weld procedure impact tests be required using the same lot P-1 and P-11B base materials as used in the alteration? Proposed Reply 1: Yes. January 2014 A task group of Walt Sperko, Bob Wielgoszinski (PM), and George Galanes will work on this inquiry. **SC RA Minutes:** January 2014 Bob Wielgoszinski presented a document request for interpretation associated with welded repairs to UHT vessels. A task group of Walt Sperko, Bob Wielgoszinski (PM), and George Galanes will work on this inquiry. **SG RA Specific Minutes:** January 2014 Bob Wielgoszinski presented a document request for interpretation associated with welded repairs to UHT vessels. A task group of Walt Sperko, Bob Wielgoszinski (PM), and George Galanes will work on this inquiry.
January 2015 **(see attachment "B")**	**Main Committee Minutes** **Item Number: IN14-0401 NBIC Location: Part 3, 1.2 Attachment Pages 72-73** **General Description:** Interpretation questions regarding requirements for production impact tests after repair or alteration of a vessel **Subgroup:** Repairs and Altterations **Task Group:** Unknown **Meeting Action:** Mr. Galanes gave a report. The Subcommittee on Repairs and Alterations voted unanimously close this interpretation with no response. The Subcommittee on Repairs and Alterations opened a new action item NB15-1405 to

	address production impact tests. Mr. Wielgoszinski explained the subject of the interpretation and the new action item. The NBIC Committee voted unanimously to close this interpretation with no response. **SC RA Minutes:** January 2015 Mr. Wielgoszinski provided a report. After consideration, Mr. Wielgoszinski decided to withdraw the inquiry and requested a new item to address impact testing of P11B material. A motion was made to close this interpretation and open up an action Item. The new action item will be: **NB15-1405 Part 3-Impact testing of P-11B Material, SC R and A** (From IN14-0401) A task group was formed with Bob Wielgoszinski, as project manager and member Ben Schaefer, Walt Sperko, Monty Bost, and Dave Ford. (Attachment Pages 8-9)
July 2015	**No report. Not included on MC or RA agendas.**
January 2016	**No minutes available.**
July 2016	**No report. Not included on MC or RA agendas.**
January 2017	**No report. Not included on MC or RA agendas.**
July 2017	**No report. Not included on MC or RA agendas.**
January 2018	**No report. Not included on MC or RA agendas.**

Attachment "A"
This is the original request for interpretation in January 2014.

Request for Interpretation

Robert V. Wielgoszinski
Hartford Steam Boiler of CT

Item	IN 14-0401
Purpose	Code Interpretation & possible revision to present Code rules
Scope:	Repairs and alterations to vessels constructed of ferritic materials with tensile properties enhanced by heat treatment, i.e. Part UHT material.
Background	During the construction of liquid propane vessels it is typical to use SA-517 Gr. E (P-No. 11B) for use as heads and shells for propane transport tanks. The ASME Code requires the base materials, welding materials, and the WPS's to be qualified with impact tests. Also, the Code requires production impact testing to be performed. This is where the actual vessel material, actual filler materials, are welded with the actual WPS to be used in production, and the weld coupon is impact tested to meet the specified results of Section VIII. To do so, the Manufacturer of the vessel is sure to purchase enough extra base and filler material to perform these tests. When repairs / alterations are made to these vessels the NBIC requires the rules of the original construction Code to be followed. As such, any new material to be added to a vessel or any WPS's used or any filler metal used for the repair must then be impact tested and meet the results stated in Section VIII. Also, production impacts must therefore be made since this is a mandatory Section VIII requirement. This is usually accomplished by making a weld coupon out of existing material cut from the vessel and welding it to the new material to be added to the vessel, and then impact testing specimens from that coupon. But, not all repairs / alterations lend themselves the ability to take existing material from the vessel. If a small nozzle is added to the vessel, only a few inches of material is taken from the vessel. Or say a crack is to be weld repaired or there is weld metal build up to be made on some worn or wasted area. Then there is no extra material to be taken away from the vessel to run coupons for production impacts. Strict interpretation of the ASME Code would now require a piece of steel to be removed to run production impacts and then a flush patch installed over the area removed. Some individuals look at the words in NBIC, Part 3, Section 1, paragraph 1.2, where it says, "…the standard governing the original construction shall conform, insofar as possible…" gives one the leeway to not require production impacts because it's not possible. Others indicated that it is possible but not practical to cut perfectly good material out of a vessel when there is no need to. And others will say that the ASME clearly requires existing material to be removed to run impact tests. One thing is clear though, and that is there is lack of uniformity in applying these rules. So we are looking to the NBIC to provide some guidance in this matter. The Jurisdiction in this case is the US DOT, and 49CFR Chapter 1 § 180.413(a)(1) states that the NBIC is to be followed for repairs and modifications. DOT is also looking to the NBIC for clarification.

	Depending on the responses to the inquiry it may be prudent revise the Code to be more specific in this area of UHT materials.
Proposed Questions	**Question 1:** The NBIC Part 3 paragraph 1.2 states that a repair shall be carried out "insofar as possible to the section and edition of the ASME code most applicable to the work planned." If a vessel is constructed using SA-517-E (P-11B) material to ASME Section VIII Div. 1, where production and weld procedure impact tests were required during construction, would a repair to a crack in the shell require production and weld procedure impact testing under the NBIC? **Proposed Reply 1:** Yes. **Question 2:** If the answer to Question 1 is yes and there was no SA-517-E material from the original lot available, would the repair require the addition of new base material (e.g. a flush patch around the area of the crack) so that production impact tests could be performed with the original base metal to the new base metal? **Proposed Reply 1:** Yes. **Question 3:** If the vessel described in Question 1 was to be altered by adding an SA-675 (P-1) pump flange to the shell, would production and weld procedure impact tests be required using the same lot P-1 and P-11B base materials as used in the alteration? **Proposed Reply 1:** Yes.

Attachment "B"
This is the attachment that was included in the NBIC Minutes from the January 2015 meeting. It is identical to the original inquiry except for the new item number assigned as a revision.

Action Item NB15-1405 from Request for Interpretation

Robert V. Wielgoszinski
Hartford Steam Boiler of CT

Item	NB15-1405 *(was IN 14-0401)*
Purpose	~~Code Interpretation &~~ possible revision to present Code rules
Scope:	Repairs and alterations to vessels constructed of ferritic materials with tensile properties enhanced by heat treatment, i.e. Part UHT material.
Background	During the construction of liquid propane vessels it is typical to use SA-517 Gr. E (P-No. 11B) for use as heads and shells for propane transport tanks. The ASME Code requires the base materials, welding materials, and the WPS's to be qualified with impact tests. Also, the Code requires production impact testing to be performed. This is where the actual vessel material, actual filler materials, are welded with the actual WPS to be used in production, and the weld coupon is impact tested to meet the specified results of Section VIII. To do so, the Manufacturer of the vessel is sure to purchase enough extra base and filler material to perform these tests. When repairs / alterations are made to these vessels the NBIC requires the rules of the original construction Code to be followed. As such, any new material to be added to a vessel or any WPS's used or any filler metal used for the repair must then be impact tested and meet the results stated in Section VIII. Also, production impacts must therefore be made since this is a mandatory Section VIII requirement. This is usually accomplished by making a weld coupon out of existing material cut from the vessel and welding it to the new material to be added to the vessel, and then impact testing specimens from that coupon. But, not all repairs / alterations lend themselves the ability to take existing material from the vessel. If a small nozzle is added to the vessel, only a few inches of material is taken from the vessel. Or say a crack is to be weld repaired or there is weld metal build up to be made on some worn or wasted area. Then there is no extra material to be taken away from the vessel to run coupons for production impacts. Strict interpretation of the ASME Code would now require a piece of steel to be removed to run production impacts and then a flush patch installed over the area removed. Some individuals look at the words in NBIC, Part 3, Section 1, paragraph 1.2, where it says, "...the standard governing the original construction shall conform, <u>insofar as possible</u>..." gives one the leeway to not require production impacts because it's not possible. Others indicated that it is possible but not practical to cut perfectly good material out of a vessel when there is no need to. And others will say that the ASME clearly requires existing material to be removed to run impact tests. One thing is clear though, and that is there is lack of uniformity in applying these rules. So we are looking to the NBIC to provide some guidance in this matter. The

	Jurisdiction in this case is the US DOT, and 49CFR Chapter 1 § 180.413(a)(1) states that the NBIC is to be followed for repairs and modifications. DOT is also looking to the NBIC for clarification. Depending on the responses to the inquiry it may be prudent revise the Code to be more specific in this area of UHT materials.
Proposed Questions	**Question 1:** The NBIC Part 3 paragraph 1.2 states that a repair shall be carried out "insofar as possible to the section and edition of the ASME code most applicable to the work planned." If a vessel is constructed using SA-517-E (P-11B) material to ASME Section VIII Div. 1, where production and weld procedure impact tests were required during construction, would a repair to a crack in the shell require production and weld procedure impact testing under the NBIC? **Proposed Reply 1:** Yes. **Question 2:** If the answer to Question 1 is yes and there was no SA-517-E material from the original lot available, would the repair require the addition of new base material (e.g. a flush patch around the area of the crack) so that production impact tests could be performed with the original base metal to the new base metal? **Proposed Reply 1:** Yes. **Question 3:** If the vessel described in Question 1 was to be altered by adding an SA-675 (P-1) pump flange to the shell, would production and weld procedure impact tests be required using the same lot P-1 and P-11B base materials as used in the alteration? **Proposed Reply 1:** Yes.

Item NB16-1402 (NBIC Part 3, Section 6)

Supplement 14
Life Extension of High Pressure Fiber Reinforced Plastic Pressure Vessels

S14.1 Scope

This document may be used to evaluate whether the service life of high pressure fiber reinforced plastic pressure vessels (FRP) can be extended for an additional lifetime. High pressure means vessels with a working pressure from 3,000 psi (20 MPa) to 15,000 psi (103 MPa). For vessels intended for cyclic service, fatigue testing of new vessels is carried out by the vessel manufacturer to be certain that the vessel will not fail in service and such testing is typically required by regulatory authorities. Fatigue design and testing is the starting point for consideration of life extension.

S14.2 General

a) The procedure for in-service testing of high pressure composite pressure vessels, **Supplement 10** herein, is incorporated by reference into this procedure for life extension of high pressure composite pressure vessels. Supplement 10 is based on acoustic emission (AE) testing, specifically modal AE (MAE) testing. The MAE inspection procedure employs detection and analysis techniques similar to those found in seismology and SONAR. Much as with earthquakes, transient acoustical impulses arise in a composite material due to the motion of sources such as the rupture of fibers. These transients propagate as waves through the material and, if properly measured and analyzed by the methods in Supplement 10, the captured waves reveal, for example, how many fibers have ruptured. Similar information about other sources is also determinable, such as the presence and size of delaminations. Delaminations can play a significant role in vessel fatigue life, particularly delaminations near the transition regions and in the heads. The rupture behavior can be used to determine the integrity of the vessel. However, the development of criteria for life extension (LE) requires an understanding of the vessel design and fatigue life.

b) Fatigue testing of out of life vessels is a crucial part of the life extension process. It is used to validate the mechanical behavior of the vessels and to develop the numerical values for the allowables in the MAE pass/fail criteria for the particular design, material and construction.

S 14.3 Life Extension Procedure

a) New vessel fatigue life testing data shall be obtained from the Manufacturer's Design Report (MDR) and the number of cycles in a lifetime shall be determined from the MDR. The type of vessel under consideration for life extension shall have been shown through testing to be capable of sustaining at least three lifetimes of cycles to developed fill pressure followed by a subsequent burst test at a pressure greater than minimum design burst pressure.

b) An evaluation of the service the vessel has seen should take into account any operational conditions that may have differed from those used in the design testing and analysis. Such conditions include for example exposure to more severe weather than expected, more cycles

per year, constant high temperature and humidity, chemical attack or any other of a number of conditions under which operations take place that were not specifically included in testing at manufacture. Any such conditions shall be listed on the attached form. If no such conditions exist, it shall be so noted on the form. The test program delineated herein shall be revised to reflect the modified conditions as documented by the user and submitted for approval to the proper authorities.

c) Data and records for all vessels considered for life extension shall be kept and made readily available to inspectors or examination personnel. This includes an operating log, number of operating cycles since the previous examination, total number of operating cycles, examinations, examination techniques and results, maximum operating pressure and any unexpected pressures, temperatures, temperature cycles, damage events or other significant events that were outside the intended operating parameters or conditions.

d) A life extension test program shall be carried out for each type of vessel under consideration. Type of vessel means the particular manufacturer, materials (fiber and resin), water volume and design. If the type of vessel passes all requirements, then that type shall be eligible for life extension testing. If such a vessel passes the life extension MAE test its lifetime can be extended for one additional lifetime in five-year increments. In order to maintain life extension a vessel must be requalified every five years using the MAE test.

S14.4 Life Extension Test Program

a) The type of vessel under consideration for LE shall be noted. Manufacturer, place of manufacture and manufacturing date shall be recorded. The vessel dimensions shall be recorded. The specific fiber, matrix and winding pattern shall be recorded. If the fiber, matrix and winding pattern are not available from the manufacturer, then a vessel of the type under consideration shall be used to verify the winding pattern (hoop and helical angles and number of plies) through destructive testing.

b) Ten out-of-life vessels of the particular type shall be tested in the manner described herein. MAE techniques shall be applied to every vessel tested. Analysis of the MAE data is described herein. Two strain gages, one in the 0-degree and one in the 90-degree direction, shall be applied to every vessel pressure tested under this program. The purpose of strain gage data is to compute the 0 and 90 modulus values and to confirm that the modulus values of the material do not vary during the fatigue cycling required herein. Strain data shall be recorded and analyzed as described later on.

c) The LE test program proceeds by Steps. If the Step 1 is not successful, then there is no need to proceed to Step 2, and so forth.

S14.5 Life Extension Test Program Steps

S14.5.1 Step 1

Three vessels shall be selected from the ten and pressurized to burst. The vessels shall be inspected for visible damage, i.e., cuts, scrapes, discolored areas, and the vessel appearance shall be documented with photographs. MAE testing shall be done in conjunction with this testing as specified in Supplement 10, except for transducer spacing, pressurization plan and accept/reject criteria values. The values in Supplement 10 are for requalification testing. The transducer spacing shall be determined by the distance at which the 400 kHz component of a suitable pulser source is detectable along the axis of the vessel (essentially across the hoop fibers) and in the perpendicular direction (essentially parallel to the hoop fibers). Detectable means that the resulting signal component has an amplitude with at least a signal to noise ratio of 1.4. Transducer frequency response calibration and energy scale shall be carried out as specified in SUPPLEMENT 10. The pressurization plan shall follow that in ASME Section X Mandatory Appendix 8, i.e., there shall be two pressure cycles to test pressure with holds at test pressure as prescribed therein, however, the time interval between the two cycles may be reduced to one minute. For the purposes of life extension, the fiber fracture energy and BEO (background energy oscillation) values shall be as specified below.

a) No BEO greater than 2 times the quiescent energy (see Supplement 10) shall be observed up to test pressure or during pressure holds.

b) No fiber break event energy shall be greater than $24 \times 10^3 \times U_{FB}$ (see Supplement 10) during the second pressurization cycle.

c) No single event shall have an energy greater than $24 \times 10^5 \times U_{FB}$ during the second pressurization cycle.

Note: The numerical values specified in b) and c) can be adjusted through documented testing and stress analysis methods in order to account for the particular design, material and construction.

d) At least two sensors shall remain on each vessel all the way to burst in order to establish the BEO pressure for this type of vessel.

e) Plots of stress versus strain shall show linear behavior up to 90% of burst pressure.

f) The burst pressures of all three vessels shall be greater than the minimum design burst pressure.

g) If the burst pressure of any one of the three vessels is not greater than the minimum design burst pressure, then these vessels shall not be eligible for life extension and there is no need to proceed with Step 2 below.

Note: It is possible that one or more of the vessels selected had damage not obvious to visual inspection. If during this burst testing phase the MAE test identifies a vessel as damaged, the substitution of three other randomly selected vessels is allowed.

S14.5.2 Step 2

If the vessels pass Step 1, fatigue testing shall be carried out on a minimum of three vessels of the same type being considered for life extension.

a) Prior to testing, the vessels shall be inspected for visible damage, i.e., cuts, scrapes, discolored areas, and the vessel appearance shall be documented with photographs.

b) Prior to fatigue testing, MAE testing as specified in Step 1 shall be done in conjunction with the fatigue testing, hereinafter called the MAE test or MAE testing, in order to determine the suitability of the vessels for fatigue testing, i.e., that they pass the MAE test.

c) Next, the vessels shall be subjected to fatigue cycles. Pressure shall be 100 psi +0, -50% to at least 1.05 x working pressure. Vessels shall survive one and one-half (1.5) additional lifetimes. If they survive then they shall be tested by an MAE test as was done prior to fatigue cycling.

d) Provided they pass the MAE test, they shall be burst tested. At least two sensors shall remain on each vessel all the way to burst in order to establish that the BEO (background energy oscillation) pressure for the fatigued vessels is consistent, i.e., is the same percentage of ultimate, with that of the vessels tested in Step 1.

e) Plots of stress versus strain shall show linear behavior up to 90% of burst pressure.

f) The burst pressures at the end of the fatigue testing shall be greater than or equal to the minimum design burst. If the burst pressure of any one of the three vessels is not greater than the minimum design burst pressure, then these vessels shall not be eligible for life extension.

S14.5.3 Step 3

If the vessels pass Step 2, impact testing shall be carried out on a minimum of three vessels of the same type being considered for life extension.

a) Prior to testing, the vessels shall be inspected for visible damage, i.e., cuts, scrapes, discolored areas, and the vessel appearance shall be documented with photographs. Prior to impact testing, MAE testing shall be done in order to determine the suitability of the vessels for impact testing, i.e., that they pass the MAE test.

b) Two vessels shall be subjected to an ISO 11119.2 drop test and then subjected to the MAE test.

If they pass the MAE test, then one vessel shall be burst tested. At least two sensors shall remain on the vessel all the way to burst in order to establish that the BEO (background energy oscillation) pressure for the fatigued vessels is consistent, i.e., is the same percentage of ultimate, with that of the vessels tested in Step 1.

c) Plots of stress versus strain shall show linear behavior up to 90% of burst pressure.

d) If the burst pressure is not greater than the minimum design burst pressure, then these vessels shall not be eligible for life extension.

e) If the first vessel passes the burst test, the other dropped vessel shall be fatigue cycled and subsequently subjected to the MAE test and, if it passes, shall be burst tested under the same conditions as before. If the vessel fails during fatigue cycling, i.e., bursts or leaks, then these vessels shall not be eligible for life extension.

f) If the modulus changes by more than 10%, then these vessels shall not be eligible for life extension. The strain gages should be mounted in a location that is away from the impact zone.

g) The burst pressure at the end of the fatigue testing of the dropped vessel shall be greater than or equal to the minimum design burst. The vessels shall have MAE testing applied during burst testing as before and the BEO shall be consistent with the previously established percent of burst ±10%.

S14.5.4 Step 4

If the vessels pass Step 3, cut testing shall be carried out on a minimum of two vessels of the same type being considered for life extension.

a) Prior to testing, the vessels shall be inspected for visible damage, i.e., cuts, scrapes, discolored areas, and the vessel appearance shall be documented with photographs. Prior to cut testing, MAE testing shall be done in order to determine the suitability of the vessels for cut testing, i.e., that they pass the MAE test.

b) Two vessels shall be subjected to an ISO 11119.2 cut test and then subjected to the MAE test. If they pass, then one shall be burst tested under all the conditions and procedures delineated in Step 2. If the burst pressure is not greater than the minimum design burst pressure, then these vessels shall not be eligible for life extension.

c) If the cut vessel passes, then the other cut vessel shall be fatigue cycled as described in Step 2 and subsequently subjected to the MAE test and then burst tested with at least two MAE sensors remaining on and monitoring the vessel as before. If it does not survive fatigue cycling, then these vessels shall not be eligible for life extension.

d) The burst pressure at the end of the fatigue testing of the cut vessel shall be greater than or equal to the minimum burst pressure specified by ISO 11119.2.

If the vessel type passes Steps 1 to 4, then that type is eligible for life extension. An out of life vessel of the type subjected to the program above may have its life extended for one additional lifetime if it passes the MAE test. The vessel shall pass the MAE test at subsequent five-year intervals or at one-third of the lifetime, whichever is less, in order to continue in service. The vessel shall be labeled as having passed the NBIC life extension test.

PART 3
SUPPLEMENT 4
REPAIR AND ALTERATION OF FIBER-REINFORCED THERMOSETTING PLASTIC PRESSURE EQUIPMENT

S4.1 SCOPE
…
S4.2 INSPECTOR QUALIFICATIONS
…

S4.3 TOOLS
The following tools may be required by the Inspector:
a) adequate lighting including overall lighting and a portable lamp for close inspections;
b) handheld magnifying glass;
c) Barcol hardness tester;
d) small pick or pen knife;
e) small quantity of acetone and cotton swabs;
f) camera with flash capability; ~~and~~
g) liquid penetrant testing kit;
h) depth and length gages; and
i) metallic tap tester (e.g. quarter dollar).

S4.4 LIMITATIONS
…

S4.5 REPAIR LIMITATIONS FOR FILAMENT WOUND VESSELS
When the MAWP is greater than 200 psig (1.38 MPa), and less than 1500 psi (10.34 MPa) field repair of filament wound ASME Code Section X, Class I vessels shall be limited to corrosion barrier or liner repairs only, provided there is access to the vessel interior. ~~No s~~Structural repairs~~, re-rating, or alterations~~ are allowed for filament wound ASME Code Section X, Class 1 vessels that have an MAWP equal to or greater than ~~200 psig (1.38 MPa)~~ 1500 psi (10.34 MPa) and Class III vessels in accordance with the requirements of S4.19.

S4.6 VESSELS FABRICATED USING ELEVATED TEMPERATURE CURED RESIN SYSTEMS

…
…
…

S4.18 REPAIR AND ALTERATION METHODS
…

S4.19 REPAIR OF HIGH PRESSURE FILAMENT WOUND VESSELS

S4.19.1 Scope
Types of damage that are addressed in this section include abrasion, cuts and scratches, impact, chemical, fire and heat, and weathering.

S4.19.2 Level of damage
- Level 1 damage, up to 0.010 inch, is repairable any time
- Level 2 damage, defined by the manufacturer (or up to 0.050 if not defined), is repairable with the manufacturer's concurrence

- Level 3 damage, defined by the manufacturer (or 0.050 or greater if not defined), is not repairable

Softening of the resin due to chemical attack, or charring due to exposure to fire, ~~are considered to be~~shall be defined as Level 3 damage.

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The manufacturer's guidance for assessing damage depth and levels shall be followed if it conflicts with general guidelines in this document.

Table S4.19.2-1 Damage Levels and Assessment

Type of damage	Definition				Comment
		Level 1 — accept	Level 2	Level 3 — reject	
Cuts/scratches	A sharp impression where material has been removed or redistributed	When depth is less than 0.010 in	Depth from 0.010 in to the limit defined by the manufacturer, or 0.050 if not defined.	Greater than the limit defined by the manufacturer, or greater than 0.050 if not defined	
Abrasion	An area that is scuffed or worn thinner by rubbing or scraping	When depth is less than 0.010 in	Depth from 0.010 in to the limit defined by the manufacturer, or 0.050 if not defined.	Greater than the limit defined by the manufacturer, or greater than 0.050 if not defined	
Charring/soot	Blackening or browning of an area, burning of an area	Soot only, which washes off	Minor discolouration; manufacturer's recommendation	Charring	
Chemical attack, including stress corrosion cracking	Vessel is subjected to a chemical that softens or dissolves the composite	Residue may be cleaned off, no evidence of softening or dissolving.	Permanent discoloration.	Softening or dissolving of the material, cracking of the composite due to stress and chemical exposure	
Impact	Composite material was struck or hit; the resin has a frosted or smashed appearance	Damaged area is less than 0.20 in^2 and no other damage is apparent	Damage is uncertain, requiring the manufacturer's advice	Permanent deformation of cylinder or liner, evidence of underlying delamination	
Weathering	Composite affected by UV exposure and general weather	Minor gloss loss or chalking, only non-structural materials affected.	Structural laminate affected to a level less than defined by the manufacturer, or 0.050 inch.	Structural laminate affected to a level greater than defined by the manufacturer, or 0.050 inch	

S4.19.3 Thickness considerations
Damage to a depth greater than 5% of the structural laminate thickness is not repairable, and the vessel shall be removed from service. Depth of damage does not include paint thickness, or material designated by the manufacturer as protective (non-structural) rather than structural.

S4.19.4 Impact damage considerations
Impact damage may result in rejection, without possibility of repair, regardless of the measurable depth due to risk of internal fracture or delamination. Impact damage may be characterized by noting permanent deformation, softness or deflection of the surface, or localized surface crazing.

S4.19.5 Assessment of damage depth
All loose fibers and affected resin ~~are to~~shall be removed. This includes material that is softened by actions of chemicals or heat. Confirmation that the material remaining is sound shall be determined by a tap test, Barcol hardness measurement, and/or visual inspection.

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S4.19.6 Repair procedure

a) Non-structural material, including paint, shall be removed from any area involved in the repair.
b) Resin used in structural repairs shall be compatible with the resin used to fabricate the vessel.
c) Cloth patches made of glass or carbon fiber may be used in the repair and to cover the repaired area.
    1) Cloth patches shall extend at least 0.5 inches beyond the edge of the repair area, and subsequent layers ~~must~~shall extend at least 0.25 inch beyond the edge of the previous patch.
    2) Total patch thickness shall not be more than 5% of the structural thickness of the original laminate.
d) A layer of fiber wound continuously in the hoop direction may be applied over the repair.
e) Non-structural material may be applied to the repaired area for protection if originally used in the vessel design.
f) The repaired area may be covered with epoxy, polyurethane, or other compatible paint.
g) The repaired area shall be cured at a temperature that will not degrade the resin in the vessel. It may be cured prior to applying any non-structural material or paint.
h) The repair shall be confirmed by either:
    1) A tap test or Barcol hardness measurement conducted on the structural material after cure and prior to applying any non-structural material or paint, or
    2) A Modal Acoustic Emission test, in accordance with Part 2 S10.10, conducted after cure of the structural material
i) A hydrostatic proof test shall be conducted following confirmation of the repair.

S4.19.7 Acceptance of the vessel for return to service

The repair shall meet the repair confirmation requirement (i.e. confirmation of soundness using the tap test or Barcol hardness measurement, or confirmation using MAE). There shall be no delamination of the repaired area resulting from ~~the~~a hydrostatic proof test in accordance with the Design Specification. A vessel that does not meet the requirements of the repair confirmation or hydrostatic proof test shall not be returned to service.

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Item 17-137
Part 3, S4.18.2.1 2) d. 2. and 4.

1) …

2) Applying Test Patches to Verify Adequate Surface Preparation

a. Test patches should be applied to any substrate that will require a secondary bond to determine the integrity of the primer bond prior to the application of the laminate.

b. The subsequent steps shall be followed:

1. Apply the primer (0,003 -0.005 in. (0.08 to 0.13 mm)) to the prepared surface, and allow primer to cure.

2. Coat the primed surface with the same resin to be used in the laminate repair. Apply 4 in. (100 mm) x 14 in. (360 mm) piece of polyester, such as Mylar®, strip to one edge of primed area. Allow the polyester film to protrude from beneath the patch.

3. Apply two layers of 1-1/2 oz/sq. ft (0.46 kg/sq. m) chopped strand mat saturated with the same resin that will be used for the repair. Mat shall be 12 in. (305 mm) x 12 in. (305 mm) square.

4. Allow the mat layers to cure completely, this may be verified by checking the hardness of the laminate.

5. Pry patch from surface using a screwdriver, chisel, or pry bar.

6. A clean separation indicates a poor bond.

7. Torn patch laminate or pulled substrate indicates that the bond is acceptable.

c. If the bond is not adequate, go back to step a) and repeat the procedure.

Note: If the repair area is smaller than the test patch dimensions, decrease the test patch size accordingly.

d. As a last resort, if the previous procedure does not provide an adequate bond, the permeated laminate must be handled differently using the following procedure:

1. Hot water wash the equipment.

2. Abrasive blast ~~with #3 sand, or equal~~ to achieve a 0.003 to 0.005 in. (0.08 to 0.12 mm) anchor pattern, and allow to completely dry.

3. Prime with the recommended primer, an area 12 in. (305 mm) x 12 in. (305 mm) and apply a test patch.

4. Prime a second spot 12 in. (305 mm) x 12 in. (305 mm) and prime with a recommended ~~epoxy resin~~ alternate primer.

5. Allow this primer to cure.

Part 3, S4.18.2.2 2)

1) …

2) Note that any cracks, delaminations, or permeated surfaces must be removed. If the damage is deeper than the corrosion barrier and the material removed reaches the structural laminate, the vessel is not repairable. An adequate size abrasive or proper sanding disc must be used to obtain a ~~0.003 to 0.005~~ 0.002 to 0.003 in (0.05 to 0.08 mm) anchor pattern to the area that requires the repair.

3) Preparation of any surface requires that basic rules, common to all substrates, be followed. These rules are as outlined below:

    a. Surface must be free of contaminants;

    b. Surface must be structurally sound;

    c. Surface must have adequate anchor pattern;

    d. Surface must be dry;

    e. Surface must be primed with recommended primer.

    Note: After the surface has been properly prepared, it must be kept clean and dry until laminating can be started. Dust, moisture, or traces of oil that come in contact with the surface may act as a mold release or act to inhibit the cure and prevent a good secondary bond. Laminating should be done within two hours of the surface preparation.

Record 17-166

S3.3 REPAIRS OF A ROUTINE NATURE

a) The following repairs shall be considered routine, and shall comply with NBIC Part 3, 3.3.2.

1) Machining — routine repair shall not include the machining of pressure-retaining parts with the exception of minor machining for cleaning and joint preparation not to exceed 1/32 in. (0.8 mm) of material thickness.

2) Repair of Gasket Surfaces — re-machining of gasket surfaces, re-serrating, or flattening is permitted if the design thickness is maintained.

3) Replacing Individual Tubes — drilling out and replacing tubes with new tubes or repaired tubes. Only certified materials shall be used for this repair.

4) Nozzle Replacement — replacement of nozzles by removing the old nozzle and cementing a new nozzle in place. This is applicable for nozzles with inside diameters not exceeding ~~18 in. (460 mm).~~ **6 inches (152 mm)**.

5) Plugging Tubes – plugging individual tubes using accepted procedures.

6) Surface Repair — surface repair by installation of plugs or inlay material shall not exceed 1 $in.^3$ (16 cm^3) of total volume.

7) Replacement or Addition of Non-Load Bearing Attachments to Pressure-Retaining Item — For attachment of non-load bearing attachments to pressure-retaining items, the cementing procedure specification need only be qualified for the pressure part and cement to be used.

b) Complete records of these routine repairs shall be kept for review by the Inspector. The records shall include the number of tubes replaced or plugged and their location within the tube bundle.

NBIC Subcommittee R&A Action Block

Subject	Code Revision to Part 3, 2.5.3.6
File Number	NB18-12 **Prop. on Pg.** 2
Proposed Revision	1
Statement of Need	The revision is to Welding Method 6 to allow for weld build-up limited to 100 square inches on only Grade 91 tube OD surfaces for local erosion or mechanical damage.

Project Manager John Siefert/G. Galanes

SubGroup Negatives **SG Meeting Date**

Background;
Welding Method 6 was successfully introduced into the NBIC, part 3 to permit butt weld repair with no PWHT. This action permits weld build-up of the Grade 91 tubes within the boiler setting and same limitations to repair erosion or mechanical damage without the need for complete tube replacement. To ensure adequate controls, the size of the repair are using a weld overlay is limited to 100 square inches.

The size limitation for the weld build-up repair of 100 square inches is predicated on similar language which appears in Part 3 Supplements 2 and 4. For weld build-up repairs, section 2.5.3.6 c) 5) f) does not limit the F-No. 43 filler materials because the need for the weld build-up may be due to corrosion or erosion. In these examples, it may be necessary to use an optimized filler material which is otherwise prohibited in section 2.5.3.6 c) 5) d) for full thickness repairs.

The rev 4 version addressed a single comment received from the comment ballot ending in early March 2019. This comment is "*Subpara. a) needs clarification regarding "the attachment material may be dissimilar" comment, as WM-6 does not allow for welding of anything other than P-15E Grp. 1, Gr. 91 to itself (ref. a) 1)). Allowing for dissimilar material repairs at the integral attachment interface would require qualification of a new PQR and generation of a new WPS, which WM-6 does not provide for.*"

NBIC Subcommittee R&A Action Block

Item 18-12
2.5.3.6 WELDING METHOD 6

This welding method provides requirements for welding only Grade 91 tube material within the steam boiler setting. When using this welding method, the following applies:

a) This method is limited to butt welds, weld build-up repairs, or attachment weld to ~~in tubing~~ NPS 5 (DN 125) or less in diameter and ½ in. (13 mm) or less in wall thickness for which the applicable rules of the original code of construction did not require notch toughness testing;

b) Application shall be limited to only boiler tube repairs at a location internal to the boiler setting;

c) Upon the completion of weld repair, the repair area shall be kept above the dew point temperature so that condensation does not form on the repair surface before returned to service or a moisture-barrier coating shall be applied to the surface.

1) The material shall be limited to P-No 15E, Group 1, Grade 91, creep strength enhanced ferritic steel (CSEF).

2) The welding shall be limited to the SMAW and/or GTAW processes, manual or automatic, using suitably controlled maintenance procedures to avoid contamination by hydrogen producing sources. The surface of the metal shall be free of contaminants and kept dry.

3) The welding procedure qualification test coupon shall be P-No 15 E, Group 1, Grade 91.

4) Qualification thickness limits of base metal and weld deposit thickness shall be in accordance with ASME Section IX, QW-451.

5) The Welding Procedure Specification (WPS) shall be qualified in accordance with the requirements of ASME Section IX. No postweld heat treatment shall be applied to the test coupon. Additionally, the WPS shall include the following requirements:

a. The minimum preheat for the GTAW process shall be 200°F (100°C). The minimum preheat for the SMAW process shall be 300°F (150°C). The preheat temperature shall be checked to ensure the minimum preheat temperature is maintained during welding and until welding is completed. The maximum interpass temperature shall be 550°F (290°C).

b. When the SMAW process is specified for a fill pass layer, the electrode diameter is restricted to a maximum size of 1/8 in. (3.2 mm). When the GTAW-process is specified any limits in filler size is to be shown on the WPS.

c. Regardless of the welding process (SMAW and/or GTAW), only the use of stringer beads shall be permitted.

d. The filler metal shall be limited to an austenitic, nickel-base filler metal ~~having a designation F-No. 43~~ to those assigned to F-number 43 in Section IX, QW-432 and limited to the following consumables: ERNiCr-3, ENiCrFe-3,

NBIC Subcommittee R&A Action Block

ENiCrFe-2, ASME B&PV Code Cases 2733 and 2734 (e.g. EPRI P87); or
e. A martensitic, iron-base filler metal to those assigned to F-number 4 or F-number 6 in ASME Section IX, QW-432 ~~having a designation F-No. 4 or F-No. 6~~ and limited to the following consumables: E8015-B8, E8018-B8 or ER80S-B8.
f. For weld build-up repairs due to wastage, the filler metal shall be limited to those assigned to F-number 43 in ASME Section IX, QW-432.

NBIC Subcommittee R&A Action Block

Subject Code Revision to Part 3, 2.5.3.6

File Number NB18-13 **Prop. on Pg.** 2

Proposed Revision Statement of Need The revision is to add a new Welding Method 7 to allow for dissimilar metal welding of Grade 91 to austenitic steels and low alloy steels in a boiler setting and limited to butt welds, in accordance with approved welding method 6.

Project Manager John Siefert/G. Galanes

SubGroup Negatives **SG Meeting Date**

Background;
Welding Method 7 is being introduced to permit dissimilar metal weld repair with no PWHT between Grade 91 boiler tubes to austenitic steels and low alloy ferritic steels. This action permits DMW of Grade 91 tubes within the boiler setting following welding method 6 with no PWHT.

NBIC Subcommittee R&A Action Block

NB Item 18-13

2.5.3.7 WELDING METHOD 7

This repair method provides requirements for dissimilar metal welding (DMW) of Grade 91 tube material to either austenitic or low alloy ferritic steel tubing within the steam boiler setting. When using this welding method, the following applies:

a) This method is limited to butt welds in tubing NPS 5 (DN 125) or less in diameter and ½ in. (13 mm) or less in wall thickness for which the applicable rules of the original code of construction did not require notch toughness testing;

b) Application shall be limited to only boiler tube repairs at a location internal to the boiler setting;

c) Upon the completion of weld repair, the repair area shall be kept above the dew point temperature so that condensation does not form on the repair surface before returned to service or a moisture-barrier coating shall be applied to the surface.

For DMW of Grade 91 to austenitic steel steel tubing;

1) The materials shall be limited to P-No 15E, Group 1, Grade 91, creep strength enhanced ferritic steel (CSEF) joined to either P-No. 8, P-No. 42, P-No. 43, or P-No. 45, as permitted for welded construction by the applicable rules of the original code of construction.

2) The welding shall be limited to the SMAW and GTAW processes, manual or automatic, using suitably controlled maintenance procedures to avoid contamination by hydrogen producing sources. The surface of the metal shall be free of contaminants and kept dry.

3) The welding procedure qualification test coupon shall be P-No 15 E, Group 1, Grade 91 joined to either P-No. 8, P-No. 42, P-No. 43, or P-No. 45 and as required for the repair application.

4) Qualification thickness limits of base metal and weld deposit thickness shall be in accordance with ASME Section IX, QW-451.

5) The Welding Procedure Specification (WPS) shall be qualified in accordance with the requirements of ASME Section IX. No postweld heat treatment shall be applied to the test coupon. Additionally, the WPS shall include the following requirements:

a). The minimum preheat for the GTAW process shall be 200°F (100°C). The minimum preheat for the SMAW process shall be 300°F (150°C). The preheat temperature shall be checked to ensure the minimum preheat temperature is maintained during welding and until welding is completed.

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The maximum interpass temperature shall be 550°F (290°C).

b). When the SMAW process is specified for a fill pass layer, the electrode diameter is restricted to a maximum size of 1/8 in. (3.2 mm). When the GTAW-process is specified any limits in filler size is to be shown on the WPS.

c). Regardless of the welding process (SMAW or GTAW), only the use of stringer beads shall be permitted.

d). The filler metal shall be limited to an austenitic, nickel-base filler metal to those assigned to F-number 43 in ASME Section IX, QW-432 and limited to the following consumables: ERNiCr-3 (e.g., Filler Metal 82), ENiCrFe-3 (e.g., INCONEL Welding Electrode 182), ENiCrFe-2 (e.g., INCO-WELD A), ASME B&PV Code Cases 2733 and 2734 (e.g. EPRI P87);
~~e. A martensitic, iron-base filler metal having a designation F-No. 4 or F-No. 6 and limited to the following consumables: E8015-B8, E8018-B8 or ER80S-B8.~~

For DMW of Grade 91 to low alloy (P-No 5A) steel tubing:

1) The materials shall be limited to P-No 15E, Group 1, Grade 91, creep strength enhanced ferritic steel (CSEF) joined to P-No. 5A steel.

2) The welding shall be limited to the SMAW and/or GTAW processes, manual or automatic, using suitably controlled maintenance procedures to avoid contamination by hydrogen producing sources. The surface of the metal shall be free of contaminants and kept dry.

3) The welding procedure qualification test coupon shall be P-No 15 E, Group 1, Grade 91 joined to P-No. 5A steels.

4) Qualification thickness limits of base metal and weld deposit thickness shall be in accordance with ASME Section IX, QW-451.

5) The Welding Procedure Specification (WPS) shall be qualified in accordance with the requirements of ASME Section IX. No postweld heat treatment shall be applied to the test coupon. Additionally, the WPS shall include the following requirements:

(a). The minimum preheat for the GTAW process shall be 200°F (100°C). The minimum preheat for the SMAW process shall be 300°F (150°C). The preheat

NBIC Subcommittee R&A Action Block

temperature shall be checked to ensure the minimum preheat temperature is maintained during welding and until welding is completed. The maximum interpass temperature shall be 550°F (290°C).

(b). When the SMAW process is specified for a fill pass layer, the electrode diameter is restricted to a maximum size of 1/8 in. (3.2 mm). When the GTAW-process is specified any limits in filler size is to be shown on the WPS.

(c). Regardless of the welding process (SMAW or GTAW), only the use of stringer beads shall be permitted.

(d). The filler metal shall be limited to a martensitic, iron-base filler metal to those assigned to F-number 4 or F-number 6 in ASME Section IX, QW-432 and limited to the following consumables: E8015-B8, E8018-B8 or ER80S-B8.

3.3.4.6 PATCHES

a) Flush Patches

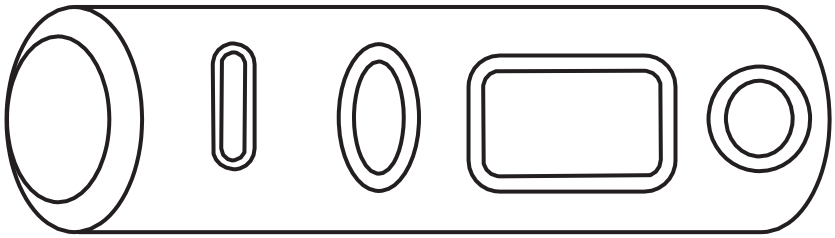
1) The weld around a flush patch shall be a full penetration weld and the accessible surfaces shall be ground flush where required by the applicable original code of construction. Examples of ~~flush welded~~ welded flush patches are shown in NBIC Part 3, Figure 3.3.4.6-a. ~~The welds shall be subjected to the nondestructive examination method used in the original code of construction or an alternative acceptable to the Inspector and, where required, the Jurisdiction.~~ Nondestructive examination will be performed in accordance with the requirements from NBIC Part 3, Section 4.2.

2) Before installing a flush patch, ~~the the~~ defective material ~~should should~~ shall be removed until sound material is reached. The patch ~~should should~~ shallshall be ~~rolled~~ formed to the proper shape or curvature. The edges ~~should should~~ shallshall align without overlap. In stayed areas, the weld seams should come between staybolt rows or riveted seams. Patches shall be made from a material whose composition and thickness meet the intended service. Patches may be any shape or size. If the patch is rectangular, a minimum radius of not less than three times the material thickness shall be provided at the corners. Square corners are not permitted. The completed welds shall meet the requirements of the original code of construction.

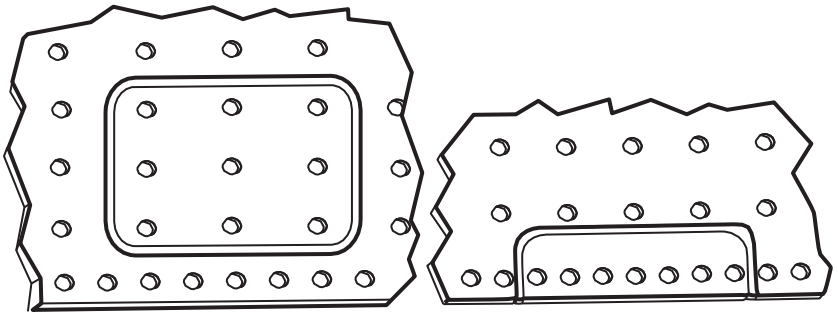
b) Tube Patches

In some situations it is necessary to weld a flush patch on a tube, such as when replacing tube sections and accessibility around the complete circumference of the tube is restricted, or when it is necessary to repair a small bulge. This is referred to as a window patch. Suggested methods for window patches are shown in NBIC Part 3, Figure 3.3.4.6-b.

FIGURE 3.3.4.6-a
FLUSH PATCH CONFIGURATIONS IN UNSTAYED AREAS



FLUSH PATCHES IN STAYED AREAS



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Item Number: 18-85

General Description: Correct the Title of SWPS AWS B2.1-1-233:2006 and AWS B2.1-1-235:2006 deleting "Flat Position Only" from the Title as it relates Part 3, Table 2.3

Sub Group: Repairs and Alterations

Task Group: Jim Sekely

Present Wording	**Proposed Wording**
B2,1-1-233: 2006 Standard Welding Procedure Specification for Argon Plus 25% Carbon Dioxide Shielded Gas Metal Arc Welding (Short Circuiting Transfer Mode) followed by Argon Plus 2% Oxygen Shielded Gas Metal Arc Welding (Spray Transfer Mode) of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER70S-3, ~~Flat Position Only,~~ As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-233: 2006 Standard Welding Procedure Specification for Argon Plus 25% Carbon Dioxide Shielded Gas Metal Arc Welding (Short Circuiting Transfer Mode) followed by Argon Plus 2% Oxygen Shielded Gas Metal Arc Welding (Spray Transfer Mode) of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER70S-3, As-Welded or PWHT Condition, Primarily Pipe Applications.
B2.1-1-235: 2006 Standard Welding Procedure Specification for Argon Plus 2% Oxygen Shielded Gas Metal Arc Welding (Spray Transfer Mode) of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER70S-3, ~~Flat Position Only,~~ As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-235: 2006 Standard Welding Procedure Specification for Argon Plus 2% Oxygen Shielded Gas Metal Arc Welding (Spray Transfer Mode) of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER70S-3, As-Welded or PWHT Condition, Primarily Pipe Applications.

Item 18-95

Existing wording:

a) Most steam locomotive boilers were manufactured in the first half of the 20th century or before. The calculations, formula, and shop practices used are now distant history and quite difficult to obtain. The rules for riveted construction were last published by ASME in Section I Code, 1971 Edition.

Proposed wording:

a) Most steam locomotive boilers were manufactured in the first half of the 20th century or before. The calculations, formula, and shop practices used are now distant history and quite difficult to obtain. The rules for riveted construction were last published by ASME in Section I Code, 1971 Edition **until the publication of ASME, Section I, Part PR and Part PL, which now govern new riveted construction and steam locomotive boiler construction.**

Background for Interpretation 18-100

Task Group PM – David Martinez;

Task Group members: Marty Russel and Nathan Carter

Item Number: 18-100 NBIC Location: Part 3, 3.3.2 Attachment Page 44

General Description: Revision adding (plugging) heat exchanger tubes with an outside diameter of ¾" or smaller to NBIC Part 3.3.2 Routine Repairs

Subgroup: Repairs and Alterations

Task Group: David Martinez (PM)

January 2019 Meeting Action: Progress Report: Mr. Martinez reported on this item and presented interpretations (98-04 and 98-29) that may satisfy the revision request, however after a presentation from TEiC regarding the use of explosive welding of tubes to be considered as a routine repair, Mr. Martinez recommend this be considered progress report to continue working to address explosive welding as a Routine Repair.

3.3.2 ROUTINE REPAIRS

a) Routine repairs are repairs for which the requirements for in-process involvement by the Inspector and stamping by the "R" Certificate Holder may be waived as determined appropriate by the Jurisdiction and the Inspector. All other applicable requirements of this code shall be met. Prior to performing routine repairs, the "R" Certificate Holder should determine that routine repairs are acceptable to the Jurisdiction where the pressure-retaining item is installed;

b) The Inspector, with the knowledge and understanding of jurisdictional requirements, shall be responsible for meeting jurisdictional requirements and the requirements of this code;

c) The "R" Certificate Holder's Quality System Program shall describe the process for identifying, controlling, and implementing routine repairs. Routine repairs shall be documented on Form R-1 with this statement in the Remarks section: "Routine Repair";

d) Alternative welding methods without postweld heat treatment as described in NBIC Part 3, 2.5.3 shall not be used for routine repairs.

(Example of proposed additional category to examples of Routine Repairs – paragraph e)

e) The following repairs may be considered as routine repairs and shall be limited to these categories:

1) Welded repairs or replacements of valves, fittings, tubes, or pipes NPS 5 (DN 125) in diameter and smaller, or sections thereof, where neither postweld heat treatment nor

NDE other than visual is required by the original code of construction. This includes their attachments such as clips, lugs, skirts, etc., but does not include nozzles to pressure-retaining items;

2) The addition or repair of nonload bearing attachments to pressure-retaining items where postweld heat treatment is not required;

3) Weld buildup of wasted areas in heads, shells, flanges and fittings not exceeding an area of 100 in.2 (64,520 mm2) or a thickness of 25% of nominal wall thickness or 1/2 in. (13 mm), whichever is less;

4) Corrosion resistance weld overlay not exceeding 100 in.2 (64,520 mm2); ~~and~~

5) Seal welding a mechanical connection for leak tightness where by-design, the pressure retaining capability is not dependent on the weld for strength and requires no postweld heat treatment; and

6) Plugging of heat exchanger tubes ¾ in. outside diameter and smaller when explosive plugging is used as method of plugging tubes.

Background Interpretation

INTERPRETATION 15-04

Subject: Part 3, Section 3

Edition: 2015

Question: Is explosion welding of plugs into leaking heat exchanger tubes considered a repair per the NBIC Part 3?

Reply: Yes.

Support for Consideration of the Proposed Action

ASME Section IX – 2019 (Addresses Procedure and Performance Qualification for Explosion Welding heat exchanger tubes to tubesheets, but not the plug to the tube)

QW-193 TUBE-TO-TUBESHEET TESTS
When the applicable Code Section requires the use of this paragraph for tube-to-tubesheet demonstration mockup qualification, QW-193.1 through QW-193.1.3 shall apply.

QW-193.1 Procedure Qualification Specimens. Ten mockup welds are required for qualifying each tube-to tubesheet welding procedure. The mockup assembly shall essentially duplicate the tube-to-tubesheet weld joint design to be used in production, within the limits of the essential variables of QW-288. The mockup test assembly shall be prepared with the tubesheet element having a thickness not less than the lesser of the thickness of the production tubesheet or 2 in. (50 mm). For tube-to-tubesheet welds to clad tubesheets, the cladding or overlay may be represented by a base material with a chemical composition that is essentially equivalent to the cladding composition. All welds in the mockup assembly shall be subjected to the following tests and shall meet the applicable acceptance criteria.

QW-193.1.1 Visual Examination. The accessible surfaces of the welds shall be examined visually with no magnification required. The welds shall show complete fusion, be free from visual cracks or porosity indications,
and have no evidence of burning through the tube wall.

QW-193.1.2 Liquid Penetrant. The liquid penetrant examination shall meet the requirements of Section V, Article 6. The weld surfaces shall meet the requirements of QW-195.2.

QW-193.1.3 Macro-Examination. The mockup welds shall be sectioned through the center of the tube for macro-examination. The four exposed surfaces shall be smoothed and etched with a suitable etchant (see QW-470) to give a clear definition of the weld and heat-affected zone. Using a magnification of 10X to 20X, the exposed cross sections of the weld shall confirm
(a) minimum leak path dimension required by the design
(b) no cracking
(c) complete fusion of the weld deposit into the tubesheet and tube wall face

Table QW-288.2
Essential Variables for Procedure Qualification of Tube-to-Tubesheet Welding (Explosion Welding)

Paragraph		Brief of Variables
QW-403 Base Metals	.35	ϕ Tube thickness
QW-410 Technique	.82	ϕ Pressure application
	.83	ϕ Explosive
	.84	ϕ Distance charge to tubesheet
	.85	ϕ Specified clearance

Legend:
ϕ Change

QW-410.83 A change in the type of explosive or a change in the energy content greater than ±10%.

QW-410.84 A change in the distance between the explosive charge and the tubesheet face greater than ±10%.

QW-410.85 A change in the specified clearance between the tube and the tubesheet greater than ±10%.

QW-193.2 Performance Qualification Specimens.
A minimum of five mockup tube-to-tubesheet welds are required to qualify each welder or welding operator. The same rules as those applicable for procedure qualification (QW-193.1) shall be followed, with the following additional requirements and exceptions:
(a) The essential variables in QW-387 shall apply.
(b) Essential performance qualification variables applicable for each welding process listed in QW-350 or QW-360 shall also be observed in addition to the variables of Table QW-388.
(c) Postweld heat treatment may be omitted.

Only one mockup weld is required to renew a welder's or welding operator's qualification when that qualification has expired or has been revoked per the requirements of QW-322.1.

Logic to consider motion for approval:

- Explosion welding to plug leaking tubes is supported by qualified written welding procedures and welder qualification procedures compared to other mechanical tube-plugging methods that are performed with no NBIC guidance.
- Explosion welding does not rely on fusion to join the two materials. It is a pressure weld in which the explosive force joins the two materials. Unlike fusion welding that is allowed in other examples of Routine Repairs, there is no heat affected zone, and PWHT is not needed nor required.
- The majority, if not all explosion tube plugging is performed on tubes ¾" and smaller, and typically under emergency conditions. No Inspector involvement would be required if this specific category was added to the categories of Routine Repairs
- The explosion tube-plugging method for tubes ¾" and smaller would be more cost and schedule effective and is proven to be a reliable method for plugging leaking heat exchanger tubes for owners and users.

Note: The only realistic test upon completion of explosion tube-plugging is a pressure test.

NB Item # 18-102 **Update NBIC Part 3, Table 2.3 (01-16-2019)**

Revise Table 2.3 adding the listed SWPSs that were revised by the AWS B2 Committee in 2018.

PROPOSED REVISION

TABLE 2.3

Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2) 1/8" [3 mm] through 1-1/2 inch [38 mm] Thick, E7018, in the As-Welded or PWHT Condition, Primarily Plate and Structural Applications.	**B2.1-1-016: 2018**
Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2) 1/8" [3 mm] through 1-1/2 inch [38 mm] Thick, E6010, in the As-Welded or PWHT Condition, Primarily Plate and Structural Applications.	**B2.1-1-017: 2018**
Standard Welding Procedure Specification (SWPS) for CO_2 Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2) 1/8" [3 mm] through 1-1/2 inch [38 mm] Thick, E70T-1C and E71T-1C, in the As-Welded, Primarily Plate and Structural Applications.	**B2.1-1-019: 2018**
Standard Welding Procedure Specification (SWPS) for 75% Ar/25%CO_2 Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2) 1/8" [3 mm] through 1-1/2 inch [38 mm] Thick, E70T-1M and E71T-1M, in the As-Welded or PWHT Condition, Primarily Plate and Structural Applications.	**B2.1-1-020: 2018**
Standard Welding Procedure Specification (SWPS) for Gas Tungsten Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2) 1/8" [3 mm] through 1-1/2 inch [38 mm] Thick, ER70S-2 and E7018, in the As-Welded or PWHT Condition, Primarily Plate and Structural Applications.	**B2.1-1-021: 2018**
Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2) 1/8" [3 mm] through 1-1/2 inch [38 mm] Thick, E6010 (Vertical Uphill) Followed by E7018, in the As-Welded or PWHT Condition, Primarily Plate and Structural Applications.	**B2.1-1-022: 2018**
Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8, Group 1) 1/8" [3 mm] through 1-1/2 inch [38 mm] Thick, in the As-Welded Condition, Primarily Plate and Structural Applications.	**B2.1-8-023: 2018**
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Standard Welding Procedure Specification (SWPS) for Self-Shielded Flux Cored Arc Welding of Carbon Steel (M-1 or P-1, Groups 1 and 2), 1/8 inch [3 mm] through 1/2 inch [13 mm] Thick, E71T-11, in the As-Welded Condition, Primarily Plate and Structural Applications	B2.1-1-027:2018

AWS B2.1-1-016:2018
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April 10, 2018

Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2) 1/8 inch [3 mm] through 1-1/2 inch [38 mm] Thick, E7018, in the As-Welded or PWHT Condition, Primarily Plate and Structural Applications

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Prepared by the
American Welding Society (AWS) B2 Committee on Procedure and Performance Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

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This SWPS is the first revision of AWS 82.1-1-019-94 that was amended to correct the permitted positions for E70T-1 electrode. Also, all references to ASME "S" material numbers have been deleted. The latest welding gas designators adopted by AWS A5.32M/A5.32 (ISO 14175 MOD) has been included. A Standard Units of Measure clause was added and the Safety clause was updated. Metric conversions were updated and Annex A on requesting an official interpretation on an AWS standard is included.

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This Standard Welding Procedure Specification is an outgrowth of the coordinated work of the Welding Procedures Committee of Welding Research Council and the AWS B2 Committee on Procedure and Performance Qualification. The Welding Procedures Committee has provided the data documented on the Summary of Procedure Qualification Records.

The welding terms used in this specification shall be interpreted in accordance with the definitions given in the latest edition of AWS A3.0M/A3.0, *Standard Welding Terms and Definitions Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*

The AWS B2 Committee on Procedure and Perfom1ance Qualification was formed in 1979 to provide welding standards concerning the subject of qualification. The primary document developed by this committee is AWS B2.1/B2.1M, *Speci;fication for Welding Procedure and Pe1formance Qualification*. This document established the foundation and framework for Standard Welding Procedure Specifications (SWPSs). The first two SWPSs were published in 1990. Since then SWPSs are continuing to be developed and published by the American Welding Society.

This SWPS is the first revision of AWS 82.1-1-026-94. All references to ASME "S" material numbers have been deleted from this edition. A Standard Units of Measure clause was added, and the Safety clause was updated. Metric conversions were updated and Annex A on requesting an official interpretation on an AWS standard is included.

A vertical line in the margin or underlined text in clauses, tables, or figures indicates an editorial or technical change from the previous edition.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, 82 Committee on Procedure and Performance Qualification, American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.

American Welding Society®

AWS B2.1-1-027:2018
An American National Standard

Approved by the
American National Standards Institute
February 16, 2018

Standard Welding Procedure Specification (SWPS) for Self-Shielded Flux Cored Arc Welding of Carbon Steel (M-1 or P-1, Groups 1 and 2), 1/8 inch [3 mm] through 1/2 inch [13 mm] Thick, E71T-11, in the As-Welded Condition, Primarily Plate and Structural Applications

4th Edition

Supersedes AWS B2.1-1-027:2011

Prepared by the
American Welding Society (AWS) B2 Committee on Procedure and Performance Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This standard contains the essential welding variables for carbon steel in the thickness range of 1/8 inch [3 mm] through 1/2 inch [13 mm], using self-shielded flux cored arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove and fillet welds. This SWPS was developed primarily for plate and structural applications.

American Welding Society®

Foreword

This foreword is not part of this standard but is included for informational purposes only.

The American Welding Society and the Welding Research Council have joined in a cooperative effort to generate standard welding procedures for industry. The need for pretested welding procedures that are supported by adequate test data and that satisfy the technical requirements for the commonly used construction codes and specifications has been expressed by many individuals and organizations. The purpose of a welding procedure qualification is to provide test data for assessing the properties of a weld joint.

This Welding Procedure Specification is an outgrowth of the coordinated work of the Welding Procedures Committee of WRC and the Committee on Welding Qualification of the AWS. The Welding Procedures Committee has provided the data documented by a Summary of Procedure Qualification Records.

The welding terms used in this specification shall be interpreted in accordance with the definitions given in the latest

Edition of AWS A3.0M/A3.0, *Standard Welding Terms and Definitions; Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying.*

The AWS Committee on Welding Qualification was formed in 1979 to provide welding standards concerning the subject of qualification. The primary document developed by this committee is AWS B2.1/B2.1M, Specification for Welding Procedure and Performance Qualification. This document established the foundation and framework for Standard Welding Procedure Specifications.

This SWPS is the third revision of AWS B2.1-1-027. All references to ASME "S" material numbers have been deleted. A Standard Units of Measure clause was added and the Safety clause was updated. Metric conversions were updated and Annex A on requesting an official interpretation on an AWS standard is included. Reference to A5.36/A5.36M and Classification E71T11-AZ-CS3 and AWS D15.1 *Railroad welding Specification for Cars and Locomotives* was added.

A vertical line in the margin or underlined text in clauses, tables, or figures indicates an editorial or technical change from the previous edition.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary of the AWS B2 Committee on Procedure and Performance Qualification, at American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.

Added for information only

Item 19-11 – Hellman – 7-15-2019

Location: Section 9 of Parts 1, 2, 3 and 4

Explanation of Need: Review the use of "Authorized Nuclear Inspection Agency" within the NBIC.

Background: An ANIA can not be an Inservice AIA since Endorsements for nuclear inspectors are issued only to new construction AIA's. The requirements for qualified Authorized Nuclear Inspectors/Supervisors are clearly specified in NB-263, RCI-1. Therefore revision to the Glossary definition is needed to clarify this requirement for the NR Accreditation Program.

Proposed Revision:

1.6.3 PREREQUISITES FOR ISSUING A NATIONAL BOARD "NR" CERTIFICATE OF

AUTHORIZATION

Before an organization can obtain a National Board "NR" Certificate of Authorization, the organization shall:

a) Have and maintain an inspection agreement with an Authorized Nuclear Inspection Agency accepted in accordance with NB-360, National Board Acceptance of Authorized Inspection Agencies (AIA) Accredited by the American Society of Mechanical Engineers (ASME) ~~or accredited in accordance with NB-369, Accreditation of Authorized Inspection Agencies (AIA) Performing Inservice Inspection Activities and Qualification of Inspectors of Boilers and Pressure Vessels~~.
b) Have a written Quality Assurance Program that complies with the requirements of this section and address all controls for the intended category and scope of activities.
c) Have a current edition of the NBIC.

Item 19-12 – Withers – 01-22-2019

NBIC NR Revisions.

Paragraph 1.6.3 – revise text to clarify Quality Assurance Program requirements:

Existing Text;

b) Have a written Quality Assurance Program that complies with the requirements of this section and address all controls for the intended category and scope of activities.

Revised text;

b) Have a written Quality Assurance Program ~~that complies with the requirements of~~ which includes the quality assurance manual and any supporting procedures, instructions and specifications required to comply with ~~-~~this section. The Quality Assurance Program shall ~~and~~ address all controls for the intended category and scope of activities requested.

Item 19-13 – Hellman – 7-15-2019

NBIC NR Revisions.

Explanation of Need: Revise text to clarify responsibilities for performing audits between the Certificate Holder and the AIA.

Location: Paragraph's 1.6.6.2 s); 1.6.7.2 s); and 1.6.8.2 s) AUDITS

The provisions identified in ASME NQA-1, Part 1, and Requirement 18 shall apply and shall include the following:

A comprehensive system of planned and periodic audits of the NR Certificate Holder's Quality Assurance Program shall be performed. ~~Audits shall include internal audits by the Certificate Holder and audits by the Authorized Inspection Agency.~~ Audit frequency shall be specified in the organization's Quality Assurance Manual. Audits shall be conducted at least annually (within 12 months) for any ongoing code activity to verify compliance with the Quality Assurance Program requirements, performed criteria, and to determine the effectiveness of the Quality Assurance Program. When no code work has been performed, the required annual audit need only include those areas of responsibility required to be continually maintained such as training, audits, organizational structure, and Quality Assurance Program revisions. The Quality Assurance Manual shall as a minimum describe the following:

a. Audits shall be performed in accordance with written procedures or checklists by qualified audit personnel not having direct responsibility in areas being audited;
b. Audit personnel shall be qualified in accordance with the current requirements of ASME NQA-1;
c. Audit results shall be documented and reviewed by responsible management for adequacy and effectiveness of the quality assurance program;
d. Requirements for follow-up actions shall be specified for any deficiencies noted during the audit;
e. Audit records and applicable documentation shall be made available to the Authorized Nuclear Inspect~~or~~ion Agency for review;
f. Audit records shall include as a minimum;
    i. Written procedures
    ii. Checklists;
    iii. Reports;
    iv. Written replies; and
    v. Completion of corrective actions.

Performance of Authorized Inspection Agency audits required by ASME QAI-1 and NB-263, RCI-1 shall be addressed in the Quality Assurance Manual.

Proposed change to repair and alteration plan certificate with respect to ASME Section VIII DIv.2 class 1 vessels

3.3.5.2 REPAIR PLAN

The user shall prepare, or cause to have prepared, a detailed plan covering the scope of the repair.

a) Engineer Review and Certification

The repair plan shall be reviewed and certified by an engineer meeting the criteria of ASME Section VIII, Division 2 or 3, as applicable, for an engineer signing and certifying a Manufacturer's Design Report. The review and certification shall be such as to ensure the work involved in the repair is compatible with the User's Design Specification and the Manufacturer's Design Report. The certifying requirement may be waived for ASME Section VIII, Division 2, Class 1 vessels that did not require the Manufacturer's Design Report to be signed during initial construction.

Note: The engineer qualification criteria of the Jurisdiction where the pressure vessel is installed should be verified before selecting the certifying engineer.

3.4.5.1 ALTERATION PLAN

a) Engineer Review and Certification

The alteration plan shall be reviewed and certified by an engineer meeting the criteria of ASME Section VIII, Division 2 or 3, as applicable, for an engineer signing and certifying a Manufacturer's Design Report. The review and certification shall be such as to ensure the work involved in the alteration is compatible with the user's design specification and the Manufacturer's Design Report.

Provided that the alteration does not introduce a condition that would require an engineer to sign the Manufacturer's Design Report for ASME Section VIII, Division 2, Class 1 vessels, the certifying requirement may be waived for vessels that did not require the ~~Manufacture's~~Manufacturer's Design Report to be signed during initial construction

Note: The engineer qualification criteria of the jurisdiction where the pressure vessel is installed should be verified before selecting the certifying engineer.

Justification,

This change is in-line with interpretation 17-08 and is on the basis that some vessel during new construction do not the Manufacture design report to be certified by and Engineer and accordingly repair or alteration plans to the same equipment do not need this step.

I changed the wording of the enquirer as it appeared to waive engineering sign off for all Div.1 class 1 vessels whereas interpretation 17-08 was specifically limited to those which were not required to be signed.

Item 19-16: NBIC Part 3, 3.2.2 e)
Submitted by: Eben Creaser eben.creaser@gnb.ca

Explanation of Need: This wording of this clause is causing confusion. I have had multiple instances where owners have requested to purchase welded replacement parts directly and read this clause with the belief that they can purchase a replacement part for in some cases a welded pressure part for an ASME Section I boiler and safe money by having the fabricator not Hydro test as per Section I even when it was not impractical to have the testing performed.

Background Information: The second sentence of 3.2.2 seems to provide optional provisions that contradict the mandatory requirement stated in the first sentence that requires 3.2.2 c) or d) parts to be pressure tested by the original code of construction. If this is the intent of the committee then the clause should be reworded to add an "or" between the sentences. The wording could also be understood to mean that all parts addressed in 3.2.2 c) or d) have to be pressure tested. But then the second sentence alludes to an optional requirement, it's just not clear.

Proposed Text:
If the intent of this clause is to provide optional pressure test requirements for parts then;

e) Replacement parts addressed by 3.2.2 c) or d) above shall receive a pressure test as required by the original code of construction prior to installation, or, when accepted by the owner, the Inspector and, where required, the Jurisdiction, parts ~~. If replacement parts have not been pressure tested as required by the original code of construction prior to installation they~~ may be installed without performing the original code of construction pressure test provided the owner, the Inspector and, when required, the Jurisdiction accept the use of one or a combination of the examination and test methods shown in Part 3, Section 4, paragraph 4.4.1 (for repairs) or 4.4.2 (for alterations). The R Certificate Holder responsible for completing the R Form shall note in the Remarks section of the R Form the examination(s) and test(s) performed, and the reason the replacement part was not tested in accordance with the original code of construction.

SUPPLEMENT 4
REPAIR AND ALTERATION OF FIBER-REINFORCED THERMOSETTING PLASTIC PRESSURE EQUIPMENT

S4.1 SCOPE

a) This supplement provides requirements and guidelines that apply to repairs and alterations to fiber-reinforced pressure-retaining items.

b) The letters “RP” shall be included on the “R” *Certificate of Authorization* for those organizations authorized to perform repairs/alterations of fiber-reinforced plastic pressure equipment.

S4.2 ~~INSPECTOR~~ QUALIFICATIONS FOR “R” ~~STAMP~~CERTIFICATE HOLDER DESIGNEE

The “R” Stamp Holder~~’s inspector shall have~~ shall designate an employee who will have the responsibility of verifying the repair and/or alteration activity meets the requirements of the NBIC. The designee shall have the following qualifications:

a) No fewer than five years of current verifiable documented experience in an occupational function that has a direct relationship to Reinforced Thermoplastic (RTP) fabrication and inspection, following customer or national standards, and be directly involved in the following activities:

1) the development of plans, drawings, procedures, inspection requirements, acceptance criteria, and personnel qualification requirements;

2) fabrication, construction, and supervision of personnel in the production of assemblies or subassemblies;

3) detection and measurement of nonconformities by application of visual or other nondestructive evaluation processes to written procedures;

4) supervision of personnel engaged in material and component examination;

5) repairs of equipment or supervision of personnel performing repairs;

6) preparation of written procedures for assembly, acceptance, nondestructive evaluation, or destructive tests;

7) qualification of secondary bonders, laminators, and welders to applicable codes, standards, or specifications;

8) operation techniques or activities used to fulfill quality control requirements for RTP fabrication or assembly; and

9) train the occupational skills of fabrication or assembly of RTP equipment.

b) The ~~Inspector~~ designee shall meet the following visual and educational requirements:

1) be able to read a Jaeger Type No. 1 standard chart at a distance of not less than 12 in. (305 mm);

2) be capable of distinguishing and differentiating contrast between colors;

3) have visual acuity checked annually to assure natural or corrected near distance vision; and

4) be a high school graduate or hold a state or military approved high school equivalency diploma.

c) The ~~employer of the inspector~~"R" Certificate Holder shall certify that the ~~employee~~ designee complies with the above qualification requirements.

S4.3 TOOLS

The following tools may be required by the ~~Inspector~~"R" Certificate~~Stamp~~ Holder's designee.:

a) adequate lighting including overall lighting and a portable lamp for close inspections;
b) handheld magnifying glass;
c) Barcol hardness tester;
d) small pick or pen knife;
e) small quantity of acetone and cotton swabs;
f) camera with flash capability; and
g) liquid penetrant testing kit.

S4.4 LIMITATIONS

All field work shall be limited to secondary bonding.

Item 19-21: Part 3, S2.11 a)

S2.11 NONDESTRUCTIVE EXAMINATION AND TESTING

a) The Inspector may require nondestructive examination (RT, PT, MT, UT, and VT) as necessary to ensure satisfactory welded repairs and alterations have been accomplished. (See NBIC Part 3, 4.2)

b) The nondestructive examination (NDE) requirements, including technique, extent of coverage, procedures, personnel qualification, and acceptance criteria, shall be in accordance with the original code of construction for the pressure-retaining item. Weld repairs and alterations shall be subjected to the same nondestructive examination requirements as the original welds.

c) Where the original code of construction is unknown or the NDE method is not possible or practicable, alternative NDE methods may be used. These methods shall be acceptable to the owner, the Inspector and where required, the Jurisdiction of the pressure-retaining item.

d) NDE methods used shall be suitable for providing meaningful results to verify the integrity of the repair and or alteration.

e) Exclusive use of visual examination (VT) for repair inspection is only permitted when following the requirements of Part 3, 4.4.1 e).

f) The integrity of repairs and alterations shall be verified by examination or test. (See NBIC Part 3, 4.4)

REFERENCE: NBIC Part 3, 4.2

4.2 NONDESTRUCTIVE EXAMINATION

a) The nondestructive examination (NDE) requirements, including technique, extent of coverage, procedures, personnel qualification, and acceptance criteria, shall be in accordance with the original code of construction for the pressure-retaining item. Weld repairs and alterations shall be subjected to the same nondestructive examination requirements as the original welds. Where this is not possible or practicable, alternative NDE methods acceptable to the Inspector and the Jurisdiction where the pressure-retaining item is installed, where required, may be used.

b) NDE personnel shall be qualified and certified in accordance with the requirements of the original code of construction. When this is not possible or practicable, NDE personnel may be qualified and certified in accordance with their employer's written practice. ASNT SNT-TC-1A, *Recommended Practice Nondestructive Testing Personnel Qualification and Certification* (2006 edition), or ANSI/ASNT CP-189, *Standard for Qualification and Certification of Nondestructive Testing Personnel* (2006 edition), shall be used as a guideline for employers to establish their written practice. Provisions for training, experience, qualification, and certification of NDE personnel shall be described in the "R" Certificate Holder's written quality system.

S6.16.4 REGISTRATION OF FORM R-1 AND FORM R-2

a) Organizations performing repairs, alterations, or modifications required by this supplement shall register such repairs, alterations, or modifications with the National Board.

b) The repair organization shall maintain a sequential Form “R” Log that shall identify the following:

1) Form number assigned ~~for Form R~~ 1to the “R” Form;
2) Identify if the activity was a repair, alteration, or modification;
3) When the repair, alteration, or modification was completed, and
4) Date sent to the National Board.

Item Number: 19-27, SG Historical
Part 3, S2.13.14.3

S2.13.14.3 REPAIR OF FUSIBLE PLUG OPENING

a) Threaded holes with damaged threads may be repaired by re-tapping or weld buildup and rethreading the threads shall be removed prior to welding.

b) Threaded opening with damaged threads that ~~can not~~cannot be repaired by re-tapping or re-threading should be repaired by welding a flush patch or half coupling connection to the sheet.

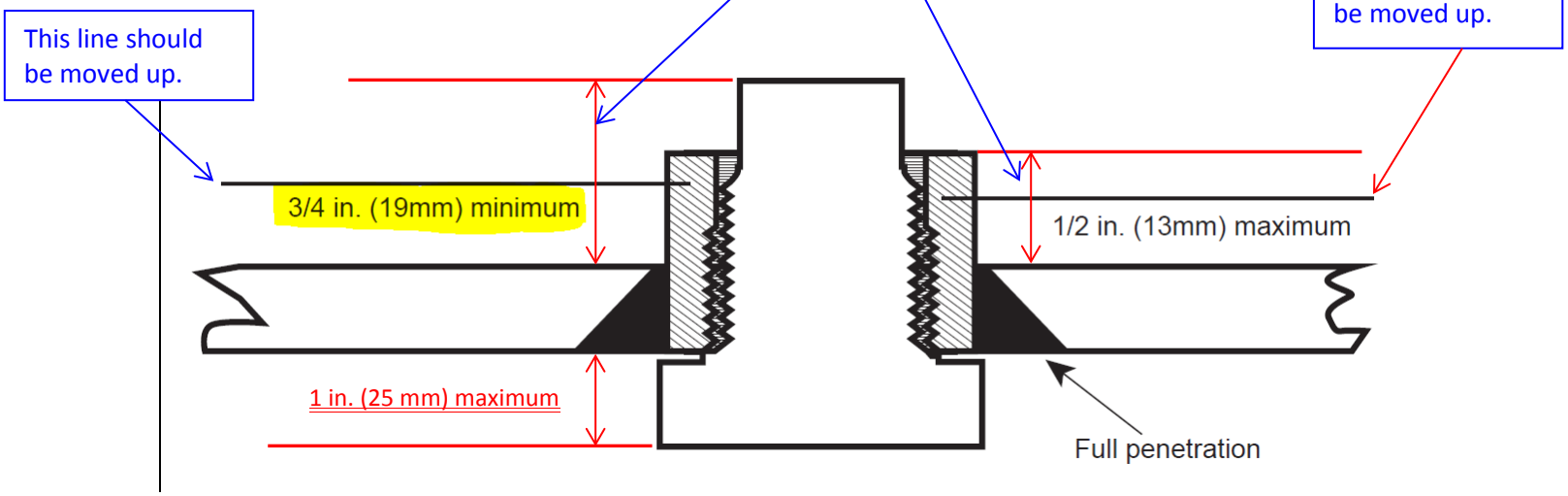
c) The half coupling connection shall be such a size as to not interfere with proper operation of the fusible plug. The half coupling shall be welded flush to the fire side using a full penetration weld. The half coupling must not project higher than ½ inch (13 mm) from the water side (See Figure NBIC Part 3, S2.13.14.3-a).

d) Flush patch type repairs are to be installed in accordance with S2.13.9.3 and S2.13.10.3 (See Figure S2.13.14.3-b).

e) A fusible plug shall be of such length that when installed it shall project at least ¾ inch (19 mm) on the water side of the plate, tube, or flue. It shall extend through the plate, tube, or flue on the fire side as little as possible but not more than 1 inch (25 mm).

add arrows to figure.

FIGURE S2.13.14.3-a
FUSIBLE PLUG REPAIR USING HALF COUPLING



2) Amended SWPSs: When an amendment occurs the suffix “AMD1” is added to the SWPS designation Amendments are issued when essential for the prompt correction of an error that could be misleading. Amendments are incorporated into the existing text of the SWPS, which is reprinted and clearly marked as incorporating an amendment(s), and which is identified in the revised Foreword of the amended SWPS.

3) Revised SWPSs: When a revision to a published SWPS occurs, the publication date is added to the SWPS designation. The date of the superseded SWPS is also noted on the cover page. Previous versions of the superseded SWPS may be used at the option of the R Certificate holder.

TABLE 2.3

(19)

CARBON STEEL — (M-1/P-1 MATERIALS)

SMAW — Shielded Metal Arc Welding	
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel, (M-1/P-1, Group 1 or 2), 3/16 in. ~~(5 mm)~~ through 3/4 in. ~~(19 mm)~~, in the As-Welded Condition, With Backing.	B2.1.001-90 and B2.1-1-001: 90(R2006)
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (~~3.2 mm~~) through 1 ½ in. ~~(38 mm)~~ Thick, E7018, As-Welded or PWHT Condition.	B2.1-1-016-94 and B2.1-1-016-94R
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, E6010, As-Welded or PWHT Condition.	B2.1-1-017-94 and B2.1-1-017-94R
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, E6010 (Vertical Uphill) followed by E7018, As-Welded or PWHT Condition.	B2.1-1-022-94 and B2.1-1-022-94R
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, E6010 (Vertical Downhill) followed by E7018, As-Welded or PWHT Condition.	B2.1-1-026-94 and B2.1-1-026-94R
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 3/4 in. ~~(19 mm)~~ Thick, E6010 (Vertical Uphill) followed by E7018, (Vertical Uphill) As-Welded Condition, Primarily Pipe Applications.	B2.1-1-201-96, and B2.1-1-201-96(R2007)
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 3/4 in. ~~(19 mm)~~ thick, E6010 (Vertical Downhill) followed by E7018 (Vertical Uphill), As-Welded Condition, Primarily Pipe Applications.	B2.1-1-202-96(R2007)
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 3/4 in. ~~(19 mm)~~ Thick, E6010 (Vertical Uphill), As-Welded Condition, Primarily Pipe Applications.	B2.1-1-203-96 and B2.1-1-203-96(R2007)
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 3/4 in. ~~(19 mm)~~ Thick, E6010 (Vertical downhill root with balance vertical uphill), As-Welded Condition, Primarily Pipe Applications.	B2.1-1-204-96 and B2.1-1-204-96(R2007)
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, E6010 (Vertical Uphill) followed by E7018 (Vertical Uphill), As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-205-96 and B2.1-1-205-96(R2007)

Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 1 ½ ~~3/4~~ in. ~~(19 mm)~~ Thick, E6010 (Vertical Downhill) followed by E7018 (Vertical Uphill), As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-206-96 and B2.1-1-206-96(R2007)
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 1 ½ ~~3/4~~ in. ~~(19 mm)~~ Thick, E7018, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-208-96
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through1 ½ in. ~~(38 mm)~~ Thick, E7018, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-208-96(R2007)
GTAW — Gas Tungsten Arc Welding	
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Carbon Steel, (M-1/P-1, Group 1 or 2), 3/16 in. ~~(5 mm)~~ through 7/8 in. ~~(22 mm)~~ Thick, in the As-Welded Condition, With or Without Backing.	B2.1-002-90, B2.1-002-90(R2006) and B2.1-1-002-90R
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 1 ½ ~~3/4~~ in. ~~(19 mm)~~ Thick, ER70S-2,	B2.1-1-207-96
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, ER70S-2, As-Welded or PWHT Condition, Primarily Pipe Application.	B2.1-1-207-96 (R2007)
Standard Welding Procedure Specification for Gas Tungsten Arc Welding (Consumable Insert) of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 1 ½ ~~3/4~~ in. ~~(19 mm)~~ Thick, INMs1 and ER70S-2, As-Welded or PWHT Condition, Primarily Pipe Application.	B2.1-1-210-96
Standard Welding Procedure Specification for Gas Tungsten Arc Welding with Consumable Insert Root of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 1-1/2 in. ~~(38 mm)~~ Thick, INMs-1, ER70S-2, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-210:2001 (R2012)
FCAW — Flux Core Arc Welding	
Standard Welding Procedure Specification for Self-Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 1 ⅛ in. ~~(38 mm)~~ Thick, E71T-8, As-Welded Condition.	B2.1-1-018-94 and B2.1-1.018-94R
Standard Welding Procedure Specification for CO2 Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 1 ⅛ in. ~~(38 mm)~~ Thick, E70T-1 and E71T-1, As-Welded Condition.	B2.1-1-019-94 and B2.1-1-019-94R and B2.1-1-94-AMD1
Standard Welding Procedure Specification for 75% Ar/25% CO2 Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 1 ½ ~~1-1/2~~ in. ~~(38 mm)~~ Thick, E70T-1M and E71T-1M, As-Welded or PWHT Condition.	B2.1-1-020-94 and B2.1-1-020-94R and B2.1-1-020-94-AMD1
Standard Welding Procedure for Self-Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 1/2 in. ~~(13 mm)~~ Thick, E71T-11, As-Welded Condition.	B2.1-1-027:~~1995~~ 1998 and B2.1-1-027-~~1998~~2011
Standard Welding Procedure Specification (SWPS) for Argon Plus 25% Carbon Dioxide Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 in. ~~(3.2 mm)~~ through 1 ⅛ in. ~~(38 mm)~~ Thick, E7XT-XM, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-234: 2006

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GMAW – Gas Metal Arc Welding	
Standard Welding Procedure Specification for Argon Plus 25% Carbon Dioxide Shielded Gas Metal Arc Welding (Short Circuiting Transfer Mode) followed by Argon Plus 2% Oxygen Shielded Gas Metal Arc Welding (Spray Transfer Mode) of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, ER70S-3, Flat Position Only, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-233: 2006
Standard Welding Procedure Specification for Argon Plus 2% Oxygen Shielded Gas Metal Arc Welding (Spray Transfer Mode) of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, ER70S-3, Flat Position Only, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-235: 2006
GTAW/SMAW Combination of Welding Processes	
Standard Welding Procedure Specification for Gas Tungsten Arc Welding Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER70S-2 and E7018, As-Welded or PWHT Condition.	B2.1-1-021-94 and B2.1-1-021-94R
Standard Welding Procedure Specification for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 1 ½ ~~3/4~~ in. ~~(19 mm)~~ Thick, ER70S-2 and E7018, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-209-96
Standard Welding Procedure Specification for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, ER70S-2 and E7018, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-209-96 (R2007)
Standard Welding Procedure Specification for Gas Tungsten Arc Welding (Consumable Insert) Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 1 ½~~3/4~~ in. ~~(19 mm)~~ Thick, INMs1 and E7018, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-211-96
Standard Welding Procedure Specification for Gas Tungsten Arc Welding with Consumable Insert Root Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, INMs-1, ER70S-2, and E7018 As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-211:2001 (R2012)
GMAW/FCAW – Combination of Welding Processes	
Standard Welding Procedure Specification for Argon Plus 25% Carbon Dioxide Shielded Gas Metal Arc Welding (Short Circuiting Transfer Mode) Followed by Argon Plus 25% Carbon Dioxide Shielded Flux Cored Arc Welding of Carbon Steel (m-1/P-1/S-1, Groups 1 and 2), 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, ER70S-3 and EXT-X, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-232:2006

Austenitic Stainless Steel — (M-8/P-8/~~S8~~ Materials)

SMAW — Shielded Metal Arc Welding	
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. ~~(3.2 mm)~~ through 1½ in. ~~(38 mm)~~ Thick, As-Welded Condition.	B2.1-8-023-94
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. ~~(3.2 mm)~~ through 1½ in. ~~(38 mm)~~ Thick, E3XX-XX, As-Welded Condition, Primarily Pipe Application.	B2.1-8-213-97 and B2.1-8-213-~~96~~97(R2007)

GTAW — Gas Tungsten Arc Welding	
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, As-Welded Condition.	B2.1-8-024-94
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 in. ~~(1.6 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, ER3XX, As-Welded Condition, Primarily Plate and Structural Applications.	B2.1-8-024:2001
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8~~1/16~~ in. ~~(1.6 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, ER3XX, As-Welded Condition, Primarily Pipe Applications.	B2.1-8-212-97
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 in. ~~(1.6 mm)~~ through 1 ½ in. ~~(38 mm)~~ thick, ER3XX, As-Welded Condition, Primarily Pipe Applications.	B2.1-8-212:2001 (R2012)
Standard Welding Procedure Specification for Gas Tungsten Arc Welding With Consumable Insert Root of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, IN3XX and ER3XX As-Welded Condition, Primarily Pipe Applications.	B2.1-8-215:1998 B2.1-8-215:2001 (R2012)
Combination Processes GTAW/SMAW	
Standard Welding Procedure Specification for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, As-Welded Condition.	B2.1-8-025-94
Standard Welding Procedure Specification for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, ER3XX and E3XX-XX, As-Welded Condition, Primarily Plate and Structural Applications.	B2.1-8-025:2001
Standard Welding Procedure Specification for Gas Tungsten Arc Welding Followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, ER3XX and E3XX-XX, As-Welded Condition, Primarily Pipe Applications.	B2.1-8-214-97
Standard Welding Procedure Specification for Gas Tungsten Arc Welding Followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, ER3XX and E3XX-XX, As-Welded Condition, Primarily Pipe Applications.	B2.1-8-214:2001 (R2012)
Standard Welding Procedure Specification for Gas Tungsten Arc Welding With Consumable Insert Followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ thick, IN3XX, ER3XX, and E3XX-XX As-Welded Condition, Primarily Pipe Application.	B2.1-8-216-1998
Standard Welding Procedure Specification for Gas Tungsten Arc Welding with Consumable Insert Root followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, IN3XX, ER3XX, and E3XX-XX As-Welded Condition, Primarily Pipe Applications.	B2.1-8-216:2001 (R2012)

Combination of Carbon Steel (M-1/P-1 Material) To Austenitic Stainless Steel (M-8/P-8 Material)

SMAW — Shielded Metal Arc Welding	
Standard Welding Procedure Specifications for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, E309(L)-15, -16, or -17, As-Welded Condition, Primarily Pipe Applications.	B2.1-1/8-228:2002 (R2013)

GTAW — Gas Tungsten Arc Welding	
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 in. ~~(1.6 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, ER309(L), As-Welded Condition, Primarily Pipe Applications.	B2.1-1/8-227:2002, 2002 AMD1 and (R2013)
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding with Consumable Insert Root of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 in. ~~(1.6 mm)~~ through 1½ in. ~~(38 mm)~~ Thick, IN309 and ER309(L), As-Welded Condition, Primarily Pipe Applications.	B2.1-1/8-230:2002, 2002 AMD1 and (R2013)
GTAW/SMAW Combination of Welding Processes	
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1,Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. ~~(3.2 mm)~~ through 1½ in. ~~(38 mm)~~ Thick, ER309(L) and E309(L)-15, -16, or -17, As-Welded Condition, Primarily Pipe Applications.	B2.1-1/8-229:2002, 2002 AMD1 and (R2013)
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding with Consumable Insert Root followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. ~~(3.2 mm)~~ through 1½ in. ~~(38 mm)~~ Thick, IN3009, ER309, and E309-15, -16, or -17 or IN309, ER309(L) and ER309(L)-15, -16, or -17, As-Welded Condition, Primarily Pipe Applications.	B2.1-1/8-231:2002 (R2015)

Chromium Molybdenum Steel (M-4/P-4 and M-~~5a~~5A/P-5A Materials)

SMAW — Shielded Metal Arc Welding	
Standard Welding Procedure Specifications for Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), E8018-B2, 1/8 in. ~~(3.2 mm)~~ through ~~1 ½~~1/2 in. ~~(38 mm)~~ Thick, As-Welded Condition, 1/8 in. ~~(3.2 mm)~~ through 1½ in. ~~(38 mm)~~ Thick, PWHT Condition, Primarily Pipe Applications.	B2.1-4-218:1999 (R2009)
Standard Welding Procedure Specifications for Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), E9018-B3, 1/8 in. ~~(3.2 mm)~~ through ~~1 ½~~1/2 in. ~~(38 mm)~~ Thick, As-Welded Condition, 1/8 in. ~~(3.2 mm)~~ through 1½ in. ~~(38 mm)~~ Thick, PWHT Condition, Primarily Pipe Applications.	B2.1-5A-223:1999 (R2009)
GTAW — Gas Tungsten Arc Welding	
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), ER80S-B2, 1/8 in. ~~(3.2 mm)~~ through ~~1 ½~~1/2 in. ~~(38 mm)~~ Thick, As-Welded Condition, 1/8 in. ~~(3.2 mm)~~ through 3/4 in. ~~(19 mm)~~ Thick, PWHT Condition, Primarily Pipe Applications.	B2.1-4-217:1999 (R2009)
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding (Consumable Insert Root) of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), E8018-B2, 1/8 in. ~~(3.2 mm)~~ through ~~1 ½~~1/2 in. ~~(38 mm)~~ Thick, As-Welded Condition, 1/8 in. ~~(3.2 mm)~~ through 3/4 in. ~~(19 mm)~~ Thick, PWHT Condition, IN515 and ER80S-B2, Primarily Pipe Applications.	B2.1-4-220:1999 (R2009)
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), ER90S-B3, 1/8 in. ~~(3.2 mm)~~ through ~~1½~~1/2 in. ~~(38 mm)~~ Thick, As-Welded Condition, 1/8 in. ~~(3.2 mm)~~ through 3/4 in. ~~(19 mm)~~ Thick, PWHT Condition, Primarily Pipe Applications.	B2.1-5A-222:1999 (R2009)

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Standard Welding Procedure Specifications for Gas Tungsten Arc Welding (Consumable Insert Root) of Chromium-Molybdenum Steel (M-5A/P-5A), 1/8 in. ~~(3.2 mm)~~ through ~~1 1/2~~1/2 in. ~~(38 mm)~~ Thick, As-Welded Condition, 1/8 in. ~~(3.2 mm)~~ through 3/4 in. ~~(19 mm)~~ Thick, PWHT Condition, IN521 and ER90S-B3, Primarily Pipe Applications.	B2.1-5A-225:1999 (R2009)
Chromium-Molybdenum Steel Processes GTAW/SMAW	
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding (Consumable Insert Root) followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through ~~1 1/2~~1/2 in. ~~(38 mm)~~ Thick, As-Welded Condition, 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, PWHT Condition, IN515, ER80S-B2, and E8018-B2, Primarily Pipe	B2.1-4-221:1999 (R2009)
Standard Welding Procedure Specifications for Gas Tungsten Arc Welded followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), 1/8 in. ~~(3.2 mm)~~ through ~~1 ½~~1/2 in. ~~(38 mm)~~ Thick, As-Welded Condition, 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, PWHT Condition, ER90S-B3 and E9018-B3, Primarily Pipe Applications.	B2.1-5A-224:1999 (R2009)
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding (Consumable Insert Root) followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), 1/8 in. ~~(3.2 mm)~~ through ~~1 ½~~1/2 in. ~~(38 mm)~~ Thick, As- Welded Condition, 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, PWHT Condition, IN521, ER90S-B3, and E9018-B3, Primarily Pipe Applications.	B2.1-5A-226:1999 (R2009)
Standard Welding Procedure Specifications (SWPS) for Gas Tungsten Arc Welded followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-4A/P-4, Group 1 or 2), 1/8 in. ~~(3.2 mm)~~ through 1/2 in. ~~(13 mm)~~ Thick, As-Welded Condition, 1/8 in. ~~(3.2 mm)~~ through 1 ½ in. ~~(38 mm)~~ Thick, PWHT Condition, ER80S-B2 and E9018-B2, Primarily Pipe Applications.	B2.1-4-219:1999 (R2009)

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2.4 AWS REFERENCE STANDARDS

The following AWS Standards have been adopted by the NBIC for use as referenced below:

a) AWS B2.1 - Specification for Welding Procedure and Performance Qualification

b) AWS B2.1 BMG - Base Metal Grouping for Welding Procedure and Performance Qualification

2.5 HEAT TREATMENT

(19) ### 2.5.1 PREHEATING

a) Preheating may be employed during use of a process to assist in completion of the joint. The need for and the temperature of preheat are dependent on a number of factors such as chemical analysis, degree of restraint of the items being joined, material thickness, and mechanical properties. The procedure specification for the material being joined shall specify the preheat temperature requirements.

b) See minimum temperatures for preheating given in NBIC Part 3, Table 2.5.1 as a general guide. It is cautioned that the preheating temperatures listed may not be the same as those of the original code of construction and do not necessarily ensure satisfactory completion of the joint. Requirements for individual materials within the P-Number listing may have preheating requirements more or less restrictive than this general guide. When reference is made in this section to materials by the ASME designation, P-Number and Group Number, the suggestions of this section apply to the applicable materials of the original code of construction, either ASME or other, which conform by chemical composition

ANSI/AWS B2.1-1-027-95
An American National Standard

Standard
Welding Procedure
Specification (WPS) for

Self-Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 3/4 inch Thick, E71T-11, As-Welded Condition

American Welding Society

ANSI/AWS B2.1-1-027:1998
An American National Standard

Standard Welding Procedure Specification (WPS) for

Self Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1,Group 1 or 2),1/8 through 1/2 inch Thick, E71T-11, As-Welded Condition

American Welding Society

Key Words—Welding Procedure Specification, base metal, allowable joint designs, filler metal, carbon steel, manual welding, shielded metal arc welding

ANSI/AWS B2.1-1-206-96 (R2007)
An American National Standard

Approved by the
American National Standards Institute
May 28, 1996

Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E6010 (Vertical Downhill) Followed by E7018 (Vertical Uphill), As-Welded or PWHT Condition, Primarily Pipe Applications

Prepared by the
American Welding Society (AWS) B2 Committee on Welding Procedure and Performance Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This standard contains the essential welding variables for carbon steel in the thickness range of 1/8 through 1-1/2 inch, using manual shielded metal arc welding with E6010 (vertical downhill) followed by E7018 (vertical uphill). It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for fillet and groove welds. This WPS was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, FL 33126

Key Words — Welding Procedure Specification, base metal, allowable joint designs, filler metal, carbon steel, manual welding, shielded metal arc welding

ANSI/AWS B2.1-1-206-96
An American National Standard

Approved by
American National Standards Institute
May 28, 1996

Standard Welding Procedure Specification (WPS) Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2) 1/8 through 1-1/2 inch Thick, E6010 (Vertical Downhill) Followed by E7018 (Vertical Uphill) As-Welded or PWHT Condition

Prepared by
AWS Committee on Welding Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by
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Key Words—Welding Procedure Specification, base metal, allowable joint designs, filler metal, carbon steel, manual welding, gas tungsten arc welding

ANSI/AWS B2.1-1-207-96 (R2007)
An American National Standard

Approved by the
American National Standards Institute
May 28, 1996

Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, ER70S-2, As-Welded or PWHT Condition, Primarily Pipe Applications

Prepared by the
American Welding Society (AWS) B2 Committee on Welding Procedure and Performance Qualification

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Approved by the
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This standard contains the essential welding variables for carbon steel in the thickness range of 1/8 through 1-1/2 inch, using manual gas tungsten arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for fillet and groove welds. This WPS was developed primarily for pipe applications.

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Key Words — Welding Procedure Specification, base metal, allowable joint designs, filler metal, carbon steel, manual welding, gas tungsten arc welding

ANSI/AWS B2.1-1-207-96
An American National Standard

Approved by
American National Standards Institute
June 7, 1996

Standard Welding Procedure Specification (WPS) Gas Tungsten Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, ER70S-2, As-Welded or PWHT Condition (Primarily Pipe Applications)

Prepared by
AWS Committee on Welding Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by
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Abstract

This standard contains the essential welding variables for carbon steel in the thickness range of 1/8 through 1-1/2 inch, using manual gas tungsten arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for fillet and groove welds. This WPS was developed primarily for pipe applications.

American Welding Society
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Key Words—Welding Procedure Specification, base metal, allowable joint designs, filler metal, carbon steel, manual welding, shielded metal arc welding

ANSI/AWS B2.1-1-208-96 (R2007)
An American National Standard

Approved by the
American National Standards Institute
May 28, 1996

Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E7018, As-Welded or PWHT Condition, Primarily Pipe Applications

Prepared by the
American Welding Society (AWS) B2 Committee on Welding Procedure and Performance Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This standard contains the essential welding variables for carbon steel in the thickness range of 1/8 through 1-1/2 inch, using shielded metal arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for fillet and groove welds. This WPS was developed primarily for pipe applications.


American Welding Society
550 N.W. LeJeune Road, Miami, FL 33126

Key Words — Welding Procedure Specification, base metal, allowable joint designs, filler metal, carbon steel, manual welding, shielded metal arc welding

ANSI/AWS B2.1-1-208-96
An American National Standard

Approved by
American National Standards Institute
May 28, 1996

Standard Welding Procedure Specification (WPS) Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2) 1/8 through 1-1/2 inch Thick, E7018 As-Welded or PWHT Condition

Prepared by
AWS Committee on Welding Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This standard contains the essential welding variables for carbon steel in the thickness range of 1/8 through 1-1/2 inch, using manual shielded metal arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for fillet and groove welds. This WPS was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, Florida 33126

Key Words—Welding Procedure Specification, base metal, allowable joint designs, filler metal, carbon steel, gas tungsten arc welding, shielded metal arc welding, manual welding

ANSI/AWS B2.1-1-209-96 (R2007)
An American National Standard

Approved by the
American National Standards Institute
June 7, 1996

Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, ER70S-2 and E7018, As-Welded or PWHT Condition, Primarily Pipe Applications

Prepared by the
American Welding Society (AWS) B2 Committee on Welding Procedure and Performance Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This standard contains the essential welding variables for carbon steel in the thickness range of 1/8 through 1-1/2 inch, using manual gas tungsten arc welding followed by shielded metal arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for fillet and groove welds. This WPS was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, FL 33126

Key Words — Welding Procedure Specification, base metal, allowable joint designs, filler metal, carbon steel, gas tungsten arc welding, shielded metal arc welding, manual welding

ANSI/AWS B2.1-1-209-96
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Approved by
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June 7, 1996

Standard Welding Procedure Specification (WPS) Gas Tungsten Arc Welding Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2) 1/8 through 1-1/2 inch Thick, ER70S-2 and E7018 As-Welded or PWHT Condition

Prepared by
AWS Committee on Welding Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by
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Abstract

This standard contains the essential welding variables for carbon steel in the thickness range of 1/8 through 1-1/2 inch, using manual gas tungsten arc welding followed by shielded metal arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for fillet and groove welds. This WPS was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, Florida 33126

Key Words — Welding Procedure Specification, base metal, allowable joint designs, consumable insert, filler metal, carbon steel, manual welding, gas tungsten arc welding

ANSI/AWS B2.1-1-210-96
An American National Standard

Approved by
American National Standards Institute
June 7, 1996

Standard Welding Procedure Specification (WPS) Gas Tungsten Arc (Consumable Insert) Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2) 1/8 through 1-1/2 inch Thick, INMs-1 and ER70S-2 As-Welded or PWHT Condition

Prepared by
AWS Committee on Welding Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This standard contains the essential welding variables for carbon steel in the thickness range of 1/8 through 1-1/2 inch, using manual gas tungsten arc welding with consumable inserts. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for fillet and groove welds. This WPS was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, Florida 33126

Key Words— Welding Procedure Specification, base metal, allowable joint designs, consumable insert, filler metal, carbon steel, manual welding, gas tungsten arc welding

AWS B2.1-1-210:2001
An American National Standard

Approved by
American National Standards Institute
October 31, 2001

Standard Welding Procedure Specification (WPS) for Gas Tungsten Arc Welding with Consumable Insert Root of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, INMs-1 and ER70S-2, As-Welded or PWHT Condition, Primarily Pipe Applications

Supersedes AWS B2.1-1-210:2000

Prepared by
AWS B2 Committee on Welding Qualification

Under the Direction of
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This standard contains the essential welding variables for carbon steel in the thickness range of 1/8 through 1-1/2 inch, using manual gas tungsten arc welding with consumable insert root. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This WPS was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, Florida 33126

Key Words — Welding Procedure Specification, base metal, allowable joint designs, consumable insert, filler metal, carbon steel, manual welding, gas tungsten arc welding, shielded metal arc welding

ANSI/AWS B2.1-21-96
An American National Standard

Approved by
American National Standards Institute
June 7, 1996

Standard Welding Procedure Specification (WPS) Gas Tungsten Arc (Consumable Insert) Welding Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2) 1/8 through 1-1/2 inch Thick, INMs-1, ER70S-2, and E7018 As-Welded or PWHT Condition

Prepared by
AWS Committee on Welding Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This standard contains the essential welding variables for carbon steel in the thickness range of 1/8 through 1-1/2 inch, using manual gas tungsten arc welding with consumable inserts, followed by shielded metal arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for fillet and groove welds. This WPS was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, Florida 33126

Key Words— Welding Procedure Specification, base metal, allowable joint designs, consumable insert, filler metal, carbon steel, manual welding, gas tungsten arc welding, shielded metal arc welding

AWS B2.1-1-211:2001
An American National Standard

Approved by
American National Standards Institute
October 31, 2001

Standard Welding Procedure Specification (WPS) for Gas Tungsten Arc Welding with Consumable Insert Root followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, INMs-1, ER70S-2, and E7018, As-Welded or PWHT Condition, Primarily Pipe Applications

Supersedes AWS B2.1-1-211:2000

Prepared by
AWS B2 Committee on Welding Qualification

Under the Direction of
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This standard contains the essential welding variables for carbon steel in the thickness range of 1/8 through 1-1/2 inch, using manual gas tungsten arc welding with consumable insert root, followed by shielded metal arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This WPS was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, Florida 33126

AWS B2.1-4-217:1999 (R2009)
An American National Standard

Approved by the
American National Standards Institute
December 8, 1999
Reaffirmed: May 29, 2009

Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), ER80S-B2, 1/8 through 1/2 in. Thick, As-Welded Condition; 1/8 through 3/4 in. Thick, PWHT Condition, Primarily Pipe Applications

1st Edition

Prepared by the
American Welding Society (AWS) B2 Committee on Procedure and Performance Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This standard contains the essential welding variables for chromium-molybdenum steel in the thickness range of 1/8 through 1/2 in. in the as-welded condition; or 1/8 through 3/4 in. in the postweld heat treated (PWHT) condition, using manual gas tungsten arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This standard welding procedure specification (SWPS) was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, FL 33126

Key Words—Welding Procedure Specification, WPS, base metal, allowable joint designs, filler metal, pipe, chromium-molybdenum steel, manual welding, gas tungsten arc welding

AWS B2.1-4-217:1999
An American National Standard

Approved by
American National Standards Institute
December 8, 1999

Standard Welding Procedure Specification (WPS) for Gas Tungsten Arc Welding of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), ER80S-B2, 1/8 through 1/2 in. Thick, As-Welded Condition, 1/8 through 3/4 in. Thick, PWHT Condition, Primarily Pipe Applications

Prepared by
AWS Committee on Welding Qualification

Under the Direction of
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This standard contains the essential welding variables for chromium-molybdenum steel in the thickness range of 1/8 through 1/2 in. in the as-welded condition, or 1/8 through 3/4 in. in the postweld heat treated (PWHT) condition, using manual gas tungsten arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This welding procedure specification (WPS) was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, Florida 33126

AWS B2.1-4-218:1999 (R2009)
An American National Standard

Approved by the
American National Standards Institute
December 8, 1999
Reaffirmed: May 29, 2009

Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), E8018-B2, 1/8 through 1/2 in. Thick, As-Welded Condition; 1/8 through 1-1/2 in. Thick, PWHT Condition, Primarily Pipe Applications

1st Edition

Prepared by the
American Welding Society (AWS) B2 Committee on Procedure and Performance Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This standard contains the essential welding variables for chromium-molybdenum steel in the thickness range of 1/8 through 1/2 in. in the as-welded condition; or 1/8 in. through 1-1/2 in. in the postweld heat treated (PWHT) condition, using manual shielded metal arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This standard welding procedure specification (SWPS) was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, FL 33126

Key Words—Welding Procedure Specification, WPS, base metal, allowable joint designs, filler metal, pipe, chromium-molybdenum steel, manual welding, shielded metal arc welding

AWS B2.1-4-218:1999
An American National Standard

Approved by
American National Standards Institute
December 8, 1999

Standard Welding Procedure Specification (WPS) for Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), E8018-B2, 1/8 through 1/2 in. Thick, As-Welded Condition, 1/8 through 1-1/2 in. Thick, PWHT Condition, Primarily Pipe Applications

Prepared by
AWS Committee on Welding Qualification

Under the Direction of
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This standard contains the essential welding variables for chromium-molybdenum steel in the thickness range of 1/8 through 1/2 in. in the as-welded condition, or 1/8 in. through 1-1/2 in. in the postweld heat treated (PWHT) condition, using manual shielded metal arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This welding procedure specification (WPS) was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, Florida 33126

AWS B2.1-4-219:1999 (R2009)
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Approved by the
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December 8, 1999
Reaffirmed: May 29, 2009

Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), 1/8 through 1/2 in. Thick, As-Welded Condition; 1/8 through 1-1/2 in. Thick, PWHT Condition, ER80S-B2 and E8018-B2, Primarily Pipe Applications

1st Edition

Prepared by the
American Welding Society (AWS) B2 Committee on Procedure and Performance Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This standard contains the essential welding variables for chromium-molybdenum steel in the thickness range of 1/8 through 1/2 in. in the as-welded condition; or 1/8 in. through 1-1/2 in. in the postweld heat treated (PWHT) condition, using manual gas tungsten arc welding followed by manual shielded metal arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This standard welding procedure specification (SWPS) was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, FL 33126

Key Words—Welding Procedure Specification, WPS, base metal, allowable joint designs, filler metal, pipe, chromium-molybdenum steel, manual welding, gas tungsten arc welding, shielded metal arc welding

AWS B2.1-4-219:1999
An American National Standard

Approved by
American National Standards Institute
December 8, 1999

Standard Welding Procedure Specification (WPS) for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), 1/8 through 1/2 in. Thick, As-Welded Condition, 1/8 through 1-1/2 in. Thick, PWHT Condition, ER80S-B2 and E8018-B2, Primarily Pipe Applications

Prepared by
AWS Committee on Welding Qualification

Under the Direction of
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This standard contains the essential welding variables for chromium-molybdenum steel in the thickness range of 1/8 through 1/2 in. in the as-welded condition, or 1/8 in. through 1-1/2 in. in the postweld heat treated (PWHT) condition, using manual gas tungsten arc welding followed by manual shielded metal arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This welding procedure specification (WPS) was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, Florida 33126

AWS B2.1-4-220:1999 (R2009)
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Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding (Consumable Insert Root) of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), 1/8 through 1/2 in. Thick, As-Welded Condition; 1/8 through 3/4 in. Thick, PWHT Condition, IN515 and ER80S-B2, Primarily Pipe Applications

1st Edition

Prepared by the
American Welding Society (AWS) B2 Committee on Procedure and Performance Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This standard contains the essential welding variables for chromium-molybdenum steel in the thickness range of 1/8 through 1/2 in. in the as-welded condition; or 1/8 in. through 3/4 in. in the postweld heat treated (PWHT) condition, using manual gas tungsten arc welding with a consumable insert root. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This standard welding procedure specification (SWPS) was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, FL 33126

Key Words—Welding Procedure Specification, WPS, base metal, allowable joint designs, consumable insert, filler metal, pipe, chromium-molybdenum steel, manual welding, gas tungsten arc welding

AWS B2.1-4-220:1999
An American National Standard

Approved by
American National Standards Institute
December 8, 1999

Standard Welding Procedure Specification (WPS) for Gas Tungsten Arc Welding (Consumable Insert Root) of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), 1/8 through 1/2 in. Thick, As-Welded Condition, 1/8 through 3/4 in. Thick, PWHT Condition, IN515 and ER80S-B2, Primarily Pipe Applications

Prepared by
AWS Committee on Welding Qualification

Under the Direction of
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This standard contains the essential welding variables for chromium-molybdenum steel in the thickness range of 1/8 through 1/2 in. in the as-welded condition, or 1/8 in. through 3/4 in. in the postweld heat treated (PWHT) condition, using manual gas tungsten arc welding with a consumable insert root. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This welding procedure specification (WPS) was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, Florida 33126

AWS B2.1-4-221:1999 (R2009)
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Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding (Consumable Insert Root) followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), 1/8 through 1/2 in. Thick, As-Welded Condition; 1/8 through 1-1/2 in. Thick, PWHT Condition, IN515, ER80S-B2, and E8018-B2, Primarily Pipe Applications

1st Edition

Prepared by the
American Welding Society (AWS) B2 Committee on Procedure and Performance Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This standard contains the essential welding variables for chromium-molybdenum steel in the thickness range of 1/8 through 1/2 in. in the as-welded condition; or 1/8 through 1-1/2 in. in the postweld heat treated (PWHT) condition, using manual gas tungsten arc welding with a consumable insert root, followed by shielded metal arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This standard welding procedure specification (SWPS) was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, FL 33126

Key Words—Welding Procedure Specification, WPS, base metal, allowable joint designs, consumable insert, filler metal, pipe, chromium-molybdenum steel, manual welding, gas tungsten arc welding, shielded metal arc welding

AWS B2.1-4-221:1999
An American National Standard

Approved by
American National Standards Institute
December 8, 1999

Standard Welding Procedure Specification (WPS) for Gas Tungsten Arc Welding (Consumable Insert Root) followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), 1/8 through 1/2 in. Thick, As-Welded Condition, 1/8 through 1-1/2 in. Thick, PWHT Condition, IN515, ER80S-B2, and E8018-B2, Primarily Pipe Applications

Prepared by
AWS Committee on Welding Qualification

Under the Direction of
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This standard contains the essential welding variables for chromium-molybdenum steel in the thickness range of 1/8 through 1/2 in. in the as-welded condition, or 1/8 through 1-1/2 in. in the postweld heat treated (PWHT) condition, using manual gas tungsten arc welding with a consumable insert root, followed by shielded metal arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This welding procedure specification (WPS) was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, Florida 33126

AWS B2.1-5A-222:1999 (R2009)
An American National Standard

Approved by the
American National Standards Institute
December 8, 1999
Reaffirmed: May 29, 2009

Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), ER90S-B3, 1/8 through 1/2 in. Thick, As-Welded Condition; 1/8 through 3/4 in. Thick, PWHT Condition, Primarily Pipe Applications

1st Edition

Prepared by the
American Welding Society (AWS) B2 Committee on Procedure and Performance Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This standard contains the essential welding variables for chromium-molybdenum steel in the thickness range of 1/8 through 1/2 in. in the as-welded condition; or 1/8 through 3/4 in. in the postweld heat treated (PWHT) condition, using manual gas tungsten arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This standard welding procedure specification (SWPS) was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, FL 33126

Key Words—Welding Procedure Specification, WPS, base metal, allowable joint designs, filler metal, pipe, chromium-molybdenum steel, manual welding, gas tungsten arc welding

AWS B2.1-5A-222:1999
An American National Standard

Approved by
American National Standards Institute
December 8, 1999

Standard Welding Procedure Specification (WPS) for Gas Tungsten Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), ER90S-B3, 1/8 through 1/2 in. Thick, As-Welded Condition, 1/8 through 3/4 in. Thick, PWHT Condition, Primarily Pipe Applications

Prepared by
AWS Committee on Welding Qualification

Under the Direction of
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This standard contains the essential welding variables for chromium-molybdenum steel in the thickness range of 1/8 through 1/2 in. in the as-welded condition, or 1/8 through 3/4 in. in the postweld heat treated (PWHT) condition, using manual gas tungsten arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This welding procedure specification (WPS) was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, Florida 33126

AWS B2.1-5A-223:1999 (R2009)
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American National Standards Institute
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Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), E9018-B3, 1/8 through 1/2 in. Thick, As-Welded Condition; 1/8 through 1-1/2 in. Thick, PWHT Condition, Primarily Pipe Applications

1st Edition

Prepared by the
American Welding Society (AWS) B2 Committee on Procedure and Performance Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This standard contains the essential welding variables for chromium-molybdenum steel in the thickness range of 1/8 through 1/2 in. in the as-welded condition; or 1/8 through 1-1/2 in. in the postweld heat treated (PWHT) condition, using manual shielded metal arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This standard welding procedure specification (SWPS) was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, FL 33126

Key Words—Welding Procedure Specification, WPS, base metal, allowable joint designs, filler metal, pipe, chromium-molybdenum steel, manual welding, shielded metal arc welding

AWS B2.1-5A-223:1999
An American National Standard

Approved by
American National Standards Institute
December 8, 1999

Standard Welding Procedure Specification (WPS) for Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), E9018-B3, 1/8 through 1/2 in. Thick, As-Welded Condition, 1/8 through 1-1/2 in. Thick, PWHT Condition, Primarily Pipe Applications

Prepared by
AWS Committee on Welding Qualification

Under the Direction of
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This standard contains the essential welding variables for chromium-molybdenum steel in the thickness range of 1/8 through 1/2 in. in the as-welded condition, or 1/8 through 1-1/2 in. in the postweld heat treated (PWHT) condition, using manual shielded metal arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This welding procedure specification (WPS) was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, Florida 33126

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Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), 1/8 through 1/2 in. Thick, As-Welded Condition; 1/8 through 1-1/2 in. Thick, PWHT Condition, ER90S-B3 and E9018-B3, Primarily Pipe Applications

1st Edition

Prepared by the
American Welding Society (AWS) B2 Committee on Procedure and Performance Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This standard contains the essential welding variables for chromium-molybdenum steel in the thickness range of 1/8 through 1/2 in. in the as-welded condition; or 1/8 through 1-1/2 in. in the postweld heat treated (PWHT) condition, using manual gas tungsten arc welding followed by manual shielded arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This standard welding procedure specification (SWPS) was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, FL 33126

Key Words—Welding Procedure Specification, WPS, base metal, allowable joint designs, filler metal, pipe, chromium-molybdenum steel, manual welding, gas tungsten arc welding, shielded metal arc welding

AWS B2.1-5A-224:1999
An American National Standard

Approved by
American National Standards Institute
December 8, 1999

Standard Welding Procedure Specification (WPS) for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), 1/8 through 1/2 in. Thick, As-Welded Condition, 1/8 through 1-1/2 in. Thick, PWHT Condition, ER90S-B3 and E9018-B3, Primarily Pipe Applications

Prepared by
AWS Committee on Welding Qualification

Under the Direction of
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This standard contains the essential welding variables for chromium-molybdenum steel in the thickness range of 1/8 through 1/2 in. in the as-welded condition, or 1/8 through 1-1/2 in. in the postweld heat treated (PWHT) condition, using manual gas tungsten arc welding followed by manual shielded arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This welding procedure specification (WPS) was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, Florida 33126

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Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding (Consumable Insert Root) of Chromium-Molybdenum Steel (M-5A/P-5A), 1/8 through 1/2 in. Thick, As-Welded Condition; 1/8 through 3/4 in. Thick, PWHT Condition, IN521 and ER90S-B3, Primarily Pipe Applications

1st Edition

Prepared by the
American Welding Society (AWS) B2 Committee on Procedure and Performance Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This standard contains the essential welding variables for chromium-molybdenum steel in the thickness range of 1/8 through 1/2 in. in the as-welded condition; or 1/8 through 3/4 in. in the postweld heat treated (PWHT) condition, using manual gas tungsten arc welding with a consumable insert root. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This standard welding procedure specification (SWPS) was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, FL 33126

Key Words—Welding Procedure Specification, WPS, base metal, allowable joint designs, consumable insert, filler metal, pipe, chromium-molybdenum steel, manual welding, gas tungsten arc welding

AWS B2.1-5A-225:1999
An American National Standard

Approved by
American National Standards Institute
December 8, 1999

Standard Welding Procedure Specification (WPS) for Gas Tungsten Arc Welding (Consumable Insert Root) of Chromium-Molybdenum Steel (M-5A/P-5A), 1/8 through 1/2 in. Thick, As-Welded Condition, 1/8 through 3/4 in. Thick, PWHT Condition, IN521 and ER90S-B3, Primarily Pipe Applications

Prepared by
AWS Committee on Welding Qualification

Under the Direction of
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This standard contains the essential welding variables for chromium-molybdenum steel in the thickness range of 1/8 through 1/2 in. in the as-welded condition, or 1/8 through 3/4 in. in the postweld heat treated (PWHT) condition, using manual gas tungsten arc welding with a consumable insert root. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This welding procedure specification (WPS) was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, Florida 33126

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Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding (Consumable Insert Root) followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), 1/8 through 1/2 in. Thick, As-Welded Condition; 1/8 through 1-1/2 in. Thick, PWHT Condition, IN521, ER90S-B3, and E9018-B3, Primarily Pipe Applications

1st Edition

Prepared by the
American Welding Society (AWS) B2 Committee on Procedure and Performance Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This standard contains the essential welding variables for chromium-molybdenum steel in the thickness range of 1/8 through 1/2 in. in the as-welded condition; or 1/8 through 1-1/2 in. in the postweld heat treated (PWHT) condition, using manual gas tungsten arc welding with a consumable insert root, followed by shielded metal arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This standard welding procedure specification (SWPS) was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, FL 33126

Key Words—Welding Procedure Specification, WPS, base metal, allowable joint designs, consumable insert, filler metal, pipe, chromium-molybdenum steel, manual welding, gas tungsten arc welding, shielded metal arc welding

AWS B2.1-5A-226:1999
An American National Standard

Approved by
American National Standards Institute
December 8, 1999

Standard Welding Procedure Specification (WPS) for Gas Tungsten Arc Welding (Consumable Insert Root) followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), 1/8 through 1/2 in. Thick, As-Welded Condition, 1/8 through 1-1/2 in. Thick, PWHT Condition, IN521, ER90S-B3, and E9018-B3, Primarily Pipe Applications

Prepared by
AWS Committee on Welding Qualification

Under the Direction of
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This standard contains the essential welding variables for chromium-molybdenum steel in the thickness range of 1/8 through 1/2 in. in the as-welded condition, or 1/8 through 1-1/2 in. in the postweld heat treated (PWHT) condition, using manual gas tungsten arc welding with a consumable insert root, followed by shielded metal arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This welding procedure specification (WPS) was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, Florida 33126

Key Words — Welding Procedure Specification, base metal, allowable joint designs, filler metal, austenitic stainless steel, manual welding, gas tungsten arc welding

ANSI/AWS B2.1-8-212-97
An American National Standard

Approved by
American National Standards Institute
March 20, 1997

Standard Welding Procedure Specification (WPS) Gas Tungsten Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1) 1/8 through 1-1/2 inch Thick, ER3XX As-Welded Condition, Primarily Pipe Applications

Prepared by
AWS Committee on Welding Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This standard contains the essential welding variables for austenitic stainless steel in the thickness range of 1/8 through 1-1/2 inch, using manual gas tungsten arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for fillet and groove welds. This WPS was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, Florida 33126

Key Words— Welding Procedure Specification, base metal, allowable joint designs, filler metal, austenitic stainless steel, manual welding, gas tungsten arc welding

AWS B2.1-8-212:2001
An American National Standard

Approved by
American National Standards Institute
October 31, 2001

Standard Welding Procedure Specification (WPS) for Gas Tungsten Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 through 1-1/2 inch Thick, ER3XX, As-Welded Condition, Primarily Pipe Applications

Supersedes AWS B2.1-8-212:2000

Prepared by
AWS B2 Committee on Welding Qualification

Under the Direction of
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This standard contains the essential welding variables for austenitic stainless steel in the thickness range of 1/16 through 1-1/2 inch, using manual gas tungsten arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for fillet and groove welds. This WPS was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, Florida 33126

Key Words—Welding Procedure Specification, base metal, allowable joint designs, filler metal, austenitic stainless steel, manual welding, shielded metal arc welding

ANSI/AWS B2.1-8-213-97 (R2007)
An American National Standard

Approved by the
American National Standards Institute
March 20, 1997

Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 through 1-1/2 inch Thick, E3XX-XX, As-Welded Condition, Primarily Pipe Applications

Prepared by the
American Welding Society (AWS) B2 Committee on Welding Procedure and Performance Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This standard contains the essential welding variables for austenitic stainless steel in the thickness range of 1/8 through 1-1/2 inch, using manual shielded metal arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for fillet and groove welds. This WPS was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, FL 33126

Key Words — Welding Procedure Specification, base metal, allowable joint designs, filler metal, austenitic stainless steel, manual welding, shielded metal arc welding

ANSI/AWS B2.1-8-213-97
An American National Standard

Approved by
American National Standards Institute
March 20, 1997

Standard Welding Procedure Specification (WPS) Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 through 1-1/2 inch Thick, E3XX-XX, As-Welded Condition (Primary Pipe Applications)

Prepared by
AWS Committee on Welding Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This standard contains the essential welding variables for austenitic stainless steel in the thickness range of 1/8 through 1-1/2 inch, using manual shielded metal arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for fillet and groove welds. This WPS was developed primarily for pipe applications.

American Welding Society
550 N.W. LeJeune Road, Miami, Florida 33126

Item 19-32: NBIC Part 3, 3.3.2 and 3.4.4
Submitted by: Paul Shanks paul.shanks@onecis.com

Explanation of Need: When heater treaters and some other similar equipment is constructed in accordance with section VIII div.1 an item called a fire tube is often removable (bolted) and should be part of the code boundary. In use these items are consumables and are replaced often with items not bearing the code markings or manufactured to code practices. This practice places the users and public in jeopardy and should be curtailed.

Background Information: ASME VIII Div.1 allows for the code boundary to terminate at a flange face only when connecting to external piping or other code items, if a code fire tube is replace with a none code item the ASME construction code has been violated and the potential for harm is increased. Please be aware that ASME has a task group focused on clarifying the requirements for fire tubes. https://www.glossary.oilfield.slb.com/en/Terms/h/heater_treater.aspx

Proposed Text Changes: see following pages

3.3.2 ROUTINE REPAIRS

a) Routine repairs are repairs for which the requirements for in-process involvement by the Inspector and stamping by the "R" Certificate Holder may be waived as determined appropriate by the Jurisdiction and the Inspector. All other applicable requirements of this code shall be met. Prior to performing routine repairs, the "R" Certificate Holder should determine that routine repairs are acceptable to the Jurisdiction where the pressure-retaining item is installed;

b) The Inspector, with the knowledge and understanding of jurisdictional requirements, shall be responsible for meeting jurisdictional requirements and the requirements of this code;

c) The "R" Certificate Holder's Quality System Program shall describe the process for identifying, controlling, and implementing routine repairs. Routine repairs shall be documented on Form R-1 with this statement in the Remarks section: "Routine Repair";

d) Alternative welding methods without posteweld heat treatment as described in NBIC Part 3, 2.5.3 shall not be used for routine repairs.

e) The following repairs may be considered as routine repairs and shall be limited to these categories:

1) Welded repairs or replacements of valves, fittings, tubes, or pipes NPS 5 (DN 125) in diameter and smaller, or sections thereof, where neither postweld heat treatment nor NDE other than visual is required by the original code of construction. This includes their attachments such as clips, lugs, skirts, etc., but does not include nozzles to pressure-retaining items;

2) The addition or repair of nonload bearing attachments to pressure-retaining items where postweld heat treatment is not required;

3) Weld buildup of wasted areas in heads, shells, flanges and fittings not exceeding an area of 100 in.2 (64,520 mm2) or a thickness of 25% of nominal wall thickness or 1/2 in. (13 mm), whichever is less;

4) Corrosion resistance weld overlay not exceeding 100 in.2 (64,520 mm2);

5) Seal welding a mechanical connection for leak tightness where by-design, the pressure retaining capability is not dependent on the weld for strength and requires no postweld heat treatment; and

6)The replacement (without welding) of a fire-tube with another physically identical item which bears the required code part stamp.

3.4.4 EXAMPLES OF ALTERATIONS

a) An increase in the maximum allowable working pressure (internal or external) or temperature of a pressure-retaining item regardless of whether or not a physical change was made to the pressure-retaining item;

b) A decrease in the minimum temperature;

c) The addition of new nozzles or openings in a boiler or pressure vessel except those classified as repairs;

d) A change in the dimensions or contour of a pressure-retaining item;

e) In a boiler, an increase in the heating surface or steaming capacity as described on the original Manufacturer's Data Report;

f) The addition of a pressurized jacket to a pressure vessel;

g) Except as permitted in NBIC Part 3, 3.3.3 s); replacement of a pressure retaining part in a pressure retaining item with a material of different allowable stress or nominal composition from that used in the original design;

h) The addition of a bracket or an increase in loading on an existing bracket that affects the design of the pressure-retaining item to which it is attached;

i) The replacement of a pressure relieving device (PRD) as a result of work completed on a pressure-retaining item (PRI) that changes the resultant capacity to exceed the minimum required relieving capacity (MRRC) required by the original code of construction as described on the original Manufacturer's Data Report.

j) For plate heat exchangers, in addition to the applicable examples of alterations above, the following changes from what is listed on the MDR or described on the Original Equipment Manufacturer's (OEM)-drawing:

1) For heat transfer plates:
    a. A change in material grade or nominal thickness;
    b. A reduction in number beyond any minimum, or when no minimum is specified;
    c. An increase in number beyond any maximum, or when no maximum is specified;
    d. A change in model type;
2) Any change in material whether described at 3.3.3 s) or as described at 3.4.4 g):
    a. A change in connection bolt or frame compression bolt diameter or material grade;

k) Performing postweld heat treatment where none was originally performed on the pressure retaining item;

l) The installation of a welded leak box; and

m)The replacement of a fire-tube with another which is either not identical or not supplied with code part stamping or requires welding activities.

Item 19-43

6/11/2019

Request for NBIC Part 3, Section 1.6 Revisions

Purpose	Update the edition of ISO/IEC-17025 to include 2017
Scope:	References to "ISO/IEC-17025:2005" need to be changed to include "ISO/IEC-17025:2017" to align with ASME Section III requirements in the following paragraphs: 1.6.6.2 m) 1), 1.6.6.2 m) 4) a), 1.6.6.2 m) 5) a), 1.6.7.2 m) 1), 1.6.7.2 m) 4) a), 1.6.7.2 m) 5) a), 1.6.8.2 m) 1), 1.6.8.2 m) 4) a), 1.6.8.2 m) 5) a)
Background	Based on Interp. 19-44: Many, if not all calibration labs are already accredited to ISO/IEC 17025:2017 and will be required to by 2020. No lab will bother accreditation to 2005 after that, so finding a calibration house will be difficult. Interpretation Item 19-44 intends to allow the 2017 edition of ISO/IEC-17025 to be used currently, however this Action Item (19-43 intends to correct the verbiage in the 2021 Edition of the NBIC.
Proposed Revision	See page 2 for proposed revisions. See pages 3-5 for 2019 ASME Sect III, NCA references.

1.6.6.2, 1.6.7.2, and 1.6.8.2 QUALITY PROGRAM ELEMENTS

m) Control of Measuring and Test Equipment

The "NR" Certificate Holder may utilize calibration and test activities performed by subcontractors when surveys and audits are performed. As an alternative to performing a survey and audit for procuring Laboratory Calibration and Test Services, the "NR" Certificate Holder as documented in their Quality Program may accept accreditation of an International Calibration and Test Laboratory Services by the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (MRA) provided this alternative method is described in the "NR" Certificate Holder's Quality Program and the following requirements are met:

1) The "NR" Certificate Holder shall review and document verification that the supplier of calibration or test services was accredited by an accredited body recognized by the ILAC MRA encompassing ISO/IEC-17025:2005 or 2017, "General Requirements for the Competence of Testing and Calibration Laboratories"."."

2) For procurement of calibration services, the published scope of accreditation for the calibration laboratory covers the needed measurement parameters, ranges and uncertainties.

3) For procurement of testing services, the published scope of accreditation for the test laboratory covers the needed testing services including test methodology and tolerances/uncertainty.

4) The "NR" Certificate Holder's purchase documents shall include:

   a. Service provided shall be in accordance with their accredited ISO/IEC-17025:2005 or 2017 program and scope of accreditation;

   b. As-found calibration data shall be reported in the certificate of calibration when items are found to be out-of-calibration;

   c. Standards used to perform calibration shall be identified in the certificate of calibration;

   d. Notification of any condition that adversely impacts the laboratories ability to maintain the scope of accreditation;

   e. Any additional technical and/or quality requirements, as necessary, which may include tolerances, accuracies, ranges, and standards;

   f. Service suppliers shall not subcontract services to any other supplier.

5) The "NR" Certificate Holder shall upon receipt inspection, validate that the laboratory documentation certifies that:

   a. Services provided by the laboratory has been performed in accordance with their ISO/IEC-17025:2005 or 2017 program and performed within their scope; and

   b. Purchase order requirements have been met.

n) Handling, Storage and Shipping

From 2019 ASME Section 3, NCA:

LIST OF CHANGES IN RECORD NUMBER ORDER

Record Number	Change
11-1037	Revised Table NCA-3200-1, Document Distribution for Division 2 Construction.
11-2161	Added new definition "Certified Design Report Summary."
14-315	Revised Table NCA-7100-2 for TR-3 and TR-4 to the following: *(a)* TR-3 "2008 through 2017." *(b)* TR-4 "2008a through 2017."
15-2538	Revised editorially NCA-4134.17(d) to add lifetime record no. 20.
15-2539	Added reference to NC- and ND-6114.2(d) to NCA-8322.1(d).
16-363	Revised Table NCA-8100-1 to address appurtenances. Revised Form N-2 to address the certification of Nuclear parts and established a new Form N-2A for the certification of Nuclear appurtenances.
16-1827	Revised NCA-3820(c).
16-2116	Updated wording of NCA-3360(b) to show that the Certifying Engineer certifies the Construction Specification and Design Drawings on behalf of the Designer.
16-2145	Revised NCA-1274 to clarify that the inlet and outlet parts of rupture disk holders are to be considered as material, part, or appurtenance.
16-2204	Revised Table NCA-7100-2.
16-2964	Added the 2006 Edition of SNT-TC-1A as an acceptable Edition within Table NCA-7100-2, Table NCA-7100-3, and Table WA-7100-2.
17-650	Restructured and renumbered NCA-3551. Clarified that date of certification is the date(s) the Design Reports are certified with an alternative of the date the Summary is Certified.
17-1111	Revised NCA-3761(a).
17-2058	Revised Table NCA-7100-1 to update the referenced standards.
17-2149	Added reference to NCA-3127 in NCA-4134.7(g).
17-2210	Errata correction. See Summary of Changes for details.
17-2214	Errata correction. See Summary of Changes for details.
17-2295	Clarified the recent revision to the Forewords for Section III and Section XI to properly address all items that have nuclear rules addressing their structural integrity.
17-3081	Changed "Registered Professional Engineer" to "Certifying Engineer" in NCA-3784.2 and NCA-3784.5.
18-340	Revised Table NCA-7100-2 to reference NQA-1-2015. Revised NCA-4100 to clarify the use of NQA-1 Part II and the use of commercial grade dedication for software.
18-355	Added ISO/IEC 17025 reference editions 2005 and 2017 to Tables NCA-7100-2 and NCA-7100-3. Deleted 2005 reference edition from ISO/IEC 17025 in NCA-3126, NCA-3127, NCA-4354.3, NCA-4255.3(c), and NCA-4255.3(d).
18-402	Revised Table NCA-7100-3 to delete two references (PTI M50.1 and AASHTO LRFD Bridge Design Specifications) that are no longer needed based on changes approved in Record 17-718.
18-955	Errata correction. See Summary of Changes for details.
18-1446	Revised NCA-5125(i).
18-1669	Revised Table NCA-7100-3 to update the applicable reference editions.
18-2668	Revised Table NCA-7100-3.

Table NCA-7100-2
Standards and Specifications Referenced in Division 1

(19)

Standard ID	Published Title	Section III Referenced Edition
The American Society of Mechanical Engineers (ASME)		
ASME NQA-1	Quality Assurance Requirements for Nuclear Facility Applications	2015
ASME PTC 25	Pressure Relief Devices	2014
ASME QAI-1	Qualifications for Authorized Inspection	Latest
American Society for Nondestructive Testing (ASNT)		
SNT-TC-1A	Personnel Qualification and Certification in Nondestructive Testing	2006, 2011
American Society for Testing and Materials (ASTM)		
ASTM A275	Standard Test Method for Magnetic Particle Examination of Steel Forgings	2009a
ASTM A673	Standard Specification for Sampling Procedure for Impact Testing of Structural Steel	1977
ASTM E8	Standard Test Methods for Tension Testing of Metallic Materials	1969 through 2015
ASTM E23	Standard Test Methods for Notched Bar Impact Testing of Metallic Materials	2002a
ASTM E94	Standard Guide for Radiographic Examination	1977
ASTM E142	Standard Method for Controlling Quality of Radiographic Testing (Discontinued 2000, Replaced by ASTM E94)	1977
ASTM E185	Standard Practice for Design of Surveillance Programs for Light-Water Moderated Nuclear Power Reactor Vessels	1982
ASTM E186	Standard Reference Radiographs for Heavy-Walled [2 in. to 4½ in. (51 mm to 114 mm)] Steel Castings	1967, 1973, 1975, 1979, 2010
ASTM E208	Standard Test Method for Conducting Drop-Weight Test to Determine Nil-Ductility Transition Temperature of Ferritic Steels	1991
ASTM E213	Standards Practice for Ultrasonic Examination of Metal Pipe and Tubing	1979
ASTM E280	Standard Reference Radiographs for Heavy-Walled [4½ in. to 12 in. (114 mm to 305 mm)] Steel Castings	1968, 1972, 1975, 2010
ASTM E426	Standard Practice for Electromagnetic (Eddy-Current) Examination of Seamless and Welded Tubular Products, Titanium, Austenitic Stainless Steel and Similar Alloys	1988
ASTM E446	Standard Reference Radiographs for Steel Castings up to 2 in. (51 mm) in Thickness	1972, 1975, 1978, 2010
ASTM E571	Standard Practice for Electromagnetic (Eddy-Current) Examination of Nickel and Nickel Alloy Tubular Products	1982 (R1988)
ASTM E606	Standard Practice for Strain-Controlled Fatigue Testing	Latest
ASTM E883	Standard Guide for Reflected-Light Photomicrography	2002
ASTM E1921	Standard Test Method for the Determination of Reference Temperature, T_o, for Ferritic Steels in the Transition Range	2016
ASTM F788	Standard Specification for Surface Discontinuities of Bolts, Screws, and Studs, Inch and Metric Series	2013
ASTM F812	Standard Specification for Surface Discontinuities of Nuts, Inch and Metric Series	2012
American Welding Society (AWS)		
AWS A4.2	Calibrating Magnetic Instruments to Measure the Delta Ferrite Content of Austenitic and Duplex Ferritic-Austenitic Stainless Steel	1991
ISO/IEC 17025	General requirements for the competence of testing and calibration laboratories	2005, 2017
Plastics Pipe Institute (PPI)		
PPI TR-3	Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Hydrostatic Design Stresses (HDS), Pressure Design Basis (PDB), Strength Design Basis (SDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe	2008 through 2017
PPI TR-4	PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe	2008a through 2017

Table NCA-7100-3
Standards and Specifications Referenced in Division 2 (Cont'd)

Standard ID	Published Title	Section III Referenced Edition
International Organization for Standardization		
ISO/IEC 17025	General requirements for the competence of testing and calibration laboratories	2005, 2017
Post-Tensioning Institute (PTI)		
PTI M10.2	Specification for Unbonded Single Strand Tendons	2017
U.S. Army Corps of Engineers		
CRD-C 36	Method of Test for Thermal Diffusivity of Concrete	1973
CRD-C 39	Test Method for Coefficient of Linear Thermal Expansion of Concrete	1981
CRD-C 44	Method for Calculation of Thermal Conductivity of Concrete	1963

Item Number: 19-50	NBIC Location: Part 3, 3.3.4.3 e) 3) l)	Attachment Page 89
General Description: Revising Part 3, 3.3.4.3 e) 3) l) to match rules of ASME PCC-2 **Subgroup:** Repairs and Alterations **Task Group:** None assigned **Explanation of Need:** There are a couple of typos in the paragraph as it does not match up with the rules of ASME PCC-2 for External Weld Metal Buildup.		

David Martinez (PM)

NBIC Part 3

3.3.4.3 WASTED AREAS

e) External Weld Metal Buildup

3) External weld buildup shall be applied in accordance with the following requirements:

l. For each repair, the maximum dimension (L, length along axis) compensated by a circular or oval weld buildup shall not exceed the lesser of 1/4 the nominal outside diameter ~~or~~ of the component ~~of~~ or 8 in. (200 mm). The length of a rectangular patch is not limited;

ASME PCC-2–2018

Article 202 External Weld Buildup to Repair Internal Thinning

202-3.1.3.1 Prequalified Design. Application of weld buildups on straight piping sections and associated welds to correct limited degradation may be considered a *prequalified design* and shall be exempt from an engineered design qualification or a proof test qualification if all of the following conditions are met:

(f) For each repair, the maximum dimension (*L*, length along axis) compensated by a circular, oval, or rectangular buildup does not exceed the lesser of one-half the nominal outside diameter of the pressure component or 200 mm (8 in.).

Issue: Is the maximum dimension (*L,* length along axis) not to exceed the lessor of ¼ or ½ the nomimal outside diameter of the pressure component, or 8”?

NBIC Part 3

L = length of area to be repaired along the axis of the component

C = length of area to be repaired along outside circumference of the component

W = the completed thickness of the overlay

ą = the angle between the component and the overlay (maximum 45°)

B = 3/4 $(Rt)^{0.5}$ minimum

R = nominal outside radius of the component

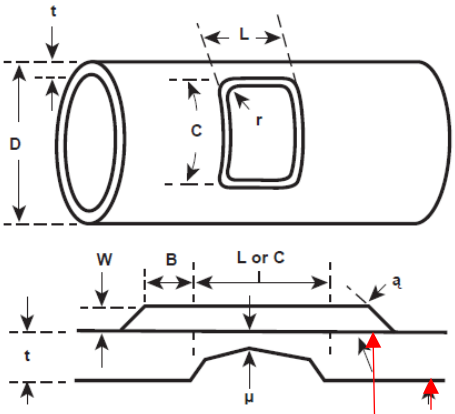
D = the nominal outside diameter of the component

t = nominal wall thickness of the component

μ = remaining wall thickness of the component shall be 1/16 in. (1.6 mm) or greater

r = minimum radius, not less than the overlay thickness

FIGURE 3.3.4.3-c
EXTERNAL OVERLAY TERMS AND DEFINITIONS

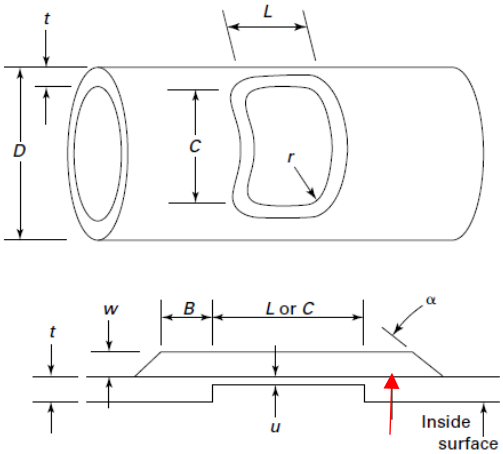


Inside surface

D

ASME PCC-2

Figure 202-3-1 Weld Buildup Profile



R

202-3.1.2.2 Extension Beyond Base Metal. The weld shall extend, at full thickness, a minimum distance, *B*, in each direction beyond the affected base metal (unless otherwise justified by a fitness for service assessment).

$$B = {}^{3}\!/_{4}\sqrt{Rt_{\text{nom}}}$$

where

R = outer radius of the component, or $\frac{1}{2}D$

t_{nom} = nominal wall thickness of the component

Item 19-52 - Hellman – 6/25/19

PART 3, SECTION 4
REPAIRS AND ALTERATIONS — EXAMINATION AND TESTING

4.1 SCOPE

This section provides requirements and guidelines for performing examinations and tests for repairs and alterations to pressure-retaining items.

4.2 NONDESTRUCTIVE EXAMINATION

a) The nondestructive examination (NDE) requirements, including technique, extent of coverage, procedures, personnel qualification, and acceptance criteria, shall be in accordance with the original code of construction for the pressure-retaining item. Weld repairs and alterations shall be subjected to the same nondestructive examination requirements as the original welds. Where this is not possible or practicable, alternative NDE methods acceptable to the Inspector and the Jurisdiction where the pressure-retaining item is installed, where required, may be used~~.~~, provided that all other requirements of this section are met.

b) NDE personnel shall be qualified and certified in accordance with the requirements of the original code of construction. When this is not possible or practicable, NDE personnel may be qualified and certified in accordance with their employer's written practice. ASNT SNT-TC-1A, *Recommended Practice Nondestructive Testing Personnel Qualification and Certification* (2006 edition), or ANSI/ASNT CP-189, *Standard for Qualification and Certification of Nondestructive Testing Personnel* (2006 edition), shall be used as a guideline for employers to establish their written practice. Provisions for training, experience, qualification, and certification of NDE personnel shall be described in the "R" Certificate Holder's written quality system.

NB19-XX

6/25/19

Request for NBIC Part 3, Supplement 2 Revision

Robert V. Underwood
The Hartford Steam Boiler Inspection & Insurance Company

Purpose	To address record retention requirements in Supplement 2.
Scope:	Revise S2.12 to refer to Part 3, 1.5.1(t) record retention requirements.
Background	S2.12 only states that job records "should" be retained by the owner. Paragraph 1.5.1(t) and Table 1.5.1 requires that all job records that substantiates the description of work on the applicable "R" Form be retained for five years. This revision will clarify record retention requirements in Supplement 2 and bring them to compliance with Part 3, Section 1.

PROPOSED REVISION TO SUPPLEMENT 2, S2.12

S2.12 DOCUMENTATION

Organizations performing repairs to historic boilers shall document the repair or alteration on Form R-1 or R-2, as applicable. Job records shall be retained in accordance with NBIC Part 3, 1.5.1 t). Additionally, ~~Permanent~~ documentation detailing repairs or alterations ~~should~~ shall be retained by the owner in permanent boiler records such as an operator log book.

REFERENCE: Part 3, 1.5.1 t)

t) Records Retention

The quality manual shall describe a system for filing, maintaining, and easily retrieving records supporting or substantiating the administration of the Quality System within the scope of the "R" *Certificate of Authorization*.

1) Records may represent any information used to further substantiate the statements used to describe the scope of work completed to a pressure-retaining item (PRI), and documented on a Form "R" report.

2) Records are not limited to those depicting or calculating an acceptable design, material compliance or certifications, NDE-reports, PWHT-charts, a WPS used, a welder, bonder, or cementing technician's process continuity records, drawings, sketches, or photographs.

3) The record retention schedule described in the Quality System Manual is to follow the instructions identified in NBIC Part 3, Table 1.5.1.

Item 19-55

7/9/2019

Request for NBIC Part 3, Section 4 Revision

Purpose	To change the maximum test pressure requirement when performing liquid pressure tests of repair and alteration activities. This proposal was initially part of item NB16-2603, which proposed changes to 4.4.1 a) 1) and 4.4.2 a) 1). However, only the changes to 4.4.1 a) 1) made it into the 2019 NBIC.
Scope:	To revise paragraph 4.4.2 a) 1) of the NBIC Part 3 to require maximum liquid test pressure be in accordance with the original construction Code.
Background	For liquid pressure testing of repairs and alterations, paragraph 4.4.2(a)(1) of the NBIC Part 3 require a maximum test pressure of 150% of the maximum allowable working pressure (MAWP) stamped on the pressure retaining item, as adjusted for temperature. However, repairs and alterations of DOT vessels are required to be tested at a minimum of 150% of design pressure which makes it virtually impossible to comply with the NBIC maximum requirement. Further, repairs and alterations to DOT ammonia transport vessels made from UHT materials require a test pressure of 200% of design pressure (49CFR 180.413(b)(6) and 177.337-16). Obviously, this is in violation of the NBIC Part 3. Paragraph UG-99 of ASME Section VIII, Div. 1 does not not specify a maximum test pressure for hydrostatic tests. Therefore, it is p[proposed that paragraph 4.4.2(a)(1) be revised to remove the maximum test pressure of 150% of MAWP. The paragraph will have new wording (similar to existing paragraph 4.4.1(b) for pneumatic testing) which states test pressure shall not to exceed the maximum test pressure of the original code of construction.
Proposed Revision	See page 2 for proposed revisions.

EXISTING PARAGRAPH 4.4.2(a)(1) of NBIC Part 3

4.4.2 TEST OR EXAMINATION METHODS APPLICABLE TO ALTERATIONS

Based on the nature and scope of the alterations activity, one or a combination of the following examination and test methods shall be applied to alterations and replacement parts used in alterations.

a) Liquid Pressure Test

Pressure testing of alterations shall meet the following requirements:

1) A pressure test as required by the original code of construction shall be conducted. ~~The test pressure shall not exceed 150% of the maximum allowable working pressure (MAWP) stamped on the pressure retaining item, as adjusted for temperature.~~ When the original test pressure included consideration of corrosion allowance, the test pressure may be further adjusted based on the remaining corrosion allowance. The pressure test for replacement parts may be performed at the point of manufacture or point of installation;

PROPOSAL OF REVISION TO 4.4.2(a)(1)

1) A pressure test as required by the original code of construction shall be conducted. The test pressure shall not exceed the maximum liquid test pressure of the original code of construction. When the original test ~~[~~pressure included consideration of corrosion allowance, the test pressure may be further adjusted based on the remaining corrosion allowance. The pressure test for replacement parts may be performed at the point of manufacture or point of installation.